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Technical assets and property rights

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Abstract - In standard neoclassical theory a double neutrality holds: the nature of the technical assets employed in production does not influence property rights and vice versa the property right structure does not influence the technology adopted by the organization. However, empirical evidence shows that changes in the technical assets employed in the economy have an important role on the evolution of its property right structure and that, vice versa, the characteristics of the owning and controlling agents influence the nature of the resources employed in production.

New Institutional economics has offered a powerful rationale for the first direction of causation: in a world of positive transaction costs, property rights will tend to be acquired by the most specific and different to monitor technical assets because they can save more on agency costs when they control the organization. However, as some radical economists have emphasized the opposite direction of causation is also highly plausible: when some agents have rights on a firm the specificity and monitoring costs of their assets tends to be dramatically reduced. By integrating these two direction of causation in a single concept of organizational equilibrium, it is possible to explain the multiplicity of varieties of capitalism and to make some hypothesis on some recent global trends, such as the increasing reification of intellectual capital and the growing financialization of the world economy.

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1. Introduction.

Standard neoclassical theory is characterized by a *double neutrality*: the nature of the technical assets employed in production does not influence property rights, and vice versa the property right structure does not influence technology. However, technological innovations and changes in the composition of productive sectors have an important role in the evolution of the property rights structure of an economy and, vice versa, the nature of the owners influences the features of the technical assets¹ employed in production. New institutional economics has offered a powerful rationale for the first direction of causation: in a world of positive transaction costs, property rights will tend to be acquired by the owners of the most specific and difficult to monitor technical assets because they can save most on agency costs when they control the organization. However, some radical economists have emphasized that the opposite direction of causation is also highly plausible: when some agents have rights on a firm, the specificity and monitoring costs of their assets tend to be dramatically reduced. Thus, if it is true that actors which are relatively difficult to monitor and specific tend to acquire the rights on organizations, it is also true that the actors controlling them tend to become relatively more specific and difficult to monitor. Other relations, such as that

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1 Technical assets include the human and non-human resources as well as the blueprints that allow their combinations for productive uses. The production function, defining these combinations, is not independent of human capabilities. The feasible technological combinations must be discovered by the agents and define the opportunities that are open to the economy (Arthur, 2009). A differential development of combination capabilities can be stimulated by different factor prices (Allen 2011) and it is more likely to occur in neighboring characteristics of the product space (Hidalgo and Hausman 2009). Also property rights influence factor prices (see section 5) and, therefore, the available technical assets.

between the degree of modularity of technical assets and IPR, can be analyzed in a similar manner². All these relations are likely to generate self-reinforcing interactions between property rights and technical assets and a multiplicity of possible organizational equilibria. This multiplicity can explain the different paths that characterize the history of real-life systems and can offer analytical tools for comparative institutional analysis.

The next section considers the grounds and limitations of the neo-classical neutrality between property rights and technical assets. Section 3 focuses on the challenge raised by the new - institutional and the new property rights literature to the *property-rights-neutrality* of technical assets and on the mechanisms by which technology can influence the rights on and governance of economic enterprises. Section 4 shows that also the *technical-assets neutrality* of property rights can be challenged because also the opposite direction of causation, from property rights to technical assets, can be grounded on precise economic mechanisms. Section 5 introduces the concept of *organizational equilibria* which integrates the two directions of causation. The complexity and multiplicity of these equilibria entails that organizations follow a path-dependent evolutionary dynamic characterized by periods of stasis and punctuated by sudden changes. Sections 6 and 7 use this framework to explain, respectively, the post-war varieties of capitalism and the recent emergence of intellectual monopoly capitalism.

2. The Double Neutrality of Technology and Rights: the neo-classical approach.

A definition of a production organization has two basic ingredients. The first consists of the technological characteristics of the resources used in production, that is, the organization's technical assets, while the second refers to the legal and/or customary rights existing on those resources. The relationship between these two factors has always been a controversial issue in the social sciences: if causation exists, it can go both ways. On the one hand, property rights can shape the nature of technical assets; on the other, the technical assets employed in production can influence the system of property rights.

This two-way relationship is at the very root of the Marxian approach. In Marx's theory of history the level of development of productive forces is considered to be the cause of a certain set of production relations or property rights. At the same time, the production relations may not only

² Landini (2012) shows that the software industry division between open-source and proprietary software can be

foster or hamper the development of productive forces but also determine their qualities.³

While the relationship between property rights and technical assets created many interesting problems and contradictions (as well as many wrong 'predictions') in the Marxian approach, it became a non-issue in neoclassical theory. In a market economy, workers' or capitalists' ownership 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 implications whatever in regard to the form of ownership which would characterize the firm.

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). Samuelson's statement can be understood as a *double neutrality* that makes sense within the framework of standard neoclassical theory. On the one hand, the nature and the combinations of the factors employed in the firm do not have any bearing on the ownership attributes of the organization (technical assets are *property-neutral*). All possible owners would efficiently maximize the firm's value independently of the particular combination of assets employed in it. On the other hand, the different property rights arrangements bias neither the combinations of the factors employed nor their nature (i.e. property rights are *technology-neutral*) because all possible owners would choose those technical assets that maximized the value of the firm.

The *double neutrality* characterizing the neoclassical relationship between technical assets and property rights had an evident influence on the training of economists. History lost relevance for economists, in a double sense. On the one hand, the history of technology became irrelevant to explaining the evolution of ownership and governance systems. On the other hand, alternative arrangements of property rights and economic organization could not contribute to the understanding of the different paths of technological development characterizing different countries and different enterprises. In other words, taken from the title of a book by Geoff Hodgson (2001), this double neutrality provides one route to understanding *how Economics forgot history*.

interpreted as a co-existence of multiple organizational equilibria.

3 There is a tension between these two direction of causation within the Marxian approach. The latter oscillates between technological determinism (stressing the primacy of technical assets) and property rights romanticism (new property rights shape individual incentives and technical assets). Cohen (1978) and Brenner (1986) are examples tending respectively towards the former and the latter approach. According to Pagano (2007b), this tension is rooted in the work of Marx and it is

3. Non-Neutral Technical Assets: the New-Institutional approach.

The rejection of the hypothesis of nil transaction costs destabilizes the foundations the neoclassical edifice. The *double neutrality* of property rights and technical assets of rights is bound to collapse. The mechanisms identified by new-institutional economists have shown that technologies are not neutral in regard to the nature of property rights and of corporate governance and the radical economists, who will be examined in the next section, have challenged the neutrality of property rights and of other institutional arrangements relatively to the nature of technical assets.

According to Williamson (1985)⁴, when it is impossible to write complete contracts, the characteristics of the productive forces influence the attribution of control rights. In the presence of contractual incompleteness,⁵ those in possession of relatively specific resources (i.e. resources which cannot be put to other uses without losing some of their value) may fall victim to the opportunism of the counterpart. By contrast, in the neoclassical world of zero transaction costs and complete contracts, resource specificity is not a problem. In this case it is always possible to protect oneself against the opportunism of the counterparties with a complete contract.

If it is not possible to obtain adequate safeguards by the means of a sufficiently complete contract, those controlling the firm have stronger guarantees than the other individuals. In these circumstances, those who invest in specific resources are made vulnerable by the absence of alternative uses for their resources, and they will seek to obtain property rights on the organization or other safeguards. Samuelson's proposition no longer holds, because in this situation "who hires whom" becomes important. When different technologies are employed, the specific assets used in production also change, and so do the kinds of property and control rights that best fit the technical assets. This is the case even if also in the new-institutional approach, as in the Marxian tradition, productive forces influence production relations and property rights via different mechanisms and outcomes.

still relevant to evaluating the relevance of his contributions after the revival of Institutional and Radical Economics.

⁴ See also Alchian 1984.

⁵ Contractual incompleteness plays an important role also in the New Property Rights approach (Hart, 1985). However, in the latter, the verification cost is either zero (total contractual completeness for some transactions) or infinitely high (total contractual incompleteness for some other transactions). In this setting the strictly positive investments in ex-post verification capabilities by actors of private orderings (managers) or of public orderings (judges) cannot make sense. A theory of the firm is not really possible in this framework. By contrast, the contributions of Williamson (1985) and Calabresi & Melamed (1972) focus on ex-post governance and can provide a useful starting point for developing Coase's (1937) analysis of the firm and of other institutions (Pagano 2010 and 2012a).

A similar reasoning applies to information asymmetries. By virtue of the latter, some agents may possess hidden private information which makes complete contracts impossible to stipulate. If some agents possess concealed information, their monitoring becomes difficult, or even impossible. In this situation, the technologies employed influence the distribution of information among agents, and certain attributions of property rights tend to prevail because they fit the technical assets better (Alchian and Demsetz 1972). Given these assets, the rights attribution that allocates the rights deriving from ownership to agents difficult to control (and/or controllable at very high costs) will be more efficient because the latter possess a greater amount of concealed private information. Also this argument implies a rejection of the *property-neutrality* of technology that characterizes the neoclassical model.

Using the new-institutional approach, it is possible to explain the changes in the structure of property rights that accompany the development of the economy. For instance, development is usually characterized by employment shifts from agriculture to industry (and, later, from industry to services), and the monitoring and the specificity characteristics of the labor input are different in these three sectors. Agriculture activity requires that workers be dispersed on the land and implies that their effort cannot be easily inferred from their output because of the influence of the weather. These two circumstances do not characterize the industrial sector, and they make agricultural workers more difficult and costly to monitor by outside observers than industrial work. At the same time, a considerable amount of human capital-specificity characterizes agricultural work. Land and weather conditions differ from place to place. Knowledge about them (often in the form of ‘tacit’ skills) can influence productivity. The same holds less generally true for industrial production. In many respects, the service sector shares many of the characteristics of agriculture. Work is necessarily dispersed. Services must be specific to particular customers and hence require specific skills.

The development of an economy may therefore require that many workers have rights in relatively small organizations in the ‘early’ agricultural and ‘late’ service stage of an economy. Larger organizations in which workers have few rights may prevail in the intermediate industrial stage. This example may be excessively schematic, but it nevertheless shows that, unlike in neoclassical economics, and similarly to the Marxian theory, new-institutional economics can aid understanding of how changes in productive forces influence property relations. In the new-institutional approach, history once again matters, decreasing the gap between theory and reality. However, it matters in a rather mechanical and linear manner (Hodgson 1996). One-way causation from technical assets to property rights cannot explain the multiplicity and the complexity of the organizational paths that characterize the real-life dynamics of economic systems.

Consider the case of the Taylorist organization of production in which workers perform repetitive tasks that are very easy to monitor and require no specific skills, while machinery is highly specific to the production process and its proper use is difficult to monitor for agents not involved with it. New-institutional economists correctly point out that the employment of these technical assets is not *property-neutral*. Under these conditions, the insurance costs for the use of specific assets and the overall monitoring cost can be saved by assigning the rights on the organization to the most difficult-to-monitor and specific actors. Thus, the institutions of capitalism evolve according to the efficiency requirements of the technical assets embodied in human beings. Moreover, when a large amount of difficult-to-monitor and co-specific pieces of capital have to be employed in production, there should be individuals who are wealthy enough to own substantial amounts of this equipment.

However, the new-institutional view does not tell us where these technical assets come from and whether they are independent of the distribution of property rights. The fact that other forms of organizations, involving different rights and technical assets, have co-existed with Taylorism also challenges the assumption of the *technological neutrality* of property rights.

4. Property Biasing Technical Assets: the Radical Critique.

The *technological neutrality* of property rights was criticized by Braverman in his book *Labour and Monopoly Capitalism* and by many other radical economists.⁶ Braverman (1974) argued that the characteristics of the assets employed under classical capitalism were outcomes of its property rights. Braverman saw the essence of classical capitalism in Taylor's *scientific management* that extended and translated into a "science" the principles of the division of labor stated by Babbage (1832) . Braverman summarized Taylor's approach in three fundamental principles.

1) *dissociation of the labor process from the skills of the workers*⁷.

2) *separation of conception from execution*⁸.

6 See for instance Marglin (1974), Rowthorn (1974), Pagano (1985) Bowles (1985, 1989).

7 According to Braverman, this 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)

3) *use of this monopoly over knowledge to control each step of the labor process and its mode of execution*⁹.

In traditional agency theory, the distribution of information is exogenously given. The problem is how endogenously to determine the incentive structure or the distribution of assets that can best solve the agency problem. In *scientific management*, by contrast, the distribution of assets is exogenously given, and the problem of Taylorism is to determine endogenously the distribution of information which is best for a given distribution of assets. When, under a certain ownership system, because of asymmetric information, the use of a technology is particularly costly, attempts will be made to devise technologies that imply a distribution of information that fits that system better.

In Braverman's analysis, there is a tendency under capitalist ownership relations to devise technologies that, by transforming (and often inverting) pre-existing information asymmetries, make labor an easy-to-monitor factor. A similar process occurs for the specificity of assets. The three principles of Taylorism imply 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.

Observe that both the difficult-to-monitor character of resources and their specificity attributes define high-agency-cost resources in the sense that they involve high agency costs¹⁰ when other individuals employ them in situations of goal incongruence. In general, any property rights system tends to use technologies that minimize high-agency-cost resources owned by individuals with goals different from (or even conflicting with) those of the owners of the firm. Thus, under 'classical capitalism' workers tend to become low-agency-cost resources.

By contrast, under 'classical capitalism', similar inhibitions do not hold for the owners of resources who have rights on the organization or who can be, somehow, motivated to share its goals. Thus, under 'classical capitalism' employers and managers tend to become high-agency-cost resources. The owners of machines and other non-human inputs control the production process.

8 Braverman refers to the following statement by Taylor: "All possible brain work should be removed from the shop and centered in the planning or laying-out department....". (F. Taylor, quoted in Braverman 1974, p. 113)

9 Braverman maintains that this 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. "The most prominent single element in modern scientific management", Taylor writes, "is the task idea. The work of every workman is fully planned in advance, and each man receives in most cases complete written instructions, describing in detail the task which he is to accomplish, as well as the means to be used in doing the work.

...This task specifies not only what is to be done, but how it is to be done and the exact time allowed for doing it... Scientific management consists very largely in preparing and carrying out these tasks" ((Taylor, quoted in Braverman 1974, p. 118).

10 On the notion of agency costs see Jensen and Meckling (1976).

Machinery can be difficult to monitor in the sense that its user-induced depreciation may not be easy to estimate by observing the state of machinery before and after use. However, this is not a problem for its owners if they are also the owners of the firm and control the production. The choice of a technology such that work is easy to monitor cheapens the use of difficult-to-monitor capital: the user-induced depreciation of machines can be easily checked by observing the actions of the workers. At the same time, employers and capitalists can be certain of the fact that they will organize the production process in such a way as to take account of the user-induced depreciation of their own difficult-to-monitor machinery. The overall result is that the technology is biased towards the intensive use of difficult-to-monitor non-human capital. A similar argument holds for the specificity of the non-human assets: the owners of machinery, in that they control the organization, can be sure that the specific nature of their machinery will be taken into account in the firm's future decisions, and that they will be safeguarded against the possible opportunism of the other agents. Capitalist property rights tend to make machines specific and to transform labor into an asset *à la* Taylor deprived of specific skills (Pagano, 1991).

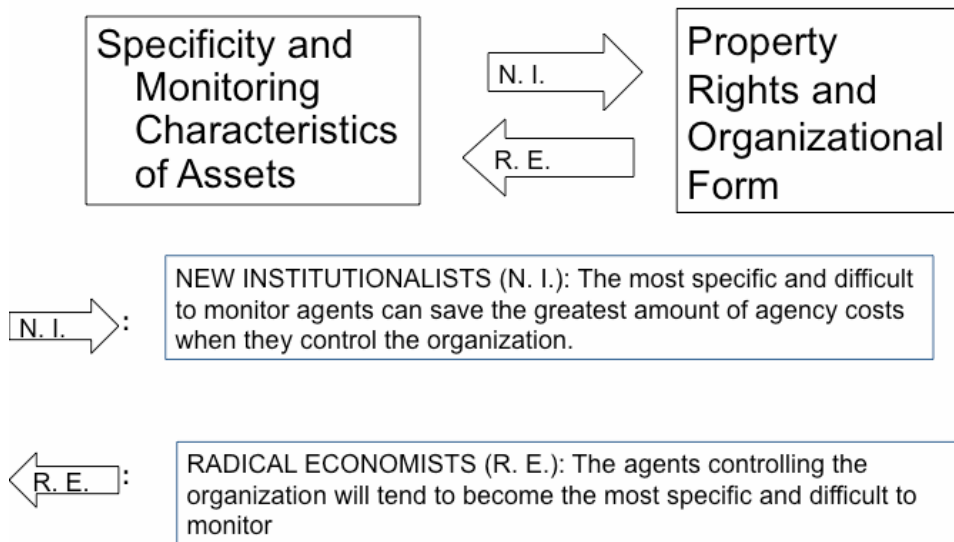
The joint implication of the monitoring and specificity arguments is that, unlike workers, machines and employers tend to become high-agency-cost factors. An unequal distribution of wealth is not a technical necessity and may instead induce the use of technical assets favoring the control of concentrated capital ownership. Technical assets employed in production are not *property-neutral* and cannot offer an unbiased ground on which to judge the property rights shaping their nature.

5. Technology-Rights Complementarities and Organizational Equilibria.

Joining together the neo-institutionalist and the radical arguments implies that neither are technical assets *property-neutral* nor are property rights *technologically-neutral* as is implicitly assumed in the neoclassical world. We thus have to deal with technological-rights complementarities where technical assets and property rights influence each other. This outcome is shown in Figure 1.

Figure 1

New Institutionalists vs. Radical Economists



According to the direction of causation considered by the New Institutionalists (N. I.), causation runs from the agency (specificity and monitoring) characteristics of the resources to property rights and organizational form. The owners of high-agency-cost factors can save the most when they control the organization. According to Radical Economists (R. E.), the relation runs in the opposite direction: owning actors have a greater tendency to become specific and/or difficult factors or, in other words, high-agency-cost factors. This is due to the fact that an owning actor has no 'inhibition' to becoming firm-specific nor to developing situations of asymmetric information under which it becomes a difficult-to-monitor factor. The N. I. and the R. E. directions of causation are far from being incompatible, and their integration can enable the definition of *multiple organizational equilibria* satisfying the *complementarities* between technical assets and property rights.¹¹

The R. E. direction of causation can be better understood by considering that changes in property rights have an effect similar to changes in relative prices. They increase the agency costs of using the non-owning factors relatively to those of the owning factors. Thus, similarly to changes in

¹¹ On the notion of organizational equilibria and institutional complementarities see Pagano (1992, 1993) and Pagano & Rowthorn (1994). According to Aoki (2001, p. 396) "Pagano (1993) and Pagano and Rowthorn (1994) are two of the earliest analytical contributions to institutional complementarities. Pagano (2007a) distinguishes between weak and strong analytical complementarities. Aoki (2010) offers an innovative analysis of the complementarities that characterize the acquisition of cognition by the different types of corporations.

relative prices, changes in property rights have a substitution effect: the high-agency-cost resources of the non-owning actors tend to be substituted away; for this reason, non-owning actors tend to become low-agency-cost factors. Or, in other words, they tend to become less firm-specific and less difficult-to-monitor than owning factors.

Thus, the changes in the technological characteristics of the resources can be explained by a mechanism familiar in standard economic theory. A change in property rights induces a process of technological substitution that tends to make non-owning agents low-agency-cost resources.

The core of the R. E. approach can be captured by the assumption that different agents face different costs when they own and run the organization and are therefore able to choose different technologies. This assumption can be formalized in a simple way that clarifies why changes in property rights induce a process of technological substitution.

In order to simplify the analysis, we assume that there are only two types of agents – capitalists and workers – that can own the organization and four types of factors: low-agency-cost and high-agency-cost capital and labor. We assume the existence of a standard production function $Q(k, K, l, L)$ such that the output Q can be produced with different combinations of low-agency-cost capital and labour (k, l) and high-agency-cost capital and labor (K, L) .

We assume that when workers own the organization they pay an additional agency cost Z in order to employ a unit of difficult-to-monitor or specific capital K – a cost that is saved when K is employed under capitalist ownership.¹² By contrast, when the capitalists own the organization, they pay an additional agency cost H when they employ a unit of difficult-to-monitor or specific labor L – a cost that is saved when L is employed under labor ownership. No such additional costs are paid for easy-to-monitor and general purpose labor and capital k and l when they are employed by either capitalists or workers.¹³

We denote with r and w the prices of respectively easy-to-monitor and/or general capital and labor, and with R and L the prices (net of agency costs) of respectively difficult-to-monitor and/or specific capital and labor. We also set the price of output equal to 1.

Under capitalist ownership, the surplus S^c of the firm is equal to:

$$S^c = Q(k, K, l, L) - [rk + RK + wl + (H+W)L] \quad (1)$$

12 These additional agency costs will be paid not only when the workers rent high-agency-cost capital but also under alternative contractual arrangements where the workers borrow monetary capital and use high-agency-cost capital as collateral. On this point refer to footnote N. 9.

13 We concentrate on a model with only two types of capital and labor. Likewise, we consider only the extreme cases of ‘pure capitalist’ and ‘pure labor’ ownership. This is for analytical simplicity. Observe that the symbols could stand for different factors: this allows alternative interpretations of the model that could be used to study the outsider-insider problem in the labor market or the relation between financial and industrial capital. .

Under labor ownership, the surplus S^L of the firm is equal to:

$$S^L = Q(k, K, l, L) - [rk + (Z+R)K + wl + WL] \quad (2)$$

We may thus formulate the R. E. direction of causation by simply assuming that the firm maximizes S^C under capitalist ownership and S^L under labor ownership. Property rights influence technology because they involve changes in the relative costs of using factors. The relative prices of the high-agency-cost capital and labor are $(H+W)/R$ under capitalist ownership and $W/(Z+R)$ under workers' ownership. Thus, under standard assumptions, the intensity of high-agency-cost capital K relatively to the intensity of high-agency-cost labor L is higher under capitalist ownership than under labor ownership; or in other words, the technology T has an intensity K/L when the property rights P are characterized by capitalist ownership. In this framework, the value of the elasticity of substitution among factors becomes a measure of the 'strength' of the effects of changes of property rights on the nature of the technology.

We have seen that the N. I. approach considers a causation mechanism running in the opposite direction. For given technical assets, the firm is supposed to be owned by that factor able to earn the highest ownership rent. This rent is equal to the difference between the cost of employing the factor in a firm that is the property of the owners of the factor and the cost of employing it in a firm that is the property of other owners. We can therefore re-state the N. I. direction of causation as follows:

For any given combination of factors employed in the firm, ownership of the firm will be acquired by the factor which can get the highest ownership rent. Therefore, capitalist property rights can prevail if, given the factors currently employed, $S^C \geq S^L$ or, alternatively,

$$ZK - HL \geq 0 \quad (3)$$

Workers' property rights can prevail if, given the factors currently employed, $S^L \geq S^C$, or alternatively,

$$HL - ZK \geq 0 \quad (4)$$

Technologies T characterized by a higher K/L ratios bias property rights P , making it relatively more appealing (or less disadvantageous) to have property rights P characterized by capitalist (instead of labor) ownership.

Thus the Radical approach focuses on the choice of the firm's technical assets for *given*

(*capitalist or workers'*) ownership arrangements. By contrast, the new-institutionalist approach analyses the property rights arrangements of the firm for any *given combination of factors employed in the firm*. We say that we have an *organizational equilibrium* when both the R. E. and N. I. directions of causation are simultaneously taken into account. For instance, in an organizational equilibrium, the behavior of the firm under particular ownership conditions must bring about technologies characterized by factor intensities that do not upset the initial ownership conditions. We can therefore give the following definition of organizational equilibrium:

An institution of production is in organizational equilibrium when it is defined by a system of property rights P and technical assets T such that T are the optimal technology under the property rights P, and P is the property rights system that maximizes ownership surplus when the technical assets T are employed in production.

Let:

$$(k^C, K^C, l^C, L^C) = \operatorname{argmax} S^C(k, K, l, L) \quad (5)$$

$$(k^L, K^L, l^L, L^L) = \operatorname{argmax} S^L(k, K, l, L) \quad (6)$$

Then a firm will be in a capitalist organizational equilibrium (COE) if:

$$ZK^C - HL^C \geq 0 \quad (7)$$

and in a labor organizational equilibrium (LOE) if:

$$HL^L - ZK^L \geq 0 \quad (8)$$

Condition (7) has an immediate intuitive meaning. Suppose that a firm is under capitalist ownership and that the production technique is such to maximise profits. Condition (7) implies that, with these technical assets, the ownership rent accruing to capitalists is at least as great as the rent which workers could obtain if they owned the firm. Hence, with this production technique, the workers would have no incentive to buy out the capitalists. This is what is meant by a capitalist organizational equilibrium. Condition (8) has an analogous intuitive meaning.

If we re-arrange conditions (7) and (4) in the following ways:

$$K^c/L^c \geq H/Z \quad (7')$$

$$K^L/L^L \leq H/Z \quad (8')$$

we can see that both conditions are simultaneously satisfied if:

$$K^c/L^c \geq H/Z \geq K^L/L^L \quad (9)$$

Since the relative prices of the high-agency-cost capital and labor are $(H+W)/R$ under capitalist ownership and $W/(Z+R)$ under workers' ownership, we have that:

$$K^c/L^c \geq K^L/L^L \quad (10)$$

(7') and (8') can be simultaneously satisfied, and we can have multiple organizational equilibria when (9) is satisfied.

Even if our four-factors model is a radical oversimplification of reality, it helps one to grasp the basic mechanisms by which property rights and technical assets, influencing each other, can generate multiple organizational equilibria.¹⁴ If, for instance, capitalist property rights prevail, some of the capitalists' agency costs are saved and a higher proportion of high-agency-cost capital is employed, making capitalist rights more convenient. However, if workers' property rights had prevailed, some of labor's agency costs would have been saved and a higher proportion of high-agency-cost labor would have been employed, making workers' property rights more convenient. These interactions between property rights and technical assets are obviously much more complex when many factors interact within the same organization. However, a multiplicity of organizational equilibria seems to be an even more likely outcome in this more realistic setting.

6. Varieties of Capitalism as Organizational Equilibria.

¹⁴ The set of agency costs (Z,K) for which there are multiple equilibria increases with the elasticity of substitution among production factors (Pagano and Rowthorn 1994). The more malleable the technology, the greater the effect of the causation flow running from property rights to technology. In the limiting case of no substitutability among factors, there is only one couple of agency costs (Z,K) for which multiple organizational equilibria exist. Earle, Pagano, Lesi (2006) show that the causation running from property rights to technology is stronger than the relation flowing in the opposite direction.

The interactions between property rights and technical assets have the capacity to generate a variety of arrangements. Even if we limit our analysis to capitalist economies, the varieties of capitalism which have characterized the world economy since the Second World War provide a good example of the multiple ways in which rights and technologies can interact to generate multiple organizational arrangements.

In the post-World War II period, until the mid-1990s, different models of capitalism prevailed in the US, (West-)Germany and Japan. In each of these economies there was a plurality of organizational arrangements. However, the stereotypes with which each model was characterized contained some truth in the sense that, in each system, network externalities in property rights and technologies involved the prevalence of some self-reinforcing organizational arrangements.

In comparison to Germany and Japan, the US were marked by a prevalence of firms based on Taylorism and Fordism, which were both developed and applied in the US. In this variety of capitalism, shareholders and management have strong liberties, including the freedom to fire workers easily. Workers are vulnerable to this freedom and have no right to a well-defined occupation or some generic job within a certain firm. The firm can be traded as a commodity, and a new management, on taking over the organization, can easily break the implicit contracts with the workers. This set of property rights is associated with technical assets characterized by the centralization of knowledge in the hands of management and by top-down co-ordination and innovations such that workers at the bottom of the hierarchy perform very detailed jobs and are simply required to execute very narrow and rigid instructions. Thus, following this highly imperfect stereotype, the 'American' variety of capitalism can be seen as an organizational equilibrium in which, *inter alia*, relatively weak property rights induce a low investment in workers' high-agency-cost skills and, vice versa, this configuration of technical assets entails that workers have scant incentives to acquire assets in firms. Specific machinery and centralized skilled scientific management are the necessary counterparts of this organizational model.

The post-war Japanese and German varieties of capitalism departed from the classical Taylorist-Fordist stereotype in two different ways. Both models relied on some decentralization of knowledge and bottom-up innovation. Japan relied very much on a company workers' capitalism mainly based on organizational rights. Whilst Japan was not the only country with firms offering lifelong employment, this organizational form was so prevalent in Japan that most people identify company workers' capitalism with that country. The German model was characterized not so much

by strong rights at firm level as by strong centralized unions and widespread occupational rights.¹⁵ Germany shared the existence of strong unions with many European countries, but its variety of capitalism was seen as an efficient blend between centralized workers' rights and their skills. As a consequence, the skills and the technology of the firms prevailing in the Japanese and German varieties of capitalism were biased in two different directions.

The Japanese model was also based on two complementary rights and technologies. This variety of capitalism emerged as a consequence of the political shocks which hit Japan after the end of the Second World War. At that time, the crackdown first on the traditional *zaibatsu* capitalist families and then on the centralized unions produced the *keiretsu* system. In this system, the workers had relatively strong rights but only within the organization – a circumstance that favored the development of organizational skills but backfired on organizational rights, reinforcing their institutional stability. More precisely, the post-war Japanese model was based on a distribution of rights which restricted the freedom to fire of shareholders and management, while complementary institutions, such as main banking and cross-shareholding, isolated the firm from the stock exchange and protected the workers' implicit contracts from takeovers. The Japanese variety of capitalism has also been based on complementary technical assets defining a consistent organizational equilibrium. The decentralization of a great deal of knowledge, bottom-up co-ordination and innovation, and rotation among different jobs led to the acquisition of remarkable team-specific skills difficult for outsiders to monitor. In turn, this configuration of technical assets implied that the long-term commitment to the firm and the job rights within it were valuable for both the organization and the workers.

The German model is also rooted in the political circumstances that have characterized the history of that country. In this case, centralized employers' and employees' associations have run the economy together with a centralized banking system. Consensus on the nature of the 'social market' characterized both the Christian Democratic and the Social Democratic Party, and it allowed the (West) German state to run the economy in co-operation with these two centralized associations.¹⁶ The existence of these political actors granted economy-wide rights to workers.

15 In Japan, workers had organisational rights, mainly in terms of job tenure and work organization, within a certain company. By contrast, in Germany the workers had (also) occupational rights on a certain activity intended to fulfill the same standards and the same job definition across all companies – a tradition rooted in never dismantled system of craft guilds (Epstein 2008). Japan approximated a "company workers' variety of capitalism" while Germany was close to a "unionised variety of capitalism" as defined in Pagano (1991).

16 Fioretos (2001) shows how the consensus on the nature of the German economy has shaped the approach to the

While Japanese workers were safeguarded against the specificity of their skills by rights at firm level, German workers were (also) directly safeguarded against the firm-specificity of their skills¹⁷. Job specifications were set and standardized by the employers' associations and the unions, with the help of the State, which also organized an excellent system of vocational education consistent with the agreed job requirements. These types of arrangement allowed the development of skills that were 'occupation specific' but at the same time 'general purpose' in the sense that they could be applied in a large number of firms. Again, a self-reinforcing interaction characterized the relation between technological assets and property rights. A system of occupational rights made it convenient to develop a technology based on general-purpose skills. At the same time, the very existence of this technology was a strong incentive for the development of institutions providing the rights and safeguards for the numerous general-purpose skills employed under this technology. Thus, the German variety of capitalism is also likely to have emerged from a complex interaction between property rights and technical assets that generated a different kind of organizational equilibrium.

The high intensity of trade which characterized the post-World War II period did not involve a convergence of these varieties of capitalism towards a single economic model. By contrast, if we consider them as different organizational equilibria, we see how the high intensity of international trade may have favored a process of international differentiation.

From the organizational equilibria perspective, different varieties of capitalism rely on different rights that change the agency costs of using different technical assets. Thus, the different rights existing in the three major capitalist economies implied different factor prices, with the consequence that each of them had a different institutional comparative advantage and a different intensity in the use of the high-agency-cost technical assets. Thus, following the predictions of standard economic theory on international trade, they specialized in those sectors where they held a

European Community shared by both of the two major German parties, distinguishing them from the similar common approach of the Labour and Conservative parties in Britain. This continuity and these national differences can only be explained by considering the different characteristics of these two economies. For their analysis see also Wood (2001).

17 Estevez-Abe, Inversen and Soskice (2001) observe that Germany is characterised by both high unemployment protection and high employment protection. Thus, there is some inducement to acquire both industry-specific and firm-specific skills. They observe (p. 152) that "high unemployment protection is also important in so far as it allows workers to turn down job offers outside their previous industry or occupation. If compelled to accept a job offer outside the worker's core competencies, either because of low benefits or a strict requirement to accept almost any job offer, this undermines the worker's incentives to invest in industry-specific skills". Thus, according to Estevez-Abe and colleagues, it lies somewhere in between a model of "company workers' capitalism" characterised by a system of "organisational rights" and a model of "unionised capitalism" characterised by occupational rights. The characteristics of these 'ideal-types' of capitalism are

comparative advantage. In each variety of capitalism, the growing intensity of international trade expanded the sectors where property rights had the effect of abating agency costs and increasing the employment of certain technical assets. Inter-country institutional diversity was thus increased by expanding only those sectors where each national system of rights entailed a comparative institutional advantage in the use of the associated technical assets. At the same time, intra-country institutional diversity could be decreased by the fact that each country tended to abandon comparatively disadvantaged institutions. As international trade intensified, the varieties of capitalism were not bound to be reduced. Different types of organizational equilibria were still feasible and could contribute to its biodiversity.

7. Global Rights and Intellectual Monopoly Capitalism.

While the increasing intensity of international trade may even stimulate institutional diversity, the global rules underlying financial integration and the regime of intellectual property rights have acted in the reverse direction. Unbounded capital mobility and the global enforcement of intellectual property rights came about in the 1990s after the fall of the socialist regimes, and they were formalized with the 1994 institution of the WTO and the annexed TRIPS (Trade-Related Aspects of Intellectual Property Rights) agreement. Financial globalization has not only had the effect of introducing uniform, and often minimum standards, in the realm of finance; it has also applied a great deal of pressure on countries to reduce various forms of social protection (Rodrik 2011). It has greatly contributed to reducing the possible set of capitalist varieties, increasingly restricting their features to those compatible with the evaluations of international capital markets. The global regime of intellectual property rights has played an equally important, even if not similarly evident, role in the reduction of the biodiversity of the organizational equilibria underlying the different varieties of capitalism.

We saw in section 4 how Braverman maintained that the *monopoly over knowledge to control each step of the labor process and its mode of execution* is a characteristic feature of capitalism. However, not even Braverman mentioned the most extreme and significant step in this monopolization process: the privatization of knowledge and its direct transformation into the most valuable proprietary asset of the firm. This process, which has characterized the last

outlined in Pagano (1991) and, with a different terminology, in Hall and Soskice (2001).

two decades, motivates the addition of the word *intellectual* to the term *monopoly capitalism* used by Harry Braverman (Pagano 2012b).

The main characteristic of *intellectual monopoly capitalism* is that monopoly is not only due to the concentration of knowledge in the hands of capital and management advocated by Taylor. It becomes also a *legal global monopoly* on some pieces of technological knowledge. While patents and other forms of intellectual monopoly existed before the industrial revolution, they were considered as a necessary evil to encourage innovation. Their enforcement was weak, and it was limited by the fact that nation-states could enforce them only within the boundaries of their jurisdictions. With the institution of the 1994 TRIPS agreement intellectual monopoly was promoted to the rank of standard private property, and its enforcement became global. The privatization of property entails that no other individual can use a piece of knowledge even if it is by its nature non-rival and all individuals could use it without depleting its availability. Unlike traditional forms of private property that interfere with the liberty of the individual in a limited physical space, intellectual private property involves a global limitation of the liberties of the other individuals. Thus the enforcement of intellectual property became really effective only when it became global.

The reinforcement and the extension of intellectual property have been compared to the enclosure of common land that preceded the industrial revolution.¹⁸ Also in this case, some commons were turned into exclusive private property. There is, however, a fundamental difference. In the case of land, the object of privatization was a local common that involved the legal positions of few individuals. By contrast, the privatization of intellectual property changes the legal positions of many individuals and has major implications for the international standings of different countries. Whilst privatizing land has only local implications, the holders of property rights on knowledge end up with global rights equivalent to the imperial powers of the past. They can decide whether a certain production process can be undertaken in particular country and they limit the future technological opportunities of other firms.

The existence of global rights in some important spheres of the economy implies that, in some cases, the choice of technical assets is limited to the set of them which is compatible

18 For instance, see Shiva (2001: pp. 44-48) and Boyle (2003). On the industrial revolution see Vespasiani (2010). Whilst the private appropriation of knowledge is supposed to stimulate growth and innovation, there is growing evidence that, beyond a certain level, private appropriability hampers economic development (Hardin 1968, Heller, Eiseberg 1998, Dosi Marengo, Pasquali 2006, Boldrin and Levin 2008, Pagano and Rossi 2004, David 2011) and, according to Pagano and Rossi (2009), it is

with these rights and the related constraints on others' liberties. In some extreme cases, only one organizational equilibrium is possible and the number of possible varieties of capitalism may be seriously limited.

Indeed, the global privatization of much new knowledge has involved some sort of revenge by the Taylorist model on the German and Japanese organizational forms (or their stereotypes that were enviously studied by American firms in the late 1980s). Until the 1980s, one could have easily gained the impression that a Taylorist system of top-down coordination and innovation was bound to be outcompeted by a system which relied also on continuous bottom-up inputs. The precise instructions and routines issued by the former could be easily imitated by the latter, which was based on tacit knowledge and uncoded routines that made imitation by the former difficult. The privatization of intellectual property reversed the situation. The private appropriation of knowledge was easier when it was formalized and centralized in Taylorist-Fordist organizations. At the same time, the increased protection of private knowledge made it difficult to exploit the advantages of marginal bottom-up improvements, which were often constrained by patents and licenses.

With the massive use of private intellectual property rights, the separation between conception and execution has become much wider. Intellectual property rights have made conception the source of non-human technical assets that are often the most valuable part of the firms' capital. Execution is then driven by privatized intellectual capital to an extent that even Taylor, with his idea of well-defined tasks, would have found difficult to predict. Execution can be decentralized to cheap labor countries, while a distant ideation process increases the firm's capital in the form of proprietary knowledge. While there is still a remarkable variety of capitalist economies, one cannot exclude the possibility that a new form of 'global Taylorism' may prevail as the unique form of organizational equilibrium of the future world economy. The unbounded mobility of financial capital and the massive privatization of knowledge are very likely to apply pressure in that direction.

Privatized knowledge must now be included among the most important technical assets available to a firm, and the skills of an organization's members are likely to become highly co-specific to those assets. The extent of the knowledge owned by the firm sets limits on its possible future technological development, including the skills which are worth developing within the organization. Firms may find themselves in a virtuous circle where the ownership of intellectual assets stimulates the acquisition of the co-specific skills and, vice

versa, the availability of these skills makes it possible to acquire new intellectual property rights. However, if a firm is to enjoy this virtuous circle, it must have monopoly on certain technical assets. This monopoly implies that some other firms will find themselves in a vicious circle: because of the lack of intellectual property rights, they do not find it convenient to enhance their skills, and because of the lack of the relevant skills, they are unable to acquire intellectual property. These virtuous and vicious circles can be seen as different organizational equilibria generated by different configurations of property rights and technical assets. The polarization of organizations between these different organizational equilibria may be another undesirable consequence of *intellectual monopoly capitalism*.

Globalization may involve a tendency to simplify the varieties of capitalism into two equilibria: a virtuous high-skills/high-IPR equilibrium for a few firms and a vicious low-skills/low-IPR equilibrium for many others (Pagano Rossi 2004). The two main novelties of globalization – the integration of financial markets and the privatization of knowledge – push in the same direction. Grandori (in this volume) observes that, whilst not all human capital can be disembodied from the minds of agents, the degree of inalienability of human capital from the agents producing it should be considered (at least partially) endogenous. Indeed, the post-WTO process of knowledge privatization has greatly increased the degree of alienability of human capital; and at the same time it has increased the reliability of financial control by firms. Privatized knowledge, like machines and buildings, can now be included among the firm's assets. Unlike the knowledge embodied in humans (who can always quit the firm), privatized knowledge is a secure asset contributing with increasing intensity to the financial value of the firm.

Financial markets have expanded because, thanks to TRIPS, much knowledge has been made alienable. Notwithstanding the much-publicized 'de-materialization' of production, an increased amount of assets has become the object of secure property rights to be exchanged on financial markets. At the same time, the globalization of finance has opened unprecedented options for financial capital, and it has induced each firm to compete, in all possible ways, to attract finance. This has greatly increased the pressure on each firm to increase the intensity of its capital disembodied from human beings and on which secure property rights can be defined¹⁹. Thus, financial global integration and the global privatization of knowledge are two mutually self-reinforcing processes which are likely to push all varieties of capitalism towards

¹⁹ By contrast, labor cooperatives flourish in regions where local banks have the relevant information on their clients (Gagliardi 2009).

a single model characterized by the greatly increased alienability and reification of human capital²⁰. Whilst a variety of organizational arrangements is unlikely to disappear, the coupling of these two process may severely reduce the biodiversity of capitalism.

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²⁰ Since knowledge is a fugitive resource on which it is increasingly difficult to define private property rights (Arrow 1996), Bowles (2004) predicts that, in the long run, its private appropriation is not sustainable.

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