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Incomplete Contracts, Property Rights and Endogenous Outside Options

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Abstract - This paper extends the framework provided by the so-called GHM approach to a context of endogenous outside options, showing how the optimality of property rights assignment might be reversed. In some cases, non-owners could over-invest in specific assets while having mere access to property rights might not prevent hold-up. Our conclusions suggest that in order to reach the desired optimality features, the design of ownership structure should take into account the dynamics of
outside options.

JEL classification: L12, L22, L42

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1 Introduction[1]

New Institutional Economics[2] has focused on the hold-up problem that arises in the absence of ex-post verifiability. Investment in specific assets may expose investors to the risk of opportunistic behaviour by contractual counterparties, who may impose a renegotiation of the terms contracted upon (the so-called *hold-up problem*). Under this framework, contractual parties have strong incentives to under-invest in asset specificity due to the risk of counterpart's opportunistic behaviour and, therefore, the potential quasi-rents – which might be generated by specific investments – are almost completely dissipated. The GHM[3] approach has outlined a theory of optimal allocation of property rights as a second best solution to hold-up. In this paper we extend this framework by assuming that parties' outside options are influenced by the investments made (Nicita and Vatiero, 2007). The economic reason to consider endogenous outside options relies on the circumstance that, intituively, since quasi-rents[4] are measured with respect to parties'outside options, there should be some interdependence between quasi-rents and outside options also at the moment in which parties decide to make investments. As Kessler and Lulfesmann (2007) have pointed out, [5] since outside options act as a default point in the bargaining game when the *outside option principle*[6] applies, then the ex-post value of parties' outside options is crucial in determining parties' ex-post bargaining power. This implies, as de Meza and

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[2]Klein, Crawford and Alchian, 1978; Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995; Williamson, 1985

[3]Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995

[4]Klein, Crawford and Alchian, 1978

[5]In particular they argue that in a in incomplete contract between an employer and an employee who has to make specific investments in learning "although the (above market) rent depends only on the worker's specific human capital, the way in which it is shared also depends on his general skills. In particular, as long as the external market opportunity of the worker (which fully reflects his marginal product from general training) is binding, negotiations will lead to the going market wage."

[6]The outside option principle asserts that the outside option of opportunistic agent, in the renegotiation game, acts as a constraint on the ex-post equilibrium division. See Sutton, 1980; Osborne and Rubinstein, 1988; MacLeod and Malcomson, 1993; Lyon and Rasmussen, 2004.

Lockwood (1997), Kessler and Lulfesmann (2007) and Chatterjee and Chiu (2007) acknowledge, that under an incomplete contract framework, beside the crucial decision on the degree of the specific investments to be made, parties also maintain strong incentives to control outside option dynamics in order to improve or defend their bargaining position in the ex-post renegotiation game. The perspective of endogenous outside options in incomplete contracts raises new incentives, new dynamics and new equilibria, quite neglected in standard literature.

While GHM assumed that investors' outside option are positively affected by the investment made but only to a limited extent, i.e. such that, by assumption, investor's outside option is never binding ex-post, we consider here a broader framework where in some case endogenous outside options turn to be binding ex-post. The application of the outside option principle in our setting may lead to counterintuitive results: each party might be induced to select those investments that negatively affect the other party's outside options and hence enhance their share of the final surplus in the ex-post bargaining. Moreover, this effect, which is defined here as 'cross competition effect', is further magnified when each party's investments positively affect his own outside option as well (as in the standard assumption of GHM). Under this framework, parties' investments may increase the ex-post competition between the contractual parties, reducing each party's outside options to an extent that depends on the impact of each investment on investors' competitors. This ex-post effect of competition, quite neglected in the standard literature, may actually reduce, at the margin, each party's incentive to choose the general-purpose investment, altering quite dramatically the inefficiency that the hold-up problem generates. In some circumstances, parties may even over-invest rather than under-invest. According to the impact of these investments on each party's outside options investment decisions may result in inefficient rent dissipation, even if in some cases the negative effect of rent dissipation might be mitigated by the endogenous enforcement effect realized by the parties' strategies over ex-post competition. We finally show that, contrary to GHM, the role played by property rights allocation in producing optimal incentives to invest in specific assets strictly depends on the impact exerted by investments on parties' outside options. Our conclusions suggest, in line with Chatterjee and Chiu (2007), but in a wider framework of outsid eoptions dynamics, that the design of optimal ownership structure for the governance of incomplete contracts should take onto account the

dynamics of market competition to preserve ex-post efficiency.

Some other recent contributions have addressed the analysis of the impact of endogenous outside options in an incomplete contract framework. Among these, Segal and Whinston (2000) analyze the role of exlcusivity clause with endogenous outside options generated by coopertaive investments, while here we focus on the case of zero brach penalties and specific self-investments; de Meza and Lockwood (1998) have formalised the role of outside and 'inside' options on the renegotiation game under a repeated setting. This is not the case of the model here addressed, where it is assumed a simple take-it-or leave-it choice in a one-shot game. MacLeod and Malcomson (1993) show how exogenous variations of parties' outside options in an incomplete contract may affect the threat point of the renegotiation game, a conclusion reached also by Edlin and Hermalin (1998). Here, the analysis goes further by stressing the crucial strategic role played by the choice of the investmentwith respect to their impact on parties' outside options. Bolton and Whinston (1993) formalize the case where, under a seller's monopoly, buyers downstream competition affects their incentive to invest. Although they are concerned with market-contracts interactions, their analysis is not fully developed in an incomplete contracts, neither they provide an explanation of the choice between investments affecting joint-surplus and/or outside options. Finally, the analysis of the role competition plays in affecting investment incentives in incomplete contracts has been independently pointed out by Kessler and Lulfesmann (2007) and by Chatterjee and Chiu (2007), who study agents' investment decisions between general purpose and specific investments with interdependent outside options. The article by Chatterjee and Chiu[7] is the only one we are aware of in which market-contracts interactions are explicitly pointed out and investigated. Aside from the basic differences in the formulation of the models, the analysis here proposed differs in some respects. While the paper by Chatterjee and Chiu puts very interesting insights under a property rights perspective, in the model here developed, cross competition equilibria are reached first regardless of asset ownership, extending thus the analysis of contractual enforcement to situation characterized by zero property rights. Moreover, we outline here the case for unilateral and bilateral over-investment equilibria. In our analysis overinvestment level is greater than the efficient level of investments and this

[7]The authors kindly address our similar independent result. We here use the level of investment, rather than the type of investment as the focus of our analysis.

marks a crucial difference with contributions by Grossman and Hart (1986), Bolton and Whinston (1993), Chung (1996), Chatterjee and Chiu (2007), Kessler and Lulfesmann (2007). The analysis by Grossman and Hart (1986) and by Kessler and Lulfesmann (2007) differs from ours since they assume thatif a party over-invests the counterpart will under-invest and vice-versa; Bolton and Whinston are not concerned with specific versus general-purpose investments; Chung's (1996) notion of over-investment differs from the one here proposed because it is referred to under-investments level rather than to efficient specific investments. We in particular focus on the co-existence of multiple equilibria in bilateral over-investment, both in specific and general purpose investments, neglected by previous literature and then analyze the impact on property rights allocation.

2 The Grossman-Hart-Moore (GHM) model

Let us assume a set of assets $A = (a_1, a_2)$ and a set of agents $M = (B, S)$. S (the seller), in combination with asset a_2, produces a single unit of a widget z which is acquired as an input by B (the buyer) at the price P or by a third party at a price p, with $P > p$, determined according to parties' contractual power[8]. Let us assume that prior to trading, both B and S make a specific self-investment that enhances respectively the marginal revenue for B and reduces the marginal cost of production for S. The marginal return to the investments depends on whether or not trade occurs between B and S[9]. When S trades with B the net total surplus generated W is given by[10]

[8]Symmetrically, B can purchase the widget, either from S (specific-relationship), or from the spot market. In combination with own a_1, B uses this widget z to produce an output x that is sold on the output market.

[9]Note that, in this respect, investments are made at $t = 0$, and the widget is supplied at $t = 1$, that is, there is uncertainty about the type of the widget which B will require in $t = 1$.

[10]Denote B's relationship-specific investment at $t = 0$ by i – a non-negative number representing the level and cost of the investment; $R(i)$ denotes the B's revenue with the trade and P is the agreed widget price. If trade does not occur, B buys a 'non-specific' widget from an outside for price p and the B's revenue is denoted by $r(i)$. In the same manner, e symbolized the Seller's level and cost of investment, $C(e)$ the production cost with the trade and $c(e)$ the production cost outside the trade. Under the setting already described, the capital letters represent the specific variables, whilst the lower case letters the non-specific (or market) ones.

$$W = R(i) - P + P - C(e) - (i + e) = R(i) - C(e) - (i + e)$$

When S or B trade with third parties, the net total surplus w is given by

$$w = r(i) - p + p - c(e) - (i + e) = r(i) - c(e) - (i + e)$$

Let us assume[11] that there are always gains, namely a surplus, from trade between S and B[12], that is: $W > w > 0$.

When contracts are complete, efficient trade between S and B will always occur, with S and B choosing respectively the investment levels $e*$ and $i*$ that maximize W and satisfy the first order conditions:

$$R'(i*; a_1) = 1 \tag{1}$$

$$\|C'(e*; a_2)\| \tag{2}$$

leading to an equilibrium on the Pareto frontier, determined according to parties' ex-ante contractual power.

Proof.

In a world with contractual completeness, the investment levels i and e, considering the net present value of the trading relationship W, are given by the first order conditions:

$\frac{\partial R(i;a_1)}{\partial i} - 1 = R'(i*; a_1) - 1 = 0$ e $\left\| \frac{\partial C(e;a_2)}{\partial e} \right\| - 1 = \|C'(e; a_2)\| - 1 = 0$

Therefore, the optimal value $i*$ and $e*$ is given by [1] and [2].

When contracts are incomplete, parties will choose their investments non-cooperatively, leading to equilibrium into the second best area and the Pareto

[11] Other three important assumptions are:

1. the parties are risk-neutral;
2. the parties have unlimited amounts of initial wealth;
3. the interest rate is zero.

[12] This condition shows the idea that investments i and e are relation-specific.

frontier is not achieved. We can calculate the quasi-rent (QR) of the investments in a world with contractual incompleteness:

$$QR^B = R(i) - P - [r(i) - p] > 0$$

$$QR^S = P - C(e) - [p - c(e)] > 0$$

By ex-post Nash bargaining we obtain the net ex-post payoffs.

$$\prod^B -i = r - p + a[R - C - (r - c)] - i = -p - aC + ac + aR + (1 - a)r - i \quad (3)$$

$$\prod^S -e = p - c + (1 - a)[R - C - (r - c)] - e = p - ac + (1 - a)R - (1 - a)C - (1 - a)r - e \quad (4)$$

Differentiating [3] with respect to i and [4] with respect to e yields the following necessary and sufficient conditions:

$$aR'(i) + (1 - a)r'(i) = 1 \quad (5)$$

$$(1 - a)\|C'(e)\| + a\|c'(e)\| = 1$$

These first order conditions lead to a Pareto inferior equilibrium with respect to complete contractual conditions. The main contribution of the GHM model is that of showing the relevance of property rights assignment on the degree of underinvestment in an incomplete contract framework. In this approach the ownership of physical assets matters because it increases investors' ex-post outside options after investments are made; namely

$R'(i; A) > r'(i; a_1, a_2) \geq r'(i; a_1) \geq r'(i; \emptyset)\ \forall i : 0 < i < \infty$ for B

$\|C'(e; A)\| > \|c'(e; a_1, a_2)\| \geq \|c'(e; a_2)\| \geq \|c'(e; \emptyset)\|\ \forall e : 0 < e < \infty$ for S

The intuition here is that ownership is a source of power since it assigns to the owner the residual right to control over non-contractible uses, even when trade occurs with third parties. The allocation of ownership over assets determines the returns to investments. As a consequence, ownership determines

parties' incentives to choice the degree of specific investments. Moreover, in GHM's model, investors' outside options are positively correlated with ownership. This is precisely the reason why ownership increases incentives to invest: since investor's outside options raise with investment, it is convenient for the owner to invest in any event, independently of counterpart's decision to maker or not cooperative specific investments. On the other hand, non-owner's incentives to make relationship-specific investments is reduced in the above framework: since non-owner's outside options are not affected by the investment made, there is no reason for a rational agent to invest in specific assets if she is not also the owner of the assets in which the investment is embedded. As a result, the full cooperative outcome will not reached and only second best outcomes could be afforded in the above framework. Thus, in the GHM model, since the allocation of property rights on physical assets can affect the degree of under-investment, the hold-up problem is transformed into the problem of selecting the ownership structure which ensures second best outcomes, provided that every ownership structure shows both (private) benefits and (social) costs.

3 Incomplete contracts with endogenous outside options

In the GHM model it is assumed that ownership affects investors' outside options. In particular, it is assumed that even when trade occurs with third parties, the incentive to raise the level of specificity of investments increases with the number of assets owned by investors. That, in turn, implies that we are assuming an ex-post market structure according to which the market opportunities for owners, after investments are made, are always greater than the ex-ante competitive conditions associated to generic investments. However, it assumed that these opportunities are never so great to overcome the first best gains from trading with the original counterpart. What happens to the above framework if we extend the GHM model to allow parties to affect outside options in such a way to improve their ex-post pay-off when trading with third parties, independently of gaining access to property rights? In other words, what happens to the above framework if we assume that parties' investments maintain the possibility to monopolize the market?

Let us assume first that the investor can sink economic resources with the

purpose of monopolizing the market. That means that he will increase his own outside option while reducing counterparts' outside options. Let us consider the case of a buyer B (a similar result could be shown for the seller) being able to select a specific investment such as to increase her valuation of contracting with third parties (as in the GHM model) while increasing the seller's cost to trade with third parties. The net ex-post pay-off of agents will be given by:

$$\prod^{B} -i = -p - aC(e) + ac(e,i) + aR(i) + (1-a)\, r(i) - i$$

and the first order conditions become:

$$\frac{\partial \prod^{B}}{\partial i} = aR'(i) + (1-a)\, r'(i) + a\frac{\partial c(i)}{\partial i} = 1 \tag{6}$$

Thus we have the following proposition.

Proposition 1. Countervailing effect of specific investments

When in the above setting, buyer's investment is such that $c'(i) > 0$, i.e. if B's investment has the effect of increasing the seller's cost of trading with third parties, thus the specific investment may have a countervailing effect on the under-investment equilibrium. Moreover, when

$$\frac{\partial c(i)}{\partial i} = \left(\frac{1}{a} - 1\right)\left[R'(i) - r'(i)\right] \tag{7}$$

the countervailing effect is such to produce a buyer's marginal return equal to the buyer's quasi-rent associated with cooperative specific investments on both sides.

Proof.

It is easy to show that when [7] holds, [6] becomes $\frac{\partial \prod^{B}}{\partial i} = aR'(i) + (1-a)\, r'(i) + a\left\{\left(\frac{1}{a} - 1\right)\left[R'(i) - r'(i)\right]\right\} = 1 \Rightarrow R'(i) = 1$, which is the first order condition for buyer's efficient investments.

Proposition 2. Countervailing effect and second best outcomes

In the above setting the countervailing effect generates a marginal return on investment for the buyer which is always higher than that associated with full ownership in the GHM model.

Proof.
Compare [5] with [6].

What is the economic meaning of propositions 1 and 2? The intuition here is to extend further the assumption held by the GHM model in order to consider the case in which investor may sink economic resources (represented by i and e) not only to increase their own outside options, as in the GHM model, but also to decrease counterparties' outside options. That is the case in which by increasing the level of the investment with respect to the underinvestment level produces some effects on counterparties' outside options. The ex-post reduction of counterparts' outside options can have several economic explanations. The main argument is that, since as in GHM parties' outside options act as default point in the ex-post renegotiation game, it is rationale to attempt to affect outside options in a way to increase ex-post bargaining power. While in GHM the only possibility to affect outside options is that of having access to the ownership of the assets involved in the production process, we show that another possibility is that of strategically sink economic resources with the purpose of decreasing counterparts' outside options.

One rationale for that could be found in the *entry deterrence effect* generated by the investor on ex-post competitors (who represent, in fact, counterparty's outside options) as in Dixit (1980). If the investor is the buyer, in the extreme case studied by Dixit any amount of i greater than the underinvestment level generates a deterrence effect on competitors so as to induce them to exit the market and/or to inhibit their entry by raising their costs to compete (Salop and Scheffman, 1983). Consequently, it would be rational for the buyer to select that amount, since this strategy will increase her ex-post gains from trade. Between the extreme cases studied by Dixit and the underinvestment equilibrium analyzed by GHM there is a range of value in which a lower degree of underinvestment increases ex-post investor's contractual power through the increase in market power generated by the change induced in parties' outside options. Comparing this conclusion with the literature on incomplete property rights, allows us to show an important

result: access to property rights could not be a sufficient safeguard against post-contractual opportunism under any circumstance, as in the GHM context. When parties may affect market configuration through their investment choices, market dynamics may be a crucial factor in determining parties' ex-post bargaining power. This result is twofold: on the one hand, it shows that ex-post market configuration may affect parties' incentives to invest so that the ability to ex-post monopolize relevant markets may positively align incentives to make specific investments; on the other hand, it shows that property rights assignment may not be as crucial as parties' ability to ex-post monopolize relevant markets under an incomplete contract framework. This is argued in the next paragraph.

4 Property rights allocation with endogenous outside options

An important issue to be pointed out is that the countervailing effect defined above does not necessarily depend on the allocation of property rights to the buyer. In particular, when the countervailing effect is so large that proposition 1 holds even if all the assets are attributed to the seller and the set of assets owned by B is empty, with $A_B = \widehat{A_B} = \emptyset$, the buyer will select the amount of investment that satisfies the following first order condition:

$$\frac{\partial \prod^B}{\partial i} = aR'\left(i; \widehat{A_B}\right) + (1-a)\, r'\left(i; \widehat{A_B}\right) + a\frac{\partial c\left(i; \widehat{A_B}\right)}{\partial i} = 1$$

One general consequence of the above argument regards the existence of strong incentives for the investing firm to monopolize the market, under an incomplete contract framework, even when it has not access to any property rights on physical assets.

Proposition 3. Countervailing effect and irrelevance of property rights assignment

When in the above setting the countervailing effect is so large that

$$c'\left(e; \widehat{A_S}\right) < c'\left(i; \widehat{A_B}\right) \leq \left(\frac{1}{a} - 1\right)\left[R'\left(i; \widehat{A_B}\right) - r'\left(i; \widehat{A_B}\right)\right] \qquad (8)$$

with $\widehat{A_S} = \{a_1, a_2\}$ and $\widehat{A_B} = \emptyset$.
then the assignment of property rights is irrelevant for the selection of specific investments both on the side of the buyer and on the side of the seller.

Proof
[8] implies that the countervailing effect is such to induce specific investment by the non-owner (the buyer) and to inhibits specific investments by the owner (the seller), as long as the impact of buyer's investment outweighs the impact of ownership on seller's outside option.

Proposition 3 also defines, on the opposite side, the conditions under which property rights matter in inducing specific investments by the seller. That is the case in which the allocation of property rights to the seller inhibits buyer's ability to influence the seller's outside options, so that $\frac{\partial c\left(i;\widehat{A_B}\right)}{\partial i} = 0$. Generally, however, it is reasonable to assume that market competition is more seriously relevant when we assume that a 'competition effect' is as much as more concentrated is the ownership:
$\frac{\partial c\left(e,i;A_B=\left(\emptyset\right)\right)}{\partial i} \leq \frac{\partial c(e,i;A_B=(a_1))}{\partial i} \leq \frac{\partial c(e,i;A_B=(a_1,a_2))}{\partial i}$ for the buyer
$\left\| \frac{\partial r\left(i,e;A_S=\left(\emptyset\right)\right)}{\partial e} \right\| \leq \left\| \frac{\partial r(e,i;A_S=(a_1))}{\partial e} \right\| \leq \left\| \frac{\partial r(e,i;A_S=(a_1,a_2))}{\partial e} \right\|$ for the seller.
In other words, ownership matters, under the above assumptions, when having exclusive access to given scarce assets is crucial in order to affect parties' outside option. Thus we have here a first puzzling result: under incomplete contracts with endogenous outside options, ownership is crucial in positively affecting incentives to make specific investments only when it is crucial also to monopolize markets. As a consequence, from a consumers' welfare perspective, the efficiency of proprietary integration (in terms of investors' ex-ante incentives) needs to be compared with the inefficiency associated to market monopolization (in terms of dead weight loss). This conclusion is particularly relevant for antitrust evaluation of horizontal and vertical mergers.

5 The emergence of 'Cross competition' equilibria

When, B can affect c with his investment i, and symmetrically S can affect r with his investment e the first order conditions become:

$$aR'(i) + (1-a)\, r'(i,e) + a\frac{\partial c(i)}{\partial i} = 1 \tag{9}$$

$$(1-a)\,\|C'(e)\| + a\,\|c'(e,i)\| + \left\|(1-a)\,\frac{\partial r(e)}{\partial e}\right\| \tag{10}$$

Proof.
departing from [3] and [4], the net ex-post payoffs become:

$$\prod^{B} -i = -p - aC(e) + ac(e,i) + aR(i) + (1-a)\, r(i,e) - i$$

$$\prod^{S} -e = p - ac(e,i) + (1-a)\, R(i) - (1-a)\, C(e) - (1-a)\, r(i,e) - e$$

Differentiating the former net payoff over i and the latter with respect to e yields the condition [9] and [10].

In [9] and [10] $\frac{\partial c(i)}{\partial i}$ and $\left\|\frac{\partial r(e)}{\partial e}\right\|$ describe the two countervailing effects which defines the cross-competition. Indeed, the comparison between [9] and [10] highlights the effect of seller's investment e on buyer's maximization calculus.

Following terminology of Bulow et al. (1985), we may analyze investments as either strategic substitutes or strategic complements. Roughly speaking, one party's strategic substitutary investment lowers counterparty's market position. On the contrary, one party's strategic complementary investment raises counterparty's market position. We will focus on the former case, that is we assume that $\frac{\partial c(i)}{\partial i} \geq 0$ and $\frac{\partial r(e)}{\partial e} \leq 0$. However, the latter case may occur when a relative improving of party's market position with respect to counterparty determines a relative 'more' improving of counterparty's market position with respect to her competitors.

Comparing [1] with (9) and (2) with (10) leads us to extend Proposition 1, as follow.

Proposition 4. Cross competition equilibria

When both parties may affect outside options, cross-competition effects may counterbalance, under given assumptions, the losses associated to bilateral under-investments.

Proof.
It is sufficient to compare the following equilibria:

- if $(1-a)\,R'(i) > (1-a)\,r'(i) + a\frac{\partial c(i)}{\partial i}$ and $a\,\|C'(e)\| > a\,\|c'(e)\| + \left\|(1-a)\,\frac{\partial r(e)}{\partial e}\right\|$, then the underinvestment level persists;
- if $(1-a)\,R'(i) = (1-a)\,r'(i) + a\frac{\partial c(i)}{\partial i}$ and $a\,\|C'(e)\| = a\,\|c'(e)\| + \left\|(1-a)\,\frac{\partial r(e)}{\partial e}\right\|$, then the optimal investment level is achieved;
- if $(1-a)\,R'(i) < (1-a)\,r'(i) + a\frac{\partial c(i)}{\partial i}$ and $a\,\|C'(e)\| < a\,\|c'(e)\| + \left\|(1-a)\,\frac{\partial r(e)}{\partial e}\right\|$, then bilateral over-investments levels are generated.

Proposition 4 illustrates the fact that parties – by their investments endogenously set parties' market positions – increases the whole incentives to invest with respect to a context with exogenous outside options. Therefore, even with contractual incompleteness both parties may over-invest, or at least not under-invest, with respect to optimum level. However, the effects of an higher level of investments by parties may be compensated by an higher level of investments by counterparty, leaving the parties' market positions partially or totally unchanged and dissipating partially or totally both investments in outside options. As a result, parties with symmetric and commons knowledge on effects of this "dissipating" cross competition may be discouraged by investments in outside options, determining a parallelism on the behaviours and under-investments level.

6 Optimal property rights assignment with endogenous outside options

Let us consider now how the assumption of endogenous outside options affects the criteria outlined by GHM in order to proceed to an optimal assignment of

property rights under an incomplete contracts framework. The propositions below show how the particular case analyzed by the GHM model is one in which it is assumed $\frac{\partial r(e;A_S)}{\partial e} \equiv \frac{\partial c(i;A_B)}{\partial i} = 0$. In fact, the GHM solution holds unequivocally only when the impact of investments on counterparty's outside option is zero.

- *Productivity of the investment.* The productivity degree denotes the impact of investments on aggregate surplus. The GHM model shows that if S' investment is comparatively estimable as one with low productivity, then it is optimal to assign to B the integrated ownership with $A_B = (a_1, a_2)$. The GHM conclusion can be reversed if the dynamics of endogenous outside options is such that nonowner is induced to over-invest in decreasing counterpart's outside option and/or to increase own outside option. If it occurs, then the optimal allocation of ownership should take into account the (cross) effects generated on incentives by alternative assignements.

- *Independency degree of assets.* Assets $a_1$and a_2 are independent if $\frac{\partial r(i;A_B=(a_1,a_2))}{\partial i} \equiv \frac{\partial r(i;A_B=(a_1))}{\partial i}$ and $\frac{\partial c(e;A_S=(a_1,a_2))}{\partial e} \equiv \frac{\partial c(e;A_S=(a_2))}{\partial e}$. When the assets are independent, according to GHM model, it is optimal to implement partial ownership with $A_B = (a_1)$ and $A_S = (a_2)$. This result may be reversed if we have endogenous outside options such that $\frac{\partial c(i;A_B=(a_1,a_2))}{\partial i} > \frac{\partial c(i;A_B=(a_1))}{\partial i}$ and $\frac{\partial r(e;A_S=(a_1,a_2))}{\partial e} \equiv \frac{\partial r(e;A_S=(a_2))}{\partial e}$, that is, such that ownership stimulates buyer (and not the seller) to invest in order to reduce the seller's outside option. When the latter case occurs, then the integrated ownership with $A_B = (a_1, a_2)$ is comparatively more efficient in order to stimulate the higher aggregate level of investments.

- *Complementarity degree of assets.* Assets a_1 and a_2 are strictly complementary if either $\frac{\partial r(i;A_B=(a_1))}{\partial i} \equiv \frac{\partial r\left(i;A_B=\left(\emptyset\right)\right)}{\partial i}$ or $\frac{\partial c(e;A_S=(a_2))}{\partial e} \equiv \frac{\partial c\left(e;A_S=\left(\emptyset\right)\right)}{\partial e}$. In this case, according to the GHM model, it is optimal to implement the integrated ownership, respectively $A_B = (a_1, a_2)$ or $A_S = (a_1, a_2)$. However, if $\frac{\partial c(i;A_B=(a_1))}{\partial i} > \frac{\partial c\left(i;A_B=\left(\emptyset\right)\right)}{\partial i}$and $\left\|\frac{\partial r(e;A_S=(a_1))}{\partial e}\right\| > \left\|\frac{\partial r\left(i;A_S=\left(\emptyset\right)\right)}{\partial e}\right\|$, then the integrated ownership reduces competition dy-

namics in the market, and partial ownership might better perform in this case.

- *Essentiality of human capital.* B's human capital is essential if $\frac{\partial c(e;A_B=(a_1,a_2))}{\partial e} \equiv \frac{\partial c\left(i;A_B=\left(\emptyset\right)\right)}{\partial e}$. In this case[13], according to GHM model, it is optimal to implement the integrated ownership of type $A_B = (a_1, a_2)$. However, it might occur that $\left\|\frac{\partial r(e;A_S=(a_1,a_2))}{\partial e}\right\| > \left\|\frac{\partial r\left(e;A_S=\left(\emptyset\right)\right)}{\partial e}\right\|$, namely integrated ownership discourage seller's investments in outside options. Then a partial ownership might better perform.

7 Conclusions

Since the seminal works by Williamson (1985) and by Grossman and Hart (1986) and Hart and Moore (1990), a large number of papers have dealt with the problem of property rights arrangements in an incomplete contract framework. In these models, since relationship-specific human capital investments increase the marginal return of the physical assets involved, investor's outside option is partially affected by the investment selected. However, a crucial assumption in most of these models is that a party's outside option (i.e. counterpart's competitors) is never binding ex-post and furthermore it is never affected by the investment made by the other party, i.e. that ex-post competitors are not affected by the actions (investments) by parties.

We have extended previous litertare by studying a two stage incomplete contract between a buyer and a seller, with specific investments and endogenous outside options. We have explicitly considered the case of a party's outside

[13]Note that:

1. the assumption of essentiality of human capital is the sum combination of complementarity and independency of assets. In other words, in GHM's view, there is essential human capital when the partial ownership structure and the integrated ownership with allocation of residual property right at the owner of physical assets is inefficient.
2. This is the same result of situation with seller's null productivity investment.
3. If both human capitals are essential then every ownership structure is efficient.

option being affected by the investment made by the other contractual party. Given that the outside option of an agent identifies the potential competitors of the contractual counterpart, with such endogenous outside options, a party is induced to invest strategically in order to encourage counterpart's competitors and/or to deter own competitors, by raising the exit costs of the other contractual party. The model proposed extends the framework provided by the so-called New Property Rights School, also known as GHM approach, in that it explicitly allows for outside options being affected by the investments made by parties. The paper thus shows that the role played by property rights allocation in producing optimal incentives to invest in specific assets strictly depends on the impact exerted by investments on parties' outside options.

This complexity calls for a broader notion of transaction in which the notion of enforcement costs should also integrate the wide range of competition costs which parties may sustain in order to improve their market position against competitors and actual and potential counterparts (Chatterjee and Chiu, 2007; Nicita and Vatiero, 2007). A clear definition of a complex transaction may be found in Commons' (1924) idea that:

> "the choice of opportunities is always a choice between the two best accessible options at the moment of choice, and if there is no possible alternative, then the exchange may be that of "hold-up" character [...] in which there is no real freedom of choice [...]. Thus there is a gradation of alternatives taken into account by each party to a transaction, and consequently, from the standpoint of the motives affecting the parties, the minimum number of persons necessary to constitute a transaction is four parties, two buyers and two sellers, namely, the actual buyer and seller, and the next best alternative for each".

The main results of the paper are as follows. First, depending on the degree of ex-post market competition, (i) contractors may have strong incentives to make an over-investment (specific or general purpose) even when they have no access to property rights; (ii) over-investment may act as an endogenous enforcement device. With endogenous outside options the parties' strategic interdependence could be influenced by the parties' ability to use ex-post market competition as a discipline device in an incomplete contract.

While the GHM approach emphasizes the efficient role played by property rights allocation in inducing at least one party to make efficient investment, we have shown how the optimality feature of rights' assignments strictly depends on the ex-post variation of parties outside options. With endogenous outside options owners and non-owners may over-invest independently of any initial ownership structure. We may conclude that the with endogenous outside options, in order to proceed to an optimal allocation of property rights (also in terms of reduced dissipation induced by over-investments) we should also consider the relevance of bilateral perspective changes under any ownership structure, thus comparing, in our example the variation induced on the two outside options components:

$$\left[a\frac{\partial c\left(e,i;A\right)}{\partial i}\right]+\left[\left\|\left(1-a\right)\frac{\partial r\left(i,e;A\right)}{\partial e}\right\|\right]$$

where A represents the ownership structure.

Our results shed light over the efficiency induced by alternative property rights allocation in a context of endogenous outside options, showing how unilateral and bilateral over-investments may be an equilibrium. We show how the characteristics of productivity's degree of investments, independency's degree of assets, complementarity's degree of assets, essentiality of human capital, represent sufficient conditions – in order to estimate the choice of ownership structure – only in a world without outside options or with fixed outside options. Our conclusions suggest that the design of optimal ownership structure for the governance of incomplete contracts should take onto account the dynamics of market competition to fully evaluate ex-post efficiency feature of the emerging equilibria.

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