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Abstract

In the property rights approach to the theory of the firm, ownership matters if parties have to make partly relationship-specific investments, but ownership would be irrelevant if the investments were completely relationship-specific. We show that if negotiations after the investment stage require transaction costs to be paid, then ownership matters even when investments are completely relationship-specific. While in the standard model without transaction costs there are underinvestments compared to the first-best benchmark, in our setting a party may overinvest in order to induce the other party to incur the transaction costs that are necessary to enter the negotiation stage.

Keywords: Incomplete contracts; investment incentives; ownership rights; relationship specificity; transaction costs

JEL classification: D23; D86; G34; L23; L24

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1 Introduction

The property rights approach to the theory of the firm developed by Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995) has emphasized the importance of relationship-specific investments.[1] However, a peculiar feature of the theory is that ownership matters only if investments are *partly* relationship-specific. Hence, it is usually assumed that while the full returns of the investments can be realized only within a specific relationship, a part of the investment returns can also be realized outside of the relationship. If the investments were *completely* relationship-specific, such that they could not be used outside of the relationship, the incentives to invest would be independent of the ownership structure. Since it is usually assumed in the property rights theory that there are no ex-post inefficiencies, the attainable surplus is fully determined by the investment incentives, so according to the standard theory the ownership structure does not matter at all when investments are completely relationship-specific.

In the present paper, we show that if the property rights theory is extended by allowing for transaction costs as formalized by Anderlini and Felli (2006), the incentives to invest depend on the ownership structure even when the investments are completely relationship-specific. As an illustration, suppose that party A has a novel idea how to use a patented technology to produce more efficient batteries for electric cars. Party A can make non-contractible investments in order to develop the idea tailored to the specific needs of party B, a leading producer of electric cars. Subsequently, party B decides whether

[1] See Segal and Whinston (2013) for a comprehensive survey of the literature on property rights.

or not to incur transaction costs in order to enter formal negotiations with party A.[2] If an agreement is reached, the idea is put to its most profitable use and the returns of the investments are realized. In line with the property rights theory, we assume that the parties divide the surplus according to the regular Nash bargaining solution. If no agreement is reached and party B is the owner of the patent, then party A cannot make use of its idea. Yet, if no agreement is reached and party A is the owner of the patent, then party A can sell its idea on the market. In the latter case the profit that can be generated with the idea is smaller than in the case of collaboration with party B and the relationship-specific investments are lost.

It turns out that even though the investments are completely relationship-specific, the incentives to invest depend on the ownership structure. In particular, when party A decides how much to invest, it anticipates that party B will incur the transaction costs only if implementing party A's idea is sufficiently profitable. Therefore, party A can have stronger investment incentives under A-ownership, because the additional surplus that can be split according to the Nash bargaining solution will be smaller under A-ownership than under B-ownership. Interestingly, in contrast to the usual property rights model, it can even be in party A's interest to invest more than the first-best benchmark level in order to persuade party B to enter the negotiations. Moreover, it turns out that sometimes B-ownership can be optimal. The reason is that under A-ownership there can be a more severe overinvestment problem or the transaction costs can be so large that under A-ownership the negotiations will

[2]For instance, the transaction costs may reflect the time needed for preparing the negotiations, conceiving of a suitable language to describe the states of the world, gathering information about the legal environment, and so forth (cf. Anderlini and Felli, 2006, pp. 226–228).

not be entered (and A does not invest), whereas under B-ownership an ex-post efficient agreement would be attained.

Related literature. The way in which we model transaction costs follows Anderlini and Felli's (2006) insightful paper.[3] While Müller and Schmitz (2016) have also introduced transaction costs into a property rights model, they do not study the case of completely relationship-specific investments and in their setup overinvestments cannot occur. Moreover, it should be emphasized that in the present paper we follow the standard property rights theory in assuming that there is symmetric information (cf. Hart, 1995). There are only a few papers in the literature on the property rights approach that have studied the effects of asymmetric information.[4] In particular, see Schmitz (2017, 2020) for models where in the presence of adverse selection or moral hazard ownership can have an impact on incentives to make completely relationship-specific investments. Finally, it should be noted that Hart (2013) has also allowed for frictions after the investment stage. However, Hart (2013) relies on behavioral assumptions which do not play a role in the present model.[5]

2 The model

There are two parties, A and B. Party A has a novel idea to generate profits using an essential asset (e.g., a patent) that may be owned by either A or B.

[3] See also Anderlini et al. (2019), who study the role of transaction costs in the context of pre-trial agreements.

[4] See Schmitz (2006, 2008) and Su (2017). Cf. also Goldlücke and Schmitz (2014), Vasconcelos (2014), and Choi and Triantis (2021), who have studied hold-up problems under asymmetric information.

[5] Hart (2013) builds on Hart and Moore (2008) who assume that contracts serve as reference points, so parties that do not get what they feel entitled to are aggrieved and shade on ex-post performance. In contrast, in the present paper we follow the traditional property rights theory in assuming that all parties are standard profit-maximizers.

Party A's human capital is indispensable in order to implement the idea. At date 1, party A can make relationship-specific investments $i \geq 0$ in order to further develop the idea, tailored to the needs of party B.[6] The investment costs of party A are given by $\frac{1}{2}i^2$. At date 2, party A can pitch its idea to party B. Party B decides whether or not to incur transaction costs $c \geq 0$ in order to enter formal negotiations with party A.[7] If an agreement is reached, then at date 3 by implementing the novel idea the parties together generate the revenue $R + i$.

If party B does not enter the negotiations or if the negotiations fail, at date 3 the parties get their default payoffs. Party B's default payoff is zero regardless of the ownership structure, because the novel idea cannot be implemented without party A. In contrast, party A's default payoff depends on the ownership structure. Specifically, if party B is the owner, then party A's default payoff is zero, because party A cannot make use of the idea without the essential asset. If party A is the owner, then its default payoff is $r > 0$, because it can sell the idea on the market. However, in this case the idea is put to a second-best use only, so $r < R$. Note that the investments are completely relationship-specific; i.e., their returns can be realized only within the relationship between A and B.

[6]Note that it is a usual assumption in the property rights theory that there are prohibitively large transaction costs before investments are made, such that it is not possible to contractually implement a desired investment level. There is a tension between this assumption and the assumption in standard property rights models according to which there are no frictions after the investments are sunk. Our setup resolves this tension by also allowing for some transaction costs after the investment stage.

[7]One could extend the model such that also party A has to incur some transaction costs to reach the negotiation stage. Yet, Anderlini and Felli (2006) have shown that the effects of transaction costs are most interesting if there is a 'mismatch' between the distributions of the parties' bargaining powers (which following Hart, 1995, we assume to be symmetric) and of the transaction costs.

Following the literature on the property rights theory (cf. Hart, 1995), we use the regular Nash bargaining solution to model the date-2 negotiations. Thus, if the negotiations are entered, the parties will always agree on the ex-post efficient outcome (i.e., they will collaborate), and each party will get its default payoff plus half of the negotiation surplus (which is the total surplus given the ex-post efficient outcome minus the sum of the default payoffs).

3 Benchmarks

Suppose for a moment that there are no transaction costs at date 2, so $c = 0$. In this case our setup corresponds to the standard model of the property rights theory (cf. Hart, 1995), except that the investments are completely relationship-specific.

Note that it is ex-post efficient for the parties to collaborate and to generate the revenue $R + i$ at date 3. At date 1, the ex-ante efficient investment level is given by $i^{FB} = \arg\max_i \left(R + i - \frac{1}{2}i^2\right) = 1$, so the total surplus in the first-best solution is $S^{FB} = R + \frac{1}{2}$.

Under A-ownership, party A's date-1 payoff is $u_A^A(i) = r + \frac{1}{2}(R+i-r) - \frac{1}{2}i^2$, while party B's payoff is $u_B^A(i) = \frac{1}{2}(R + i - r)$. Hence, party A invests $i^A = \frac{1}{2}$ and the total surplus is $S^A = R + \frac{3}{8}$. Under B-ownership, party A's date-1 payoff is $u_A^B(i) = \frac{1}{2}(R + i) - \frac{1}{2}i^2$, while party B's payoff is $u_B^B(i) = \frac{1}{2}(R + i)$. Thus, party A invests $i^B = \frac{1}{2}$ and the total surplus is $S^B = R + \frac{3}{8}$.

Observe that there is always underinvestment compared to the first-best solution and the investment levels do not differ between the ownership structures ($i^A = i^B < i^{FB}$). Therefore, given that ex-post efficiency is always attained,

the total surplus is the same under both ownership structures ($S^A = S^B$). This finding illustrates that ownership does not matter in the standard property rights theory when investments are *completely* relationship-specific.[8]

Proposition 1 *If there are no transaction costs at date 2, then the fact that the investments are completely relationship-specific implies that the ownership structure does not matter. There are always underinvestments compared to the first-best benchmark solution.*

4 Main results

Now suppose that there are positive transaction costs $c > 0$ at date 2.

Consider A-ownership first. At date 2, party B is willing to incur the transaction costs c whenever $\frac{1}{2}(R + i - r) - c \geq 0$. Hence, party A's date-1 payoff is

$$\hat{u}_A^A(i) = \begin{cases} r - \frac{1}{2}i^2 & \text{if } i < 2c - (R - r), \\ r + \frac{1}{2}(R + i - r) - \frac{1}{2}i^2 & \text{if } i \geq 2c - (R - r), \end{cases}$$

while party B's payoff is given by

$$\hat{u}_B^A(i) = \begin{cases} 0 & \text{if } i < 2c - (R - r), \\ \frac{1}{2}(R + i - r) - c & \text{if } i \geq 2c - (R - r). \end{cases}$$

[8]Note that ownership would matter if investments were only *partly* relationship-specific. To see this, suppose that party A's default payoff under A-ownership would be $r + \varepsilon i$, where $\varepsilon \in (0, 1)$, so A could realize a part of the investment returns without B. It is straightforward to show that then under A-ownership the investment level would be $\frac{1}{2}(1+\varepsilon)$ and the total surplus would be $R + \frac{1}{2} - \frac{1}{8}(1 - \varepsilon)^2$. Hence, there would still always be underinvestment compared to the first-best solution, but A-ownership would be strictly better than B-ownership.

Observe that at date 1, party A's payoff is maximized by $i = \frac{1}{2}$ if $c \leq \frac{1}{4} + \frac{1}{2}(R-r)$.

Now consider the case $c > \frac{1}{4} + \frac{1}{2}(R-r)$. If party A wants to induce party B to incur the transaction costs, it is most profitable for party A to invest $i = 2c-(R-r)$, such that party B is just willing to enter the negotiations. If party A does not want to induce party B to incur the transaction costs, it is most profitable for party A to invest $i = 0$. Hence, party A prefers to induce party B to enter the negotiations whenever $\hat{u}_A^A(2c-(R-r)) \geq \hat{u}_A^A(0)$ holds, i.e. whenever the condition $c \leq \frac{1}{4} + \frac{1}{2}(R-r) + \frac{1}{2}(\frac{1}{4}+R-r)^{1/2}$ is satisfied.

Therefore, at date 1 party A invests

$$\hat{i}^A = \begin{cases} \frac{1}{2} & \text{if } c \leq \frac{1}{4} + \frac{1}{2}(R-r), \\ 2c-(R-r) & \text{if } \frac{1}{4} + \frac{1}{2}(R-r) < c \leq \frac{1}{4} + \frac{1}{2}(R-r) + \frac{1}{2}(\frac{1}{4}+R-r)^{1/2}, \\ 0 & \text{if } c > \frac{1}{4} + \frac{1}{2}(R-r) + \frac{1}{2}(\frac{1}{4}+R-r)^{1/2}, \end{cases}$$

and the total surplus is

$$\hat{S}^A = \begin{cases} R + \frac{3}{8} - c & \text{if } c \leq \frac{1}{4} + \frac{1}{2}(R-r), \\ r + c - \frac{1}{2}(2c-(R-r))^2 & \text{if } \frac{1}{4} + \frac{1}{2}(R-r) < c \leq \frac{1}{4} + \frac{1}{2}(R-r) + \frac{1}{2}(\frac{1}{4}+R-r)^{1/2}, \\ r & \text{if } c > \frac{1}{4} + \frac{1}{2}(R-r) + \frac{1}{2}(\frac{1}{4}+R-r)^{1/2}. \end{cases}$$

Next, consider B-ownership. In this case, party B is willing to incur the transaction costs c at date 2 whenever $\frac{1}{2}(R+i) - c \geq 0$. Thus, party A's date-1 payoff is

$$\hat{u}_A^B(i) = \begin{cases} -\frac{1}{2}i^2 & \text{if } i < 2c-R, \\ \frac{1}{2}(R+i) - \frac{1}{2}i^2 & \text{if } i \geq 2c-R, \end{cases}$$

while party B's payoff reads

$$\hat{u}_B^B(i) = \begin{cases} 0 & \text{if } i < 2c - R, \\ \frac{1}{2}(R+i) - c & \text{if } i \geq 2c - R. \end{cases}$$

Similar arguments as before now imply that at date 1 party A invests

$$\hat{\imath}^B = \begin{cases} \frac{1}{2} & \text{if } c \leq \frac{1}{4} + \frac{1}{2}R, \\ 2c - R & \text{if } \frac{1}{4} + \frac{1}{2}R < c \leq \frac{1}{4} + \frac{1}{2}R + \frac{1}{2}(\frac{1}{4} + R)^{1/2}, \\ 0 & \text{if } c > \frac{1}{4} + \frac{1}{2}R + \frac{1}{2}(\frac{1}{4} + R)^{1/2}, \end{cases}$$

and the total surplus reads

$$\hat{S}^B = \begin{cases} R + \frac{3}{8} - c & \text{if } c \leq \frac{1}{4} + \frac{1}{2}R, \\ c - \frac{1}{2}(2c - R)^2 & \text{if } \frac{1}{4} + \frac{1}{2}R < c \leq \frac{1}{4} + \frac{1}{2}R + \frac{1}{2}(\frac{1}{4} + R)^{1/2}, \\ 0 & \text{if } c > \frac{1}{4} + \frac{1}{2}R + \frac{1}{2}(\frac{1}{4} + R)^{1/2}. \end{cases}$$

As a consequence, when there are positive transaction costs, several insights of the standard property rights model are overturned. First, a comparison of $\hat{\imath}^A$ and $\hat{\imath}^B$ immediately shows that ownership matters for the investment incentives, even though the investments are completely relationship-specific. Second, there can be overinvestments compared to the first-best benchmark.[9] Third, even though party A is indispensable, B-ownership can lead to a larger total surplus than A-ownership.[10]

Intuitively, these results hold because at date 2 party B is willing to incur

[9]Note that if $c = \frac{1}{4} + \frac{1}{2}(R - r) + \frac{1}{2}(\frac{1}{4} + R - r)^{1/2}$, then $\hat{\imath}^A = 2c - (R - r) > 1 = i^{FB}$. Analogously, if $c = \frac{1}{4} + \frac{1}{2}R + \frac{1}{2}(\frac{1}{4} + R)^{1/2}$, then $\hat{\imath}^B = 2c - R > 1 = i^{FB}$.

[10]Let $\tilde{c} = \frac{1}{2}R - \frac{1}{4}r + \frac{1}{2}$ and consider $c > \tilde{c}$. Observe that $\hat{S}^B = c - \frac{1}{2}(2c - R)^2 > \hat{S}^A = r + c - \frac{1}{2}(2c - (R - r))^2$ must hold for sufficiently small values of c and $r > 0$.

the transaction costs only if party B's anticipated payoff from reaching an agreement with party A is sufficiently large. In order to ensure that this is the case, party A may have to invest more than the first-best level. Given an investment level i, party B's anticipated payoff from reaching an agreement with party A is smaller under A-ownership than under B-ownership. Therefore, the overinvestment problem may be more severe under A-ownership. Moreover, contrary to the standard property rights theory, it can happen that party A would invest under B-ownership but not under A-ownership, since party B would enter the negotiations under B-ownership only.[11]

Proposition 2 *If there are positive transaction costs at date 2, then ownership can matter even though the investments are completely relationship-specific. There may be overinvestments compared to the first-best benchmark solution, and party A may invest more under B-ownership than under A-ownership.*

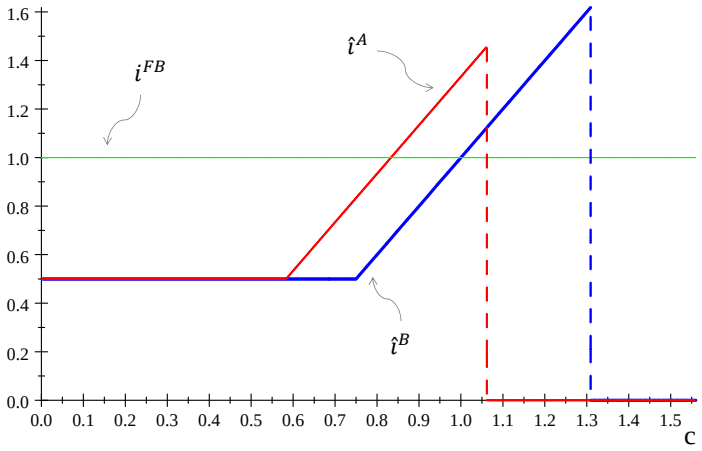
5 Conclusion

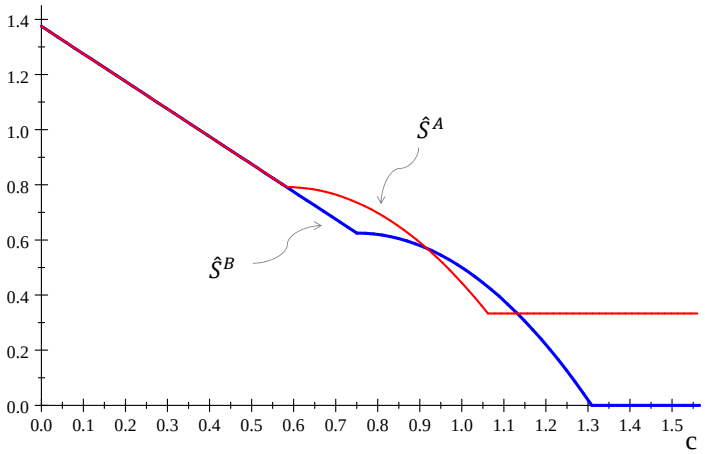
Our main results are illustrated in Figure 1. The upper two panels show how the investment levels and the total surplus levels as functions of the transaction costs c depend on the ownership structure. For small levels of c, in accordance with the standard property rights theory there is no difference between the ownership structures, since the investments are completely relationship-specific. When c becomes larger, the investment level starts to go up under A-ownership while it initially remains unchanged under B-ownership, so A-ownership is optimal. Yet, when c further increases, the investment level

[11] Observe that if $c = \frac{1}{4} + \frac{1}{2}R + \frac{1}{2}(\frac{1}{4} + R)^{1/2}$, then $\hat{\imath}^B = 2c - R > 0 = \hat{\imath}^A$.

under A-ownership becomes too large compared to the first-best level, while under B-ownership the investment level is closer to the first-best benchmark, so B-ownership is optimal. Finally, for even larger levels of c the investment level drops to zero first under A-ownership (so B-ownership can still be optimal) and ultimately also under B-ownership (so A-ownership is optimal, due to A's larger default payoff). The panel at the bottom of Figure 1 shows which ownership structure is optimal depending on the parameters c and r.

Finally, it should be emphasized that the case of completely relationship-specific investments is very special. The property rights approach as outlined by Hart (1995) has had a broad impact since in many applications investments are partly relationship-specific. In future research, it might thus be promising to study how the novel effects highlighted in the present paper interact with incentives to make investments that can in part be recouped outside of the relationship.





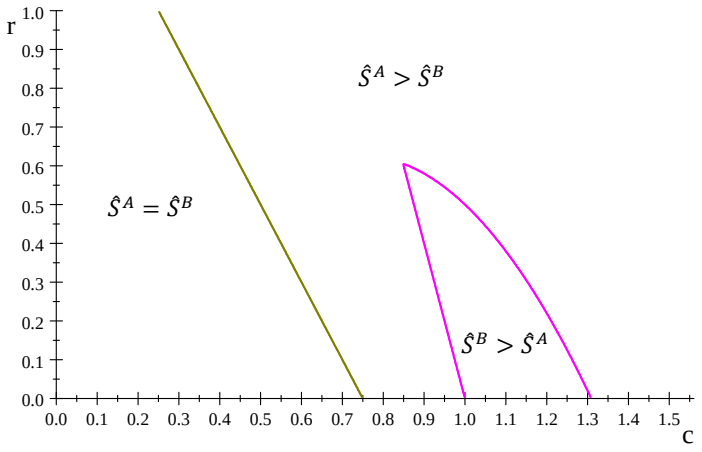


Figure 1. The figure illustrates the case $R = 1$. The upper two panels depict the investment levels and the total surplus levels as functions of c, given $r = 1/3$. The panel at the bottom displays the surplus-maximizing ownership structures depending on c and r.

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