1. Institutions and the beginnings of economic growth in Eighteenth-century Britain*

Joel Mokyr

1.1. INTRODUCTION

The new institutional economics has, so far, had little to say about the Industrial Revolution. In their survey of Institutions and Modern Growth, Acemoglu, Johnson, and Robinson (2005) acknowledge eighteenth century Britain as a successful economy and much like North and Weingast (1989) before them search for the institutional causes in seventeenth-century political developments and in the constraints placed on the British executive (the monarchy and the royal bureaucracy) by Parliament before and after the Glorious Revolution. In this framework a grand coalition of merchants and landowners emerged, keen on protecting commerce and property. For the first time in British history, the commitment problem, in which property rights were enforced by a suitably constrained entity, approached solution.

While neither Acemoglu et al. nor North and Weingast actually say so explicitly, they imply that these reforms paved the road to the British Industrial Revolution.[1] Others are not so prudent. Mancur Olson (1982, pp. 78–83, 128) had no doubt that 'a few decades after stable and nationwide government had been established in Britain, the Industrial Revolution was on its way'. The accounts pointing to the formal political institutions established in late Stuart and Williamite Britain rely on the notion of credible commitment: the crown deliberately relinquished many of its prerogatives to Parliament, and thus committed itself to pay its debts and to respect the property of its citizens. At the same time, Parliament made its own commitment to sound public finance credible by not removing all of the Crown's power. One way or another, if institutions were the key to economic growth and 'rule' in the formulation of Rodrik et al. (2005), they should have played a major role in the central event that triggered modern economic growth: the British Industrial Revolution. Adam Smith, in a widely-cited line that does not appear in his *Wealth of Nations* but was reported posthumously

by Dugald Stewart, thought that 'Little else is requisite to carry a state to the highest degree of opulence from the lowest barbarism but peace, easy taxes, and a tolerable administration of justice, all the rest being brought about the natural course of things'.[2]

Yet, surprisingly, there has been little effort to apply the new insights of institutional analysis to the central event of modern economic history to date, and the institutional origins of the Industrial Revolution remain poorly understood. The reason for this gap in the literature relates to two sources of confusion. One is the distinction between the events in *Britain,* which made it the leading economy in the Industrial Revolution, and developments in the larger North Atlantic economy, which refer to the Industrial Revolution in a wider area and the origins of modern growth in the West. One approach stresses the the exceptionalism of Britain, in trying to explain why it was the pioneer of the Industrial Revolution, and thus focuses on events such as the Glorious Revolution, the British Empire, or the fortunate mineral endowment of Britain (Prados de la Escosura, 2004).The alternative extreme approach regards Britain as a chance leader in a European phenomenon in which cultural phenomena such as the Enlightenment were decisive (Jacob, 1997; Mokyr, 2002). Institutional analysis falls somewhere in between those two approaches. Each country had its own national and local institutions, but certain institutional elements were shared, imitated, and spilled over so that a 'European mode' may be discerned in the continent-wide pressures toward reform after 1750. Institutional changes were inspired by Enlightenment thought that affected much of the Western World (Mokyr, 2006c). The analysis in this chapter will be concerned with the 'smaller' question of Britain's leadership and will thus focus primarily on the institutional environment in Great Britain. In other Western societies, however, institutional changes before 1850 helped create the convergence club as it existed in 1914.

The second source of confusion is that the new Institutional Economics literature focuses on formal institutional transformations, in which the Crown committed to respect the property rights of the landowning and mercantile classes, made contracts more enforceable, and reduced transactions costs and uncertainty. Such an account explains growth in an economy in which institutions lubricated the wheels of commerce, finance, agriculture, and premodern artisanal manufacturing and cottage industries. It led to an improvement in the allocation of resources and the accumulation of more capital. In this fashion such changes provide an explanation of Smithian Growth, in an economy with a static technology. The Industrial Revolution, however, rested on key technological breakthroughs and their application to production by a class of successful industrial entrepreneurs. These successes did not, moreover, lead to a new technological equilibrium but made room

for the far more astonishing phenomenon of the non-convergence of technology to a new set of dominant designs. Instead, continued improvement in technology after 1800 became the rule. How are we then to link the essence of the British Industrial Revolution to the events of 1688, and beyond and how did institutional factors, broadly defined, help elevate Britain to the leading position it took in the Industrial Revolution?

Below I argue that the traditional emphasis on *formal* institutions has been over-emphasized, and that the enforcement of property rights by the state was less crucial than the Northian interpretation has suggested. The importance of institutions extended beyond politics and formal institutions. We need to take account 'cultural beliefs' as defined by Greif (2005), which created an environment in which inventors and entrepreneurs could operate and cooperate freely. Equally important, we need to pay attention to those institutions that stimulated and encouraged technological progress and not just the growth that depends on well-functioning markets. Formal institutions such as state-enforced patent rights may have been overestimated at the expense of informal private order institutions

1.2. LAW, ORDER, AND INSTITUTIONS

Economic growth depends on law and order (Smith's 'tolerable administration of justice'), but the two are not identical. Law is enforced by public-order formal institutions. The issue then becomes one of credible commitment between a Hobbesian entity with a monopoly of violence, and its subjects. The subjects want the state to enforce the rules of the game but not to accumulate so much power that the state can threaten those very rights it is asked to protect. 'Order' in the sense of the protection of property and contract enforcement can be attained through norms reflecting the willingness of individuals to voluntarily overcome their tendency to behave opportunistically. In that fashion they create what can be called an *economic civil society* in which reputational or other mechanisms support a world in which most people believe that it is proper to behave in a cooperative way. The key to successful economic exchanges here is not necessarily an impartial and efficient third-party enforcing agency, but the existence of a level of trust or other self-enforcing institutions within relevant networks of commerce, credit, wage-labor, and other contractual relations that support free market activities. In other words, the state is neither necessary nor sufficient. The simple model in which it is *only* the state and threat of its justice and police systems that makes people behave cooperatively seems a poor description of any known situation.

How much of a 'law and order society' was Britain before the Industrial Revolution? Crime was of course a serious problem in this society, though it is not easy to quantify it. Yet the admittedly somewhat tenuous evidence suggests that violent crime was declining over the eighteenth century and that crimes against property moved more or less pari passu with population growth (Beattie, 1974; Beattie, 1986). There was also collective crime. Local rioting, either for economic or political grievances, was common. Machine breaking, bread riots, turnpike riots, or rioting against some unpopular group like Catholics, Irish immigrants, or dissenters were common. Turnpike riots, the Gordon riots of 1780, and the Bristol Bridge riot of 1793 all sowed fear in the hearts of property-owning classes. Food rioters, forgers, thieves, and those who resisted enclosures and new machinery forcibly were all threatened by execution and transport. However, daily crime that seriously endangered the accumulation of capital and the proper conduct of commerce was on the whole rare. To be sure, eighteenth century Britain passed a myriad of draconic laws protecting property by imposing ferocious penalties on those who infringed on it.[3] The harshness of the penalties seems to suggest that violent crime and crimes against property were regarded as serious issues. Yet it also meant that the authorities were reluctant to spend resources on law-enforcement, hoping that the harsh punishments could deter would-be criminals.[4]

Moreover, in Hanoverian Britain law enforcement was largely farmed out to the private sector. It had no professional police force comparable to the constabulary that emerged after 1830, and the court system was unwieldy, expensive, and uncertain.[5] Britain depended on the deterrent effect of draconian penalties because it had no official mechanism of law-enforcement, prosecution was mostly private, and crime prevention was largely self-enforcing, with more than 80 per cent of all prosecutions carried out by the victims. Few victims were willing to proceed with the costly and burdensome tasks of prosecuting a crime (Emsley, 2005, pp. 183–86). Patrick Colquhoun noted in 1797 that 'not one in one hundred offences that is discovered or prosecuted' (1797, p. vii). The growing volume of both domestic and international commerce and credit was supported less by formal law and order and third-party arbitration than by private-order institutions.

If formal law enforcement was a last resort in the enforcement of contracts and the protection of property rights, how did markets function? What kept transactions costs and opportunistic behavior to mushroom to the point where they jeopardized the levels of exchange and division of labor required for a sophisticated economy? A different way of posing the same question was expressed by the young French economist Adolphe Blanqui (1824, p. 326) visiting London who wondered how a town twice the size of

Paris (nearly a million people) could maintain order with only a handful of watchmen and constables. He seemed less than satisfied by the answer that the English go to bed and lock up their shops early, and was more inclined to believe that they were harder-working and more enlightened.

At closer examination, day-to-day security depended more on social conventions and self-enforcing modes of behavior than on the administration of justice by an impartial judiciary. Commercial disputes rarely came to court and were often settled through arbitration.[6] Even patent litigation was rare: out of almost 12,000 patents issued between 1770 and 1850, only 257 ever came before the courts (Dutton, 1984, p. 71). Indeed, the number of civil cases that came to court in the eighteenth century declined precipitously relatively to their mid seventeenth century levels: the number of cases heard at the King's Bench and Common Pleas in 1750 was only a sixth of what it was in 1670 (Brooks, 1989, p. 364). As Figures 1.1–1.3 demonstrate, there can be little doubt that the British as a whole were becoming less litigious in the eighteenth century before things picked up again in the nineteenth century. Interpreting this fact seems less than straightforward. Does it support the view that legal institutions were becoming less important as a contract enforcement mechanism? One could argue that if courts were extremely efficient, they might be used less.[7] Or was there a deeper social transformation? Historians such as Lawrence Stone (1985) have indeed argued that the social tensions and violence of the English world before 1650 gradually transformed it into a kinder and gentler environment in which contentiousness declined. Some contemporary commentators felt that in the late eighteenth century, behavior was slowly changing.[8]

Whether eighteenth century Britain was really becoming a kinder and gentler place is a difficult issue, but at least within the circles of commerce, finance and manufacturing, trust relations and private settlement of disputes seem to have prevailed over third party enforcement. Most business was conducted through informal codes of conduct and relied on local reputation and religious moralizing to imbue honesty and responsibility. Voluntary compliance and respect for property and rank as social norms (private-order institutions, in Greif's terminology) may have been as important as formal property rights in turning the wheels of the British economy. These norms involved a variety of signalling devices associated with 'gentlemanly' codes and were commented on by contemporaries as 'politeness' in a variety of contexts (Langrod, 2000). Economics suggests that such behavior is often associated with attempts to signal one's trustworthiness to potential partners in the market. These norms applied only to the middling classes. The laboring classes and the unwashed poor remained outside this society, so the norms did not apply to them. Hence, these classes had to be controlled by

force, and the draconian laws protecting property from them reflected this need.

Observant contemporaries noted that informal institutions, that is, customs, traditions, and conventions delineating acceptable behavior were at least as important as a formal rule of law An increasing number of people were bargaining 'in the shadow of the law', that is, the parties in disputes knew what the stakes were and the (substantial) loss they would incur in case they went to trial. Yet the law itself set a guideline to dividing up the resources in dispute, and thus made the bargaining process more likely to result in cooperation, since knowledge of the law, as well as the costs of going to trial, were common to both sides, and the legal process may have become more conducive to private ordering by discouraging people to go to trial and compromise.[9] The Hobbesian view, that insists that order can only achieved through firm third-party enforcement, may well be true for many societies (depending on many parameters, delineated by Cooter, Marks, and Mnookin, 1982), but it appears that for Britain in the century following Hobbes's death (1679), it was becoming an increasingly less apt description of social reality in Britain. What this means is that we cannot really place the efficiency of the State at the center of the stage of institutional explanations of the British economic miracle.

Indeed, North's belief that Britain's advantage in leading the Industrial Revolution was due to its efficient enforcement of property rights after 1688 needs to be revisited. For one thing, property rights were not sacrosanct. Secure property rights in land may have been important in a technologically static commercial economy, whereas a more technologically dynamic economy required the flexibility provided by eminent domain and even the option to extinguish some traditional property rights if need be, such as happened through enclosure and railway acts. The rent-seeking institutions of the mercantilist economy had established monopoly rights, exclusionary rents, privileges and sinecures (known in the quaint terminology of the time as 'freedoms') were all property rights of one kind or another, but they had to be extinguished if the economy was to modernize and shake itself loose from the 'old corruption' that plagued the British stae for much of the eighteenth century.

How, then, did commerce and credit work in this society in the absence of strong third-party enforcement? What mattered was that within the merchant and artisan classes there existed a level of trust that made it possible to transact with non-kin, and increasingly with people who were, if not strangers, certainly not close acquaintances. In an age when the costs of legal action went up, its availability and efficiency declined, fewer and fewer people took a recourse to the law and replaced by common behavioral cultural norms among people belonging to the same class and the same social

circles.[10] We might have expected the reverse: the growing integration of goods and factor markets and the widening of the domestic market, and especially the increase in transactions at arm's length throughout the period of the Industrial Revolution eventually necessitated a formal system of law enforcement. This is what eventually happened during the Victorian age. But in the eighteenth century matters were quite different.

Most enlightenment thinkers believed that the correlation between people cooperating and behaving honestly was caused by a mechanism running from prior commercialization to behavior. It was thought that commerce led to more trustworthy behavior, much like Montesquieu's influential notion of *doux commerce* which established an association between the 'gentle ways of man' and the establishment of trade (Hirschman, 1977, p. 60).[11] But it seems more plausible that the causal arrow went primarily in the other direction, that is, certain forms of behavior led to cooperative behavior that made market transactions possible, even at arm's length, and thus encouraged economic development.

The central concept that determined these concepts was a set of 'bourgeois virtues' (to use McCloskey's term) ironically known as 'gentlemanly behavior'. By 1700, 'gentleman' had come to mean quite different things, one a socio-economic status, the other a code of behavior.[12] A gentleman, Asa Briggs (1959, p. 411) notes, was someone who accepted the notion of progress but was always suspicious of the religion of gold. An individual signaled that he was trustworthy and would not behave opportunistically because, like a true gentleman, he was not primarily motivated by greed and was not maximizing short-term profits. Instead, he was primarily concerned with his reputation.

Gentlemanly Capitalism was a way in which opportunistic behavior was made sufficiently taboo that only in a few cases was it necessary to use the formal institutions to punish deviants, since the behavior is to a large extent internalized.[13] The notion that eighteenth century landowners were scrupulously honest or indifferent to money is a myth, but the pretension was a good signal for behavior that was less than maximally opportunistic and could thus sustain more readily cooperative trust-equilibria. The idea of a gentlemanly culture is traditionally associated with an aristocratic aversion to business and is thus often held to be antithetical to economic development.[14] But in a different sense, being a gentleman meant that one could be trusted and Gentlemanly Capitalism provided a shared code, based on honor and obligation, which acted as a blueprint to prevent opportunistic behavior (Cain and Hopkins, 1993). In eighteenth-century Britain, a businessman's most important asset was perhaps his reputation as a 'gentleman' even if he was not a gentleman by birth or occupation.

Economists and other social scientists have come to the conclusion that social norms of cooperation and decency can prevail even in societies with ineffective formal law enforcement (Ellickson, 1991). This happens in tightly knit groups in which reputational mechanisms work effectively and social remedial norms can be applied. One such model (for example, Spagnolo, 1999) is supported by the linkage of two types of games, one a social game that lasts for a very long time and the other a one-shot economic game. If two agents face one another in both spheres, the punishment in one game may be used to induce cooperation in the other.[15] This is in some sense a formalization of the importance of trustworthiness through social networking and its effect on market efficiency. These models point to the likelihood that trust can be transferred from a social relationship into an economic relation and thus sustain cooperative outcomes in which exchange can take place and disputes are resolved even without the strict enforcement of contracts by a powerful system of impartial courts or arbiters. It is this kind of environment, whether or not one wants to refer to it as 'social capital', that created the possibility of cooperation even when standard behavior in finite games would suggest that defection and dishonest behavior might have been a dominant strategy.

In sum, then, in Britain during the Industrial Revolution, the social norms of what was perceived to be a gentlemanly culture with an emphasis on honesty and meeting one's obligations, supported cooperative equilibria that allowed commercial and credit transactions to be consummated and partnerships to survive without overly concern about possible defections and other forms of opportunistic behavior. Gentlemen (or those who aspired to become gentlemen) moved in similar circles and faced one another in a variety of linked contexts. Blackstone referred to Britain as a 'Polite and Commercial People'. Politeness was widely equated with law-abiding behavior, and it was intuitively sensed that commercial success depended a great deal on politeness. A market economy depended on people constraining their inclination to behave opportunistically. In other words, economic agents did not play necessarily 'defect' (even if that might have been in their immediate interest) and expected others to do the same. Modern economics teaches that if this is to be effective, agents need to send out costly signals that indicate to others that they are reliable and trustworthy because they belong to a class of reliable and trustworthy agents (see for example, Posner, 2000). Such signals were what 'politeness' were all about: gentlemanly customs in dress, manners, housing, transportation, and speech observed by the British upper classes, and their gradual adoption by the commercial and skilled artisanal classes in the eighteenth century marks the change in British society. They helped created a gentlemanly capitalism and thus an environment in which businessmen and entrepreneurs could deal with one

another and with their subordinates in a cooperative fashion that made commerce work even without the heavy hand of third-party law enforcement. In other words, what made commerce and credit possible was that middle class people increasingly absorbed and imitated a set of behavioral norms that made them eschew opportunistic behavior that might have been personally advantageous in the very short run but socially destructive.

This kind of behavior was observed and blessed by Enlightenment thinkers.[16] The Enlightenment view associated with Montesquieu cited above that commerce made people more virtuous and honest must be seen to operate in reverse: it is a sense of honesty and the importance of maintaining a gentlemanly reputation that allowed a market economy to function effectively. To be sure, the ideal of 'gentleman' was not static and changed over the course of the eighteenth century, and the relation between ideal and norm on the one hand and reality on the other is always problematic. The question is not whether the preponderance of British middle-class economic agents invariably behaved like this, as much as whether it affected their behavior (and the way other expected them to behave) sufficiently to make a growing market economy feasible without the need for incessant litigation.[17]

One issue is whether the cooperative norms of behavior were the result of the fear of social sanctions and loss of reputation, or whether they had been 'internalized' into a belief in virtue and good behavior (McCloskey, 2006, *passim)*. Intellectual Historians seem to favor the internalization hypothesis. Pocock (1985, p. 49) feels that 'manners' (that is, cooperative codes of behavior) combined ethical behavior with legal concepts, 'with the former predominating'. Yet the importance of a good reputation in the business world of eighteenth century Britain was clearly paramount, and Daniel Defoe was only one of many to realize this when he compared the reputation of a tradesman to that of a maiden, easily damaged by evil tongues and almost impossible to repair and describes how such reputations were made and lost around the coffee house through slander (Defoe, 1738, Vol. I, p. 197). Elsewhere he notes (ibid., p. 361) that a shopkeeper may borrow at better terms than a prince 'if he has the reputation of an honest man'. An illustration is the career of William Stout (1665–1752), whose autobiography appeared in 1851, and whose economic success was largely fueled by his meticulous reputation for honesty and generosity.[18] He covered the debts incurred by a dissolute apprentice as well as a nephew. As a Quaker, Stout may have been an unusual case, but his success in business was clearly consistent with the notion that cooperation was a remunerative strategy.

In order to function, a reputation-based system needed good information and communications, and these were provided through the many networks of friendly societies and masonic lodges that emerged all over Britain in the

eighteenth century (Jacob, 1997, pp. 92–94). Such networks exist in every society, but the ones established in the eighteenth century were open and accessible to middle class men and thus were an ideal vehicle for the transmission of the information that supports reputational mechanisms. The number of associations and clubs of a variety of nature increased at an astounding rate in the eighteenth century, leading the expert of the topic to refer to it as the 'associational society' (Clark, 2000). Many of these clubs were purely social, eating and drinking clubs, or devoted to common interests and hobbies, but they clearly functioned as clearing houses for information as well.[19] From the point of view of commercial and financial development, what mattered was the emergence of networks of merchants, professionals, industrialists, engineers, and financiers whose interactions and information exchanges (much of it in the form of gossip and rumor-mongering) were critical to the emergence of these social norms.[20] This was clearly an elite phenomenon, encompassing perhaps no more than 15 or 20 percent of British adult male society. The unskilled workers and paupers were not part of these circles and thus not expected to behave the same way, but harsh as this may sound, they did not matter much in this context.

1.3. COOPERATION AND THE INDUSTRIAL REVOLUTION

As noted, institutions that foster cooperative behavior are conducive to efficiency and well-functioning markets, which are clearly growth-enhancing. However, it is not clear how they would be instrumental in bringing about an Industrial Revolution, which was driven by *innovation*. How does cooperation foster technological progress? One way to connect social norms and technological progress is to realize that social norms determined the way entrepreneurs interacted with their economic environment, with customers, suppliers, workers, and competitors, and to stress that within a competitive economy, many of the most successful actors were actually more cooperative than we would like to expect. These were norms that were increasingly important in determining the behavior of the inventors, skilled craftsmen, financiers, merchants, and the owners of the new mills and mines that defined the Industrial Revolution.

An emphasis on middle class social norms provides us with answers to some long-debated issues regarding entrepreneurship in the British Industrial Revolution (Mokyr, 2008). How was the scarce resource called venture capital generated? The answer is in part that personal trust allowed partnerships and other credit-relations to develop. This meant that investors often spread their interests over different projects and even different sectors.

A tell-tale sign of that is the diversified projects in which many of them engaged, investing in local improvements and subscribing to projects such as roads, bridges, canals, dockworks, and later railroads.[21] They could diversify their portfolios by investing in sectors they knew little about because they felt they could trust their partners (Pearson and Richardson, 2001). Cotton masters and other textile producers in Manchester, Leeds, and Liverpool could be found as directors of insurance companies, canal- and turnpike companies, gas companies, banks, and other sectors. Country banks were the diversifying instrument par excellence, and many bankers were diversified in a variety of business, and thus so were their partners. It may thus be the case that an entrepreneurial explanation of Britain's early success has some value, but rather than look only at the incentives and characteristics of individuals, we may be advised to see how they dealt with one another.[22] The typical successful British entrepreneur in the Industrial Revolution was not so much a self-absorbed obsessive monomaniac as much as a networked and connected member of a community, his behavior constrained by its moral codes.

Another interesting possibility for a connection from cooperation to innovation is through the idea of cooperation in technological progress itself. Economic historians have found some examples of what Allen (1983) has termed collective invention, that is, the main actors in technological innovation freely sharing information and claiming no ownership to it. There are three reasonably well-documented cases of successful collective invention: the case documented by Allen (1983) of the Cleveland (UK) iron industry between 1850 and 1875; the case documented by MacLeod (1988, pp. 112–13, 188) of the English clock- and instrument makers, and the case documented by Nuvolari (2004) of the Cornish steam-engine makers after 1800. Examples of such cases are not many, and they required rather special circumstances that were not common, and collective invention in its more extreme form, to judge from its short lifespans, was vulnerable and ephemeral.

On a more general level, however, Gentlemanly Capitalism generated a great deal of cooperation in the generation of technological progress. The main point to keep in mind is that many and perhaps most of the people who generated useful knowledge during the British Industrial Revolution did not do so *primarily* to make money. This does not mean that they were indifferent to money (though a few were independently wealthy) but rather that the game they were in was not a profit-maximizing project but a signaling game in which individuals tried to demonstrate to their peers their intellectual and technical capabilities. Useful knowledge that was not immediately patentable (and some that was) was placed in the public realm.[23] Scientific discoveries of any kind were to be published and communicated.[24]

When the unusual case occurred that an eccentric scientist (for example John Flamsteed, the first astronomer royal, or the pathologically shy Henry Cavendish, a leading chemist of the second half of the eighteenth century) refused to do so, others would take exception.

Open science, much like open source technology, was not practiced primarily by idealistic altruists whose objective was the warm glow from seeing humanity enriched by their knowledge (though there were some of those). It was run by ambitious and hard working people who had clear objectives in mind. Yet the standard pecuniary incentive system central to the economic interpretation of technological change must be supplemented by a more complex one that includes peer recognition and the sheer utility of being able to do what one desires. Credit was given in terms of reputation, which correlated with university positions, court-related appointments, public honors, and sometimes a pension from a ruler or a rich citizen. But scientists, in order to be trusted and believed, had to establish reputations as gentlemen as well (Shapin, 1994). Even those scientists who discovered matters of significant importance to industry, such as Claude Berthollet, Count Rumford, Joseph Priestley, or Humphry Davy, usually wanted credit, not profit.[25]

Berthollet willingly shared his knowledge of the bleaching properties of chlorine with some savvy Scots, who soon were able to turn his discovery into a profitable venture'. When one loves science,' wrote Berthollet to one of those Scots, James Watt, 'one had little need for fortune which would only risk one's happiness' (cited by Musson and Robinson, 1969, p. 266). The great engineer John Smeaton took only one patent in his entire illustrious career, his colleague John Rennie none at all. Some entrepreneurs, too, refused to take out patents out of principle. Abraham Darby II declined to take out a patent on his coke-smelting process allegedly saying that 'he would not deprive the public from such an acquisition' (cited by McLeod, 1988, p. 185) and Richard Trevithick, a century later, likewise failed to take out a patent on his high pressure engine. William Godwin noted in 1798 that 'Knowledge is communicated to too many individuals to afford its adversaries a chance of suppressing it. The monopoly of science is substantially at an end. By the easy multiplication of copies and the cheapness of books, everyone has access to them' (Godwin, 1798, pp. 282–83). In that more general sense, social norms did have an effect on technology, though it is hard to quantify them.

A third mechanism linking trust and 'culture' to technological progress in eighteenth century Britain concerns the formation of human capital. As I have argued elsewhere, what set Britain apart from other European countries was not its capacity to accumulate more and better science or even a higher propensity to invent, but the much higher level of *competence* of its skilled

workers. Britain could draw on a large cadre of highly skilled craftsmen and technicians. These people might not have been the flashy inventors who came up with the revolutionary insights, but they were those who could read a blueprint, understood practical technicalities such as tolerance, lubrication, tension, and torque, and had experience with the qualities of iron, wood, leather and other materials (Mokyr, 2007b).[26] Harris (1992, p. 33) describes them as 'unanalysable pieces of expertise, the 'knacks' of the trade,' that is to say, knowledge that is primarily tacit and could not be learned except through experience and imitation. Harris's view may be conditioned by his expertise of the coal and iron industry, but much of the same was true in hardware, textiles, instrument-making, and engineering. He notes that such skills were taken for granted at home and thus were noted mostly by foreign visitors, including industrial spies (ibid.,p. 26, see also Harris, 1998).[27] It was understood that these skills could not be readily transferred from country to country.[28]

The evidence that Britain's comparative advantage was in the skills and competence of her workmen as much as in the characteristics of her entrepreneurs is above all that it imported technological ideas and exported machines and skilled workmen, even if there were legal restrictions on those exports.[29] When it imported an invention, such as the Jacquard loom or chlorine bleaching, Britain improved them by a sequence of microinventions. The reverberatory furnace, first described by Vanoccio Biringuccio in 1540 in glassblowing , was adopted in Britain in the early seventeenth century. By 1700, this device had been adapted successfully to non-ferrous metals by unknown British skilled workmen before its famous adaptation to iron-puddling. The British paper industry, imported the Frenchman Nicolas Robert's paper-making machinery, but British mechanics such as Bryan Donkin and Henry Fourdrinier made important improvements in it. Chlorine bleaching, invented in France, was perfected by the Scotchman Charles Tennant, who made a fortune in the process.

What were the institutional causes of Britain's high level of competence? It had preciously little to do with institutions of formal education, even if some of the dissenting academies were increasingly committed to teach practical skills. There were no engineering schools until about 1830, and even then they were limited in range. Instead, it was almost entirely the result of apprenticeships. It was the product of a process of human capital formation that relied precisely on the kind of trust that contracts would be honored even if the fine details of daily contact between master and apprentice were impossible to specify, much less monitor. Britain's increasingly weak guilds had little to do with this enforcement, and indeed there is some evidence from court cases that in many cases the process went awry. All the same, while courts provided some kind of protection of last

resort, the normal case was clearly for the contract to be carried out and most apprentices completed their terms. It has been estimated that in the eighteenth century about two thirds of all British lads completed their apprenticeships.

Those who did on average benefitted economically. Despite the fact that apprenticeship relationships lent themselves to opportunistic behavior (such as hold-up strategies by both master and apprentice, depending on the timing pattern of the training), the system served Britain well and supplied it with a layer of skilled artisans like no other because apprenticeship contracts were largely self-enforcing and efficient (Humphries, 2003).[30] Apprenticeship took place within a 'traditional network of friends, neighbours, co-religionists, and next of kin' (Humphries, 2007, p. 11).[31] The apprentices themselves had quite a few incentives to complete their contract: only an apprentice with a completed term received the right of settlement in a county, and in those areas and trades controlled by guilds, they were barred from practicing a trade if they did not complete their term.[32] This stricture was repealed in 1814, but the institution of apprenticeship survived. It was obviously to a large extent self-enforcing rather than dependent on the letter of the law or the power of the guild. In the later nineteenth century apprenticeship as an institution was weakened, yet it was sufficiently flexible to withstand the changes and survive until deep into the twentieth century. Apprenticeship was ideal to transmit the kind of tacit artisanal knowledge that was the essential component of competence. It was not perfect, but by all appearances it worked as a self-enforcing institution rather than as one that relied entirely on third party enforcement (though for the social norms to work, a recourse to legal action as a *pis aller* was necessary).

To summarize, it is the complementary relation between the human capital and the social capital that explains Britain's leadership in the Industrial Revolution. The economy that could produce the technical acumen to follow up on new ideas and turn them into an economic reality was also able to create a group of entrepreneurs to exploit it, people with the ability to take advantage of the opportunities that the inventors and the mechanics created. This relationship appears up in the many pairings of technical ability and businessmen. Boulton found his Watt, Clegg his Murdoch, Marshall his Murray, and Cooke his Wheatstone. These pairings were made possible by a network of information flows and personal relationships that made trust and cooperation *within a certain class of people* the default. Here, too, the importance of private order seems predominant, and while they, too, existed in the shadow of the law, the success of the institutions was determined by its self-enforcing properties.

1.4. INSTITUTIONS, POLITICS, AND ECONOMIC PROGRESS

Why did sustained economic growth not occur more often and in more places before the nineteenth century? One standard argument is that technology was constrained by the poor understanding of the fundamental principles of the natural regularities that made certain technologies work (Mokyr, 2002). The alternative argument is one of negative feedback. In one version, Malthusian dynamics undid any gains in technology, institutions, and even favorable environmental shocks (Clark, 2007).To that, however, we should add the underappreciated problem of negative institutional feedback and institutional inertia, which held back pre-industrial societies. Jones (1988) has gone so far as to argue that growth might well have been the normal state in pre-industrial societies had not institutional blockages again and again terminated it.

Before 1800 economic growth was more of a regional than a national phenomenon; throughout the pre-industrial past there were some areas and cities that did well for a variety of reasons. Such local wealth gave rise to two kinds of negative institutional feedback: *internal* feedback, in which local priests, rulers, and powerful strongmen tried to extricate the rents for their own use and *external* feedback, generated by strong but poor neighbors or more remote predators. One way or another, regions that did well through trade or manufacturing were likely to attract predators like flies to honey. Time and again, prosperous regions in Germany, Central Europe, the Low Countries, and Northern Italy, had their wealth physically destroyed through war, their trade impeded by tariffs, navigation acts, and privateers, or were forced to spend crippling amounts on defense. In this world growth, in an almost dialectical way, generated the mechanisms that undid it.

In the eighteenth century, the political culture of Britain gradually turned away from the zero-sum approach and slowly became more liberal and more enlightened. Two political phenomena were at the center of this process. One was the centralization of rent-seeking and lobbying. By allowing growing domestic market integration (through turnpike and canal bills, for instance), Parliament oversaw the gradual disappearance of local monopolies. By the late eighteenth century, Prime Minister William Pitt refused to meddle in local matters, which were ‘large areas of policy in which ministers and party politicians need not involve themselves’ (Langford, 1991, p. 205). Rent-seeking and redistribution remained an essential part of the Hanoverian state until the closing years of the eighteenth century, but it became more nation-wide and coordinated. Mercantilist practices had been mostly part of a complex rent-seeking alliance between crown and mercantile interests (Ekelund and Tollison, 1997). Once centralized, however, the process was

more amenable to changes from the top down (Mokyr and Nye, 2007). The striking fact is that the Industrial Revolution was accompanied, on the whole, by a growing liberalization of economic activity.

The other was the growing backlash against rent-seeking. Why and how did redistribution fall on hard times in Europe during and after the Industrial Revolution? Part of the reason must have been that these institutions had been very much part of the zero-sum mentality of the pre-enlightenment world. The notion that exclusionary rents were on the whole Pareto-dominated did not come naturally to most actors, either on the giving or the receiving end of rent-generating privileges. The areas against which British (and continental) policy makers particularly aimed their arrows were monopolies, subsidies, labor market restrictions, tariffs, poor relief, and price controls. By 1850, much of this regulatory machinery had been dismantled. Foreign trade, too, was regarded differently with eighteenth century enlightenment thought foreshadowing the insights of political economy.[33] The growing influence of the beneficial effects of trade promulgated by Smith and Ricardo made their mark on policy makers (Grampp, 1987; Mokyr, 2006).[34]

Enlightenment-induced changes in ideology and beliefs on the part of policy makers in charge of writing the rules played a central role in the American and French Revolutions, as well as the various reforms attempted in various European nations before 1789 (Scott, 1990). Reforms in Britain did not always come easy even if they did not require a Bastille. The liberal reforms of the 1780s (including the Eden treaty with France in 1786) made room for the more conservative and reactionary 1790s and early1800s, when war with Revolutionary France caused a retrenchment. But it was *reculer pour mieux sauter*. After Waterloo, the reform movement picked up steam led by both Whigs and so-called liberal Tories, and within a few decades had dismantled much of the remaining rent-seeking apparatus. Thus, the Statute of Artificers was abolished in 1814, the enumeration clauses (that forced British colonial goods to be shipped to third markets through Britain) in the Navigation Acts were repealed in 1822, the monopoly of the East India company was ended by two parliamentary acts in 1813 and 1833, the law prohibiting the emigration of artisans was repealed in 1824, the export prohibition on machinery was weakened in 1824 and repealed in 1843, the Bubble Act thrown out in 1825.[35] Other exclusionary arrangements that fell out of favor were serfdom and colonial slavery, prohibitions restricting the use of certain kinds of machinery, usury laws (repealed as late as 1854 but rarely enforced long before), and similar rent-seeking relics. As Nye (2007) has argued, protection was the last vestige of privilege and the ancient regime economy to go. By the middle of the nineteenth century, it is hard to

find many instances of the kind of age-of-mercantilism rent-seeking that still predominated in 1721 when Robert Walpole became the first Prime Minister.

Perhaps the most telling proof of the change in political culture is the sharp decline in patronage and sinecures, that in 1750 still had been very much part of the power structure. The transition from Walpole to Pitt marks one of the most notable shifts in political culture. The forms of government spending that constituted a possible source of corruption and waste (pensions, fees, and the salaries of corrupt officers) in the 1780s and 1790s constituted at most 2 percent of annual spending, less than a quarter than in France (Brewer, 1988, p. 73). These figures do not, of course, include further corruption and waste in military spending and the appointment of officers, but still indicates that British government was turning away from ancien régime rent-seeking modes of government. By 1830, the Duke of Wellington said that as prime minister he commanded virtually no patronage (cited by Rubinstein, 1983, p. 57). By the mid-1830s, the total cost of all unreformed sinecures was estimated at under £ 17,000, down from £ 200,000 two decades earlier (Harling, 1995, p. 136). Rent-seeking in all its manifestations had become socially and politically unacceptable in early nineteenth-century Britain. There is no good explanation for this decline except to attribute it to the impact of Enlightenment thought, filtering through many layers and channels to the minds of the members of the British political elite in both parties. In England the influence of the Enlightenment had been more mixed with religious sentiment than in Scotland or on the Continent. Evangelical beliefs of what was moral mixed with Enlightenment notions of what was socially desirable to produce a regime that cultivated a governing style of disinterested public service. When the process was complete, by the second third of the nineteenth century, the British economy was as free of distributional institutions as any economy can ever hope to be.

A similar change happened, if somewhat belatedly, to international economic relations. Predatory warfare between the major European nations, continental and colonial, remained the rule during much of the eighteenth century and was a direct outgrowth of the zero-sum ideology that underlay Mercantilist-Cameralist policies. After the defeat of Napoleon, such predatory wars within Europe became rare, although Europeans obviously did not include non-western nations in their more enlightened approach to foreign policy. Whether the century of the *Pax Britannica* was entirely attributable to a new and less aggressive political outlook in Europe or the result of a new balance of power is unclear, but the few wars fought on European soil after 1815 (or elsewhere in the world between European colonial powers) were less predatory, destructive, and costly to the industrializing powers. As a result, the fruits of economic growth were not wasted on military spending and wars until the disasters of 1914 and beyond.

The enforcement of property rights through private-order institutions reflects something deep and supremely important about British institutions in the eighteenth century. The culture of respectability and gentility helped, if only for a while, solve the standard collective action problems that bedevil the production of public goods. The emergence of a plethora of networks, clubs, friendly societies, academies, and associations created a civil society, in which the private provision of public goods became a reality. What was true for property right enforcement was true for other projects where elsewhere in Europe the State played a major role. Roads, harbors, bridges, lighthouses, river navigation improvements, drainage works, and canals were initiated through private subscriptions. In some case, of course, there was the hope of making a profit, but commonly the entrepreneurs were motivated by the desire to improve local trade and employment. Voluntary associations founded hospitals, schools, orphanages, prosecution societies, charitable relief committees, as well as turnpike and canal trusts.[36] The belief that an improvement in the condition of the poor required knowledge of social conditions necessitated the collection of information and data about social conditions, and this knowledge, too, became a central tenet of the later Enlightenment. A typical institution was the Society for Bettering the Condition of the Poor, founded in 1797. Its founder wrote 'let us make the inquiry into all that concerns the poor and the promotion of their happiness into a science' (cited by George, 1966, p. 25). These philanthropic projects, typical of the age: a project that elsewhere was carried out by the State or the Catholic Church, they were voluntary and patterned after a commercial organizations, replete with a board of directors.

The way British society overcame the paradoxes of collective action in the eighteenth century was through reputation mechanisms. People wanted to do good, because they wanted to be seen as good, and that was to their advantage. This was particularly true in the new industrial urban areas, where the old poor law was less effective. Collective action to palliate the effects of economic crises were particularly necessary and effective in the new industrial cities. Middle class people wanted to take part in a community of socially-minded individuals (Lewis, 2001, pp. 250–55). Many of these organizations were subsequently confirmed by statutory authority acts, but they were initiated and managed by the spontaneous organization of private individuals, who banded together voluntarily to accomplish a common goal. These organizations formed a substitute for a more powerful and aggressive central government and they go some way toward explaining how an economy with a weak state was, all the same, so successful in transforming its economy faster and smoother than its rivals in Europe.

To sum up, what is most striking is what did not happen. The British state may have had the theoretical capability to be more predatory and repressive,

but was generally constrained from doing so. Taxes, while heavy in the eighteenth century and even more so during the French Wars, were levied primarily on consumption of the middle classes, whereas landowners (who had the political power to block progress) saw their relative tax burden lighten and entrepreneurs had no real worry that the government would in some way expropriate their profits. The Industrial Revolution began to generate large surpluses and profits for entrepreneurs and those who owned the resources they needed, though their exact timing and magnitude are not quite clear. These surpluses could have readily been expropriated by the powerful political factions that controlled British government, and used for their own benefit or perhaps to bankroll colonial adventures. Nothing of the sort happened. Once the distractions of the Napoleonic Wars were over, the income tax was abolished with great glee, and real government spending per capita was sharply contracted.[37] After Waterloo a more liberal creed began to replace the mercantilist instincts that had still ruled during much of the Hanoverian years. Neither the British government nor powerful special interests had more than a nibble from the gains that improving technology generated.

Another blockage to economic progress before the Industrial Revolution was resistance by vested interests, who had large fixed capital invested in the technological and political status quo. Acemoglu, Johnson, and Robinson (2005) raise a central question: if the income distributions in all societies were closely associated with the distribution of political power, why would anyone in a position to block change ever agree to give it up? In Britain, the landed classes had traditionally controlled much of Parliament, after 1688 in an informal coalition with the resurgent mercantile interests. Both of these groups had a lot to gain from maintaining the status quo in which mercantilist measures channeled rents to merchants and shipping interests and landlords received bounties on farm exports. How did this cosy arrangement slip between their fingers in the nineteenth century? In terms of political economy, the astonishing fact remains that the coalition that controlled parliament until deep in the nineteenth century, the large landlords and the merchant-financial elite, did not block the process that was to end their grip on power and enfranchised the middle class. Indeed, in a series of measures starting in the early 1820s and culminating in the great reform acts of 1829 and 1832, they opened the political process and provided increased political power to groups that had previously been excluded from de iure power.

Part of the answer must simply be that nobody saw it coming: the technological innovations of the Industrial Revolution transformed the British economy to a degree that was completely unforeseeable in the mid eighteenth century. Part of the answer was that the old coalition was given a

soft landing, and that eventual losers were compensated and bribed to cooperate: the Corn Laws were renewed in 1815 to maintain the income of those classes in a position to block economic reforms and some of the old arrangements were phased out gingerly and gradually. A third part of the answer is that the old landowning class benefitted from the development, in part because of the continued rise in rents until 1815, but also because many of them were able to profit from the rise in value of urban properties, mining areas, and other real estate.[38] Economic losers who were not political losers, as Acemoglu, Johnson and Robinson (2005, p. 435) maintain, would have been able to redistribute the incremental income to themselves if they retained political power. Indeed, the powerful British political elite did so, at least for a transition period long enough to absorb the shock and weaken their resistance. Finally, of course, there was the fear of rebellion. Commercial and industrial interests acquired *de facto* power during the Industrial Revolution, and obviously at some point those who wrote the rules had to heed their desires. Acemoglu and Robinson (2006, p. 350) argue that the concessions made after 1832 (they had actually started in the mid 1820s, with the repeal of the Combination Acts), were in large part motivated by a desire to pre-empt a rebellion or the need to repress it violently. Such pre-emptive action seems plausible (the British had closely followed the unfolding events in Paris in 1830), and it is clear that the Reform Crisis of 1831–32, including the rather serious Bristol riots in October 1831, was instrumental in bringing about reform (Stevenson, 1979, p. 221).

But the exact magnitude of the threat to overthrow the existing order remains unknown. The modest scale of British political riots, and the poor coordination between different groups suggests that the likelihood of success was never overwhelming. The reforms enfranchised the middle classes, but did little for the unskilled working poor, the displaced domestic workers, and paupers. Archer (2000, p. 93) concludes that the middle classes were as fearful of a violent revolution as any hard-line conservative. The Chartist movement, which was largely middle class and which in its early stages prompted a few outbreaks of local violence, actually followed rather than preceded the 1832 electoral reforms and led to no further franchise enlargements.[39] The year 1848 passed by relatively peacefully in Britain. On the other hand, any serious threat to the existing order would have been suppressed harshly. During the biggest threats, in the late 1790s and early 1800s, the government clamped down hard on dissidents through both legal and violent methods.

A separate role for changing ideology among the ruling elites therefore cannot be dismissed. Economic interests were important, but people at that time (or any other) do not vote *just* their pocketbook. The abolition of the profitable slave trade in 1807 was clearly a moral, not an economic choice.[40]

The impact of liberal political economy, the Enlightenment's proudest offspring, on many of the policymakers of the epoch is visible simply by examining the beliefs of the leadership. The dominant figure in the 'liberal Tory' government of Lord Liverpool of the 1820s was William Huskisson, an avowed Smithian, who passed a series of tariff reductions and was instrumental in re-energizing the reform movement in the 1820s.[41] The Enlightenment led to the more extreme radical reform movement of the 1820s in which ideologues like Joseph Hume and Francis Place fought for reform legislation informed and inspired by Political Economy as they interpreted it. The astonishing historical fact is not that such radicals were tolerated (though Place was dubbed 'a bad man' for his outrageous advocacy of contraceptives; he himself sired sixteen children), but how successful they eventually proved to be in implementing their liberal programs.

The other potentially important institutional impediment to the Industrial Revolution was resistance by the interests most directly affected by the technological changes affecting various industries after 1750. Resistance to new technology by organized or unorganized workers was a major issue in the eighteenth century and remained so during the Industrial Revolution. The groups that were on the losing end were above all domestic-industry workers who were being out-competed by factories, artisans of various levels of skills whose human capital was threatened by obsolescence, and small-scale farmers, the victims of the enclosure movement. These groups had access to a variety of effective means that were a times quite successful: from peaceful petitions to Parliament to legal strikes, to illegal rioting and machine-breaking, skilled and semi-skilled workers found ways to signal their disapproval. Many of these struggles had short term or local effects, and may well slowed-down the path of technological change in some regions.[42] The struggle over 'employment' can be seen in part as one over the sunk cost in specific human capital, and in part over threatened local market power. In fact, if there was ever a serious chance of popular uprising (Acemoglu and Robinson's *de facto* power), this may have been it. But the state did not make many concessions; it cracked down mercilessly on rioters, siding unilaterally with innovating employers.

In the 1790s and early 1800s the world was inevitably viewed by British policy makers in harsher terms than the peaceful harmony between cooperative nations that Enlightenment writers dreamed about. The implication of this new outlook was that in a hostile world Britain could not afford to pass on technological opportunities and supported employers against workers. In 1806, a Committee was appointed to decide the complaints of the West Country clothiers into the new gig mills that they felt threatened their livelihood. It is telling that the final report of the committee was written by William Wilberforce, M.P., better known for his successful

moral campaign against the slave trade. These principles supported the employers' rights without any hesitation. There can be no doubt that the concern about foreign competition was the main motive of the men in power to refuse the demands of the anti-innovation lobbies.[43] While the *Report* piously reiterated its conventional recognition of the 'merits and value of the domestic system,' it also felt that the 'apprehensions about it being rooted out by the Factory System were *at present at least* wholly without foundation' (Great Britain, 1806, p. 10, emph. added). Above all, however, Wilberforce and his colleagues regarded as gospel that 'the right of every man to employ [his] Capital according to his own discretion... is one of those privileges every Briton considers his birthright' (p. 12).[44] The resistance movement went underground, but with enough determination and force on the part of the State, it had little chance to prevail. The people in power had made up their minds — the eighteenth century was over. The determined and sometimes harsh policy in support of innovation was not entirely due to enlightened beliefs in the salutary effects of technological progress. Nationalism (and especially the fear of France) played as important a role. But liberal political economy had assigned to government a well-defined role, and redistributing income was not one of them.

There are other answers to question why the lower classes, both the working and the indigent poor, did not rebel more. British institutions provided something no other state did, a mandatory outdoor poor-relief system that remained in force until 1834. Its net effects on industrialization remains a matter of dispute (Solar, 1995). The poor law provided a big carrot next to a large stick of violent suppression and achieved its main goal, namely domestic order. The British government, more than in any other state West of the Elbe river, was able to keep its laboring poor in their place. The Poor Law, by providing the poorest workers with a safety net and thus reducing the need to cling to land at all costs, contributed to the creation of a proletariat needed for the factories and the railroad. It also helped in smoothing the labor supply both cyclically and seasonally. In addition, the poor law supported the practice of so-called pauper apprenti ceships. The provision of young factory workers from workhouses run by local Poor Law guardians provided an important source of unskilled la bor for the f actories, especially in rural and small-town mills before 1800.[45] All the same, the magnitude of these effects is hard to ascertain and in all probability was second order.

1.5. CONCLUSION

What were the institutional origins of the Industrial Revolution? As argued, this question only makes sense if we distinguish the 'big question' (why Europe?) from the 'small question' (why Britain?).We should emphasize that the differences between Britain and its European competitors was one of degree and of timing. The question is what kind of institutional environment, formal and informal, was most fertile to the successful sprouting of the seeds of the Industrial Revolution? The commercial environment and incentives that institutions created for the innovators and entrepreneurs who made the Industrial Revolution may have been central to Britain's leadership, even if they are harder to observe and measure than differences in the availability of coal. In part, its success was due to adaptive flexibility: the formal institutions of the British polity, rather than being 'right' or 'wrong,' proved to be sufficiently agile to change with the changing needs of the economy. Eventually, many of these advantages that gave Britain its lead were weakened and the lead that it had in the Industrial Revolution was lost. To the extent that the Enlightenment and its political and economic effects were important, other European nations could take equal advantage of them.

The solution to 'the commitment problem' after 1688 and the role of Parliament in constraining the executive have been at the center of the literature until now. We need, however, to be concerned with a wider set of issues than just the matter of 'who shall guard the guardian'. In part, the answer to the question of economic success in this age is about the informal social norms that defined the cultural beliefs of the elites, and allowed market exchange and innovation to operate in a regime of low transactions costs and reasonably self-enforcing norms of what Greif has called private-order contract-enforcement institutions. Hence, we need to consider the cultural beliefs of the political and technological elites. Cooperative behavior and trust based on gentlemanly codes allowed not just market exchange to operate but also created opportunities for new technology by allowing partnerships between inventors and entrepreneurship, and by providing Britain with a large contingent of highly skilled and dexterous craftsmen through well-functioning apprenticeships.

Institutional analysis is an important component of the emergence of modern economic growth and not just its continuation at later because the British Industrial Revolution occurred in a society that overcame successfully and at comparatively low cost the institutional obstacles to sustained economic growth in earlier times. Technological inertia, negative feedback, and opportunistic behavior at both the micro- and the macro level were gradually overcome in Britain in the century after the Glorious Revolution. In addition, formal institutions, above all the changing role and

orientation of Parliament, complemented the changes in informal institutions, to create an unexpected confluence of factors and circumstances that created the British Industrial Revolution. Enlightenment ideas, through a variety of mechanisms, influenced decision makers and legislators, hence real outcomes.

Assessing the 'importance' of institutions relative to other factors such as geography or demography assumes a separability that may be ahistorical. The synergy created by the interaction between the growth of useful knowledge in the eighteenth century and the formal and informal institutions that emerged side-by-side suggests a strong complementarity. With just technological progress but no institutional change, the process would have hit barriers that would have aborted the take-off, as in nineteenth century Russia. Had there been only better institutions, but no technological advances, the system would have similarly run out of steam and asymptoted off into a new stationary state (Mokyr 2006a). Sustainable and continuous economic growth needed both.

NOTES

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1. North (1981, p. 166) comes close to linking the institutional changes of the late eighteenth century with the Industrial Revolution when he maintains that it was explained by 'a combination of better-specified and enforced property rights and increasingly efficient and expanding markets'. North and Weingast (1989, p. 831) are more prudent and wonder if arguing that without the Glorious Revolution the British economy would have followed a very different path and would not have experienced an Industrial Revolution would be 'claiming too much'.
2. Stewart (1794, p. 72), who adds that the sentence appears in a small manuscript that was now in his possession, but which was not to be published.
3. By 1760, the great legal scholar Blackstone complained that 'Yet, though . . . we may glory in the wisdom of the English law, we shall find it more difficult to justify the frequency of Capital Punishment to be found therein, inflicted ... by a multitude of successive independent statutes upon crimes very different in their natures'. He added that the list was so dreadful that crime-victims were reluctant to press charges and juries reluctant to convict (Blackstone, 1765–69, Vol. 4, p. 18).
4. This argument has been made with great emphasis by Hay (1975), who stressed the strong class-bias in eighteenth-century British criminal law. For a critique, see Langbein (1983a), who has argued effectively that the bark of these draconian criminal codes was worse than their bite.

5. Eighteenth century law enforcement was in the hands of local magistrates and a part-time local parish constables. For the rest, justice had to rely on volunteers, local informers, vigilante groups, and private associations specializing in prosecutions of felons. Some 450 such organizations were established in England between 1744 and 1856. London developed its first constables after Henry Fielding was appointed magistrate at Bow Street in 1748, and his professional assistants or thieftakers became known as 'Bow Street Runners'. Yet it was not until after 1830 that anything remotely resembling a professional police force began to emerge in the rest of Britain and as late as 1853, half the counties in Britain were still without police. In fact, the eighteenth century idea of 'police' was quite different from ours: the word meant something like a series of regulations and regulatory agencies for the supervision of the manners, morals, and health of society rather than a body of officers (Paley, 2004).
6. Small debts could be settled through courts of voluntary arbitration known as Courts of Conscience (also known as Courts of Requests), which became increasingly popular after 1750 for settling debts without the burden of expensive court cases. These courts, significantly, were unpopular among working people who objected to the way they dealt with tallies run up in ale houses — a tell-tale sign that they were effective.
7. The most likely alternative to a decline in litigiousness is that courts became less accessible and more costly. On the other hand, courts enforced contracts (both written and verbal) increasingly through procedures called 'actions on the case' (such as assumpsit for debt) in which courts enforced contracts without a formal trial (though such trials could sometimes still result). Brooks (1998, p. 91) adds that it is even possible that the high volume of trials in the seventeenth century may have exerted a 'pedagogic effect' on debtor-creditor relationships.
8. Francis Place, (1771-1854), the radical politician and reformer, for instance, noted that 'the progress made in refinement of manners and morals seems to have gone on simultaneously with the improvement in arts, manufactures and commerce... we are a much better people than we were [half a century ago], better instructed, more sincere and kind-hearted, less gross and brutal' (cited by George, 1966, p. 18). Beattie (1986, p. 138–9) concurs with this view, and concludes that in 1800 British cities, and especially London, were less violent and dangerous places than in 1660.
9. The term 'bargaining in the shadow of the law' originates with Mnookin and Kornhauser, 1979.
10. As Brewer, 1982, p. 214, who was one of the first to point to the importance of this phenomenon, noted, 'reliability, fairness and generosity were the qualities most highly valued ... these attitudes oiled the wheels of commerce and enabled men to make greater profits'.
11. Adam Smith, in his Lectures of Jurisprudence, thought he had the answer: 'Whenever commerce is introduced into any country, probity and punctuality always accompany it. These virtues in a rude and barbarous country are almost unknown. Of all the nations in Europe, the Dutch, the most commercial, are the most faithfull to their word ... There is no natural reason why an Englishman or a Scotchman should not be as punctual in performing agreements as a Dutchman. It is far more reduceable to self interest, that general principle which regulates the actions of every man, and which leads men to act in a certain manner from views of advantage, and is as deeply implanted in an Englishman as a Dutchman. A dealer is afraid of losing his character, and is scrupulous in observing every engagement ... Where people seldom deal with one another, we find that they are somewhat disposed to cheat, because they can gain more by a smart trick than they can lose by the injury which it does their character' (1762, p. 327).

12. Defoe (1703, p. 19) famously wrote that 'Wealth, however got, in England makes lords of mechanics, gentlemen of rakes; Antiquity and birth are needless here; Tis impudence and money makes a peer'. Dr. Johnson, in the same spirit, noted that 'An English tradesman is a new species of gentleman' if he prospered sufficiently (Porter, 1990, p. 50). McCloskey (2006, pp. 294–96) traces the transformation of the word 'honor' in English and French from its aristocratic sense ('reputation') to its more capitalist sense of 'honesty' (reliability, truth-telling) and 'politeness' ('doing the right thing') when the importance of these concepts began to increase in the eighteenth century, and discovers that the same change occurred in the Dutch language.
13. By the mid-Victorian times, this was expressed almost as a caricature by Samuel Smiles describing what really mattered for the gentleman: 'The true gentleman has a keen sense of honour – scrupulously avoiding mean actions. His standard of probity in word and action is high. He does not shuffle or prevaricate, dodge or skulk; but is honest, upright, and straightforward. His law is rectitude – action in right lines. When he says YES, it is a law ... Above all, the gentleman is truthful. He feels that truth is the 'summit of being,' and the soul of rectitude in human affairs' (Smiles, 1859).
14. As Daunton (1989, p. 125) summarizes the traditional argument, 'the more an occupation or a source of income allowed for a life style which was similar to that of the landed classes, the higher the prestige it carried and the greater the power it conferred. The gentleman-capitalist did not despise the market economy but he did hold production in low regard and avoided full-time work'.
15. An example of this kind of arrangement existed in Manchester in the 1820s, where the Manchester Fire and Life Assurance Company's boardroom provided 'interconnected circuits of political, business, and social activities' to generate not only information underlying collective action but also regarding the reputations of the major players. Similar conditions were noted among Bristol sugar refiners in 1769 (Pearson, 1991, p. 388).
16. John Locke, for instance, wrote in 1693 that a gentleman's upbringing should endow him with a love of virtue and reputation make him from within 'a good, a vertuous, and able man' and with 'Habits woven into the very Principles of his Nature,' not because he feared retribution but because this defined his very character (Locke, 1733, pp. 46–7). Many decades later, the French historian Hippolyte Taine, who stayed in London in 1858, summarized the concept of a gentleman as 'the three syllables that summarize the history of English society' (Taine [1872], 1958, p. 144). The essence of the gentleman as Locke and his successors saw him 'was to be his integrity' (Carter 2002, p. 335). Paul Langford (2000, p. 126) observes that one of the British aristocracy's prime characteristics was the belief in fair play and that a cheating lord was a traitor to his class.
17. The French traveler Pierre Jean Grosley noted the 'politeness, civility and officiousness' of citizens and shopkeepers 'whether great or little' (Grosley, 1772, Vol. 1, pp. 89, 92). The eighteenth century Italian writer and philosopher Alessandro Verri felt that London merchants were far more trustworthy than their Paris counterparts (cited by Langford, 2000, p. 124). One French visitor to early nineteenth century London noted that British shopkeepers were fundamentally honest, and that a child could shop as confidently as the most street-wise market shopper (Nougaret, 1816, vol. ii, p. 12). Charles Dupin (1825, pp. xi-xii) went as far as to attribute Britain's economic successes to the 'wisdom, the economy and above all the probity' of its citizens. Reputation was critical. Prosper Mérimée, commenting on the open access policies in the British Museum Library in 1857, observed that 'The English have the habit of showing the greatest confidence in everyone possessing character, that is, recommended by a gentleman ... whoever obtains one is careful not to lose it, for he cannot regain it once lost' (1930, pp. 153–4).

18. 'At my begining I was too credulos and too slow in caling, and seldom made use of atturney, except to write letters to urge payments, being always tender of oppressing poor people with law charges, but rather to loose all or get what I could quietly, than give it to atturnies. And I never sued any to execution for debt, nor spend 20s in prosecuting any debter, and to loose all was more satisfaction to me than getting all to the great cost of my debtor, and to the preservation of my reputation' (Stout, 1967, pp. 120–1).
19. The extent of the spreading of these clubs is reflected by the founding of the Sublime Club of Beefsteaks' devoted to carnivory in 1735. The total number of friendly societies membership in 1800 is estimated at 600,000 (Porter, 1990, pp. 156–7).
20. Pearson (1991) documents in details the interconnected political, social, and financial networks of Manchester's cotton elite in the post 1815 period. These tight circuit were more effective in provincial towns, where information flowed more easily than in the metropole, and may have been a contributor to the advantage that provincial towns had over the capital.
21. The great ironmonger John Wilkinson, who played such a strategic role in helping Watt cast his cylinders, invested widely outside his field of expertise such as banks, agricultural improvements, mines, and the many canals promoted by his friend and fellow ironmaster, Richard Crawshay. Profits made in shipbuilding and banking were invested in breweries (Mathias, 1979, p. 240). Abraham Darby III invested not only in turnpike trusts but also in the great hotel built to face his great iron bridge in Coalbrookdale. The woolen manufacturer Edward Pease became George Stephenson's partner and a major entrepreneurial force in the early railroad enterprises.
22. Recent work on the history of entrepreneurs in the United States seems to have come to the same conclusion that networks and trust-through-connections are as important in entrepreneurial success as talent and ambition. See Laird (2006).
23. Other early examples of such priority disputes can be cited such as the dispute between Newton and Hooke (about the inverse-square force law) or the battle between two Dutchmen, Jan Swammerdam and Reinier de Graaf. on the discovery of certain aspects of female reproduction.
24. This process has been documented in great detail by Eamon (1994, pp. 319–50) who pointed to the influence of Francis Bacon and his followers in establishing this rule, as they realized that any progress was going to be the result of a cooperative effort. More recently Paul David (2004) has argued that open science established the quality of intellectual superstars, much in demand by courts and universities for prestige reasons.
25. A recent survey (Bowler and Morus, 2005, pp. 320–1) refers to the class of 'gentlemanly specialists', men who led the development of useful knowledge but did not make their living from it and were suspicious of anyone who did. At the same time, those who were not independently wealthy needed to find patronage either as University Professors or from government, industry, or wealthy individuals.
26. Josiah Tucker, a keen contemporary observer, pointed out that 'the Number of Workmen [in Britain] and their greater Experience excite the higher Emulation, and cause them to excel the Mechanics of other Countries in theses Sorts of Manufactures' (Tucker, 1758, p. 26). He must have thought of men like John Whitehurst, William Murdoch, Bryan Donkin, John Wilkinson, John Kay, Edward Troughton, not quite hall of fame inventors, but brilliant craftsmen.
27. Harris singles out the competence of the British iron puddler, requiring not only skills but experience and 'almost artistic judgement,' and adds that foreigners would have had a hard time importing this competence, because it was the British skilled worker who was the repository of the knowledge. He absorbed the skills needed to work with coal and iron 'with the sooty atmosphere in which he lived' and would find it hard to know even what needed to be explained (Harris, 1992, pp. 28, 30)

28 The French scientists and industrialists Jean-Antoine Chaptal noted that in many branches of manufacturing the British had become dominant, but that even after importing the machinery the French could not compete and sold at twice the price of the British because they lacked the immense details, the customs, and the 'turns of hand' (dexterity) and that while the slow progress of industry could be accelerated by learned men, there was no substitute for experience (Chaptal, 1819, Vol. 2, pp. 430–1).

29. The French political economist Jean-Baptiste Say, a keen observer of the economies of his time, noted in 1803 that 'the enormous wealth of Britain is less owing to her own advances in scientific acquirements, high as she ranks in that department, as to the wonderful practical skills of her adventurers in the useful application of knowledge and the superiority of her workmen' (Say [1803], 1821 Vol. I, pp. 32–3.). Another Swiss visitor, De Saussure had noticed the same seventy-five years earlier: 'English workmen are everywhere renowned, and justly. They work to perfection, and though not inventive, are capable of improving and of finishing most admirably what the French and Germans have invented' (de Saussure, 1902, p. 218, letter dated May 29, 1727). The great engineer John Farey, who wrote an important treatise on steam power, testified a century later that 'the prevailing talent of English and Scotch people is to apply new ideas to use, and to bring such applications to perfection, but they do not imagine as much as foreigners'.
30. Local studies have concluded that in the eighteenth century while masters had an incentive and opportunities to exploit and abuse the young, few apparently did so (Rushton, 1991, p. 101). Reputation effects seem to have been important here, since apprentices without parents protecting them were in greater jeopardy of being in some way cheated by their masters.
31. Humphries (2007, pp. 22–3) recounts a number of cases in which disputes between master and apprentice were resolved by social and reputational pressures, many of them supported by the need of the master to maintain his social relations with the parents. Her sample of hundreds of autobiographical accounts of working class people, provides a unique picture of the centrality of apprenticeship in the intergenerational transfer of human capital.
32. In 1777 the calico printers admitted that fewer than 10 percent of their workers had served because 'the trade does not require that the men they employ should be brought up to it; common labourers are sufficient' (Mantoux, 1928, p. 453).
33. Thus Jean-François Melon, a friend of Montesquieu's, wrote in the 1730s that the 'the spirit of commerce and of polity are inseparable ... the spirit of conquest and the spirit of commerce mutually exclude each other in a nation' and added that it was commerce, not violence that supplied the 'wisdom for preservation' (Melon, 1738, pp. 136–9).
34. Kindleberger (1978, p. 52) who admits that in some cases 'free trade is the hypocrisy of the export interest' felt that 'in the English case it was more a view of a world at peace, with cosmopolitan interests served as well as national'.
35. As Harris (2000) has shown, the Bubble Act was primarily used as an exclusionary tool by incumbents to reduce entry and competition.
36. The example of Thomas Coram, described eloquently by Colley (1992, pp. 56–60) is illustrative: a successful merchant, he became a leading philanthropist particularly concerned with foundlings and orphans, and established a famous foundling hospital in London in 1741. The Marine Society, established by Jonas Hanway in 1756, similarly was a project run by merchants.
37. Total government gross income went from a peak of £ 69.2m in 1817 to a trough of £56.3m in 1854. The national debt peaked at £ 844 m in 1819 and then fell to £ 774m in 1854. Nominal GDP went from £ 322m in 1821 to £ 718m in 1854, thus reducing per capita taxation by 57 percent and national indebtedness by 59 percent.

38. Rubinstein's rather heroic estimate of landed and non-landed millionaires and half millionaires dying between 1809 and 1859 shows 179 landed millionaires vs. 10 non-landed millionaires, and 338 landed half-millionaires as compared to 54 non-landed ones (1981, pp. 60–5). As Rubinstein (ibid., p. 61) remarks, 'an observer entering a room full of Britain's 200 wealthiest men in 1825 might be forgiven for thinking that the Industrial Revolution had not occurred'.
39. William Lovett's Charter dated from 1838 and fizzled out after 1848, twenty tears before the next big electoral reform. The most serious outbreak of violence was the 1838 Newport riot that left fifteen people dead.
40. Scottish serfdom, a quaintly anachronistic institution in the eighteenth century that involved miners and salters was abolished in 1774 (the last traces were removed as late as 1799). These Acts, declared Parliament, would 'remove the reproach of allowing such a state of servitude to exist in a free country' (cited by Smout, 1969, p. 406).
41. Huskisson 'zealously and consistently subscribed to the theories of Adam Smith. Smith's teaching, reflected in practically every reform in the twenties' (Brady, 1967, p. 133). Equally well-documented is the enormous influence that Wealth of Nations had on other policy makers, especially after Dugald Stewart, Smith's successor at Edinburgh, turned the book into a fountainhead of wisdom (Herman, 2001, pp. 229–30; see also Rothschild, 2001). Among Stewart's pupils were two future Prime Ministers, Palmerston and John Russell. His program was to remove all state support and protection for manufacturing and agriculture.
42. Thus, in Wiltshire, shearmen through the 'Wiltshire outrages' of 1802 were able to prevent the introduction of gig mills until after 1815; the machinery destroyed during the Luddite riots took some years to replace; and as late as 1830, the Captain Swing riots delayed the introduction of agricultural machinery into the South of England by many years. Randall (1991, p. 289) feels that the resistance, at least in some areas, gave the artisans 'many extra years respite'.
43. The language used by the committee is telling: 'If Parliament had acted on such principles [on which the use of these particular machines is objected to] 50 years ago, the Woollen Manufacture would never have attained to half its present size ... its Augmentation is principally to be ascribed to the general spirit of enterprize and industry among a free and enlightened people ... It is likewise an important consideration ... that we are at this day surrounded by powerful and civilized Nations, who are intent on cultivating their Manufactures and pushing their Commerce' and specifically mentioned the worrisome evidence of such an establishment being set up in Paris. See Great Britain, B.P.P. 1806 No. 3 ('Select Committee on State of Woollen Manufacture of England'), p. 7.
44. As the biography written by his sons recalls, Wilberforce had to mediate between the valuable men 'of small capital who, with the aid of their own families, prepared the goods at home' and 'enterprising capitalists'. He laid down the 'clear principles on which trade must be conducted' (Wilberforce, 1838, Vol. 3, pp. 263–7).
45. Some of the transactions between Poor Law authorities and mill owners resembled the slave trade; for example, the purchase of seventy children from the parish of Clerkenwell by Samuel Ol dknow in 1796 (Mantoux, 1928, p. 411).

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