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The Factory: An Historical Theory of the Firm View

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1. Introduction

One stylized fact about the factory is that it was the result of the British Industrial Revolution (BIR); another is that it was the first form of the capitalist firm. As a result of the rise of the factory, the *firm* as such became the dominant form of production.

Economic historians have always investigated the rise and the spread of the factory system, analyzing, in this way, the *origin* of the factory system in depth. However, by its nature this inevitably lacks an analysis of the essence and *nature* of the factory, which is a core question in the theory of the firm. The theory of the firm, however, due to the dominance of formal models explains *the* firm as such, and in this way is ahistorical.¹ There is no doubt that the first papers in the theory of the firm (e.g., Coase 1937) explained the nature of the firm irrespective of time and space, a perspective that later became dominant. The rare exceptions who put the firm in a historical context were Langlois (1999), Pitelis (1998) and Leijonhufvud (1986).

So, the two major questions, namely what caused the factory system to emerge (the *origin* question) and what is the nature or essence of the factory (the *nature* question) are asked and answered separately by economic history and the theory of the firm, irrespective of their organic relationship. The major argument of this paper is that the *origin* and the *nature* questions have to be answered simultaneously, which leads to a *historical* theory of the firm view for an understanding of the factory. The starting point of this perspective is the view that the capitalist firm is historically specific (Hodgson 2001); that is, it emerged in a concrete historical context – accordingly, an explanation for the factory needs a historical perspective. On the other hand, the *nature* of the capitalist firm, i.e., its distinctive characteristic, has to be emphasized in the explanation, too. Having said that, an *historical* theory of the firm perspective helps us not only to explain why *the* capitalist firm emerged, but also highlights its distinctive attribute at the same time.

A basis for this framework is a critical analysis, from the viewpoint of the theory of the firm, of the existing economic history views on the factory which attribute to the factory three major characteristics, namely centralization of production in one place, the use of machinery and factory discipline. Economic historians put one or more of the above characteristics at the centre of their argumentation concerning the rise of the factory. From the viewpoint of my approach, the main shortcoming of these views is that they do not identify the distinctive attribute of the factory, i.e., the characteristic that marks its basic difference compared to previous production forms, because the presence of the above three attributes do not necessarily imply firm-ness. This analysis relies basically on a comparison with the previously existing production form, namely the putting-out system (cottage industry).

To sum up, in this paper I approach the factory from a historical perspective, that is, through the process of its emergence in the BIR. This historical approach will lead me not only to the Coasean argument that the employment relationship (authority) is the essence of the factory (firm) but here the *why* will also be highlighted through historical events.

¹ See Pitelis (1998) for a critique of transaction costs economics for its lack of a historical basis.

The paper is organized as follows. In section 2 I will show the historical background of the factory, that is, the system that prevailed before it: the putting-out system. The economic history views on the factory will be summarized and criticized in section 3. Section 4 will be devoted to a clarification of what the factory system is. In section 5 I will bring the *origin* and the *nature* questions together, developing the framework for a *historical* theory of the firm view on the factory. In section 6 I will provide a summary.

2. Historical background of the factory: the putting-out system

The dominant production system before the BIR was the cottage industry which operated mainly in the framework of the putting-out system.² The putting-out system was already known by the late Middle Ages, especially within the textile industry and it was the major organizational form for commercial production until the early 19th century.

In fact the putting-out system was a "big production organization" in the sense that the putter-out subcontracted with many artisans producing in their own homes, managing in this way a complex network of contracts of manufacture. The putter-out supplied raw material and capital, especially working capital, because fixed capital was insignificant at that time (Marglin 1974). The head of the domestic craftshop was the artisan who worked with family members and a couple of apprentices. The household was the unit of production and the work was divided between members of the family; so household and workplace were not separated (Mokyr 1993, 2002). The raw materials, the tools and the products were owned by the merchant – the putter-out, who outsourced the production to the artisans working at home and paid not a wage, but a price, for the products.³ Accordingly, the putting-out system was a decentralized production system, supervised by the putter-out, in which the artisans were subcontractors. The putter-out performed both managerial and entrepreneurial roles since he or she supplied capital, supervised the output, and organized distribution and sales.

This system was of course adapted to different economic, social and cultural settings: it had prevailed for a long period in England, France, Germany and Italy. In particular settings the putter-out had only a subordinated role, while in others, where investments were important, he or she played the principal role.

From a theory of the firm perspective, the putting-out system should not be considered a firm, rather it consisted of market contracts, although these were long-term contracts.⁴ The artisan was formally independent, he or she determined the production, and exchanged the product against raw material with the putter-out (Cohen 1981). The putter-out did not have authority over the artisans; accordingly, he or she could motivate the artisans only through prices, i.e., market coordinating mechanisms. The shortcomings of this system, in this way, derive from the absence of authority-based coordinating devices such as command. All this led to relatively high costs for the putter-out in monitoring the quality, and what is more, the monitoring of the production process itself was simply impossible. Embezzlement and fraud were common features of the putting-out system, which served to increase artisans' income. It covered different activities: pilfering of raw material for direct sales, embezzling of materials, working secretly with stolen materials and pilfering of finished goods. This was a kind of principal-agent problem. Later on, when the division of labor became more extended and the product more complicated, the putter-out had to face even higher agency costs, which loosened the system.

² For details on putting-out see Landes (1966) and Magnusson (1991).

³ Of course, there were slight differences as regards the practice of different merchants, but the common feature was that the producers worked up raw material put out by the putter-out and the product was taken care of by the putter-out. In some cases, however, artisans utilized their own tools (Magnusson 1991).

⁴ Note also that the putting-out system had no organizational characteristics either (Kieser 1994).

The factory system, however, did not arise overnight and the transition to the factory system was a slow process. In this process the putting-out and the factory system co-existed for a long period, and it took almost 100 years for the factory to become the dominant form of production (Mokyr 1993, 2001, 2002, Jones 1987). This means that the cottage industry and the factory system were alternative trajectories; either of them could become more advantageous under particular circumstances.⁵

However, it must be noted that the BIR did not invent the factory system, the industrial revolution contributed only to its transformation and spread (Mokyr 2002). Here factory means a production unit (organization) involving many workers under one roof. But, as Geraghty (2003) argues, such plants existed in Britain largely before the BIR.⁶ One category of such workplaces involved production processes too large or energy-intensive to be performed in a small shop or at home. These were fulling mills, glassworks, breweries, paper mills, and hammer forges. The other category of large-scale production units was the protofactory, an agglomeration of workers using more-or-less traditional hand technologies. The primary rationale for these centralized workplaces was organizational: direct supervision allowed improved quality control and a more intensive work pace. According to Geraghty (2003), the emergence of these early factories was not the result of the technological changes brought about by the BIR; the first factories appeared in textile, more specifically in carding and bleaching.

Factories satisfying the criteria of the capitalist firm⁷ appeared first in textiles, in the silk industry. Thomas Lombe's silk mill, built in Derby in 1718 marks a radical departure from the typical pre-industrial factory by using a centralized power source. Jones (1987), analyzing in detail the development of the silk industry, shows convincingly that the spread of the factory system in silk followed technological breakthroughs. The first wave of factories was in silk throwing following the exploration of Thomas Lombe's patent in 1732. Weaving was slower to enter the factory: the Jacquard-loom invented in France was first used in England in about 1822, which resulted in the movement of silk weaving into the factory. To sum up, the transition to the factory system in the silk industry was relatively significant, but this process was never completed in the sense of including all production units (Jones 1987, 1999).

The spread of factories in other branches of the textile sector was less spectacular. First, a kind of mixed system developed, as in the cotton industry. Here some production activities were outsourced to small craftsmen working in their homes, while the rest of the production was organized within mills.⁸ While the transition to the factory from domestic work was the most dramatic in textiles, it still took a century or more to complete (Mokyr 2002).⁹

Besides textiles, factories also penetrated other industries in England (Geraghty 2003). In the British iron industry two major innovations transformed both scale and organization: coke smelting and the puddling and rolling process. Coke smelting increased the capital-intensity and the minimal efficient scale in iron production. The puddling and rolling process extended the division of labor and permitted an almost continuous process. In metalworking the large-

⁵ In fact, large-scale production and small craftshops represent two extreme poles as regards the organization of production. In many regions of Europe (Lyon, Sheffield, Northern Italy) networks in which small- and large-scale production were combined developed (Piore and Sabel 1984).

⁶ See the Pollard's examples (1965).

⁷ The capitalist firm is historically specific and has certain different characteristics compared to the firms of the previous era. These are: private ownership of assets and the employment relationship (see Hodgson 2001).

⁸ Richard Arkwright's cotton spinning mills of the 1770s were the archetype of the early modern factory, and utilized sophisticated water power systems and a nearly continuous flow of materials (Geraghty 2003).

⁹ In the Continent the emergence of factories lagged behind that in Britain (Geraghty 2003). In addition, the system itself, due to the different social-economic-cultural environment, was slightly different. As Kieser (1994) argues, in Germany for instance, as a result of poor education, there was a lack of a skilled labor force, which led to Germany's well-developed apprenticeship system, assisted by mill owners.

scale production and the use of steam power were commonplace. In the pottery industry Josiah Wedgwood pioneered large-scale factory production, and used innovative production techniques and steam power. In Britain by 1860 the progress of mechanization had led to a kind of industrial dualism in many industries.

3. Economic history views on the factory

Since the rise of the factory was the result of the BIR, economic history has long devoted special attention to an explanation of the emergence of the factory, dealing, in this way, with the *origin* question: Why did the factory system arise when it did? Traditional economic history sees new technology brought about by the BIR as the core factor culminating in the rise of the factory (Mantoux 1961, Landes 1969, 1986, Mokyr 1990, 2001, 2002, Jones 1982, 1987): "The factory system was the necessary outcome of the rise of machinery" (Mantoux 1961:252).

Three major strands of explanation can be distinguished within the large literature at our disposal. One focuses on those factors that led to the centralization of production "under one roof" (Mokyr 1990). The second sees the cause of the rise of the factory in the use of machinery (Mantoux 1961, Landes 1986, Marx 1867). The third strand equates the rise of the factory with the appearance of factory discipline. In what follows I will present these theories, while also providing a criticism on the grounds of the neglect of the *nature* question.

3.1. (Centralization of) production "under one roof"

Mokyr (2001, 2002) is the leading scholar in arguing that technology, together with knowledge drove the emergence of the factory. According to him, one of the major novelties of the BIR was a huge expansion in the knowledge base of the techniques in use. This means that efficient production required more knowledge than a single household could possess. Due to the macroinventions of the BIR many of the industries increasingly required a level of knowledge and a set of operating procedures that were beyond the capacity of the individual household. Factories became the repository units for technical knowledge and reduced access costs to this knowledge for individual workers. In addition, factories could employ experts (engineers, mechanics, chemists) to assure the critical knowledge for production.

What is emphasized by Mokyr (2001) is not simply the new technique, but the changed character of the technique: the inventions of the BIR required new knowledge, basically mechanical-technical knowledge, which led to the separation of households and production: the location of production became a centralized place, namely the factory (mill). In this way, Mokyr believes that the rise of the factory is the result of the increased technical knowledge required by the inventions, and such knowledge was simply not available within households. Inside the plant agents knew and could trust each other, and this turned out to be an efficient way of sharing knowledge. As long as the minimum knowledge requirement was small, plants could be small and coincided with households (Mokyr 2001, 2002). When production unit, which extended the division of labor within the plant: everyone specialized in one task, increasing in this way the distributiveness of knowledge (see also Hayek 1945). The plant not only made the workers specialize, but it also coordinated the exchange of knowledge between them.

Accordingly, the whole issue of the emergence of the factory is reduced to the question of the physical location of production. In the theoretical framework of Mokyr, production units needed increasing internal specialization and a higher level of competence – which led to a

better division of labor – because more knowledge was necessary to operate the best-practice technique.

So, in fact, Mokyr (2001) argues that technology affected not only the output, the income and well-being, but also the location where production took place: a major attribute of the BIR was the concentration of former artisans and domestic workers under one roof. As previously noted, according to him, this phenomenon was largely driven by technology. Mokyr also recognizes that large firms were quite widespread before the Industrial Revolution, but their employment was domestic labor (cottage industry), on a putting-out basis. In this system the technology did not require that physical production be located in a central place; the workers were independent farmers or craftsmen.

As a leading factor behind the concentration of workers under one roof Mokyr (2001) highlights the change in the ratios of costs and benefits of moving information relative to that of moving people: due to cheaper transportation (railroads, roads, urbanization), it became relatively cheaper to move people (Sosztak 1989). So, the benefits of the concentration of production were related to the size and the complexity of the knowledge needed for production to take place (Mokyr 2001). It was simply more efficient to move specialized workers to the job than try to communicate all the necessary information through a decentralized production network.

The fact that the factory system centralized the production under one roof is, of course, an important aspect of the factory. However, the "under one roof" view is related only to the *origin* question; more precisely, it provides an answer – from a given perspective – to the question of why and how the factory emerged. But this perspective does not deal with the *nature* of the factory, and accordingly, cannot establish the nature of the factory. Clearly, the essence of the factory was not centralization under one roof. Even historical facts undermine this. As Landes (1969:14, 24) shows, production in many industries, including iron, chemicals and ship-building took place in a single location, but was not organized along "factory lines"; that is, although production was centralized, it was not organized as a firm (factory). As I mentioned above, Geraghty (2003) highlights that some production processes, such as fulling mills, glassworks, breweries, paper mills and hammer forges were too large or energy-intensive to be performed in small shop or in the home. So while location distinguished the putting-out system from the factory, it does not follow that centralization automatically implied factory organization (Cohen 1981): in many cases workers at these places were single artisans working with their own tools, being is this way independent (sub)contractors.

To conclude, centralization of production in one place is, of course, an important attribute of the factory, but cannot distinguish the factory from previous organizational modes of production.

3.2. The use of machinery: large-scale production

Another strand of the economic history literature also sees the rise of the factory as a wholly technical event by emphasizing the role of the use of machinery. In fact, mechanization increased fixed capital, and accordingly, by leading to increasing returns to scale, it increased the optimal scale of production (Mantoux 1961, Landes 1986).

So, the increase in the optimal scale of production was largely due to the use of the new machines brought about by the BIR.¹⁰ As argued by Landes (1986), machines and new techniques meant gains in productivity and a shift in the relative importance of factors of

¹⁰ "... what made the factory successful in Britain was not the wish, but the muscle: the machines and engines. We do not have factories until these were available, because nothing less would have overcome the cost advantages of dispersed manufacture (Landes 1986:607).

production. He also emphasized that the logic of technology was towards even wider mechanization (ibid p. 615).

Of course, some equipment could not be made equally efficiently in small craftshops and in large plants (e.g., chemicals, iron making). Heating, lighting, power supply and security were all activities in which scale economics were the result of technical considerations. In addition, there were non-technical economies in scale, too, such as marketing or finance. Besides these factors, according to Landes (1986), more extended specialization also contributed to the cost advantage of the factory as compared to the putting-out system.¹¹

The cotton industry was the first to use machinery and became the example of modern large-scale industry (Mantoux 1961). Thomas Lombe's silk factory was the real beginning of the factory system in England, he was a precursor. Just to give an idea of the scale of his plant, let me recall here Mantoux's description of the factory: five hundred feet long, five or six storeys high and pierced by 460 windows, it employed 300 workers, used automatic tools and maintained continuous and unlimited production.

Economies in scale were important for the factory, of course, but they were not omnipotent and cannot fully explain the rise of the factory (Leijonhufvud 1986). As argued by Cohen (1981) the use of machinery in itself cannot explain the rise of the factory system; rather, the use of machinery contributed primarily to a decrease in production costs, and, accordingly, to the spread of the factory. Moreover, according to Pollard (1964), the role attributed to fixed capital is exaggerated: while in some industries the proportion of fixed capital as compared to working capital increased during the BIR, in a typical mill it was about 50% between 1780 and 1830, which is not so high (Pollard 1964:302). In fact, capital finance problems were much more related to the working capital, consequently it was not a factory-specific problem, but rather that of the putting-out system.¹²

The fact that large-scale production was not synonymous with the factory can be historically proven. As mentioned before, large-scale production units were present largely before the BIR: in even in 16th century England large cotton mills or mines operated whose size was not dictated by technology (machinery). Moreover, as argued by Mantoux (1961), large-scale production was almost exclusively artificial in France and it was supported by the French Crown. The best example of this was the Gobelins works. But the creation of these royal manufacturers in the 17th century must not be confused with the spontaneous growth of the factory in the following century in England. Mokyr (2002), when characterizing the putting-out system, clearly argues that, in terms of the size of production, it also was a large-scale production unit, since the merchant-entrepreneurs worked with a large number of artisans; and on the other hand, as argued by Landes (1969), there were many small-scale factories, as well.

Besides the above-mentioned historical facts which cast doubt on the equivalence between the factory and large-scale production, there is an even more fundamental problem, namely that it is very difficult to decide at what point machinery begins and tools end, since the factory did not arise overnight and the introduction of machinery was not accomplished at once; rather, as argued before, the transition to the factory system was a slow, gradual process, characterized by a mixed system; there was no clearly marked division between manufacture and the factory system.¹³ But how can we distinguish manufacture from the

¹¹ The extent of specialization is well documented by the data of the Wedgwood porcelain plant: out of the 278 people that Wedgwood employed in June 1790, only five had no specified post, the rest were specialists (McKendrick 1961).

¹² Pollard (1964) also emphasizes that the finance of fixed capital was much more difficult, something which caused serious problems in utilities (roads, canals).

¹³ According to Mantoux (1961), the use of machinery was only one of the principal factors, but probably the most fundamental one, in the modern factory system.

modern factory? According to Marx (1867) the distinguishing feature of the factory is the use of machinery. However, machinery was used even in domestic production, such as the jennies and mules that were present almost exclusively in domestic production (Berg 1991).

To conclude, the use of machinery is a non-exclusive attribute of the factory; accordingly, it cannot establish the *nature* of the factory. However, it clearly refers to macroinventions of the BIR, establishing in this way an important relationship with historical facts.

3.3. Factory discipline

The third line of the economic history literature on the factory devotes attention to an aspect that brings us closer to the theory of the firm perspective. Rather than emphasizing technological aspects like the other two, it puts an organizational issue at the centre of the explanation, namely the nature of the work involved. The nature of work altered greatly during the BIR, as employees were subject to supervision, coordination and discipline (Geraghty 2003). As soon as fixed cost became important, the employer had an interest in supervising workers because shirking reduces the utilization rate of fixed capital.

Those scholars (e.g., Geraghty 2003, Pollard 1963, McKendrick 1961, Clark 1994) who share this perspective seem to admit that technology alone does not explain the rise of the factory system. This kind of explanation is related to organizational considerations: the factory arose to solve asymmetric information problems.¹⁴

In factories there was expensive capital equipment, interdependent production processes, and the need for improved quality. For these reasons, as explained by Geraghty (2003), owners introduced fixed working hours, punctuality and consistent attendance, high levels of work effort, an emphasis on the uniformity of finished product and proper care of the equipment. In smaller factories direct process supervision and face-to-face contact between supervisors and workers was sufficient to establish rudimentary levels of discipline. In larger factories where direct communication and control was not feasible factory discipline regimes were codified into work rules. Enforcement of discipline relied on deterrent mechanisms such as corporal punishment or the threat of dismissal (Pollard 1963). Later owners turned to positive incentives, including piece rate pay, or bonuses tied to productivity. Owners tried to engender loyalty by offering their workers various paternalistic fringe benefits (housing, sickness and accident insurance, pensions, medical care, educational facilities, etc.).

The factory discipline contributed to a large extent to a standardization in and improvement of product quality through the introduction of quality standards (Magnusson 1991), quality control (Cohen 1981) and the training of workers within the plant¹⁵ (McKendrick 1961). This quality control contrasts sharply with the experience of earlier modes of production. Under the putting-out system quality was largely unobservable as direct process supervision was not possible.

To state it explicitly, supervision took two basic forms. Where a large number of skilled workers were used, owners relied on a subcontracting system. Master craftsmen were responsible for hiring, supervising, disciplining and paying their own workers. The masters were also often responsible for setting up and maintaining their own machinery and had the power to determine the pace of work. Where many workers were unskilled, shop-floor management was typically carried out by a group of foremen who formed a lower level of management.

¹⁴ Note that some scholars from the theory of the firm school (e.g., Langlois 1999) offer a hybrid theory that incorporates elements of both the technology and organizational views.

¹⁵ Mokyr (2002) points to the fact that factories changed the formation of human capital as well: the factory assumed a role in training its workers both within the factory and via a subsidy of schools.

This strand of the literature also suggests that the factory system was important not only as a way to centralize physical plant, but also as a means to centralize organizational decision-making concerning the aspects of production: the factory was a new type of organization in which the factory owner had more control over both technological and organizational issues.¹⁶

From a theory of the firm perspective, factory discipline, in fact, was monitoring. Quality standardization, punctuality, supervision, etc. served to overcome the information asymmetric problem present in the production process (see Alchian and Demsetz 1972). From the perspective of my concern here, an important advantage of this strand of economic history is that it takes the factory as a both technical and organizational unit, a view that comes closer to the theory of the firm. However, it is still not clear what caused factory discipline and whether factory discipline marks the distinctive attribute of the factory.

4. What is a factory?

What exactly constituted a factory is difficult to establish based on the economic history literature. This is partly because the *nature* question is not at the forefront of this literature. However, when dealing with the rise of the factory even this literature sheds some light on what the distinguishing feature of the factory was. So, the term "factory" is not as unambiguous as it would seem to be at first glance. Basically two different meanings are present in the economic history literature, and these two are not always clearly separated from one other. One meaning is rather technical, the other is organizational. The views adopting the "under one roof" and the "use of machinery" arguments rely on a technological perspective, while completely neglecting the organizational aspect of the factory. The "factory discipline" view emphasizes organizational aspects, but does not refute its technological roots. How is the factory understood by these two views?

In the first view the essence of the factory is almost exclusively embodied in how production was organized within it: a central power source, machinery, continuous production, scale and efficiency (Jones 1999) etc. But even scholars within this branch of the literature admit that the factory was more than just a large production unit; it was rather a system of production in which the worker and the capitalist were bound by supervision and discipline (Landes 1986). Mantoux (1961) also argues that by the factory one means a particular organization, a particular system of production. Sombart (1902:26) tries to define the factory both by technical and economic characteristics. From the technical point of view he emphasizes the same points as Mokyr, namely that its main feature is the concentration of production in one establishment, with machinery moved by central force. From an economic point of view he points to the special relationship that existed between the capitalist and the worker: a kind of commanding power.

The above technical view of the factory must be augmented by the Smithian one, emphasizing the introduction of line production replacing the craft production of the puttingout system. He stressed that line production (Smith 1776) may allow an increase in the degree of the division of labor. In the Smithian story, however, the shift to the factory is not initially characterized by a new technology, but by the extension of market (demand), which led to the division of labor (Morroni 1992). Adam Smith, in his example of the pin factory, showed how an increase in demand may allow a reorganization of production, which brings about an increase in productivity and a shift from craft production to line production, typical of the factory system.

In contrast to the above views, Georgescu-Roegen (1970) clearly argues that the factory system is independent of technology. He explains that in a factory the economy of time

¹⁶ This view is given evidence by Gerarghty (2007) in his empirical analysis testing his complementary thesis.

reaches its maximum because line production allows a shift in workers and tools without interruption to the following process. He stresses that in every elementary process every agent is idle over some definite periods, and there is only one way to eliminate this idleness: the factory system. So, according to him, the root of the factory can be found in domestic workshops that introduced line production due to an increased demand. In his sense not every production activity can be turned into a factory. In Georgescu-Roegen's (1970) view the factory is a new type of organization of work, based on line production, which is different from the production characteristic of previous times.

The above views are in sharp contrast with the modern theory of the firm which identifies the nature of the firm in elements different from a simple association with production issues. Even the "factory discipline" view of economic history is much closer to the theory of the firm because it clearly recognizes that the factory was an organization. What is missing from this view is a clear recognition of the fact that the factory was the first form of the capitalist firm. In this spirit Mantoux (1961) was right when saying that "[t]here was more difference between a spinning mill and a domestic workshop as they existed side by side between 1780 and 1800, than between a factory of that day and the modern one" (Mantoux 1961:251).

To sum up, what is missing from economic history is the recognition that the factory was the first form of the capitalist firm. Following Hodgson (2001, 2002) who argues that the firm is a historically specific institution, I propose to rely on his definition: "A firm is defined as an integrated and durable organization involving two or more people, acting openly or tacitly as a legal person, capable of owning assets, set up for the purpose of producing goods or services, with the capacity to sell or hire these goods or services to consumers" (Hodgson 2002:56). This definition points to two aspects of a firm: technological and organizational, and both are present within the factory

In what follows, when proposing a *historical* theory of the firm view on the factory, I take the factory as a *firm*. Accordingly, I augment the economic history views discussed and criticized above, by relying on what the theory of the firm says on the distinctive feature (nature) of the firm.

5. Taking the "origin" and the "nature" questions together

The stylized fact about the BIR, emphasized by economic history, is that it brought about the factory system. The one proposed by the theory of the firm is that it is the capitalist firm that came into existence with the emergence of the factory. These two stylized facts are stated by two different disciplines whose analyses are centered on different key questions. Economic history focuses on analyzing why the factory system arose (the *origin* question), while the theory of the firm is concerned with analyzing the essence of the factory (the *nature* question). The two disciplines basically developed in separation from one other. My argument is that the *nature* and the *origin* questions should be answered simultaneously. To arrive at such a perspective, the two disciplines must admit, at least partially, each other's characteristics.

As for the theory of the firm, except for – among others – Langlois (1999) and Pitelis (1998), it explains *the* firm without paying attention to historical specificities (Hodgson 2001). However, there is no doubt that the theory of the firm needs a historical background when it comes to the factory.¹⁷

Economic history, on the other hand, as shown by the above discussion, provides us with a detailed analysis of three aspects of the factory, namely the centralization of production under one roof, large-scale production and factory discipline. The major criticism vis-à-vis

¹⁷ Kieser (1994) provides general arguments in favor of why the theory of the firm necessities historical analysis.

these views from a theory of the firm perspective is that they cannot reveal the distinctive attribute of the firm, the one that differentiates it fundamentally from other forms of production of previous times. Thus the factory had numerous common attributes of previous modes of production; accordingly, these cannot be considered distinctive ones. Table 1 summarizes the attributes of the factory as contrasted with those of the previous forms of production as is emphasized in economic history. So, the characterization of the factory, as featured in economic history, is an important analysis, but it cannot be equated with an explanation for the *nature* of the factory.

	Scale	Technology	Work organization
	(workers)		
Domestic	1-5	Simple hand tools	Subcontractor for merchants
system		-	Limited division of labor
			Mostly family labor
Protofactory	6-30	Simple hand tools,	Supervision and discipline
-		limited use of	Female and child labor
		powered machinery	
Factory	30+	Powered machinery	Supervision and discipline
-		-	Division of labor

Table 1: Historical organizational forms of production

That the above-mentioned three attributes of the factory are not *sine qua non* attributes of the factory can be shown by historical evidence. As for the centralized "production under one roof", as already argued above, it is not necessarily a firm-like organization. In many cases the workers used their own tools and worked as subcontractors in ship-building, iron and chemicals (Landes 1969:14, 24). Neither is large-scale production (due to the use of machinery) the distinctive attribute of the factory. There is plentiful evidence in the literature to prove that large-scale production was present in various non-firm organizations such as Gobelins in France or even in the putting-out system itself. On the other hand, some factories produced only on a small-scale.

The third strand of economic history literature sees factory discipline as an important aspect of the factory (Geraghty 2003, Pollard 1963, McKendrick 1961). Here it is argued that technology brought about the need for coordination between workers, which led to the introduction of factory discipline: supervision and regulations. However, factory discipline, as opposed to what is suggested in economic history, was not in itself the essence of the factory, rather the introduction of factory discipline was a consequence of the appearance of authority and the coordinating mechanisms related to that authority. In this sense, factory discipline in itself cannot be considered the distinctive attribute of the factory. At this point the question arises: How do we approach the essence of the factory in a *historical* theory of the firm?

To integrate the *nature* of the factory into economic history, one should take into account what the theory of the firm literature (e.g., Foss 2002, Kapás 2004) says on the distinctive characteristic of the firm. The issue of the distinctive attribute of the firm has received more attention during the past 10 years, due to an increasing analysis of the boundaries of firms in the knowledge economy. This literature (Foss 2002, Kapás 2004) takes the view that the distinctive attribute of the firm is the preponderance of firm-like coordinating mechanisms (authority) among the coordinating mechanisms used within the firm. Applying this to the factory, the distinctive attribute of the factory, i.e., the one that implies firm-ness, is firm-like authority, as opposed to the putting-out system which was characterized by a market-type network of contracts.

Thus, the major question is why and how authority appeared during the Industrial Revolution. Since the essence of the BIR was macroinventions (see Mokyr 1990), the question, in fact, is how radical technological changes led to an authority-based organization

of production. That is, a *historical* theory of the firm has to show how and why authority became an inevitable coordinating mechanism due to macroinventions.

Thus, a *historical* theory of the firm view on the factory must be built on what the essence of the BIR was. Mokyr (1990) clearly argues that a clustering of macroinventions was the essence of the industrial revolution which, from the viewpoint of my approach, led to two fundamental and closely interwoven processes, namely the extension of markets and an improved division of labor to an extent never seen before, which in turn increased the demand for new and better quality goods (Mantoux 1961). New products, that is, products due to macroinventions, required the new technology, and the improvement of the already existing products also needed the new technology. The production of the new goods required a monitoring different from that of the putting-out system. As noted before, this new kind of monitoring was the most important element of factory discipline, and it relied on firm-like authority.

How can we characterize this new type of monitoring? The monitoring under the puttingout system differed from that in the factory in two respects. First, the subject to be monitored changed. While in the putting-out system, the merchant-entrepreneur supervised the product itself, in the factory it was possible to monitor the production process. Second, according to Cohen (1981) the essential difference between the factory and the putting-out system lay in who controlled the production process: in the household it was the family head, in the factory it was the factory owner.

So, the factory did not invent monitoring and the essential difference between the two systems was not to be found in the fact that there was monitoring in one but not in the other. Both systems had monitoring, but the factory fundamentally changed its character: the contract (market)-based monitoring of the putting-out system (Langlois 1999) turned into firm-like monitoring.¹⁸

Accordingly, monitoring – which, at that time, was the most important building block of authority – as such was not a distinctive feature of the factory; rather its distinctive attribute was firm-like monitoring. Put differently, the distinctive attribute of the factory was that authority-based monitoring became the most important coordinating mechanism among the coordinating mechanisms used within the factory.

To sum up, based on historical facts, I associate firm-like monitoring with two developments: (1) a monitoring of the production process instead of a monitoring of the output, (2) a change in the individual charged with monitoring; instead of the family head, it became the factory owner. The above two characteristics of monitoring brought about by the factory are precisely those the theory of the firm understands by firm-like monitoring (see Foss 2002), which constitutes the essence of the firm.

Moreover, firm-like monitoring, in its turn, brought about the employment relationship, which, according to Coase (1937) is an essential element of the firm. That is, the factory is a Coasean firm. The employment relationship emerged as a result of a fundamental change in the nature of labor exchange (Gintis 1976): the worker sold his/her labor power for a specific period of time and in return agreed to accept the authority of the factory owner (in the sense of Simon 1951) in matters of discipline, supervision and organization of the work process.¹⁹

¹⁸ Note that firm-like monitoring was also present in the putting-out system in the sense that there was a hierarchy in monitoring itself. When the number of producers tended to become unmanageable, the putter-out simply engaged a sub-putter-out who dealt on their behalf with a number of producers. Normally, this strategy could not increase costs, since the sub-putter-out made a profit by increasing supervision on producers (Kieser 1994).

¹⁹ As shown by Pitelis (1998), another explanation of why there is a capitalist employment relation to start with is the Marxist one as developed by, among others, Marglin (1974) and Hymer (1979). According to this, the employment relation was imposed on workers by capitalists through coercion. The Marxist view focuses on the power-control related distributional benefits for capitalists of the employment relation.

So, basically the authority that became the major coordinating device within the factory embodies the relationship between the employee and employer (entrepreneur): the entrepreneur exercises direction, and employees agree to obey him/her within certain limits. This concept of authority was formalized by Simon (1951) and has become common in the literature: authority refers to the manager's right to direct the workers within their "zone of acceptance". Here authority is based upon the control and monitoring of individual efforts.²⁰

To summarize, as opposed to the modern theory of the firm view (e.g., Alchian and Demsetz 1972, Williamson 1980, 1985) which sees an economizing in transaction costs as the major cause, the historical account of the transition from the putting-out system to the factory can be claimed to have been, at least in part, the result of the extension of markets and the division of labor leading to new technology-intensive product (see above). In this sense, the roots of the factory are to be found in the putting-out system itself that prevailed before the BIR. That is, the rise of the factory can be best understood as an evolutionary process (for more details see Kapás 2008).

The above perspective, integrating economic history and the theory of the firm, shows why firm-like monitoring implied at the same time an employment relationship (authority), and led, accordingly, to the emergence of a *firm (factory)*. Of course, once the Coasean firm had been established, the productive benefits related to teamwork and knowledge enhancement in the framework of an administrative organization could lead to additional changes as regards the organization of the (Coasean) firm.

Summary

The factory was one of the most significant institutions of the BIR. Economic historians tended to point to the technological origins of the factory, while the theory of the firm has not paid special attention to this, its general concerns being related to the nature of the firm. Seemingly, the two disciplines focus on different aspects of the factory and are separated from one other. In this paper I argued that a better understanding of the factory needs a framework in which the two disciplines are taken together.

In this endeavor, I built upon the idea that the factory was the first form of the capitalist firm and I augmented economic history views on the factory with a theory of the firm perspective. The added value of this *historical* theory of the firm view on the factory was to recognize the distinctive feature of the factory through the historical process of its emergence.

 $^{^{20}}$ In line with Pitelis (1998), note that authority existed in a family craftshop as well, but the latter would not be a Coasean firm.

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