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Information Technology and the "Biodiversity" of Capitalism

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1. Introducing the argument: technological and institutional change in Coase and Marx.

In 1937 Coase considered the consequences of his theory of transaction costs on the analysis of one of the first massive introductions of modern information technology: telephone lines allowing the transmission of voice among distant sites. He predicted that:

"Changes like the telephone and the telegraph, which tend to reduce the cost of organising spatially, will tend to increase the size of the firm" (p. 46)

However in a footnote he observed also that:

"It should be noted that most inventions will change both the cost of organising and the costs of using the price system. In such cases, whether the invention tends to make firms large or smaller will depend on the relative effect of these two set of costs. For instance, if the telephone reduces the costs of using the price mechanism more than it reduces the costs of organising, then it will have the effect of reducing the size of the firm" (ft. 31 costs p. 46).

While in the Coasian framework the existence of the firm was explained by referring to market transaction costs, some times Coase seemed to believe that competitive markets economy were able to produce the optimal institutional mixture between markets and firms. In another footnote of the same article he exclaimed that, unlike a centrally planned economy:

"In a competitive market there is an optimum amount of planning!" (p. 37)

Coase meant that activities were planned by firms' managers only when this was more efficient than leaving it to the working of the market. According to Coase an optimisation problem was continuously solved by the competitive system: the optimal mixture of planning and markets was "recalculated "and "implemented" each time that the technological data changed.

Coase's pioneering analysis of the institutional changes is very insightful but somehow contradictory. On the one hand his explanation of the co-existence of different institutions, based on the analysis of their comparative costs, emphasises that neither

markets nor firms can be "first best" solutions in the sense that they are both constrained by their own organisational costs. At same time, sometimes, Coase seems to be claiming that an efficient institutional mix, corresponding to the level of development of the technology, is created without relevant organisational costs by a market economy. Consistency would seem to require that the same market transaction and managerial costs, which limit the size of markets and firms, should also limit the efficiency of their institutional mix and constraint the transition from one organization to the other when this is required by technological changes.

Transition from market-type to firm-type organization must imply transaction costs and/or managerial costs. In a world of positive transaction costs "transition costs" must also be positive and the institutional mix cannot simply tend to correspond to the level of technological development but must also be heavily influenced by the pre-existing institutional structure of the economy. In a world of positive market transaction costs the institution of centralised firm must be constrained by the inefficiencies of the markets and, vice versa, in a world of positive management costs the disintegration of a firm must be constrained by the inefficiencies of firm-type organization[1].

Moreover, efficient transitions are also inhibited by the pre-existing institutional arrangements because they imply redistributions of resources that damage the individuals working under them: under markets individuals who have developed marketing skills do better than within large firms that favour individuals who have developed management skills. Efficient transitions are not only constrained by the degree of organisational efficiency of pre-existing institutions but also by the distributive struggle that they must often imply.

In many respects Coase, as well as much New Institutional economics, share the same limitations of the technologically deterministic version of the Marxian theory of history.

Indeed the Marxian theory of history illustrates the tension (and often the ambiguities) of a theory which aims to consider both aspects of the two ways relationship between property rights and technology. One could even say that the Marxian theory embodies two views which could be nicknamed a *"technological deterministic view"* and

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[1] In this sense the Coasian approach must necessarily lead to some form of "evolutionary" economics where the starting institutional point is necessarily relevant for the explanation of the final outcome. The many versions of the "so-called Coase theorem" (Coase, 1988 p. 13 uses this expression outlining how the literature has derived implications from his writings that ignore the fundamental importance of positive transactions costs) assume either zero transaction costs or, in other words, a zero-transaction-cost institutional environment. One could assume that the Coase theorem involves also some "efficient" bargaining on the relevant institutions, but the efficiency of these institutions depends, in turn, on the fact that they are negotiated in a zero-transaction-cost institutional environment. This generates an infinite logical regress. If one wants to avoid the "Nirvana fallacy" of a zero-transaction-world one must specify the organisational costs of the initial institutional set-up; or, in other words, one must move towards some sort of history-dependent evolutionary economics. On a related issue see Anderlini and Felli (1998).

a *"romantic view"* of history. The former view stresses the influence that the characteristics of productive forces, which it is optimal to employ at a certain stage of technological development, have on property rights. The latter stresses the influence of property rights and institutions on the characteristics of the resources which are employed and developed. Marx struggled to melt these two visions in a single interpretation of history but he ended up having two "utopias" alternative to capitalism - each one of them being strictly related to one of his view of history.

Like Coase (and well before him) Marx regarded the firm as a form of organization alternative to the market (Pagano 1992). Unlike Coase, Marx believed that the increase of efficiency in the organization of production (or the development of the productive forces) would have necessarily required an expansion of the firm-type organization relatively to market-type organization. According to Marx this tendency was already at work under capitalism but it could have only been completed under socialism. Socialism (at least in its early stages) was bound to be a single-firm economy where the authority of a chief employer was extended from the firm to the society taken as a whole. In other words, an outcome of the *"technological deterministic view"* of history was an authoritarian model of a "single firm socialism" corresponding to the alleged needs of the development of productive forces.

At the same time, in the Marxian theory, the set of rights characterising the capitalist firm were not simply an expression of a certain stage of the development of productive forces but were also developing a particular quality of productive forces. De-skilled and detailed jobs, alienated and oppressed workers, machines and organization of production complementary more with workers' stupidity than with their skills were the productive forces developed by the capitalist firm. Communist rights (at least at a later stage) should have developed productive forces characterised by different qualities. Highly skilled men and women performing interesting and challenging production activities should have become the most important of the productive forces to be developed by the new society. In other words, in the Marxian theory, the *"romantic view of history"* was somehow related to an "anti-capitalist firm model of communism" (Pagano 1985) where the quality of the development of productive forces would finally correspond to the needs of people as producers.

The relationship between property rights and the characteristics of productive forces, which created so many interesting problems and contradictions (as well as so many wrong "predictions") in the Marxian approach became a non-issue in neo-classical theory. In a market economy workers' or capitalists' ownership would have had no effect on the characteristics of the resources (or of the productive forces) employed by the firm. At the same time, the characteristics of the resources employed in the firm had no

implication whatever on the form of ownership which was going to characterise this organization.

This point of view was well expressed by Samuelson when he argued that "In a perfectly competitive economy it doesn't really matter who hires whom...." (1957 p. 894).

After Coase path breaking contribution recently, both New Institutional and Radical Economists have re-considered the interaction between rights and technology. However, their relationship is still very controversial. Like in the Marxian theory in these two streams of literature the direction of causality runs in two opposite directions. Following the Coasian insights in New Institutional economics the nature of rights and organisations is endogenously and efficiently determined by the characteristics of the resources employed in the firm: namely their degree of specificity and their monitoring requirements. By contrast, in the Radical Literature, which has inherited the tradition of the Marxian "*Romantic view*" of history the characteristics of the resources employed in the firm are in turn determined by the rights which owners of different factors have on the organization.

There is little doubt that we are leaving a third industrial revolution and that the changes in information technology are having very deep effects on the rights that individuals have on the organisation of production. The New Institutional Literature has helped to clarify the mechanisms by which this may happen. However, it can be seriously misleading to consider only the direction of causality running from the fast changing characteristics of resources employed in production to the rights of the agents over these resources and, in general, the institutional mix that tends to prevail in modern economies. One must also consider the opposite direction of causality running from the nature of institutions to the resources employed in production. In the following sections of this paper we will claim that this double relation between the nature of the resources employed in production and the characteristics of the organisation of production originates mechanisms of cumulative causation that may help to understand the diversity of organisations that exists in spite of some common features of the information revolution. We will call "organisational equilibria" these self-reinforcing relations between organisational rights and technology and we will maintain that multiple organisational equilibria are still likely to characterise the future of modern economies in the age of information technology.

2. Information technology as the cause of the re-distribution of asymmetric information.

One of the main arguments that underlies the idea that information technology causes a change in property relations and, in general, in the structure of the organisations prevailing under capitalism is that it brings about a dramatic change in the distribution of the information that must be available to the producers. Even since Hayek famous (1945) contribution economists have considered the influence of the distribution of private information on the distribution of property rights. If information is distributed among various agents and it can only be transmitted at a very high (sometimes infinite) cost the distribution of decision making power has better to follow a similar pattern. Otherwise, the members of society would not make an efficient use of the knowledge distributed among them.

In Hayek's view centralised planning failed because of the difficulty to obtain the private information from other agents. A socialist economy required an extremely costly and even unfeasible transmission of information from the periphery to the centre. However, as Coase had pointed out, also markets require the costly gathering and processing of information. Indeed, information costs are largely overlapping with market transaction costs (Engelbrecht, 1997) and modern economic theories have clarified how in situations of asymmetric information adverse selection and moral hazard may threaten the very existence of markets .

In their famous 1972 article Alchian and Demsetz argued that, in situations of team work, when each worker finds it costly to gather information about the other workers, specialised centralised monitoring is necessary to avoid a situation of generalised free riding. According to them the emergence of the capitalist firm is due to the fact that, in many cases, efficiency can be greatly increased by giving hiring and firing rights to an entrepreneur who can easily monitor assembly line types of workers and terminate the employment contract of those workers who do not work with satisfactory effort. Moreover the entrepreneur should also own that part of physical capital that is difficult to monitor in the sense that measuring its user-induced depreciation was very costly and rental arrangements are prohibitively expensive. Alchian and Demsetz observed that, unlike for the case of unskilled workers, in "artistic" or "professional" work "watching a man's activities is not a good clue to what he is actually thinking or doing with his mind". In this case the distribution of information is different and ownership arrangements are likely to follow a different pattern where difficult to monitor workers rent capital. In this case the centralised monitoring solution of the capitalist firm is replaced by forms of decentralised workers' ownership.

According to New Institutional theory, besides the distribution of private information, information technology can also change the degree of specificity of the resources employed in production. Also these characteristics can cause changes in ownership relations and organisational arrangements. Specific resources cannot be easily employed in alternative uses. For these reasons the owners of specific resources will work for organisations where they have no rights (or, at least, safeguards against unfair termination) only at a premium that compensates them for the "illiquidity" of their investments. By contrast this premium is not necessary for the owners of general purpose resources because they can easily find alternative employment. Whenever the distribution of specificity characteristics is not matched by the distribution of rights and safeguards efficiency may be increased by shifting them from the owners of the general purpose resources to the owners of specific resources. An important corollary of this argument is that, whenever this is possible, co-specific resources should be owned together to avoid the hold up risks that separate ownership would otherwise involve. Thus a high degree of co-specificity of physical capital must necessarily involve a high degree of concentration of ownership.

Coupled with the original Coasian analysis the monitoring and the specificity arguments provide some powerful mechanism by which New Institutional theory and the New Property Rights approach (Brynyolfsson 1994, Hart 1995) can help to explain the impact of information technology on institutional change.

Information technology favours dis-integration in smaller firms and greater incentives to the workers (often in the form of ownership of small firms) as long as:

a) Unlike the case of the Coasian telephone and telegraph lines the more recent novelties in information technology reduce the cost of decentralised co-ordination occurring in the market more than the cost of centralised co-ordination within firms. The impact of information technology on the development of electronic markets, where many agents interact with other agents, may be greater than its impact on the development of electronic hierarchies where a centralisation and a simplification of these interactions has already been carried out (Malone, Yates, Benjamin 1994). The shift to market relations is likely to occur when the introduction of centralised hierarchies has reduced coordination costs at the expenses of production efficiency. In this case information technology, reducing the relative impact of all types of co-ordination costs, may imply that total costs (the sum of co-ordination and production costs) become relatively lower under market arrangements.

b) Machines become easily re-programmable and, therefore, less co-specific to other machines. Decentralised ownership does not cause any hold-up problem and allows an efficient flexible re-allocation of machines to their changing best uses. Moreover information technology may make it less expensive to check cases of misuse of equipment and make it relatively cheaper to arrange rental contracts or financial support for workers' owned firms..

c) Re-programming machines and handling the massive information that becomes available with information technology involves many skilled tasks. Thus, information technology involves that workers must acquire a lot a valuable knowledge to perform their tasks. The monitoring characteristic of their work become more similar to those features of artistic and professional work mentioned by Alchian and Demsetz than to those of the easily observable assembly line workers. Moreover, relatively to assembly line workers who could be easily re-allocated to other tasks, their ability may become more specific to the problems involved by some production activities. Because of the changes in the monitoring and specificity characteristics of their jobs, workers should be given high powered incentives for their daily effort and adequate safeguards for their investment in specific human capital. Both things may be provided to a relatively larger number of workers-entrepreneurs if, thanks to effects of information technology considered under the preceding two points, small organisations become not only feasible but even more efficient than large firms[2].

By contrast information technology will favour firm-type hierarchical organisation as long as:

a') It facilitates the monitoring of the other agents. An Orwellian "big brother watching you" world become feasible or much cheaper and, because of information technology, agents who cannot be easily observed under the traditional technology become "easy to monitor factors". In this case asymmetric information can be re-distributed and concentrated and some features of the traditional Fordist model can be extended beyond its traditional boundaries. Among the numerous possible examples one is particularly striking: truck drivers were considered hard-to-monitor workers who, in absence of self employment and truck ownership, would have taken long breaks and little care of their trucks. Satellite control and black boxes allow now employers to get very cheaply

[2] In other words, according to this view, information technology would push in the direction of "flexible specialisation" and small scale production. Sabel and Zeitlin (1997) show how the two systems have always co-existed and only a unilateral view of history could see it as a constant expansion of mass and large scale production. For instance, Poni (1997) observes that while, in the case of cotton, the industrial revolution was typically associated to these characteristics , at the same time the silk industry was characterised by flexible specialisation and small scale production.

detailed information about truck drivers. Both the recent French and UPS strike in America seem to indicate that sector is not only experiencing the organization but also the labour relations typical of the Fordist relations.

b') It increases the extent of economies to scale and complementarities both in the gathering and the use of information. Economies to scale and complementarities have always characterised these two processes. Each piece of information is more useful and often makes sense only in the context of other information. Moreover each piece of information can be used many times without additional costs. These characteristics of information can make the concentration of much information in one or few persons very productive. Each individual is characterised by bounded rationality or, in other words, by a bounded capacity to gather and process information. However, information technology can relax these constraints on bounded rationality allowing a single individual to exploit to a larger extent the economies to scale and the complementarities that characterise information. As long as this occurs the ownership of assets has better to follow a similar pattern. Asset owners who do not hold the information relevant for their best use should bargain with the individuals who hold this information. Thus, in the world of incomplete contracts considered by Hart (1995) and Brynyolfsson (1994), these agents would have a lower incentive to invest than the agents who control both the physical assets and the relevant information. In other words, information technology, making it convenient the concentration of information in few hands, would also lead to a concentration of assets[3].

According to Hart (1995), Brynyolfsson (1994) and Barca (1994) the first set of effects prevails on the second sets of effects and, therefore, information technology tends to cause greater disintegration and forms of dispersed ownership[4]. However, this conclusion is dubious for two reasons. In the first place we have seen that, in principle, information technology can push the distribution of information and of the physical assets in both directions. When we consider the case of countries different from the United States, the impact of information technology is ambiguous (Carnoy 1997). Secondly the distribution of assets cannot only be seen as a consequence of an "optimal" distribution of information corresponding to the state of technology. The distribution of

[3] This effect may be so strong to induce some form of retreat in sectors that used to be leading cases of small scale production and flexible specialisation. Capecchi (1997) observes how this type of retreat from flexible specialisation to a wide but relatively fixed menu of product can be observed in the case of the Bologna automatic packing machinery production that was one of the most successful cases of small scale production and flexible specialisation. The key element seems to be the importance of the economies to scales and complementarities that characterise the modern information technology and, in particular, electronic engineering which entails a fundamental role for top down science-based innovations.

[4] Moreover, according to Barca (1995), information technology tends to make ownership a less efficient incentive system because, while many individuals need high powered incentives, ownership can give incentives only to few of them.

assets may influence the distribution of information by making it more convenient to apply information technology in a particular direction. We will see that this may lead to a diversity of configurations that we have called "organisational equilibria".

3. Distribution of assets and distribution of information: a two way relation.

The relation of causality considered in the preceding section is surprisingly similar to the "deterministic" view of history contained in the Marxian theory. Some "radical" authors, appealing to the "romantic" view of history that is also contained in Marx, have argued that technological parameters such as the distribution of the information and specificity characteristics are themselves influenced by the prevailing property rights.

According to Braverman (1974), the approach of "scientific management", that was started by Taylor at the beginning of this century has had a lasting impact on the development of the organisation of work under capitalism. Taylor realised that the traditional system of management was badly suited to increasing workers' effort. Traditional management relied on the knowledge of the workers in the sense that the managers believed that the workers knew better than they did how to perform their jobs. Under traditional management, the workers could work less than "fairly" by maintaining that a certain time was required to perform a certain job. The situation of "asymmetric information", existing under traditional management, implied that the managers had no means to challenge this sort of statement. Taylor' s solution to this problem was straightforward: the managers (and not the workers) should know how the jobs could be best performed, plan how they should be executed and give the workers detailed instructions about their execution[5]. It was only by gaining the control of the labour process that the managers could invert this situation of asymmetric information and control workers' effort. In spite of some considerable limitations of his analysis, Braverman has the merit of providing an example of causation opposite to standard economic theories where the exogenously given distribution of information is used to determine endogenously the most efficient incentive structure or the distribution of assets that can best solve the agency problem. In Braverman the distribution of assets is exogenously given and, according to him, Taylorism tried to determine endogenously the best distribution of information for a given distribution of assets. When, under a certain ownership system, because of asymmetric information, the use of a technology is

[5] In this way "scientific management" did not only challenge the traditional craftsman apprenticeship system but also the traditional forms of "family capitalism" where the members of the "family dynasty" could govern the firm without acquiring the relevant managerial skills. In this sense, Taylorism was also associated to the managerial revolution and to the growth of managerial hierarchies. The rights of the members of the family dynasty could seriously inhibit the growth of these hierarchies and the system of competence-based promotion rights that were associated to them.

particularly costly, there will be attempts to device technologies that imply a distribution of information that fits better that system.

In Braverman's analysis, under capitalist ownership relations, there is a tendency to device technologies that, inverting pre-existing information asymmetries, make labour an easy-to-monitor factor. A similar process occurs for the specificity of assets. Taylorism also implies that much of the specific knowledge, used by the workers, is made redundant by introducing a technology under which the workers are ordered to perform homogeneous tasks requiring only generic skills[6].

While according to the New-Institutional view assembly line workers do not have rights in their organisations because the current technology requires that they do not hold relevant "hidden" information or specific skills, according to the "Radical view" the opposite is true: the workers do not have relevant information nor specific skills because, under the current system of property rights, workers with these characteristics are very costly. Only a property right regime where workers have adequate incentives to identify with their organization can make their hidden information and their specific skills cheaper and change the nature of the human resources employed in production.

Thus "New-Institutional" and the "Radical" approach have emphasised two different directions of causality. However this does not make their approaches contradicting each other. Indeed the main thrust of my own work on "organisational equilibria" (Pagano 1993) is that the self-sustaining nature of economic institutions can be properly understood only by unifying these two approaches. The fact that (a) causes (b) and (b) causes (a) are not mutually incompatible; rather, they imply that (a) can reinforce itself via (b) and (b) can reinforce itself via (a). When this occurs, the New Institutional and Radical mechanisms taken together imply that an institution of production such as the Tayloristic firm is characterised by a self-reinforcing mechanism that may give it a remarkable degree of institutional stability. The small information and specific skill content of workers' jobs imply that very small amounts of agency costs would be saved by giving them rights in the organisation at the expense of high-agency-cost capital and management. At the same time these rights feedback on the characteristics of technology

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6 Both things are evident when we consider the three fundamental principles of Taylorism as they are summarised by Braverman (1974): 1) *dissociation of the labour process from the skills of the workers.* 2) *separation of conception from execution.* 3) *use of this monopoly over knowledge to control each step of the labour process and its mode of execution*. According to Braverman the first principle is implicit in the following quotation from Taylor "The managers assume... the burden of gathering together all the traditional knowledge which in the past has been possessed by the workmen and then classifying, tabulating, and reducing this knowledge to rules, laws, and formulae...." (F. Taylor, quoted in Braverman 1974, p. 112) The second principle can be found in the following Taylor' s statement: "All possible brain work should be removed from the shop and centred in the planning or laying-out department....". (F. Taylor, quoted in Braverman 1974, p. 113). Finally, according to Braverman, the third principle is clearly pointed out by Taylor when he states that, unlike under traditional types of management, under scientific management the managers should give the workers detailed instructions about each task to be performed and these tasks should specify not only what is to be done, but how it is to be done and the exact time allowed for doing it." ((F. Taylor, quoted in Braverman 1974, p. 118)

in a self-reinforcing manner creating incentive conditions under which it is not convenient that the workers hold hidden information or invest in specific skills. Again this reinforces the pre-existing rights and so on. In other words the nature of rights and of the technology reinforce each other creating situations of organisational equilibrium which are characterised by institutional stability in the sense of being resistant to "weak" property rights and technology shocks. Indeed Pagano and Rowthorn (1996) have shown how organisational equilibria have an intrinsic resistance against "efficient" alternative owners. Alternative owners are efficient because they allow a great saving of the agency costs that would otherwise be paid if they were employed by the current owners; but exactly for this reason they tend to be substituted away by the latter and the conditions under which switching ownership becomes convenient may never come about. Moreover, since network externalities exist among both property rights and the technological characteristics of resources (David 1994) the nature of organisational equilibria implies that the tendency to homogenise technological standards brings about a tendency to homogenise property right standards and vice versa. Multiple institutionally stable economic systems are therefore likely to exist and it may be impossible for a single firm to move to a new organisational equilibrium even if this could be advantageous if all the firms were undergoing this change.

4. Organisational Equilibria and Species of Capitalism.

The self-reinforcing characteristics of organisational equilibria may explain some puzzling features of the dynamics of capitalism: coexistence of different "national" forms that occurs in spite of common technological innovations, such as those associated to information technology, and the fact that "new organisational species", whose success is often related to these new technological opportunities, tend often to emerge in countries that are different from those that were successful in the preceding phase of capitalist development[7].

Chandler (1990) pointed out how the managerial revolution (that was later going to lead also to the development of Taylor's "scientific management") was paradoxically inhibited in England by its prominence in the first industrial revolution.

In the first industrial revolution, where textiles allowed successful small scale production, family controlled firms were adequate. In this framework, while family

[7] In other words the evolution of capitalism seems to be characterised by forms of "allopatric speciation" in the sense that new forms of capitalism tend often to emerge in countries different from those where the preceding forms had had a successful development. Pagano (1999) considers the problems related to the origin of new species in biology and some common law of structure and change that characterise the formation of new organisational species; in particular, the emergence of American and German managerial forms of capitalism are considered in the framework of the theories of "allopatric speciation" developed in evolutionary biology.

members had an incentive to make firm-specific investments and could also, without serious organisational costs, become difficult-to-monitor factors the same was not true for non-family-member managers. These managers were trapped in an "organisational equilibrium" that was a vicious circle for them: because of the family system, weak managerial rights implied an unfavourable the distribution of asymmetric information and of specific skills which, in turn, implied that the case for managerial rights remained very weak. In England this "organisational equilibrium" resisted the pressure of the "second industrial revolution" where the changes associated to development of railways pushed in the direction of the development of sophisticated managerial hierarchies. Thus, the self-reinforcing aspects of "organisational equilibria" can explain why the "new species" of managerial capitalism, together with the full strength of the second industrial revolution, blossomed with much greater intensity in the U. S. and Germany than in England. Still, the new species of capitalism co-existed with the original species and no country was purely characterised by a single organisational form.

Under "managerial capitalism", often independently of their ownership entitlements, managers acquired considerable rights on the organisation and accumulated great amounts of hidden information and specific skills. By contrast, the development of "scientific management" implied that the large majority of workers were "expropriated" of the hidden information and of all the specific skills that had survived the first industrial revolution. Workers' weak rights on the organisation were associated to an unfavourable distribution of asymmetric information and specific skills causing the self-sustaining organisational equilibrium that characterised Taylorism.

Also in the case of the "Tayloristic organisational equilibrium", one of the most important challenge to its vicious circle was not generated at the centre of the system in the U. S. where the competition among the numerous members of the "Tayloristic" species was strongest. By contrast, it came about in the defeated post-war Japan contributing in a impressive way to exceptional development of its economy that, for a while, seemed even to challenge the supremacy of American capitalism[8].

Besides its peripheral location, the new species did not emerge "spontaneously" as the exclusive outcome of the workings of market forces. By contrast, the strong "institutional shocks", that characterised the years of the military defeat and the American occupation of the Japan, had a fundamental, and very often unintended role, in the complex delivery of the new organizational equilibrium. While a comparison with American capitalism can

[8] Another challenge came from West Germany and its system of "unionised" capitalism based on occupational markets. In this case employers' associations and the trade unions with the help of the State used to agree on a common division of labour within each firm that allows the creation of "flexible" occupational markets characterised by the fact workers can move from one firm to another without wasting much organisational specific knowledge. Observe how this flexibility is strictly associated to the internal rigidity of the firms that must be characterised by a common type of division of labour and related professional competencies. On these issues see Pagano (1991) and (1993).

be easily used to emphasise the numerous elements of continuity within the history of Japanese capitalism, the discontinuity between the *zaibatsu* and the *keiretsu* system is, indeed, striking[9] and cannot convincingly be explained without referring to the institutional shocks that characterised that period.

The American expropriation of the zaibatsu families and the compulsory retirement of senior managers was coupled with an initial period of strong unions rights. These factors helped the birth of a new organisational equilibrium where the workers acquired strong rights in their organisation. These rights favoured the accumulation of job specific and difficult to monitor skills[10]. that, in turn, reinforced the rights of the workers. In other words the institutional shocks created the conditions for a new self-sustaining organisational equilibrium (Pagano 1998) characterised by a distribution asymmetric information and of specificity characteristics that was in sharp contrast with the theory and the practice of Taylorism.

Similar self-reinforcing mechanisms characterise other modes of production such as Italian districts, "German Corporatism"[11]. and the enormous varieties of organisational forms that is emerging in the ex-socialist countries[12].. Like in the case of the second industrial revolution the "third industrial revolution" will have a great impact in re-assessing the relative merits of these organisational forms and some may turn out not viable. However, also in this case the diversity of organisational forms is unlikely to be narrowed. While we have seen the influence of informational technology to be far from bringing about unidirectional transformations, pre-existing property rights will somehow continue to shape (also information) technology.

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[9] The discontinuity between pre-war and post-war Japan capitalism and the relevance of the post-war institutional shocks can be clearly understood by considering an alternative (an perhaps more appropriate) comparison with Italian capitalism. While the policies of the Allied Powers reinforced the Italian system of family capitalism, the American occupation terminated its Japanese version. The "institutional bifurcation" that was created had long lasting consequences and shaped the development of the two countries (Barca, Iwai, Pagano, Trento 1999).

[10] In particular team work, that often replaced the assembly line in Japanese organisations, was necessarily characterised by the specificity of the skills (each skill becoming specific to those of the other team members) and by the difficulty to monitor the workers (it is difficult for an outsider to disentangle the contribution of a single worker from those of the other members of the team).

[11] In many respects the Japanese species of capitalism represented a "mixture" of rigidities and flexibility opposite to those of the German system. In the German system the rigidity of the internal division of labour allows the external flexibility of occupational markets; by contrast, in the case of the Japanese system, the flexibility of the internal organisation of the firm implies that often no equivalent "slots" for the skills of its workers could be found in other organisations. In this sense the "internal flexibility" of Japanese firms is somehow associated to their "external rigidity". Thus, given the two different associated technologies, the German system could be regarded as a system of self-sustaining "occupational rights" and the Japanese could be regarded as a system of "self-sustaining organisational rights" (Pagano 1997).

[12] This multiplicity of feasible organisations is very important for economic policy and, in particular, for the problems related to the transformation of the former socialist countries (Aoki 1995, Pagano 1998). A comparative institutional analysis is required to consider the self-reinforcing mechanisms or the complementarities (Aoki 1996) that characterise each one of the feasible alternatives.

A possible argument, predicting a reduction in the "Biodiversity" of capitalism, could be based on the observation that information technology favours the process of globalisation of the world economy and that, in a "globalised world", imitation and other factors may bring about an increase of organizational homogenisation. However, in a globalised world the existing different forms of national capitalism's may more effectively exploit their "comparative institutional advantage" in different sectors of the economy and some new viable forms of capitalism may even emerge in this process. In this sense, globalisation allows the specialisation of the economies in those sectors where they have or develop a "comparative institutional advantage" related to their own particular organisational equilibrium and may even favour the diversity of the forms of capitalism. Thus, there is no reason to believe that the "Biodiversity" of capitalism is bound to decrease. By contrast, at least in this particular sense, we are far from reaching an "end of history"[13].

Conclusion

A diversity of organisational equilibria is possible. Both "political" shocks on property rights and "technological" shocks can threaten the institutional stability of a system and bring about a new type of organisational equilibrium. The shocks of the information technology are not likely to destroy this diversity of organisations for at least three reasons:

In the first place the nature of the shocks induced by information technology is ambiguous and it can either mean more decentralised ownership and decision making or more concentration of both.

In the second place, organisational change is not simply characterised by the transfer of given bundles of rights but more often by an "unbundling" and redistribution of them. For instance, the institution of life employment "unbundles" share holders' right to use their machines with the employees that they prefer from other ownership rights (such as the right to sell their machines) and gives the workers the right to work with the machines for a certain length of time. Rights can be bundled unbundled and redistributed in

[13] Other reasons for which this is a very unlikely outcome are given in Hodgson (1999) who points out how the idea of the "end of history" is "deeply connected to an Enlightenment principle. This is the idea of a universal history: the notion of an universal destination, underpinned by absolute rational principles." (Hodgson 1999 p 153)

numerous ways. A remarkable diversity of organisational equilibria is therefore possible and does, indeed, exist in reality.

Finally, either because of the ambiguity of shocks induced by information technology or because of the diversity of the possible organisational arrangements, political shocks on property and control rights are likely to continue to have a crucial importance in selecting one of the self-reinforcing mechanisms defining organisational equilibria.

Information technology, re-defining the distribution of information and the specificity characteristics required by many jobs, has a serious impact on the rights on physical assets. However, the latter have also an important influence on the former and may determine which one is going to be the particular way in which information technology may be applied. In principle, information technology may favour both the "concentration" and decentralisation of information (Zuboff 1988); the particular organisations and "bundles" of property rights prevailing in the economy may reinforce one of these two effects. The impact of information technology should neither be studied with a "deterministic" nor with a "romantic" approach but it should analysed with an open mind towards both the directions of causality emphasised in these two views. Information technology should make us increasingly aware of the strong complementarity existing between the distribution of information and the distribution of assets. A democratic society, where most people have access to important pieces of information, tends to be egalitarian. And, on the other hand, an egalitarian society, where many people have rights on physical assets can help to create the conditions under which many people acquire relevant information or, in other words, the conditions for a full blown democracy.

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