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Competitive Imitation, Asset specificity and Efficiency.

COMPETITIVE IMITATION, ASSET SPECIFICITY, AND EFFICIENCY*

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Abstract: assuming potentially imitable investments, in this paper it is argued that, while a quasi-rent is always necessary for specificity because otherwise the threat of opportunistic behavior would be innocuous, it is also sufficient only when the analysis is restricted to just bilateral relations as in the standard new-institutional approach. When multilateral relations are considered, one can have a quasi rent without specificity simply by imitating an existing investment because, in this context, their return depends on their novel character and therefore remains unchanged until the next innovation.

From this reasoning two propositions follow. First, in explaining economic institutions, a 'free-riding organizational' problem must be added to that of 'hold-up'. Second, a grouping form of economic organization, based on non market relationships between groups and on market relationships within the group, can emerge as a solution to the inefficiencies implied by the resulting tendency to over- or under-invest. Applications to the actual forms of institutional regulation between cooperation and competition in some post-fordist production modes are also provided.

1. INTRODUCTION

New-institutional economics pointed out that specific investments need non market or authoritarian relationships to avoid the counterparty exploiting the fact that such investments would not have the same value in relations with other agents (Williamson, 1975; 1985; Klein, Crawford, and Alchian, 1978). In this way, it added the missing empirical content to the Coase's idea (1937) to hypothesize economic organizations as efficiently emerging from an exchange process between farsighted individuals with no wealth constraints[1].

By definition, when an investment is specific to a relationship, it is attributed with a quasi-rent, that is, an excess of its value over the next best alternative use. By the additional assumptions of opportunism and limited rationality, such quasi-rents can be appropriated by the generic counterparty because of contractual incompleteness. In this situation, to have market relationships as a discipline device is a solution associated with high transaction costs, defined as the costs of writing and enforcing contracts (Grossman and Hart, 1986) or as bargaining costs (Milgrom and Roberts, 1988). Therefore, since optimality calls for the achievement of the the extra value of the specific asset at minimum cost, when specificity increases, we would observe a progressive substitution of the market as a coordination mechanism.

The specificity of investments, however, has not to be necessarily taken as exogenously given. Simply originating from the lack of alternative users, it is often dependent on what is happening in the rest of the economy. In this paper the role of timing and competition in determining the degree of specificity of investments is emphasized by focusing on the case in which productive activities are potentially imitable. In this case, while the return of the investments depends on their novel character and therefore remains unchanged until the next innovation (Schumpeter, 1911), their specificity is destined to vanish or at least to gradually reduce once they are imitated and alternative users become available. As a consequence, the costs of specificity and of the associated non market relationships end up by being 'organizational

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[1]As warned by its leading exponents, however, in new-institutional economics the efficiency principle is only used for positive predictions referring to the adopted partial equilibrium approach (Williamson 1985, pp. 22-23; Milgrom and Roberts 1992, pp. 24-25; Hart 1995, p.55). This restriction is also recognized in some recent contributions where multilateral relations are explicitly considered (Hart and Tirole, 1990; Bolton and Whinston, 1993) but, differently from the present work, they do not focus on the consequences of this more general approach for the concept of specificity.

experimentation costs' in the sense that later investors can save them by exploiting competition among counterparties.

In such a context, in other words, it turns out that asset specificity is not able to create value as in the definition above. More prosaically (but with no minor empirical and theoretical relevance), it appears to be a costly consequence of the fact that to be first also means to be unique and a source of important externalities not just in the relations between investors and counterparties but also in the relations among investors. While its benefits can be appropriated by opportunistic counterparties because of the 'hold-up' problem, its costs can be saved by potential competitors behaving as 'organizational free-riders'.

Thus, together with the causation mechanism emphasized by the new-institutional literature -which goes from specificity to the contracts-, for this class of investments there is also another which goes from expected competition to specificity. Accordingly, the resulting institutional structure of production would be marked by a tendency to over- or under-invest, meaning that the benefits of specific investments are achieved at the price of a multiplication of their organizational costs or are not achieved at all. A necessary condition for the attractiveness of the investments being the certainty of remaining unique at least the time needed to recover the costs sustained to be the first, in equilibrium, in specificity, either all invest (being all unique), or no-one invests (nobody being the first).

As a solution to this problem, finally, we study a grouping form of economic organization, based on non market relationships between groups and on market relationships within the group. In this way, it is indeed possible to implement assets which have an extra value over the next best alternative use because they maintain their novelty character, but are not under the threat of opportunistic behavior because they have lost their character of uniqueness. Of course, this is not a first-best solution since there are costs in reaching the needed agreement between investors but, precisely because of this, in productive systems where such costs are not too high, the substitution of the 'invisible hand' of the market with the 'visible hand' of authority (or rules) can be rationalized not only for the (bilateral) relations between investors and counterparties, but also for the (group) relations between investors.

The paper is organized as follows. Next section illustrates the 'free-riding organizational' problem with an example built on the conventional new-institutional story. Its resulting non cooperative outcomes are described with a

simple entry game in sub-section 2.1. Sub-sections 2.2 and 2.3 are respectively concerned with its cooperative group solution and some possible extensions and applications. Section 3 concludes.

2. THE 'FREE-RIDING ORGANIZATIONAL' PROBLEM:
AN EXAMPLE

Before introducing explicitly the possibility of imitation, consider the following adaptation of the situation which is typically employed to show the effect of specificity on contracts.

At the time t=0, an element of the set X of investors, called A, must decide whether or not to make an investment that will reduce the costs or improve the quality of her product. This investment is specific because the capital will be committed irreversibly for two periods, its costs will be repaid by the consumers in both periods and, to implement the investment, A needs the cooperation of B, an element of the workers' set Y. For these three reasons, at t=1 the capital previously employed will have a greater value within the relationship between A and B than elsewhere but, for the lack of alternative users, this surplus can be appropriated by B instead of being used to repaid the sunk component of the investment of A.

To fix ideas, it may be useful to refer to two often cited examples that are cases in point (see, for example, Milgrom and Roberts, 1988). The first is the rejection by Fisher Body of the General Motors' proposal to construct a plant close to theirs to obtain a reduction in transportation costs. The second concerns any firm that must decide whether or not to invest in a new computer system whose advantages depend in part on the development of specific skills in its workforce.

In both cases, as in the scenario outlined, the problem is that the market is not really able to cope with the specificity of the investment by one (or by both) of the parties. Once the investment has been effected, either General Motors or the workers of the firm in question are indeed in a position to threaten to break the relationship, and in this way, to obtain more than was originally agreed or to reduce their effort without this serving as ground for dismissal. Together with contractual incompleteness, this is the reason why a substitution of the market discipline permits savings in transaction costs and therefore it increases the ex ante incentives to invest. In other words, here we have the combined effect of

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the Williamsonian 'fundamental transformation' with the Grossman's and Hart's non-verifiability condition or with the Milgrom's and Roberts' bargaining costs. Thus, returning to the case under discussion, given that the investment is worth making, it is rational that A and B negotiate to the maximum before and to the minimum after this 'fundamental transformation' takes place, meaning that, at t=0, a contract is agreed that lasts two periods and gives to A the authority to decide in the event of unforeseen contingencies and to monitor the performance of B. This contract is efficient in the sense it maximizes the benefits to the parties involved (the investment is made at minimum cost) and such a removal from competitive markets illustrates the effect of specificity on the (optimal) contracts.

According to the exchange process from which economic organizations are hypothesized to come out, however, it is probable that B must be compensated in some way for the accepting such a long term contract in a subordinate position. While in a context *à la* Grossman and Hart one can think of any reason for which B dislikes being monitored, in a context *à la* Milgrom and Roberts, one can think of the amount needed to make B's renegotiation threat not credible. In any case this compensation, advanced by A in t=0, forms part of the surplus that it is expected to obtain from consumers together with the sunk component of the investment of A and it can be rationalized as another possible cost of non market relationships[2].

In respect to the literature it is important to make two additional points. The first is that, in this example, to have a non market relationship with the counterparties does not necessarily mean to buy them but to bind them by a long term contract of which ownership represents the limiting case in which the term is 'infinite'. In order to understand what changes exist between a 'just more' (or 'less') market contract than that effectively concluded, the differences in the ways productive relations are organized can only be a matter of degree[3].

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[2]Other typologies of these costs studied in the literature are the impossibility of selective intervention (Williamson, 1985), the lack of incentives for the party without authority (Grossman and Hart, 1986), and the so-called 'influence costs' (Milgrom and Roberts, 1988). Notwithstanding the differences in the context, however, the closest to such a compensation is the notion of 'enforcement rent' introduced by Bowles and Gintis (1993). In any case, this relative abundance makes its existence not strictly necessary to the robustness of the argument. For this latter it is sufficient that any one of these costs exists, but that is also necessary to the standard new-institutional approach because otherwise it is not easy to understand how markets can exist at all.

[3]"Once we attempt to add empirical detail to Coase's fundamental insight that a systematic study of transaction costs is necessary to explain particular forms of economic organization, we find that his primary distinction between transactions made within a firm and transactions made in the marketplace may often be too simplistic. Many long-term relationships (such as franchising) blur the line between

The second is that at this point nothing has been said about the level of competition in the product market and, consequently, it is possible that those making specific investment obtain exactly what would be required by another for the same investment, that is, the profits of A are zero. Therefore, the existence of specific assets is not incompatible with a competitive equilibrium in the product market, even if obviously it is neither true that such compatibility is necessary. In this context, to put it another way, rent and quasi rent are distinct and diverse concepts[4].

As will be seen, even this proposition crucially depends on the adopted partial equilibrium approach. For the present, nonetheless, indicating with C the compensation that A must pay B for accepting the two-periods contract, with F the irreversible component of the investment A and with $\bar{c}$ the marginal cost of production, the per period profit function of A is the following:

$$(1) \quad \Pi^A(p,Q(p)) = \left[pQ(p) - (\frac{C+F}{2} + \bar{c}Q(p)) \right],$$

where $Q(p)$ is a demand function with the usual properties and

$$(2) \quad C^A(q) = \frac{C+F}{2} + \bar{c}Q$$

is a simple cost function with constant marginal costs referring to every single period.

Consequently, the zero profit condition is satisfied if, in each period, A sells its product at price:

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market and the firm. (...). Firms are therefore, by definition, formed and revised in markets and the conventional sharp distinction between markets and firms may have little general analytical importance. The pertinent economic question we are faced with is 'what kinds of contracts are used for what kinds of activities, and why?'" (Klein, Crawford, and Alchian, 1978, p.326).

[4]" An appropriable quasi rent is not a monopoly rent in the usual sense, that is, the increased value of an asset protected from market entry over the value it would have had in an open market. An appropriable quasi rent can occur with no market closure or restrictions placed on rival assets. Once installed, an asset may be so expensive to remove or so specialized to a particular user that if the price paid to the owner were somehow reduced the asset's services to that user would not be reduced. Thus, even if there were free and open competition for entry in the market, the specialization of the installed asset to a particular user (or more accurately the high cost of making it available to others) creates a quasi rent, but not a 'monopoly' rent. At the other extreme, an asset may be costlessly transferable to some other user at no reduction in value, while at the same time, entry of similar assets is restricted. In this case, monopoly rent would exist, but not quasi rent." (Klein, Crawford, and Alchian, 1978, p.299).

$$(3) \quad \overline{p} = \frac{C+F}{2Q(\overline{p})} + \overline{c}$$

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   With these specifications, we are now in a position to analyze the possibility of competitive imitation. To do so, imagine that in t=1 another element of set X of investors, A', is in the same situation as A, her predecessor. Assuming that the investment of A is replicable, however, A' now has an additional option, that of imitation. In the case of General Motors and Fisher Body, A' could be any supplier of automobile component that transfers its own plant to the same geographical area as those of GM and FB, while, in the case of the computer system, imitation obviously consists in the purchase of the same system and the development of the same skills.

If she behaves in this way, that is imitating the investment of A, A' does not need to agree a long term contract with B', another element of set Y necessary to A' as B to A. Notwithstanding her investment is also irreversible for two periods, in t=2 the contract with B expires which is sufficient to guarantee against the threats of appropriation of B'. In the two quoted examples, the second producer of component that sites itself in the area of GM and FB and the second firm that adopts the computer system can substitute without damages its own producer of automobiles and its own workers with GM and with the workers of the first firm.

Thus, if A' can confine herself to have a contract with B' for one period only, she does not have to provide the corresponding compensation and she is able to gain positive profits to the detriment of A, which suffers a loss near to the compensation advanced to B in t=0. Due to its innovative character, the investment continues to be worth more in one particular sector of the economy than elsewhere, but now there are fewer differences in the relative substitutability of the two parties. Given that the investment is imitable, asset specificity is not able to create the extra value over the next best alternative use by which it is usually defined but it ends up by being a costly consequence of the fact that to be first also means to be unique. In this context, therefore, the quasi rents attributed with specific investments present an appropriability problem not just in regard to the partner but also in regard to potential competitors.

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Actually, once A' has entered the same 'market' as A, it is reasonable to assume that the two producers end up by dividing the monopoly profits according to the Nash bargaining solution. While competing à la Bertrand would be self-destructive for both, with Cournotian competition the situation would be better but still inferior to the cooperative solution.

However, since C does not appear in the cost function of A', and so in each period we have:

$$(4)\, C^{A'}(Q)= \frac{F}{2}+\bar{c}Q \,,$$

A' has a better disagreement point in respect to A whatever the non cooperative outcome chosen to work out this function. Therefore, at price p^M, A' will produce a greater quantity than A ($Q_{A'}^M > Q_A^M ; Q_{A'}^M + Q_A^M = Q^M$).

If we assume that in the first period A had charged monopolistic prices and quantities, in t=1 she must again recover:

$$(5)\quad (C+F)-(p^M-\bar{c})Q^M = c+f$$

Consequently, it turns out that A loses:

$$(6)\, L =(c+f)-(p^M-\bar{c})Q_A^M,$$

while the gains of A' are:

$$(7)\, G =(p^M - \bar{\bar{p}})Q_{A'}^M , \text{ where}$$

$$(8)\, \bar{\bar{p}} = \frac{F}{2Q(\bar{\bar{p}})}+\bar{c}$$

is the zero profit price for A'[5].

If instead A' effects another investment, different from that of A and specific to B', let us assume for the moment that she sees repaid the costs sustained in the case she is not in turn imitated, while she expects to suffer a loss in the opposite case. Finally, if she neither invests nor imitates she will obtain nothing.

Thus, it is clear enough that A' will imitate[6] and this in turn implies that, at t=0, A will not effect her own specific investment. Since A does not invest, on the other hand, A' continues to avoid specific investment because in the contrary case she would certainly imitated by A.

Imitation, exploiting the situation created by the leader, re-establishes the attractiveness of the market discipline which permits the follower to save the costs of non market relationships, obtaining the same advantages that the leader has paid for. Of course, from this it follows that the leader will take account of it before making her own specific investment and this behavior, due to the free-riding risk between potential competitors, shows the effect of expected competition on specificity.

It is not true, however, that such an effect would always produce this result of complete absence of specific investment, that is, it is not always true that imitation is the dominant strategy as so far has been the case in this simple example. Effecting an investment different from that of the leader and specific to her own counterparty, the follower can increase the product market

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In words, both L and G must be strictly positive, and the share of fixed costs that A must yet recover in t=1 must be grater than that which must be recovered by A' in the same period. With F>L, finally, we avoid that A makes the investment without protecting it with a long-term contract. In this case, there is no imitation and so, because new-institutional reasoning applies, F is the amount which B appropriate to A. But, because this is greater than the maximum which A would loose in the other case, the strategy we want to eliminate is effectively dominate.

[6]Since the competitive equilibrium is an important reference for all the example, it may be worth noting that the 'market' of A is attractive for A' even if in the first period A prices competitively as defined in (3). In this case, in fact, (6) becomes:

$$(6') \quad L = \frac{C+F}{2} - (p^M - \bar{c})Q_A^M, \text{ where}$$

$$(5')(C+F) - \left[(\bar{p} - \bar{c})Q(\bar{p})\right] = \frac{C+F}{2}.$$

The conditions (9) and (11) become instead:

$$(9') \quad C + F - \left[(\bar{p} - \bar{c})Q(\bar{p})\right] > (p^M - \bar{c})Q_A^M > 0$$

$$(11') \quad F > L.$$

differentiation and, if not imitated, she is able to extract a rent which is certainly preferable to the earnings obtained by immediate imitation[7]. In turn, this implies that for the leader it can be optimal to make first her own specific investment if there are good reasons to believe that the follower, when it is her turn, will effect this alternative specific investment rather than competitive imitation.

In the terms of the example under discussion, representing the intensity of the expected competition with the probability of being imitated -q-, it may be that for A' the following holds:

$$(12) \ -qL+(1-q)R > G,$$

with

$$(13) \ R =(p^M - \bar{p})Q^M > G \ .$$

Then, and contrary to before, in this case both agents make specific investments and each protects herself from the hold-up risk by long term contracts with the counterparties. To A', the lack of expected competition, that is a low value of q, renders it less attractive to behave as a free-rider, and, as a consequence, A is little concerned about it. Not surprisingly, the effect of expected competition produces opposite results depending on its own intensity.

In any case, in a context such as this characterized by the assumption of imitable investments, the consideration of the 'hold-up' problem is not sufficient for an understanding of the actual economic organizations. Neither of these two possible outcomes appears to be fully explained taking account only of the effect of specificity on the contracts, that is, only of the relation between investors and their generic conterparties. In fact, if in a certain sector of the economy we observe generic assets and competitive market contracts, it is not necessarily the case that no-one was able to plan profitable specific investment. More simply, if the imitability assumption holds, it could be that no-one has been willing to provide free benefits to potential competitors.

Analogously, if there are specific assets and non market contracts, the conventional new-institutional thinking succeeds in explaining the situation only in the case in which the parties carry on an activity that no others can match with

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[7]Depending on the return of the investment comes from a cost reduction or a quality improvement, we will have either horizontal (GM-FB example) or vertical (computer system example) differentiation.

comparable results, that is, when the investments cannot be replicated without imitations being worthless copies of the prototype. If some other parties can do the job, and rationally prefer not to, evidently they are better of at carrying out another activity which, in turn, implies that they are extracting a rent. As a matter of fact, in the contrary case these other parties could certainly enter the market in question and obtain positive earnings exploiting the situation created by the (observed) first couple. Therefore the first investor, when she decided to invest, was certain that this rent was sufficiently high, that is, that her potential competitors would not have been interested in appropriating the benefits from her investment.

In addition, a competitive equilibrium in the product market here, meaning a tendency to the zero profit condition, is incompatible with the presence of specific investments, because it is not the case that someone effects specific investments and obtains just the minimum necessary for being induced to make them. In equilibrium, either there is imitation and therefore, not being possible to achieve the minimum, there are no specific investments, or there is no imitation and so, receiving more than the minimum, equilibrium does not exist in a competitive sense.

The contradiction between specificity and competition, that in terms of bilateral relations can rationalize the existence of the firm, in terms of multilateral relations extends from input markets to output markets determining too much or too little differentiation.

After making this discussion more precise with a very simple entry game, in the next sections the attention is directed above all to its efficiency consequences.

2.1. A very simple entry game
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Strategically, the described situation can be represented by a three-period extended form game as shown in fig 1. The payoffs L, R, G e $[-qL+(1-q)R]$ have been respectively defined in (6), in (7), in (12), and in (13), while the strategies available to the players are imitation (I), or high (H) or low (L) specific investments. Indicating the game with g and the subgame in which the players have the possibility of imitating the investment of the preceding with g',

S_x^i is then the generic strategy available to the player i at the node x (I = A, A',

x= g, g').
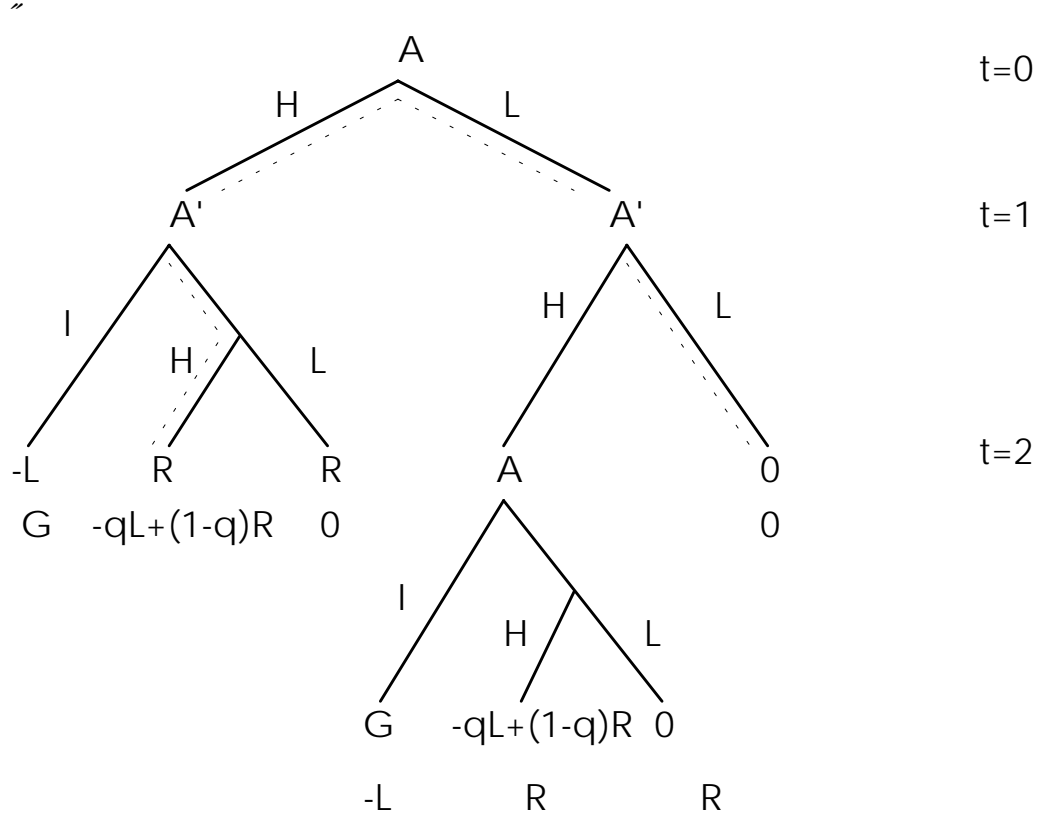
FIG. 1

It is now easy to verify that the two outcomes previously discussed in words are effectively the equilibria of g. Since the game is finite, it turns out that they can be found by backward induction critically depending on the variable representing the intensity of expected competition.

Accordingly, if $q > \dfrac{R-G}{R+L}$, that is, if $G > -qL + (1-q)R$, both players play the generic investment strategy in g (L). For these values of q, the player in g' will

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choose the imitation strategy (I) and, consequently, L is the optimal choice in g given that $0 > -L$.

The probability of being imitated and hence of not being able to enjoy the benefits of the investment is so high that neither of two players will be willing to invest in specificity. Therefore, both players end up with a zero payoff.

Vice versa, if $q \leq \dfrac{R-G}{R+L}$, that is, if $G \leq -qL + (1-q)R$, the g'-player will choose the specific investment strategy (H) and so the g-player also chooses the same strategy because $R \geq -qL + (1-q)R$ (see footnote 8).

The probability of being imitated is now so low that the earnings obtainable with certainty imitating, or with the generic investment, do not outweigh the risk associated with the specific investment.

Essentially for expositional convenience, these considerations can be summarized in the form of the following

PROPOSITION 1:

For the game g, the subgame perfect equilibrium paths are:

$$L_g^A, L_g^{A'}(I_g^A, I_{g'}^{A'}) \qquad \text{if } q > \dfrac{R-G}{R+L} \ ,$$

$$H_g^A, H_{g'}^{A'}(H_g^{A'}, H_{g'}^A) \qquad \text{if } q \leq \dfrac{R-G}{R+L} \ .$$

2.2. The group solution

As a result of this proposition, the chain of externalities generated by the specificity of the investments determines a tendency to uniformity in the behavior of the economic agents, who end up by all choosing the same strategy. The intermediate situation in which the investment strategy co-exists with that of imitation is not a (plausible) equilibrium of g [8].

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[8]Actually, when $q = q^* = \dfrac{R-G}{R+L}$, $-q^* L + (1-q^*)R = G$ and so the generic g'-player is indifferent between the imitation (I) and the specific investment (H) strategies. Indicating with p the

A necessary condition for the attractiveness of the specific investment decision is the certainty of not being imitated before the recovering of the related costs which, in turn, implies that, in equilibrium, either all invest or no-one invests depending on expected competition is lower or higher than a given threshold level.

Intuitively, the economic organization emerging from this situation seems therefore to be characterized by a spontaneous tendency to over- or under-invest in the sense that the benefits of specific investments are achieved at the price of a duplication of their organizational costs or are not achieved at all. In both cases, the total costs of production (technological and organizational) would not be minimized and hence the corresponding institutional structure of production would not be the efficient one.

To see this point, consider an agreement between A and A' which provides for the possibility of imitation, that is, an agreement linking A and A' in a sort of 'business group' and implementing the strategies' profile ($H^A, I^{A'}$). Since the two investors effect the same investment, B and B' continue to have limited substitutability in respect to the other elements of the workers' set Y, but between them there is now perfect substitutability. Accordingly, in respect to the counterparties, the agreement between A and A' corresponds to contracts for two periods at the group level but for one period only within the group.

Compared to the outcome in which A and A' invest separately ($H^A, H^{A'}$), this agreement has the advantage of eliminating, or at least reducing, the 'hold-up' problem and, correspondingly, the costs of the non market relationships with B and B'[9]. Their perfect transferability within the group equates indeed to the creation of a 'quasi-market' for the internalization of the risk of their opportunistic behavior. Compared to the outcome in which no-one invests

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probability this player imitates, in addition to the pure equilibrium of the Proposition 1 ($H^A, H^{A'}$), when q=q* we also find a continuum of mixed equilibria in which A plays H and A' randomizes between I and H with probability p*<$\dfrac{R-G}{R+L}$.

For this probability value, in fact, both players are in equilibrium because they respectively obtain $-p^* L + (1-p^*) R > G$, and $p^* G + (1-p^*)[-q^* L + (1-q^*) R] = G > 0$. However, given that q must be exactly equal to q* and the typical difficulties to make meaningful to the mixed strategies, this set of equilibria does not seem very plausible both in probabilistic and interpretative terms.

[9] In a context *à la* Grossman and Hart, this happens because B and B' do now the same job and for this reason the necessities of monitoring are reduced. In a context *à la* Milgrom and Roberst, instead, this happens because the hold-up behavior becomes costly since it has to be coordinated and this reduces the amount needed to make it not credible.

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$(L^A, L^{A'})$, the A-A' agreement has instead the obvious advantage that the investment is made and therefore generates its benefits, represented by the difference between the marginal costs of production before and after the investment $(\overline{\overline{c}} - \overline{c}, \overline{\overline{c}} > \overline{c})$.

Like the advantages, the disadvantages are both technological and organizational. On one hand, in respect to the outcome of the absence of investment, the fixed costs of the investment must be paid. On the other hand, in regard to the outcome of non-cooperative investment, to reach their agreement the two investor must bear some bargaining costs, which can be represented by the symbol B. These latter have therefore the same justification of the organizational costs that must be paid to solve with non market relationships the 'hold-up' problem in regard to the counterparties but in this case they refer to the 'free-riding' risk between investors.

Obviously, the best form of economic organization depends on the relative level of these costs and benefits in the three possible outcomes discussed so far. Adopting them as a measure of the efficiency of the corresponding institutional arrangement, the joint profits of A and A' are respectively:[10]:

$$(14)\ \Pi^{A+A'}(H^A, H^{A'}) = (p^M - \overline{c}) \sum_{t=0}^{2} Q_t - 2(C + F)$$

$$(15)\ \Pi^{A+A'}(L^A, L^{A'}) = (p^M - \overline{\overline{c}}) \sum_{t=0}^{2} Q_t$$

$$(16)\ \Pi^{A+A'}(H^A, I^{A'}) = (p^M - \overline{c}) \sum_{t=0}^{2} Q_t - (2F + B).$$

Then, the conditions under which the contract that links A and A' is the best way to organize production can be expressed precisely in the following:

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[10]For the sake of simplicity, in this formulation are implicit two hypotheses. For the first, in the case of cooperative investment, the costs of non market relationships with B and B' are zero. For the second the produced quantities in the three different outcomes are always the same. Actually, both these hypotheses are not very realistic. The first because these 'non market costs' are most probably just reduced. The second because in the case of non cooperative investment the produced quantity would be greater than in the others due to an higher product differentiation. Nevertheless, their elimination makes the analysis more complex without adding significant changes (see the next footnote).

PROPOSITION 2:

Assume $C > \dfrac{B}{2}$ and $(\overset{=}{c} - \overline{c})\sum_{t=0}^{2} Q_t > B + 2F$ [11].

Then, $\Pi^{A+A'}(H^A, I^{A'}) > \Pi^{A+A'}(H^A, H^{A'})$,

and $\Pi^{A+A'}(H^A, I^{A'}) > \Pi^{A+A'}(L^A, L^{A'})$.

Under these conditions, obtaining a partial reintroduction of the market in the relations with the counterparties, the 'visible hand' of authority (or rules) can also be justified in efficiency terms for the relations between investors. The cooperative internalization of the externality between investors and counterparties, in other words, can also be a way to internalise the externalities between investors.

Thus, beyond the identification of the free-riding organizational problem among investors, the recognition that specificity is not always capable of creating value leads to the adding to specific and generic assets a third possible characteristic of resources. Naming them as 'general purpose' assets, it is indeed possible to define assets which have not yet been overtaken by subsequent innovation but have already been imitated within a certain number of relations. Such assets present an extra value over the next best alternative use because they maintain a novel characteristic, but are no more exposed to opportunistic behavior because they have lost the characteristic of uniqueness. Being specific among the groups in which they have been imitated and generic within them, they can be understood as their combinations and this is why they need market relations within the group and non market relations at the group level.

Of course, however, if in this sense it seems possible to generate the advantages of specificity without having to sustain its costs, one cannot neglect the fact this is not a first-best solution due to the bargaining costs for the investors'

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[11]To confirm the preceding footnote, indicating with $C' < C$ the reduced cost of non market relations in the group and with $\sum_{t=0}^{2} Q^M_{(H^A,H^{A'})t} > \sum_{t=0}^{2} Q^M_{(H^A,I^{A'})t}$ the produced quantities by A and A' in the two cases of non cooperative and cooperative investment, the first condition of the text

becomes $C' - C > \dfrac{(\sum_{t=0}^{2} Q^M_{(H^A,H^{A'})_t} - \sum_{t=0}^{2} Q^M_{(H^A,I^{A'})_t})(p^M - \overline{c}) + B}{2}$.

agreement. And, as will be seen shortly, the existence of these costs provides a point of departure to classify its possible empirical applications.

2.3 Extensions and applications

The 'free-riding organizational problem' and the notion of 'general purpose assets' are also relevant for the ownership of physical assets. For instance, in his famous article on the division of labor and the extent of the market, Stigler (1951) noted that firms tend to self-produce their own inputs and to vertically integrate relatively more often in infant industries rather than in mature ones. And, without questioning his technological explanation in terms of increasing returns to scale, it is nonetheless quite easy to interpret this circumstance by recalling the preceding definition of 'organizational experimentation costs' given that they only exist in the early stages of the industries' development. Analogously, for organizational innovation, it is not difficult to think that some forms of common property can play a similar role to that played by the joint ventures in the R&D technological projects.

Nevertheless, having adopted an approach in which the differences between the ways productive relations are organized can only be a matter of degree, their best empirical applications can be found in the correspondence between industrial relations and principles of the division of labor. In particular, meaning by a better acquisition of new skills the Smithian principle of the maximization of 'learning by doing', and with the optimal utilization of given skills the Gioia-Babbage's principle of the minimization of 'learning before doing' (Pagano, 1991)[12], historical examples of the group solution can be looked for among the institutions which, not necessarily formally but effectively, combine cooperation and competition in the various forms of 'flexible specialization' studied first by Piore and Sabel (1984). Especially for some late developed non Anglo-Saxon productive systems like these partially present in Italy, Germany, and Japan, the organization of work induced by both computer based technology and the volatility of markets typical of the post-fordist era, can be actually seen as a combination of the two just referred to principles. For example, if the temporal transfers to manage the employment crises and the 'job rotation' practices are a demonstration of a flexible use of the resources according to the Gioia-Babbage's principle, the high specialization and the slogan of 'permanent

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[12]This and the preceding section owe a great deal to that article as well as to discussions with the author.

training' testify to the recognition of the necessity of their continuous refining as prescribed by the Smithian principle. Therefore, to the extent this type of technology and demand require resources according to the preceding definition of 'general purpose' assets, the corresponding mix between market and non market productive relations must be assured by the appropriate institutional regulation as best shown by the following quotation: "[Under flexible specialization] No firm or individual has a right to any particular place within the community, but all have a claim to some place within it." (Piore and Sabel, 1984, p. 269).

Clearly, economics can only predict that this type of group solution will prevail when its organizational costs are not too high but, in turn, this raises the problem of detecting their determinants. As a first attempt in this direction, one can think of the group size, of the source of the sense of membership upon which it is based, and of the adopted non market coordination system. In this way, one can begin to fill the gap between models and reality by giving a tentative classification of the various forms in which it has appeared in the most significant way. Based on more descriptive analysis of their historical, social and cultural origins, the table below illustrates the main differences between the Italian industrial districts (Brusco, 1982; 1990), the Japanese Keiretsu (Gerlach, 1992; Yamamura, 1978), and the German 'organized capitalism' (Kocka, 1978; 1990).

ORGANIZATION	NON MARKET COORDINATION SYSTEM	MEMBERSHIP'S SOURCE	SIZE
Italian industrial district	informal rules	socio-politic community	small
German 'organized capitalism'	formal rules	nation	big
Japanese Keiretsu	'mother' firm's ˝ authority	family-like firm	small

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Even with the usual warnings against the risk of oversimplification, finally, to be applicable to exercises of comparative business history like this, the presented formalization has a limit in its intrinsically static character since, as usual in game theory, the equilibrium strategies are chosen in t=0. In Battistini (1998), to catch the crucial element of path dependency, the analysis is then performed in explicitly dynamic terms by using a simplified version of the so-called Polya Processes[13]. In addition, in this way we do not have to take as a given the variable employed to represent the expected competition, but we can determine it together with contracts and assets' features. Given the irreversible character of this type of investment, taking serious account of time means to recognize the existence of a cumulative causation process by which, when the number of specific investments in the economy increases, because of the increase in the average length of the contracts needed to protect them, the attractiveness of additional specific investment increases further because of the diminishing probability of being imitated. The direction of causality which goes from specificity to contracts, in other words, links itself to that which goes from

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[13]An exhaustive treatment of such processes is in Arthur (1994). Further references are in Battistini (1998).

expected competition to specificity because the prevailing type of contracts in the economy determines the intensity of expected competition. Between these two directions of causality, therefore, starts a self-reinforcing mechanism for which, as usual, the stable equilibria are only the extreme ones, that is, the equilibria in which the agents all choose the same strategy. Thus, while the knowledge of the initial conditions is indispensable to solve the over- or under-investment equilibrium selection problem, for this context too the group solution continues to find an efficiency justification because the intermediate equilibrium in which the competitive strategy spontaneously co-exists with that of innovation is intrinsically unstable.

3. CONCLUSIONS

With a clear picture, the important change implicit in the recent re-discovery that 'institutions matter' can be represented by putting firms in the same category as markets (Kreps, 1990). Starting from the general equilibrium model, in other words, the number and the structure of markets are no longer exogenous (Arrow, 1974). In this sense, the focus of the analysis shifted from the interactions between consumers and firms to find the equilibrium of given markets to the interactions between economic agents in determining the various contractual forms which are used to organize their productive relations.

In the standard new-institutional economics, this analysis is performed connecting transaction costs, asset characteristics, and efficiency reasoning in the proposition by which, with asset specificity, the price system would be substituted by the authority system. For a discipline which has been successful in proving the optimality of market mechanisms, a problem was indeed to explain why such mechanisms were actually so little used in the real world situations[14].

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[14]"Suppose that [a mythical visitor from Mars] approaches the Earth from space, equipped with a telescope that reveals social structures. The firms reveal themselves, say, as solid green areas with faint interior contours marking out divisions and departments. Market transactions show as red lines connecting firms, forming a network in the spaces between them. Within firms (and perhaps even between them) the approaching visitor also sees pale blue lines, the lines of authority connecting bosses with various levels of workers. (...). When our visitor came to know that green masses were organizations and the red lines connecting them were market transactions, it might be surprised to hear the structure called a market economy. 'Wouldn't 'organizational economy' the more appropriate term?'" (Simon, 1991, pp.26-27)

To analyze the economic institutions of a system as a whole, however, this theory has a limit in taking account of just bilateral relations[15]. In this paper it has been shown that this restriction is especially relevant for the notion of specificity because, due to its intrinsically relative character, it is often misleading to say an asset is specific to a particular relation without knowing what is happening in the rest of the economy. Reasoning in terms of just bilateral relations, one can have the impression that a quasi-rent is both necessary and sufficient for asset specificity. While an extra value over the next best alternative use is always necessary for specificity because otherwise the lack of alternative users and the corresponding threat of opportunistic behavior would be innocuous, in this context it is also sufficient because without specificity there is no extra value and so the alternative is between bearing the costs of specificity, and obtaining its benefits, or obtaining nothing. Unfortunately, the underlying misunderstanding becomes immediately apparent when the analysis is extended to multilateral settings. Here, a quasi rent and the lack of alternative users are forced to be mutually implied only when productive activities are inimitable. In the other cases, one can have an extra value over the next best alternative use without specificity simply by imitating an existing investment not yet overtaken by subsequent innovations. From the addition of this third possibility or, alternatively, from the recognition that in these cases a quasi rent is not a sufficient condition for asset specificity, it follows that the 'free-riding organizational' problem must be added to that of 'hold-up' and, most importantly, that 'business groups' can emerge as a solution to their resulting tendency to over- or under-invest. As especially shown by some non Anglo-Saxon post-fordist production modes, the cooperative internalization of the externalities between investors and counterparties -that is the creation of a 'quasi-market' which protects the novelty character eliminating that of uniqueness- can be a way to simultaneously internalise the externalities between investors. Precisely such possible empirical applications to the actual forms of institutional regulation between cooperation and competition, however, confirm that this solution is neither free nor necessarily self-generating and

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[15]According to his own pioneer, in effect, to fully understand the determinants of the institutional structure of production, the chapter of the relations between firms has yet to be added to the explanation of their existence: "In 'The Nature of the Firm' the job [to construct a theory which will enable us to analyze the determinants of the institutional structure of production] was only half done- it explained why there were firms but not how the functions they perform are divided up among them." (Coase, 1988, p. 47). See also footnote 1.

therefore, the problem of detecting the policies needed to reduce its organizational costs is open.

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