UGO PAGANO - ROBERT ROWTHORN .

OWNERSHIP, TECHNOLOGY AND INSTITUTIONAL STABILITY.*.

For a given technology, the ownership of the firm goes to the high-agency-cost factors that can save the most on agency costs when they own the organisation. At the same time, owning factors choose technologies that save on the use of other high-agency-cost factors. Thus, ownership and technology define self-reinforcing multiple organisational equilibria. The institutional stability of an organisational equilibrium depends on the possibility of substituting non-owning high-agency-cost factors away from the organisation; it increases together with the elasticity of substitution.

Introduction.

In recent economic theory the firm is defined as an institution where some agents exercise some governance over other agents. Governance can improve on market transactions when agency costs are high because of the existence of specific or difficult-to-monitor assets.

Three questions arise in this context:

1) which factors will control the organisation and will have the power to "design" the production process[1]?

2) how will different factors exercise this power?

3) will the exercise of this power change the nature of the technology and of the factors employed in the firm?

1) The first question can be answered by observing that if governance arises to save on agency costs, organisations should be controlled by the most specific or difficult-to-monitor factors: they will able to save the most on the risk-premium due to resource specificity or on the monitoring expenses that would have to be paid if they were employed in other people's organisations . In other words, these agents should control the organisation so as to economise on the high agency costs which would be incurred if they were employed in organisations owned by others.

2) As to the second question, it can be argued that the exercise of power will change according to the particular factor that controls the organisation. Observe that the factor owning the organisation does not pay for its own agency costs whereas it does pay for the agency costs of the other factors. Thus each type of owner will tend to develop a technology that saves on the agency costs of employing the remaining non-owning factors.

3) Finally, an answer to the third question can be deduced from the argument outlined above. Owning factors have to pay high agency costs in order to employ difficult-to-monitor

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[1] In this paper we will assume that the owners of one factor (capital or labour) will also be the "owners" of the organisation and will have the power to design the "production process". This is a very unrealistic assumption that we have introduced in order to simplify the study of the relation between rights and technology. A more general analysis should allow for the fact that many agents exercise their "influence" on the "design" of the production process. On the role of "influence costs" in the theory of the firm see Breton and Wintrobe (1982) and Milgrom and Roberts (1990).

and specific factors. Thus they will try to replace these factors by easy to monitor or non-specific factors: an attempt will be made to change the nature of the non-owning factors and to make them "easy to monitor" and "general purpose". This does not happen to the owning factors because no agency cost for their use has to be expended by the firm. Thus, owning factors choose a technology that tends to make themselves more difficult-to-monitor and specific than would be the case if they did not own the organisation. Ownership biases the nature of the factors: owning factors tend to become more specific and more difficult to monitor (compared to the situation where they do not own the organisation); non-owning factors tend to become less specific and less difficult to monitor (compared to the situation where they do own the organisation).

Observe that the last point concerns something we assumed <u>to be given</u> to answer the first question: we have just argued that owning factors tend to become more specific and difficult to monitor but we also argued that ownership goes to those factors that are more specific and more difficult to monitor. If it is accepted (as we do) that both arguments are correct, then it must also be maintained that property rights and the nature of technology tend to be self-reinforcing: the nature of technology and of resources may have a tendency to re-generate itself via property rights while the latter in turn re-generate themselves via technology. Let us define such a self-sustaining construction as an "<u>organisational equilibrium</u>". The following new questions then arise:

1) Does an organisational equilibrium exist for any pattern of agency costs?
2) When do multiple organisational equilibria arise? Are they the exception or the rule? Are there patterns of agency costs that always cause multiple equilibria?
3) How do more or less rigid technologies (or different elasticities of substitution among factors) affect the existence and the multiplicity properties of organisational equilibria?
4) How stable are organisational equilibria to changes in agency costs due to institutional shocks, changes of the social climate and changes of the "governance technology"?
5) Do inefficient organisational equilibria exist? Are they "institutionally stable"? Can we justify economic policies that aim to change organisational equilibria ?

In this paper we try to answer these questions. In the following section we define more precisely the concept of organisational equilibrium and we show that it can encompass mechanisms and interpretations that are typical of the New Institutional and the Radical

literature. In the second section we outline the assumptions of our model and give a formal definition of organisational equilibrium.

In the third section we show that for each pattern of agency costs an organisational equilibrium always exists. We identify the conditions under which there are capitalists' or workers' unique equilibria and/or multiple equilibria: we show that for any technology there is always a pattern of agency costs for which multiple equilibria exist and that, for each pattern of agency costs, the likelihood of multiple equilibria increases with the elasticity of substitution.

The elasticity of substitution σ plays an important role in our argument. We will show that a high σ acts like a good "anti-virus": it favours the rejection of the non-owning factors, that, because of the increase in their agency costs, threaten to upset the health of the existing ownership regime. Unfortunately, the "anti-virus" works particularly well with the factors that are the most efficient potential alternative owners. They are efficient potential alternative owners because of the high agency costs that must otherwise be paid when they are employed by other factors . A high σ causes an unfortunate "preventive treatment":these factors are promptly replaced by factors that are cheaper for the present owners.

In the forth and fifth sections we consider the "institutional stability" and efficiency properties of organisational equilibria: we show that, for sufficiently high values of the elasticity of substitution between factors, inefficient but institutionally stable equilibria are likely to exist.

In the concluding section we observe that our analysis offers a possible argument in favour of policies for the extension of democracy to economic life.

1. The "inverted" arguments of New Institutionalists and Radicals.

Consider a traditional capitalist firm organised on strict Tayloristic principles and suppose that a representative Radical economist and a representative New Institutional economist[2] agree to examine and explain the nature of this firm. They agree that two sets of facts, one concerning the property rights and the other the nature of the technology and of the resources, characterise this firm:

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[2] Both New Institutionalist and Radical theories are so complex and developed that it is very difficult to make any clear-cut division between them. No economist will completely identify himself/herself with the ideal types considered above. However, we believe these ideal types to be fair representetions of these alternative view points.

(a) <u>the rights that the owners of the resources have on the firm</u>:

They observe that the owners of capital own the organisation and they have hiring and firing rights. By contrast, workers have no rights in the organisation, they can be fired whenever the employers decide that it is convenient for the firm.

(b) <u>the technological nature of the resources employed in the firm:</u>

Much capital equipment is specific to the firm: many machines appear to be tailored to the production needs of that particular organisation and could not be used in other organisations. Moreover, machines are "difficult-to-monitor"[3]: in the sense that it is not possible to infer their user-induced depreciation by simply observing their physical state before and after they have been used: the use of the machine must be directly monitored if one wants to assess user-induced depreciation. The characteristics of the workers lie at the opposite pole: they perform simple movements at the assembly line that require no firm-specific skills. It is easy for supervisors to monitor the workers who are often also "monitored" by the pace of machines themselves.

Does the consensus on these facts imply some consensus on the theory explaining them?

We believe not. Each one of the two economists can claim that the correlation between these two sets of facts is not inconsistent with their own theory about the direction of causation among them.

According to the New Institutionalist[4] (b) causes (a).

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[3] The concept of "difficult to monitor capital" is due to Alchian and Demsetz (1972). If the owners of the firm own the capital employed in the organization, then they have a incentive to take care of their capital. When user induced depreciation is difficult to monitor, the possibility of careless use makes the rental of "difficult to monitor capital" more expensive than its ownership.(Alchian and Demsetz 1972). A possible objection to this argument is that, instead of renting machines, the workers may borrow money, buy the machines and use them as collateral. Still, this objection can be answered by observing that difficult-to-monitor machines are less valuable as collateral than easy-to-monitor machines because it is more difficult to liquidate them in case of bankruptcy. In both cases it will be more expensive to rent difficult-to-monitor capital than easy-to-monitor capital. An analogous argument applies for firm-specific machines. Of course, labour can be "difficult to monitor" in many other different and more complex ways.

[4] The New Institutionalist school stems from Coase (1937), (1960). It includes the contributions of Alchian (1987), Alchian and Demsetz (1972a) and (1972b), Jensen and Meckling (1976), Demsetz (1966), North (1981), and Williamson (1985). They see the firm and the property rights structure of the firm as an efficient answer to the cost of using the

The New Institutional Economist maintains that capital controls the organisation because it is a difficult to monitor or a specific factor. Workers lack these rights because they are general or easy to monitor factors. Thus, the nature of the resources employed in the organisation shapes "efficiently" the structure of rights: "efficiency" implies that capital should hire labour, not vice versa.

For, suppose that we change the system of property rights and assume that workers own the organisation and hire the machines. The fact that easy-to-monitor or general labour hires difficult-to-monitor or specific capital increases the agency costs in the form of monitoring or insurance against opportunistic behaviour. For example, firm-specific capital would be rented to others without rights or safeguards only at a very high price: an insurance premium would need to be paid to cover the risks due to the absence of alternative employment for specific resources. Conversely, the owner-workers would be willing to employ these factors only if their productivity compensates for the risk that it is difficult to replace specific factors. Analogous arguments apply in the case of difficult to monitor capital.

Under some alternative sets of unforeseen circumstances, each factor could be a victim of the opportunism of the other - a circumstance that make very high the transaction costs of employing difficult-to-monitor and/or specific factors. These costs are saved in the "Tayloristic" firm, examined by our two economists. Here, following the New Institutionalist "predictions", difficult-to-monitor or specific capital does "efficiently" hire easy-to-monitor or general labour.

However, the Radical economist[5] can also claim that the correlation of facts observed in the Tayloristic firm is not inconsistent with his or her theory. Indeed, according to Radical theory, (a) explains and is the cause of (b).

The Radical Economist believes that the argument of the New Institutional Economist can be turned upside down. According to such an economist the workers have become "easy-to-monitor" factors without firm-specific skills because they do not have any rights in the organisation.

This lack of rights implies that the workers do not identify themselves with the goals of the firm. As a result, monitoring workers is very expensive and capitalists have replaced difficult-

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market mechanism. From this point of view also Grossman and Hart (1986), Hart and Moore (1990) can be considered part of this school. Useful readers are Putterman (1986) (that includes also "radical" contributions)and Williamson and Winter (1991). The relation between the modern transaction cost approach and earlier approaches based on the disequilibrium costs of the market mechanism is considered in Pagano (1992a).

[5] Radical contributions start with Braverman (1974) and Marglin (1974) and Rowthorn (1974). They include Bowles (1985), Bowles and Gintis (1986), Edwards (1979), Pagano (1985) and Putterman (1982). They emphasise that property rights and power relations shape technology and the organisation of labour.

to-monitor with easy-to-monitor labour. This substitution has occurred also in cases when difficult-to-monitor labour was (net of agency costs) considerably more productive than easy-to-monitor labour.

According to the Radical economist a similar explanation holds also for nature of labour-skills: the development of firm-specific skills is inhibited by the absence of rights and safeguards for these factors; this makes their employment very costly. On the one hand, the workers fear that, in unforeseen circumstances, in case of dismissal they may be lose their firm-specific investment in human capital. On the other hand, the employers fear that, in other unforeseen circumstances, the workers, lacking rights and attachment to the firm, may opportunistically exploit the fact that the specificity of their skills makes it difficult to replace them.

Thus, according to the Radical economist, under capitalist property rights there is a strong incentive to replace difficult-to-monitor with easy-to-monitor labour and there is a similar incentive to replace specific with "general-purpose" labour. The "substitution effect", due to "capitalist property rights", explains the fact that the firm makes such an intensive use of assembly line unskilled worker. These workers repeat simple movements that are easy to monitor and do not require any firm-specific skill - an outcome that is perfectly consistent with the "predictions" of Radical Theory. By contrast, under this system of property rights, capital tends to become relatively difficult-to-monitor and firm-specific because, unlike the workers, no risk premium or monitoring costs have to be expended on this factor.

The Radical and the New Institutional Economist disagree also on the desirability of policies aimed at changing the situation of the firm. According to the New Institutionalist the change will "spontaneously and correctly" come about if technology requires a new set of property rights that minimises transaction costs; policies intending to change rights will be counterproductive and inefficient. By contrast, according to the Radical the existing property rights are shaping the development of the technology in a way that is undesirable: new rights are required to change the type of development which is occurring within the context of the present technological paradigm.

We have constructed our imaginary debate between a New Institutionalist and a Radical economist in such a way that their differences come out very sharply and clearly. But are the Radical and the New Institutionalist theories really incompatible?

We strongly believe that the answer to this question is no. Indeed the main thrust of this paper is the <u>self-sustaining nature of economic institutions</u> 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 self-sustaining. In this case we can say that we are in a situation of "organisational equilibrium"[6].

Thus an organisational equilibrium is defined by the fact that property rights "re-generate" themselves via technology and technology "re-generates" itself via property rights. An organisational equilibrium is therefore characterised by equilibrium property rights and technologies. We may interpret an organisational equilibrium as a property right or a technological equilibrium according to the nature of the initial shock: a property rights equilibrium is an organisational equilibrium when the initial shock is to the property right system whereas a technological equilibrium is a an organisational equilibrium where the initial shock is a technological change such as a new invention.

In many cases it is impossible to identify a single initial shock and we cannot say whether we are in a technological equilibrium or in a property right equilibrium. However, we may still define an institution as an organisational equilibrium as long as we can identify the "New Institutional" and "Radical" mechanisms that make it self-sustaining after its establishment.

In this respect, independently of its historical origins (which may be different in different countries) the "Tayloristic firm", visited by our two economists, defines an organisational equilibrium: the rights of management and capital on the organisation induce a Tayloristic technology (difficult-to-monitor or specific capital and easy-to-monitor general purpose labour) that can only be cheaply operated under ownership; or, alternatively, the Tayloristic technological specification of resources induces capitalist ownership under which it is optimal to choose a Tayloristic technology.

Our concept of "organisational equilibrium" is related to the Marxian notion of "mode of production"[7] that is also based on a close interaction between property rights (relations of production) and technology (productive forces). This relation, however, is subject to two qualifications:

a) our analysis is related to what Hirschman (1981, p. 89) has aptly defined as "micro-marxism". Hirschman observes that Marx "oscillated between the grand generalisation with which to characterise an entire epoch or process and the discriminating analysis of events which

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[6] The concepts of organisational equilibria and property rights equilibria are developed in Pagano (1991b) (1992b) and (1993).

[7] Rowthorn (1974) argues that what is missing in both Neo-classical and Neo-Ricardian economics is the concept of "mode of production".

made differences between countries and subperiods stand out in richly textured detail"[8]. Our analysis is clearly related to the second approach. For example, we would define as alternative "organisational equilibria", or modes of production, Fordist-type firms and Japanese-type firms.

   b) Marxist analysis has often oscillated between "technological determinism" (technology invariably gives rise to a unique set of property rights) and "property rights romanticism" (alternative property rights can invariably bring about an alternative technology)[9]. We claim that our concept of organisational equilibrium can clarify and overcome the limitations of these two extreme views.

   This last point takes us to the threshold of the formal analysis of the next section. A consequence of this analysis is that "technological determinism" is untenable because, for whatever technology, there is always some combination of agency costs such that multiple organisational equilibria are possible. At the same time, we show that "property rights romanticism" is also seriously flawed because the set of agency cost combinations under which multiple property rights equilibria are possible is both bounded and conditioned by the possibilities of "technological substitution" existing in the economy. The analysis of the institutional stability and efficiency have additional consequences for these issues.

2. A formal definition of organisational equilibria.

   The two fundamental assumptions of our model may be traced back to the two fundamental "Radical" and "New Institutionalist" mechanisms that we have considered in the preceding section.

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[8]   Such a definition of "micro-marxism" does not necessarily have a "left-wing" political connotation. It could include Demsetz (1966) contribution and many other so called "right-wing" analysis. The fact is that when we come to "theories of history" "there is so little in the way of an alternative vision which is available" (Hicks 1969 p. 3).

[9] Marx contains both types of elements and is not often able to find the right balance between them. Marxists have given different importance to the "primacy" of the productive forces or to the influence of property rights on technology. For instance Cohen (1978) defends this "primacy" whereas Brenner (1986) criticises it. Roemer (1988) offers an useful survey of both. Observe that both New Institutionalists and Radicals could claim that Marx is one of their predecessors.

The "Radical" assumption is that capitalists and workers face different costs when they own (and run) the organisation (and are therefore likely to choose different technologies). When workers own the organisation 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 By contrast when the capitalists own the organisation they pay an additional agency cost H when they employ a unit of difficult-to-monitor or specific labour L - a cost that is saved when L is employed under labour ownership. No such additional costs are paid for easy-to-monitor and general purpose labour and capital k and ℓ when they are employed by either capitalists or workers[10];. Thus, denoting by r and w the prices of respectively easy-to-monitor and/or general capital and labour and by R and L the prices (net of agency costs) of respectively difficult-to-monitor and/or specific capital and labour, we can formulate our "Radical" assumption as follows:

Assumption 1.
Under capitalist ownership firms maximise profits equal to:

$$R^c = Q\,(k, K, \ell, L) - [rk + RK + w\ell + (H+W)L] \qquad (1)$$

Under labour ownership firms maximise profits equal to:

$$R^L = Q\,(k, K, \ell, L) - [rk + (Z+R)K + w\ell + WL] \qquad (2)$$

The New Institutionalist assumption is that the firm is owned by that factor which can earn the highest ownership rent. This rent is equal to the difference between the cost of employing the factor in a firm that is property of the owners of the factor and the cost of employing it in a firm that is property of other owners.

Assumption 2.

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[10] We concentrate our attention on model with two types of capital and labour. Likewise we consider only the extreme cases of pure capitalist and pure labour ownership. This is done 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 labour marker or the relation between financial and industrial capital.

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, $R^c \geq R^L$ or, alternatively,

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

workers' property rights can prevail if, given the factors currently employed, $R^L \geq R^c$, or alternatively,

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

Thus "the Radical assumption" concerns the behaviour of the firm for any *given (capitalist or workers') ownership*. By contrast the "New Institutionalist assumption" concerns the ownership conditions of the firm for any *given combination of factors employed in the firm*. We say that we are in an *organisational equilibrium* when both the Radical and New Institutionalist assumptions are simultaneously satisfied: in an organisational equilibrium the behaviour of the firm under particular ownership conditions must bring about technologies characterised by factor intensities that do not upset the initial ownership conditions. We can therefore give the following definition of an organisational equilibrium:

Definition 1.
An institution of production is an <u>organisational equilibrium</u> when it is defined by a system of property rights P and a technology T such that T is the technology that maximises rent under the property rights system P, and P is the property rights system that maximises ownership rent with the factor intensities associated with T.

In other words, there will be a capitalist organisational equilibrium (COE) if there is a technology that maximises (1) and satisfies (3) and there will be a labour organisational equilibrium (LOE) if there is a technology that maximises (2) and satisfies (4). Let:

$$(k^c, K^c, \ell^c, L^c) \quad = \quad \mathrm{argmax} \ R^c\,(k, K, \ell, L) \qquad\qquad (5)$$

$$(k^L, K^L, \ell^L, L^L) \quad = \quad \mathrm{argmax} \ R^L\,(k, K, \ell, L) \qquad\qquad (6)$$

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

$$ZK^c - HL^c \geq 0 \qquad\qquad\qquad (7)$$

and in labour organisational equilibrium (LOE) if:

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

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

It will also be useful to write the conditions for COE and LOE in the following equivalent ways:

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

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

Conditions (7') and (8') have also an intuitive meaning. Observe that K/L is the ratio of high-agency-cost (H-A-C) capital to H-A-C labour or <u>the H-A-C capital intensity</u>; observe also that H/Z is the <u>agency cost ratio</u> between the capitalist's extra-cost in employing H-A-C labour and labour's extra-cost in employing H-A-C capital. Thus (7') means that a COE is feasible when the intensity of H-A-C-capital is greater than the agency cost ratio and (8') means that a LOE is feasible when the intensity of H-A-C capital is lower than the agency cost ratio. For instance, high agency costs per unit of labour could be compensated by the employment of a great amount of H-A-C capital and make it feasible a COE.

The conditions for the existence of organisational equilibria can also be interpreted as a Nash equilibrium. Organisational equilibria may be defined by the fact that "production

managers" choose that technology that maximises profits <u>given the existing property rights</u> <u>system</u> and by the fact that "financiers" arrange property rights that maximise ownership rent <u>given the existing technology</u>. In this sense condition (7) says that capitalist property rights are the best response of "financiers" given the technology chosen by the "production managers". The same condition says also that a H-A-C capital intensive technology is the best response of the "production managers" given the capitalist property rights chosen by the "financiers". Condition (8) has an analogous interpretation[11].

3. Existence and multiplicity of organisational equilibria.

We now establish some propositions concerning the conditions under which we have multiple and unique organisational equilibria.

We start by defining by R^O as the profits of a traditional neo-classical firm where agency costs are equal to zero. Thus:

$$R^O = Q\,(k, K, \ell, L) - [rk + RK + w\ell + WL] \qquad (9)$$

and

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[11] Thus the concept of organisational equilibria is based on the assumption that "financiers" have perfect knowledge of the value of the company for alternative owners using the existing technology but they are ignorant of the value of the company under alternative technologies. This informational structure is based on the idea that technology is not a "menu" that is available for free to everybody but has to be created, developed and transmitted at certain costs in a given institutional framework, characterised by certain property rights. When certain property rights are missing, much of the knowledge about the associated "optimal" technology is also likely to be missing.

Our point is consistent with the idea that it is very unlikely that an isoquant, describing all the production techniques, can ever be "produced" and be known to all the agents The techniques, that are currently used, are likely to determine the "piece" of the "new" isoquant that is "produced". Property rights act similarly to factor prices and, indeed, affect these prices (when they include also agency costs). In this way, they influence the choice of the current technique and the set of new techniques that are going to be "produced". On the "path dependency" characteristics of technological development see David (1975), Nelson and Winter (1982), Dosi (1988), and Inkster (1991).

$$(k^o, K^o, \ell^o, L^o) \quad = \text{argmax} \ \ R^o \ (k, K, \ell, L) \tag{10}$$

Since

$$(H+W)/R \geq W/R \geq W/(Z+R)$$

it follows under standard assumptions about technology that:

$$K^c/L^c \geq \ K^o/L^o \ \geq K^L/L^L \tag{11}$$

and therefore:

$$K^c/L^c \ \geq K^L/L^L \tag{12}$$

The value of H/Z either falls in the interval defined by these two values or outside it. This has the following consequences:

(A) Suppose that H/Z is such that:

$$K^c/L^c \ \geq \ H/Z \ \geq \ K^L/L^L \tag{13}$$

Then both (7') and (8') are satisfied and we have multiple (capitalist and labour) organisational equilibria.

(B1) Suppose that H/Z is such that:

$$K^c/L^c \geq K^L/L^L > H/Z \tag{14}$$

Then (7') is satisfied but (8') is not satisfied. In this case only a COE exists.

(B2) Suppose that H/Z is such that:

$$H/Z > \ K^c/L^c \geq K^L/L^L \tag{15}$$

Then (8') is satisfied but (7') is not satisfied. In this case only a LOE exists.

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(C)   Since the ratio H/Z must necessarily fall in one of the three intervals just considered, for any H/Z ratio at least one organisational equilibrium must always exist.

We can now state the following proposition:

Proposition 1.
(A)   multiple organisational equilibria exist if the closed interval defined by the H-A-C capital intensities under the two property rights regimes includes the agency cost ratio H/Z
(B1)   a unique capitalist equilibrium exists if the agency cost ratio H/Z is smaller than the H-A-C capital intensity with the labour ownership.
(B2)   a unique labour equilibrium exists if the agency cost ratio H/Z is greater than the H-A-C capital intensity with capitalist ownership.
(C)   for any agency cost ratio H/Z at least one organisational equilibrium exists.

How likely is it that the ratio H/Z falls in a multiple organisational equilibria interval or in one of the two unique organisational equilibria intervals?

Given any exogenous agency costs ratio H/Z the values of the H-A-C capital intensities depend on the shape of the production function and it is impossible to say a priori whether they will define an interval including or excluding H/Z.
We can, however, show that under fairly general assumptions there is <u>always</u> some value of H/Z such that multiple organisational equilibria exist:

Proposition 2.
For any "standard" production function and for any set of factor prices (W,W,R,R), there exists at least one pair (H, Z) of agency costs such that multiple organisational equilibria exist.

<u>Proof.</u> Choose the rate H/Z such that:

$$H/Z = K^o/L^o \tag{16}$$

It follows from (11) that

$$K^c/L^c \geq H/Z \geq K^L/L^L$$

This is identical to condition (13) for the existence of multiple organisational equilibria.

Thus, under standard assumptions about technology and factor prices, there always exists at least one agency cost ratio for which multiple organisational equilibria exist: multiple organisational equilibria are clearly something more than an intellectual curiosity! Still this does not give us much information about the "size" of the set of agency costs for which multiple organisational equilibria exist. Economic intuition suggests the "rigid" or "malleable" nature of the technology may have a lot to do with the size of this set. The more "malleable" are input ratios, the easier is it for any set of property rights to adjust input ratios to its own needs. The set of agency costs, for which we have multiple organisational equilibria, should then be fairly wide when the inputs ratios are very "malleable". By contrast rigid input ratios should limit the ability of property rights to shape the "technology" in such a way that they become self-sustaining institutions. Rigid input ratios should reduce the set of agency costs under which COE and LOE are feasible and therefore diminish the set of agency costs for which multiple equilibria are feasible. Consider the following proposition:

Proposition 3.

If the elasticity of substitution is equal to zero , i. e. if K and L are perfect complements, there is only one H/Z agency cost ratio for which multiple equilibria are possible.

Proof. If K and L are perfect complements, then (11) become equalities:

$$K^c/L^c = K^o/L^o = K^L/L^L \qquad (11')$$

From which it follows we have multiple equilibria only when (16) is satisfied, and a unique equilibrium otherwise·
In particular:

$$H/Z < K^o/L^o$$

implies that

$$K^c/L^c = K^L/L^L > H/Z$$

and hence a unique COE.

Conversely

$$H/Z > K^o/L^o$$

implies that

$$H/Z > K^c/L^c = K^L/L^L$$

or a unique LOE.

Thus, in the case of perfect complementarity the set of agency costs for which multiple equilibria exist shrinks to one single point. We may gain additional intuition on the influence of "malleability of technology" on organisational equilibria by considering the opposite case of perfect substitutability. We concentrate our attention on a particular case - the knife-edge in which both inputs are used when agency costs are zero, and we obtain the following proposition:

Proposition 4.
Suppose that $K^o > 0$ and $L^o > O$. If the elasticity of substitution is infinite, i. e. if K and L are perfect substitutes, then any positive combination of agency costs (H, Z) will imply that multiple organisational equilibria exist.

Proof: By assumption $K^o > 0$ and $L^o > O$. Since these factors are perfect substitutes, any deviation in relative user prices (inclusive of agency costs) from the knife-edge situation will imply that one factor or the other is no longer employed. Under capitalist ownership $K^c > O$ and $L^c = 0$; under labour ownership $K^L = 0$ and $L^L > .0$ These imply that:

$$K^c/L^c = \infty \quad \text{and} \quad K^L/L^L = 0$$

which in turn imply that any positive combination (H,Z) will always satisfy the following conditions

$$K^c/L^c \geq H/Z \geq K^L/L^L \qquad\qquad (13)$$

for which multiple equilibria exist.

Denote by σ the elasticity of substitution between K and L. Propositions 3 and 4 show that, for the two extreme values of σ, the relation between technology and organisational equilibria behaves in the way in which our economic intuition suggests. In order to explore this type of relation for other values of σ consider the following definition of "neutral" changes of σ.

Definition 2.

A change in the elasticity of substitution of the factors σ is <u>neutral</u> if is accompanied by compensatory changes in other parameters such that the ratio K^o/L^o remains unchanged at existing factor prices.

It can be shown that the following proposition holds for any CES production function:

Proposition 5

A "neutral" increase in σ strictly enlarges the set of (H,Z) for which:

(i) a capitalist organisational equilibrium is feasible.

(ii) a labour organisational equilibrium is feasible.

(iii) multiple organisational equilibria are feasible.

<u>Proof:</u>   see appendix.

The content of proposition 6 is clarified by the following figure (the derivation of which is explained in the appendix)
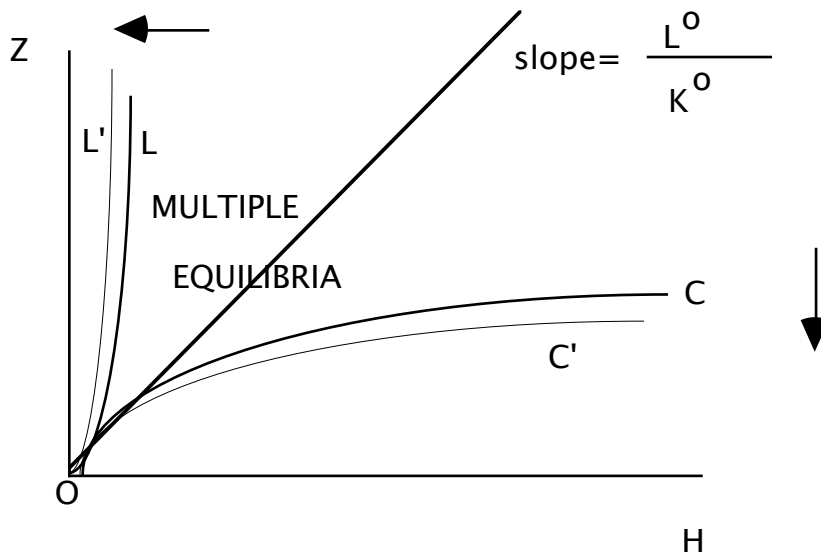
Z

slope= $\dfrac{L^o}{K^o}$

L' L

MULTIPLE

EQUILIBRIA

C

C'

O

H

Figure 1.

The pair of (H, Z) for which a COE exists lies above the curve OC. A neutral increase of σ has the effect of lowering this curve to OC' and, so, enlarging the set of points for which a COE is feasible. Similarly, the pair of (H, Z) for which a LOE exists lies to the right of the curve OL. A neutral increase in σ moves the curve leftwards to OL', so enlarging the set of points for which a LOE exists. Both movements also have the effect of enlarging the set of points for which multiple organisational equilibria are possible.

We conclude this section by observing that the notion of complete "technological determinism" is not valid because there are always combinations of agency costs for which an arbitrary organisational equilibrium may prevail. Moreover, even in the case of "rigid" technologies there are combinations of agency costs for which multiple property rights equilibria are possible. However, the degree of "rigidity" of technology has an important implications for property rights. The more rigid is the technology the smaller is the set of agency costs for which any given type of property right system can shape the technology in such a way as to become self-sustaining; consequently, the smaller is the set of agency costs for which multiple organisational equilibria exist and the less justified is "property rights romanticism".

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4. Institutional Stability.

Agency costs may change for various reasons. An increase in social conflict or an innovation in the monitoring technology can cause changes in agency costs. The agency costs paid for the employment of specific resources can also be subject to shocks: specificity is not a stable natural characteristic of the resources employed in one firm but it is a measure of the difficulty of employing these resources in other organisations. Suppose that we are in a particular organisational equilibrium and agency costs change for one of the reasons that we have just considered. Will this organisational equilibrium be "institutionally stable" in the sense that the agency cost shock will not imply any change in the ownership of the organisation?

We start by observing that "institutional stability" is a matter of degree: institutions can be more or less "stable". We try to capture this point in the following definition:

Definition 3
The institutional stability of an organisational equilibrium is the probability that an equilibrium is still feasible after a stochastic shock to agency costs.

We now consider the relation between institutional stability and the degree of "malleability" of the technology.

Suppose that agency costs (H, Z) are subject to a proportionate stochastic shock (r_h, r_z) where $r_h, r_z \in [0, \infty]$ and the density function $f(r_h, r_z) > 0$ for values in this range..
For a given (H,Z), let $P^c(H,Z)$ and $P^L(H,Z)$ be the probability that capitalist and property rights equilibria remain feasible following a stochastic shock to agency costs. We can now show the following proposition:

Proposition 6 .
Any neutral increase in σ will increase the probability that any given organisational equilibrium is stable with respect to a stochastic shock in agency costs.

Proof. Let A^c be the set of (H,Z) for which a COE is feasible at existing factor prices. Suppose (H,Z) $\in$ A^c and there is a stochastic shock (r_h, r_z) to (H,Z). The new agency costs will be $(r_h H, r_z Z)$. A COE will remain feasible at the new agency costs if:

$$r_h H, r_z Z] \in A^c.$$

Thus,

$$P^c(H,Z) = \text{Probability } \{(r_h H, r_z Z) \in A^c\}$$

From Proposition 5, for any neutral increase in σ, the set A^c is strictly enlarged. Hence $P^c(H,Z)$ is increased. Analogous arguments apply in the case of a LOE.

Social and technological changes challenge the institutional stability of organisational equilibria through agency costs shocks. Organisational equilibria absorb shocks in the following way. When agency costs change, the owning factors reduce the employment of those non-owning factors whose agency costs have increased and may, therefore, threaten to become owners of the firm; this characteristic of institutional stability is clearly related to the ability to absorb shocks by substitution and it is not surprising that P^c and P^L are increasing functions of σ. A high σ acts like a good "anti-virus": it favours the rejection of the non-owning factors, that, because of the increase in their agency costs, threaten to upset the health of the existing ownership regime.

5. The (in)efficiency of organisational equilibria.

The definition of efficiency in the present context is not free from ambiguities. Some "partial" type of efficiency is built into the definition of organisational equilibria themselves: in each organisational equilibrium property rights are efficient in the sense that they give maximum ownership rent given the structure of the resources employed in the firm and technology is efficient in the sense that it maximises profits given the ownership structure of the firm.

However, the type of "partial" efficiency considered above may be the cause of "overall" inefficiency. Alternative more efficient owners are such because they are very costly to employ

for other owners; however, precisely for this reason it is not efficient for other owners to employ them. Thus, more efficient potential owners may never get employed in such quantities that the agency costs sustained to employ them become greater than the ownership rent of the present proprietors. Thus the "partial" efficiency, built into the present organisational equilibrium may prevent the achievement of "overall" efficiency which requires a change of organisational equilibrium. Observe that this inefficiency is linked to factor substitution: the most efficient potential owners are substituted for by the least efficient potential owners because, ceteris paribus, the latter are cheaper than the former when they do not own the firm.

In order to make these points more clear let us define what we mean by the (overall) efficiency of an organisational equilibrium. In the present context efficiency can only refer to "second best" situations because the existence of agency costs makes it impossible to achieve any first best solution. Moreover, the "agency costs" per unit of factor, which are assumed to be given in our model, should be endogenously determined in order to state general efficiency criteria. Although we are aware of these problems, we suggest two possible definitions of the (overall) efficiency of organisational equilibria.

The first definition is very simple. We can consider profits (as defined in assumption 1) as an index of efficiency. When factor prices express genuine social scarcities, there is much to be said in favour of this criterion of efficiency that may be summarised as follows:

Definition 4.
A capitalist (labour) organisational equilibrium is said to be efficient if R^c is greater (smaller) than R^L.

If factor prices do not represent social opportunity costs we can use a more restrictive definition of efficiency that is based only on direct agency costs and say that overall efficiency involves minimum direct agency costs.

Definition 5.
A capitalist (labour) organisational is efficient when ZK^L is greater (smaller) than HL^c.

According to both definitions, except for the particular cases in which $R^c = R^L$ or $ZK^L = HL^c$, the existence of multiple organisational equilibria implies the existence of an inefficient equilibrium. The fact that an organisational equilibrium may be inefficient means that the self-

reinforcing characteristics of an institution may hold in spite of its inefficiency. We have already observed that this self-sustaining mechanism works by substituting potential efficient alternative owners (that can only be employed at high agency costs) for cheap factors (that cannot be efficient owners). Inefficiency is therefore related to the malleability of the technology. This same point may also be made by observing that inefficiency is necessarily linked to the existence of multiple equilibria and that the size of the set of agency costs for which multiple equilibria arise increases when the elasticity of substitution increases. Thus an increase of σ increases the size of the set of (H,Z) for which inefficient organisational equilibria exist. We may summarise the argument considered above in the following proposition:

Proposition 7. Suppose that $R^c \neq R^L$ and $ZK^L \neq HL^c$. A neutral increase in σ will strictly enlarge the set of (H,Z) for which inefficient organisational equilibria exist.

Proof: Under the conditions assumed here multiple organisational equilibria necessarily imply the existence of one inefficient equilibrium. Proposition 7 follows from proposition 5 according to which a neutral increase in σ strictly enlarges the set of (H,Z) for which multiple organisational equilibria exist.

6. Conclusion.

The self-reinforcing interactions between property rights and technology examined in this paper may help to explain the diversity of the institutions of production that we observe even when we restrict our analysis to similarly advanced capitalist economies. Institutional shocks may originate different self-reinforcing relations between property rights and technology and generate new self-sustainig ownership systems. For instance, one may advance the hypothesis that the institutional shocks caused by the American occupation provide one important explanation for the different kind of "organisational equilibria" that characterise Japanese firms[12].

The analysis considered in the preceding sections may also offer a possible argument in favour of policies for the extension of democracy to economic life. Authoritarian institutions where the owners of capital and few managers have all the rights in an organisation may in

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[12] See the concluding section of Pagano (1993).

principle be institutionally stable and simultaneously inefficient. Under these conditions economic democracy and workers rights will be more efficient on purely economic grounds. However, the self-sustaining characteristics of capitalist institutions may block the establishment of this alternative organisational equilibrium: whenever technological substitution is possible, those workers, who would be the most efficient alternative owners[13], are replaced by other factors which cost less under traditional capitalist property rights

These reasons may justify an active policy in favour of economic democracy. They also imply that such a policy will meet considerable obstacles; indeed, it can only succeed if it breaks the self-sustaining mechanisms between property rights and technology. Action only on property rights (including voting rights on some issues) is likely to fail: the new democratic property rights may look useless and empty if they are not supported by a technology where workers exercise skills that require those rights; without the support of the associated technology the new rights will fade away and will be eventually re-acquired by the owners of those factors that value them most. Likewise, action only on technology is also likely to fail: the skills necessary for the exercise of this technology will never be developed without the existence of democratic property rights under which these skills can be utilised and cultivated without fear.

The economic policy problem is difficult because it may be necessary simultaneously to change together property rights and technology. Moreover these changes should often be made in the context of strong "network externalities" that tend to polarise technological and property rights towards one single standard.

The case of technology has attracted the attention that it deserves[14]:: for instance, it has been argued that network externalities can arise from the fact that imitating one particular technology involving a certain combination of inputs is cheaper than trying to develop and learn a new one; we may also observe that network externalities can also arise from the fact that common inputs, produced under a regime of economies of scale, may be used by all the firms operating under a certain property rights system.

However, the case of property rights is equally important: it is far cheaper to set up organisations according to established property rights, used by other firms, than according to a

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[13]   In the model considered in this paper we have concentrated our attention on the extreme cases of complete "capitalist" and "labour" ownership. This has only been done for reasons of analytical simplicity. Intermediate forms of ownership such as the labour-capital partnerships advocated by James Meade (1972) and (1993) may be a more appropriate alternative when both some high-agency-cost capital and labour must both be employed. However, we claim that the self-sustaining nature of property rights and technology also holds for these more complex cases. The same argument applies for job rights and other workers rights.
[14] See Arthur (1989) and Agliardi (1991).

new system of rights; moreover, for all the firms using the same property rights system legislation is a common input that is also produced under a system of pronounced economies of scale: the same type of legislation may be used by many firms without being destroyed.[15].

The nature of organisational equilibria implies that the network externalities that characterise property rights and technology may sustain each other: the need to standardise technology may cause the "homogenisation" of property rights and the need to homogenise property rights may cause the "standardisation" of technology. The uniform path taken by technological development may also be due to the homogeneity of the existing "ownership standards"; at the same time, the uniform path taken by legislation and by the other institutions that favour a certain ownership system may also be due to the homogeneity of the existing "technological standards". Changing the property rights and the technology that are the outcome of this "homogenisation" process may not be convenient for each individual agent; however, in some cases, if the costs of co-ordinating actions could be reduced, many agents could benefit from the change.

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[15] For istance, consider the case of the legislation on limited liability and its importance for the case of joint stock companies. Leijonhufuld (1986) considers the importance of the creation of these institutions to make capitalist overcome asset-specificty problems. Rowthorn (1988) and Pagano (1991a) point out the relative underdevelopment of corresponding labour institutions.

Proof of Proposition 6.

Suppose the elasticity of substitution between all variables is constant in the production function:

$$y = F(x_1, x_2 \ldots \ldots \ldots \ldots x_n) \qquad\qquad (A1)$$

Let
$(p_1 \ldots \ldots \ldots p_n)$ be the vector of prices and suppose all factors receive their marginal products. Then it can be shown that for all i,j:

$$(x_i/x_J) = (p_J/p_i)^\sigma \quad (a_i/a_j)^\sigma \qquad\qquad (A2)$$

for some constants $(a_1, \ldots \ldots \ldots a_n)$ and σ is the constant elasticity of substitution. The above formula applies whether there are constant or variable returns to scale.

In the present case, our production function is $y = Q\,(k, K, \ell, L)$.

In the no-agency cost case, factor prices are (R, R, W, W). Hence in equilibrium:

$$K^o/L^o = \quad (W/R)^\sigma \quad (a_k/a_L)^\sigma \qquad\qquad (A3)$$

Under capitalist property rights, factor prices are (R, R, W, H+ W). Hence in equilibrium:

$$K^c/L^c = (1+H/W)^\sigma \quad (W/R)^\sigma \, (a_k/a_L)^\sigma \; = (1+H/W)^\sigma \; (K^o/L^o) \qquad\qquad (A4)$$

For $K^o > 0$, $L^o > 0$ this implies that $\;K^c/L^c \; > \; K^o/L^o$.

With workers property rights factor prices are (R, Z+R, W, W). Hence in equilibrium:

$K^L/L^L = [1/(1+Z/R)^\sigma] \ (W/R)^\sigma \ (a_k/a_L)^\sigma \ = \ [1/(1+Z/R)^\sigma] \ (K^o/L^o)$ (A5)

For $K^o > 0$, $L^o > 0$ this implies $K^L/L^L < K^o/L^o$.

Thus, for H, Z > 0 the following <u>strict</u> inequalities hold for any CES production function:

$K^c/L^c > K^o/L^o > K^L/L^L$ (A6)

The condition for <u>capitalist organisational equilibrium</u> (C0E) is:

$ZK^c \ - \ HL^c \ \geq \ 0$

or:

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

In the CES case this condition is equivalent to:

$Z \geq Z^c$

where from (A4):

$Z^c = [H / (1+H/W)^\sigma] \ \ (L^o/K^o)$ (A7)

An analogous condition holds for <u>labour organisational equilibrium</u> (LOE).

We now investigate the conditions under which each type of equilibrium holds separately and, in particular, the conditions for a capitalist organisational equilibrium.

Differentiating Z^c with respect to H we find after manipulation that:

$\partial Z^c/\partial H \ = \ (L^o/K^o) \, [(1 + (H/W)]^{-(\sigma+1)}[1 + (1 - \sigma) \, (H/W)]$ (A8)

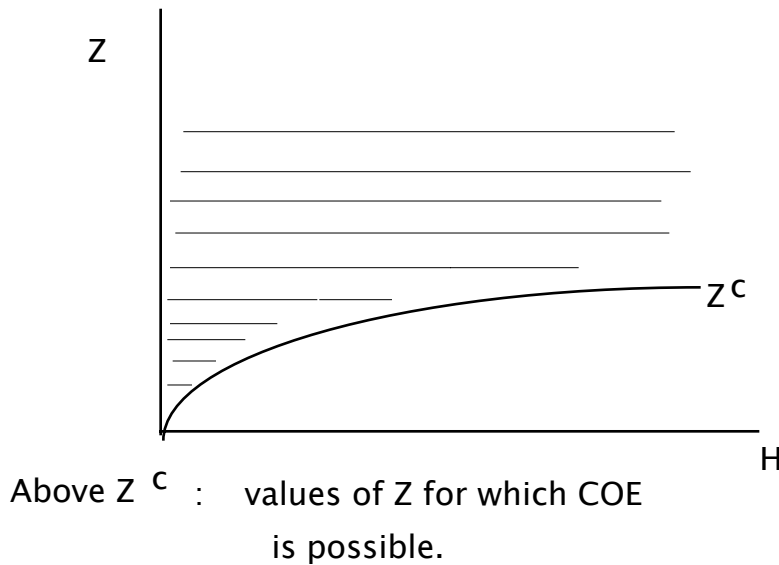For a sufficiently small H the expression (A8) is approximately equal to L^o/K^o

Differentiating again:

$$\partial^2 Z^c/\partial H = \{(-\sigma)/[W(1+H/W)^{(\sigma+2)}]\}[2+(1-\sigma)(H/W)](L^o/K^o)\quad (A9)$$

For H small and $\sigma > 0$ we have: $\partial^2 Z^c/\partial H < 0$.

Thus the range of Z for which a COE is possible lies above a frontier of the type shown in Fig. 3:

Figure 3.

Above Z^c :   values of Z for which COE
              is possible.

Now consider the effect of "neutral" change in σ. Recall that a change in s is said to be <u>neutral</u> if it is accompanied by changes in parameters (i. e. the ratio a_K/a_L) such that the ratio K^o/L^o remain unchanged at existing factor prices.

To see the effect of a neutral increase in σ write (A7) in logarithm form:

$$\log Z^c = \log H - \sigma \log[1+(H/W)] + \log(L^o/K^o)$$

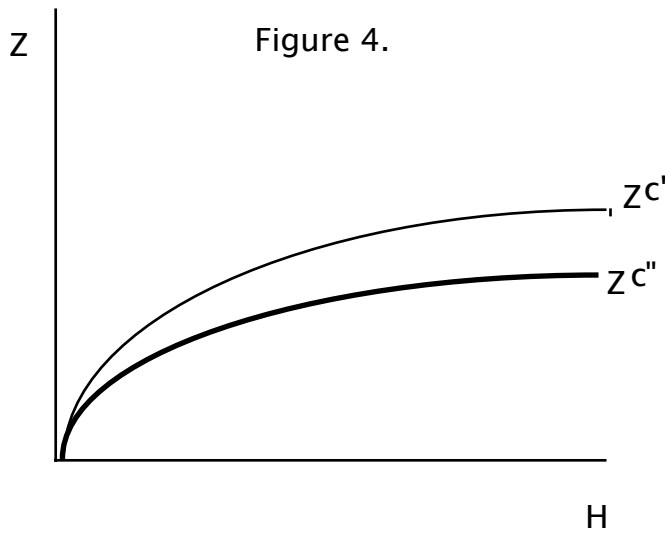Holding H constant and differentiating with respect to σ (remember (L^o/K^o) is constant):

$$(1/Z^c)(\partial Z^c/\partial\sigma) = -\log[1+(H/W)]$$

Hence:

$$\partial Z^c / \partial \sigma = \ - \ Z^c \log [1+(H/W)]$$

which implies that $\partial Z^c / \partial \sigma < 0$.

Thus for any given value of H, a larger σ implies a smaller value of Z^c. Diagrammatically this means the frontiers shifts downwards from $Z^{c.'}$ to $Z^{c''}$. as in figure 4:

Figure 4.

Thus for any neutral increase in σ, the range for which a COE is possible expands.

By symmetry it follows that for any neutral increase is σ, the range of H,Z for which a LOE is possible also expands.

Multiple equilibria occur for (H,Z) in the intersection of the two sets.
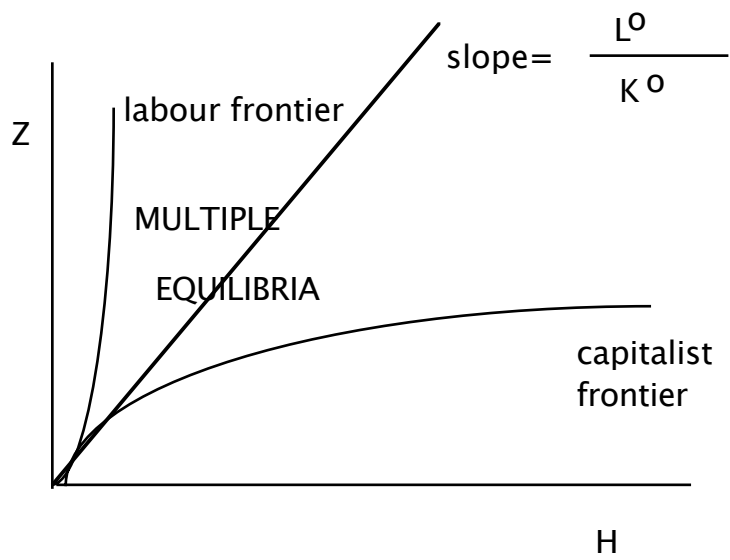
Figure 5.

The effect of a neutral increase in σ (as shown in figure 1 in the text) is to enlarge the set of points in the intersection. This increases the range over which multiple organisational equilibria are possible. Q. E. D.

References

Agliardi E. (1991) Essays on the Dynamics of Allocation under Increasing Returns to Adoption and Path Dependency. Ph. D. Thesis, University of Cambridge.

Alchian A. (1987) "Property Rights" in J. Eatwell, M. Millgate and P. Millgate eds. *The New Palgrave*, pp. 1031-1034. Macmillan, London.

Alchian and Demsetz (1972a) Production, Information Costs and Economic Organisation. *American Economic Review*, 62 pp. 777-95.

Alchian A. and Demsetz H. (1972b) "The Property Rights Paradigm". *Journal of Economic History* 33 pp. 16-27.

Arthur B. (1989) Competing Technologies, Increasing Returns, and Lock-in by Historical Events, *Economic Journal*, 99 pp. 116-131.

Bowles S. (1985) "The Production Process in a Competitive Economy: Walrasian, Neo-Hobbesian, and Marxian Models". *The American Economic Review*, 75 pp. 16-36.

Bowles S. and Gintis H. (1986) *Democracy and Capitalism*. Basic Books, New York.

Braverman H. (1974) *Labour and Monopoly Capital*, Monthly Review Press, New York

Brenner R. (1986) *The Social Basis of Economic Development*. in Roemer (1986)

Breton A., Wintrobe R. (1982) *The Logic of Bureaucratic Control*. Cambridge University Press. Cambridge.

Coase R. H. (1937) " The Nature of the Firm" *Economica* pp. 386-405.
.
Coase R. H. (1960) "The Problem of Social Costs" *Journal of Law and Economics*, 3 pp. 1-44.

Cohen G. A. (1978) *Karl Marx's Theory of History: a Defence*. Oxford University Press.

Demsetz H. (1966) "Toward a Theory of Property Rights", *American Economic Review. Papers and Proceedings* no. 2 pp 347-359.

David P. A. (1975) *Technical Choice, Innovation and Economic Growth*. Cambridge University Press, Cambridge.

Dosi G. (1988) Sources, Procedures and Microeconomic Effects of Innovation. *Journal of Economic Literature*. Vol XXVI (September) pp. 1120-1171.

Edwards R. (1979) *Contested Terrain*. Basic Books, New York.

Grossman S. and Hart O. (1986) The Costs and the Benefits of Ownership. *Journal of Political Economy* Vol. 94 no. 4 pp. 691-619.

Hart O., Moore J. (1990) Property Rights and the Nature of the Firm. *Journal of Political Economy*. Vol. 98 No 6 pp.1119-1158.

Hicks J. (1969) A Theory of Economic History. *Oxford University Press*, Oxford.

Hirschman A. O. (1981) *Essays in Trespassing. Economics to politics and beyond.*. Cambridge University Press, Cambridge.

Inkster (1991) *Science and Technology in History*. Macmillan, London.

Jensen M. C. and Meckling (1976) Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure. *Journal of Financial Economics* 3.

Langlois R. N. (1986) *Economics as a Process, Essays in the New Institutional Economics*, Cambridge University Press, Cambridge.

Leijonhufvud A. (1986) Capitalism and the Factory System, in R. N. Langlois (1986).

Marglin S. (1974) What Do Bosses Do? *Review of Radical Political Economy* vol. 6 pp. 60-112.

Marx K. (1967) *Capital*. New York International Publishers.

Meade J. E. (1972) The theory of Labour-Managed Firms and Profit Sharing. *Economic Journal,* vol. 82 pp. 402-28.

Meade J. E. (1993) *Liberty, Equality and Efficiency. Apologia pro Agathopia Mea*. Macmillan, London.

Milgron P. and Roberts J. (1990) Bargaining Costs, Influence Costs and the Organization of Economic Activity. in Alt J. E. and Shepsle K. J. *Perspectives on Positive Political Economy*. Cambridge University Press, Cambridge.

Nelson R., Winter S. G. (1982) *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge Mass.

North D. C. (1981) *Structure and Change in History*. Norton, New York.

Pagano U. (1985) *Work and Welfare in Economic Theory*. Basil Blackwell, Oxford.

Pagano U. (1991a) Property Rights, Asset Specificity, and the Division of Labour under Alternative Capitalist Relations. *Cambridge Journal of Economics*. Vol. 15 No 3, p. 315-42. Reprinted in in G. Hodgson (1993) *The Economics of Institutions* Edward Elgar, Cheltenham.

Pagano U. (1991b) Property Rights Equilibria and Institutional Stability. *Economic Notes*. Vol. 2 No 2 pp. 189-228.

Pagano U. (1992a) Authority, Co-ordination and Disequilibrium: an Explanation of the Co-existence of Markets and Firms. *Economic Dynamics and Structural Change*.. Vol. 3, No 1 pp 53-77. Reprinted in in G. Hodgson (1993) *The Economics of Institutions* Edward Elgar, Cheltenham.

Pagano U. (1992b) Organisational Equilibria and Production Efficiency. *Metroeconomica* Vol. 43 No 1-2 pp. 227-246.

Pagano U. (1993) Organisational Equilibria and Institutional Stability. In Bowles S., Gintis H. , Gustafson B. eds. *Markets and Democracy*. Cambridge University Press, Cambridge.

Putterman L. (1982) Some Behavioural Perspectives On the Dominance of Hierarchical over Democratic Forms of Enterprise. *Journal of Economic Behaviour and Organisation* 3 pp. 139-60.

Putterman L. (1986) *The Economic Nature of the Firm. A Reader.* Cambridge University Press, Cambridge.

Roemer J. (1988) *Free to Lose. An Introduction to Marxist Economic Philosophy.* Radius London.

Rowthorn R.(1974) Neo-classicism, Neo-Ricardianism and Marxism. *New Left Review* vol. 86 pp 63-82.

Rowthorn R. (1988) Solidaristic Corporatism and Labour Process Performance. In *Economics and Institutions.* Proceedings of the International School of Economic Research, Siena.

Samuelson P. (1957) "Wage and Interest: A Modern Dissection of Marxian Economic Models", American Economic Review No 47 pp. 884-912.

Williamson O. E. (1985) *The Economic Institutions of Capitalism.* The Free Press, New York.

Williamson O. E. , Winter S. G. eds. (1991) *The Nature of the Firm. Origins, Evolution and Development.* O. U. P. New York and Oxford.