Destructing the Hold-up

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Abstract

This paper shows in an example of hold-up that giving the investing party the ability to destroy his relationship-specific investment is possible in accommodating a new type of equilibria without under-investment. It suggests that destruction can be a possible incentive device in enhancing efficiency in bilateral relationships with hold-up.

Keywords: Destruction, Bilateral relationship, Hold-up

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1 Introduction

Although the term “destruction” seems to relate to inefficiency, previous research has shown that a bilateral relationship with and without destruction may entail different sets of equilibria. Some equilibrium outcomes with destruction can even have a higher level of efficiency relative to those without destruction. In a buyer-seller asymmetric information situation à la Myerson-Satterthwaite (1983), for instance, Manea and Maskin (2010) show that inefficiency can potentially be reduced by destroying the seller’s surplus. Destroying the good traded, destroying money, and destroying the value for buyers, however, are not possible in reducing inefficiency.

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This paper focuses on another source of inefficiency in bilateral relationships. I show in an example of hold-up that destruction gives rise to improvement of efficiency. In the example, a supplier is the only one who invests ex ante, and a buyer has all the ex post bargaining power. A hold-up problem thus arises: expecting the buyer to fully extract his ex post return, the supplier simply doesn’t invest ex ante regardless of his investment being socially efficient or not.

I show that allowing the supplier to destroy the surplus, surprisingly, accommodates a new type of equilibria without under-investment.\(^1\) The possibility of destroying surplus arises quite naturally under two conditions. First, it takes time to realize all the return from a relationship-specific investment, a rather usual case for most investment opportunities in real life. Second, before all of the potential return is realized from a relationship-specific investment, noncontractibility of at least some dimensions of the investment gives rise to opportunities where the owner may twist those non-contractible dimensions of his investment in ways that alter the future return streams. An extreme case, for instance, is burning a machinery.

In this new type of equilibria, destruction does not happen, yet investment is made. It is the mere possibility of destruction that allows efficiency to be achieved in equilibrium. The intuition is that the ability to destroy the investment entails the supplier an ability to threaten the buyer not to fully extract him ex post after he has made the investment. In turn, it strengthens the supplier’s incentive to invest ex ante.

It is interesting to draw a parallel between this result, and a controversial argument in the law literature. This result is in the same spirit as Strahilevitz (2005), which argues that “the right to destroy” helps restore investment incentive. His intuition, however, is that one has a lower incentive to make a move when one knows that there will be trails left.\(^2\)

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1 In contrast to Manea and Maskin (2010), who do not specify which party destroys surplus, the model here specifically gives the ability to destroy to the supplier.

2 The reverse is: if one is given the right to destroy later, one has a higher incentive to create now. An interesting example concerns about the U.S. presidents. Before Nixon, presidents were allowed to destroy whatever they have hand-written on papers. After Nixon, presidents are not allowed to do so as whatever they have been hand-written belongs to the properties of the president’s library. One therefore expects much
2 The model

In period $t = 0$, a supplier (S) decides whether to make an investment that costs him $c$. Making the investment ($I$) enables him to trade with a buyer (B) in the subsequent two periods. In both period 1 and 2, they split a pie of size $\alpha_1y$, and $(1 - \alpha_1)y$. B offers how they split the pie; S then decides whether to accept or to reject the offer. Rejecting an offer ends the game.\(^3\) If S does not make the investment ($O$), the sizes of the two pies are 0. Assume no discounting and assume it is socially efficient to invest, i.e., $c < y$. Denote the vector $\vec{\alpha} \equiv (\alpha_1, 1 - \alpha_1)$ as the surplus dynamics, where $\alpha_1 \in [0, 1]$.

Consider two scenarios: (1) No destruction is possible. (2) In-between the two trading periods, S may destroy the relationship-specific investment which shrinks the period 2 pie to zero. To incorporate possible destruction, suppose between the first and second period, S can decide whether to destroy the investment ($Q$) or not ($C$). Figure 1 shows the extensive game $\Gamma_E(\vec{\alpha})$ that models the situation.

The notion of equilibrium I use is subgame perfect equilibrium. By backward induction, it is easy to show that scenario (1) has a unique equilibrium outcome: no investment.\(^4\) In less revealing, controversial, and embarrassing messages would have been written by the presidents.\(^3\) This implies some continuity of the trade across periods.\(^4\) In the equilibrium strategy profile, S does not invest. If he does, in each period, he accepts any proposal higher than or equal to zero. B offers zero in each period.
scenario (2), the model has two types of equilibria: one with no investment (inefficient), and one with investment (efficient).5

The equilibrium strategy profile with efficient investment is that S invests. In each period, he accepts any offer larger than or equal to zero. He does not destroy the investment if the period 1 offer is “acceptable,” and he does if otherwise. In period 1, B offers the minimum “acceptable” price; in period 2, he offers zero. Denote $P^A$ as the set of “acceptable” period 1 offer, and denote its minimum as $m(P) = \min \{ p : p \in P^A \}$. Refer to any strategy profile involving this structure a spiteful strategy profile. S’s payoff and B’s payoff under any spiteful strategy profile is $m(P^A) - c$, and $y - m(P^A)$, respectively. The following proposition formally states the main result.

**Proposition 1.** The game $\Gamma_{E}(\vec{\alpha})$ has a pure strategy subgame perfect equilibrium in which B invests if and only if $\alpha_1 \in [0, 1 - c/y]$. Every such equilibrium involves the players playing a spiteful strategy profile.

Proposition 1 states that 1) the game can sustain efficient investment, and 2) every equilibrium with investment involves the players employing a spiteful strategy profile. The equilibrium outcome is that there is no destruction of the investment but its mere possibility sustains incentive to invest.

To prove it, we address three questions. (i) is S’s threat credible? (ii) is it incentive-compatible for B to honor the threat? (iii) is it rational for S to invest? These questions nail down the necessary and sufficient condition, $c/y \leq 1 - \alpha_1 \leq 1$.6

(i) Since the subgame in period 2 is an ultimatum game, S is indifferent between destroying and not destroying the investment. His threat, therefore, is credible.

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5For the no investment case, the equilibrium strategy profile is that S does not invest. If he does, in each period, he accepts any proposal higher than or equal to zero. He does not destroy the investment. B offers zero in each period.

6The formal proof for the first statement employs the one-deviation principle. For the second statement: Every such equilibrium involves the players playing a spiteful strategy profile, I prove by contradiction. Suppose the statement is incorrect, then there exists a pure strategy subgame perfect equilibrium with a strategy profile that is not a spiteful strategy profile. I show that this is impossible. The formal proof is available upon request.
(ii) Consider B’s best deviation: in period 1, he would have offered a minimum price that S would have accepted (i.e., $p_1 = 0$). S would then destroy the investment. Under this deviation, B’s payoff is $\alpha_1 y$. His equilibrium payoff under a spiteful strategy profile is $y - m(P^A)$. Therefore it is incentive-compatible for him to offer $m(P^A)$ if and only if $y - m(P^A) \geq \alpha_1 y$, or in terms of the upper bound of $m(P^A)$,

$$m(P^A) \leq (1 - \alpha_1) y.$$  \hspace{1cm} (IC)

(iii) Since S’s equilibrium payoff is $m(P^A) - c$, investing is individually rational if it is larger than or equal to his payoff of not investing, which is zero, i.e., $m(P^A) - c \geq 0$. This corresponds to the lower bound of $m(P)$:

$$m(P^A) \geq c.$$  \hspace{1cm} (IR)

A spiteful strategy profile is subgame perfect if there exists a non-empty set $P^A$ that has a minimum and satisfies both (IR) and (IC); i.e., the upper bound of $m(P^A)$ has to be at least equal to or greater than its lower bound, and therefore the necessary and sufficient condition.

3 Concluding Remarks

When hold-up creates under-investment and therefore inefficiency, I show in an example that the investing party’s ability to destroy surplus can give rise to equilibria without under-investment. The intuition is that such a destruction ability enables him to threaten the non-investing party not to fully exploit him ex post. This strengthens his incentive to invest ex ante. This points to destruction as a possible incentive device for bilateral relationships beyond asymmetric information. However, given the setting involves extreme one-sided ex post bargaining and one-sided investment, the paper also calls for research in more general
setting of hold-up.

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References

