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The Impact of Managerial Flexibility on Negotiation Strategy and Bargaining Power

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Abstract:

Using a dynamic real options approach we show that in a sequential bargaining framework managerial flexibility is strengthening the first-mover advantage by undermining the bargaining power of the second mover. Furthermore we compare the results of the sequential framework with the results of cooperative bargaining.

Keywords: real option, game theory, sale, negotiation, flexibility, ultimatum game

JEL Code: G3, G70, D81

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Abstract:

Using a dynamic real options approach we show that in a sequential bargaining framework managerial flexibility is strengthening the first-mover advantage by undermining the bargaining power of the second mover. Furthermore we compare the results of the sequential framework with the results of cooperative bargaining.

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1. Introduction

On March 30th 1867 the Russian Empire sold the Alaska-Territory for US-$ 7.2 Million to the United States, in 2010 Hewlett-Packard acquired Palm, Inc. for approximately $1.2 billion and on July 11th 2009 Real Madrid paid 80 Million Pound Sterling to Manchester United for the Portuguese world-class football player Cristiano Ronaldo. All three examples have in common that a unique asset was sold to an interested buyer. In absence of comparisons the pricing appears to be arbitrary or randomly. In general, trade is creating a surplus by transferring an asset from the seller to the buyer, to whom it is of greater value. This surplus is shared between the buyer and the seller. Therefore the question arises who gets which fraction of the surplus? This question is usually avoided, see e.g. Gupta & Lebrun (1999), by using axiomatic methods, like the Nash bargaining solution, where the fractionizing is done following an exogenous coefficient which expresses the degree of bargaining power (Nash, 1950). In contrast methods of non-cooperative game theory like the sub-game perfect equilibrium (Selten, 1975) fractionize endogenously but usually show the existence of a first-mover-advantage. In the ultimatum game (created by Güth et al., 1982) the first-mover advantage reaches its maximum. The offering party gets the whole surplus while the reacting party gets nothing. But this solution is obviously not transferable into reality.[1] Rubinstein (1982) sets up a model in which the buyer and the seller are alternately making offers how to share a pie of size 1 until an agreement is reached. It is shown that if time is valuable, i. e. both players i, j consider an individual discount factor δ_i, δ_j, the only sub-game perfect equilibrium is to reach an agreement directly with the first offer. Expressed formally, party i gets $(1 - \delta_i)/(1 - \delta_i \delta_j) < 1$.

Subsequently, researchers have extended the model of Rubinstein in several ways. Admati & Perry (1987) are presenting a model where bargainers may wait with their response to an offer to signalize their relative strength. However, the parties might also postpone the response to an offer because they want to wait for new information and thus to resolve uncertainty regarding the value of the traded asset. Only recently, researchers have implemented such managerial flexibility rights by means of real option theory. In brief, a real option expresses the flexibility assigned to a decision, i.e. for example the decision to delay an investment or to abandon an investment project without being obliged to.[2] Betton & Moran (2003) use a real options approach to analyze the sale of a company. The bargaining is modeled as a non-cooperative game where the seller offers a price he is claiming for the company and the buyer can accept this price but is able to wait with his

[1] Empirical research on the ultimatum game (for example Sutter et al., 2003; Rankin, 2003 or Wichardt et al., 2009) shows that the sub-game perfect solution is not the outcome in reality.

[2] For example Dixit & Pindyck (1994) or Trigeorgis (1996).

decision to resolve some uncertainty about the value of the company. The results show that the parties reach an agreement only after a time delay which is stochastic and that the selling party gets a higher percentage of the created surplus than the buying party.

Our paper originates from Betton & Moran (2003) but differs in the fact that the total gain of the asset sale is known by both parties, that transferring the asset creates transaction costs for both parties and that the buyer can be the offering party, too. We show that in the absence of any interest-effect the bidding party gets the whole surplus generated by the trade of an asset. In line with Rubinstein's (1982) findings, we demonstrate that an interest-effect impacts the first-mover advantage. Under uncertainty, however, managerial flexibility marginalizes the impact of the interest-effect. As is generally known the sale happens inefficiently late after sequential bargaining compared to the results of the cooperative bargaining framework (Nash, 1950). However, we can show that the preference between the two bargaining modes depends on the bargaining power. For some values of bargaining power the stronger party prefers sequential bargaining and the weaker party prefers cooperative bargaining, while for other values of bargaining power it is the other way round. Thus a range of values for the bargaining power exists where the stronger party as well as the weaker party prefers cooperative bargaining.

2. The Model

Consider a person S (seller) who owns an asset that has at time t a value of V_t. For another person B (buyer) the same asset has a higher value of θV_t ($\theta > 1$). By selling the asset from S to B transaction costs of A arise for S as well as for B. We assume that the value of the asset is not constant over time but is following a geometric Brownian motion:

$$dV(t) = \eta V(t)dt + \sigma V(t)dW(t)\,, \qquad V(0) = V_0 \tag{1}$$

with $\sigma \geq 0 \in \mathbb{R}_+$ as the volatility of the asset value, $\eta > 0 \in \mathbb{R}_+$ as the growth rate of the asset value and $dW(t)$ as an increment of a Wiener process with zero mean and variance equal to dt. Finally, we assume that all agents are risk neutral and that the riskless interest rate $r,\ (r \geq \eta)$ controls for the time-value of money. Upon selling the asset the seller gets the sales price ψV_t, ($\psi > 0$), has to pay the transaction cost of A and has to transfer the asset of value V_t to the buyer. He does not incur a loss, if $\psi \geq 1 + A/V_t$. By buying the asset the buyer gets the asset with value θV_t and in return has to pay ψV_t the sales price, and the transaction cost A. He does not incur a loss if $\psi \leq \theta - A/V_t$. Consequently, a sale of the asset from S to B will create a surplus if and only if $(\theta - 1)V_t > 2A$. The surplus is $(\theta - 1)V_t - 2A$ and its partitioning has to be negotiated by the choice of ψ. Therefore, at time t_0 one party is offering a $\psi > 1$ to the other party which can accept or reject the offer. The reacting party has not to decide immediately at time t_0 of the offer whether it accepts or rejects the offer. Rather, it can postpone the decision. We assume that there is no possibility for further rounds of negotiation or for counteroffers. Hence, accepting the offer leads to a purchase of the asset. In addition, we will make the following generalizations. The party who places the bid receives upon closing the deal $a(\psi)V - A$ while the other party, i.e. the reacting party, receives $c(\psi)V - A$. We will assume that time is continuous, i.e. $t \in [t_0, \infty)$. Thus the offering party has the action set $\psi \in (0, \infty)$ and at every point in time the reacting party has the action set {accept, wait}.

We rely on a Markovian Perfect Nash Equilibrium to determine the equilibrium strategy for both parties. In particular, the party that places the bid optimally defines ψ in stage one. Conditional on the offered premium ψ the reacting party will choose a threshold value $V^*(\psi)$ in stage two at which the offer will be accepted, which corresponds to an optimal timing decision with $t^* = min\,\{t \geq t_0 |\, V(t) > V^*\}$. Hence, this degree of managerial flexibility can be interpreted as a real option. Exercising the option right refers to accepting the offer by acquiring the asset.[3]

Consequently, the value of the option to acquire the asset held by the reacting party is the solution of the following maximization problem in stage two:

$$F(V) = \max_{\tau} \mathbf{E}\,[(a(\psi)V_\tau - A)e^{-r\tau}\,], \tag{2}$$

where **E[…]** denotes the expectations operator. Solving equation (2) yields:

$$F(V) = (a(\psi)V^* - A)\left(\frac{V}{V^*}\right)^{\beta} \tag{3}$$

with $\beta = \frac{1}{2} - \frac{\eta}{\sigma^2} + \sqrt{\left(\frac{\eta}{\sigma^2} - \frac{1}{2}\right)^2 + \frac{2r}{\sigma^2}} > 1$ and

$$V^* = \frac{\beta}{(\beta - 1)}\frac{1}{a(\psi)}A. \tag{4}$$

In contrast, the bidding firm will choose ψ in stage one such that it maximizes

[3] We will assume that this managerial flexibility is not limited by a fixed maturity date. Therefore the possibility to accept the offer is a perpetual real option.

$$f(\psi) = \max_{\psi} \mathbf{E}\left[(c(\psi)V^*(\psi) - A)e^{-rt^*}\right], \tag{5}$$

subject to the other party's reaction function, i.e. $V^*(\psi)$. The solution of equation (3) leads to the following propositions.

Proposition 1: *The optimal demanded premium depends on whether the seller or the buyer of the asset places the bid. If the bid is placed by the seller then the optimal demanded premium results to:*

$$\psi_S = \frac{\beta\theta + \beta - 1}{2\beta - 1}. \tag{6}$$

If the buyer is the offering party then the optimal demanded premium results to:

$$\psi_B = \frac{\beta\theta + \beta - \theta}{2\beta - 1}. \tag{7}$$

Proof: See Appendix.

Proposition 2: *The optimal timing threshold* V^* *is independent of whether the buyer or seller is the reacting party and given by:*

$$V^* = \frac{\beta}{(\beta-1)^2}\frac{(2\beta-1)}{(\theta-1)}A. \tag{8}$$

Proof: See Appendix.

In the following, we will give an answer to the questions what surplus is generated by the sale and how much of wealth is distributed to the parties? Because the deal is closed at the same time the generated surplus yields:

$$G(V_0) = \left((\theta-1)V^* - 2A\right)\left(\frac{V_0}{V^*}\right)^{\beta} = \frac{3\beta-2}{(\beta-1)^2}A\left(\frac{V_0}{\frac{\beta}{(\beta-1)^2}\frac{(2\beta-1)}{(\theta-1)}A}\right)^{\beta}. \tag{9}$$

However, depending on which party holds the bargaining power, this surplus is unevenly shared between the seller and the buyer. The expected profit of the party that holds the bargaining power (first mover, offering party) is $\alpha_1 \mathrm{G}$ with a share of the surplus of $\alpha_1 = (2\beta - 1)/(3\beta - 2)$. Contrary, the fraction $\alpha_2 G$ with $\alpha_2 = (\beta - 1)/(3\beta - 2)$ is assigned to the second party.

Proposition 3: *The expected profit for being the offering party is greater than for being the accepting party, i.e.* $\alpha_2 < \alpha_1$ *. This first-mover advantage is reduced by an uncertainty-independent interest effect and reinforced by a flexibility effect which is increasing with uncertainty (* $\partial\alpha_1/\partial\sigma > 0$ *).*

As Figure (1) depicts for $r > \eta$ we have that $\alpha_1 > \alpha_2$. The difference is due to a first-mover advantage. The extent of this advantage is affected by two factors, the size of interest and managerial flexibility respectively. While the impact of the latter on the first-mover advantage becomes the more pronounced the higher the uncertainty associated with the value of the asset the impact of the first factor is uncertainty-independent. The intuition behind this result is twofold. The net gain associated with the exchange of the asset becomes the smaller the longer the postponement regarding closing the deal. In particular, the greater the ratio r/η becomes the stronger the decrease of the net gain. Consequently, the reacting party holds some kind of bargaining power because he controls the exercise of the real option. Uncertainty, however, has a contrary impact on the net gain. Here, an increase in uncertainty increases the net gain because it pays to wait, i.e. the offering party profits from the postponement. Hence, an increase in uncertainty diminishes the bargaining power the reacting party holds. As a result, the gain associated with the first-mover advantage increases.

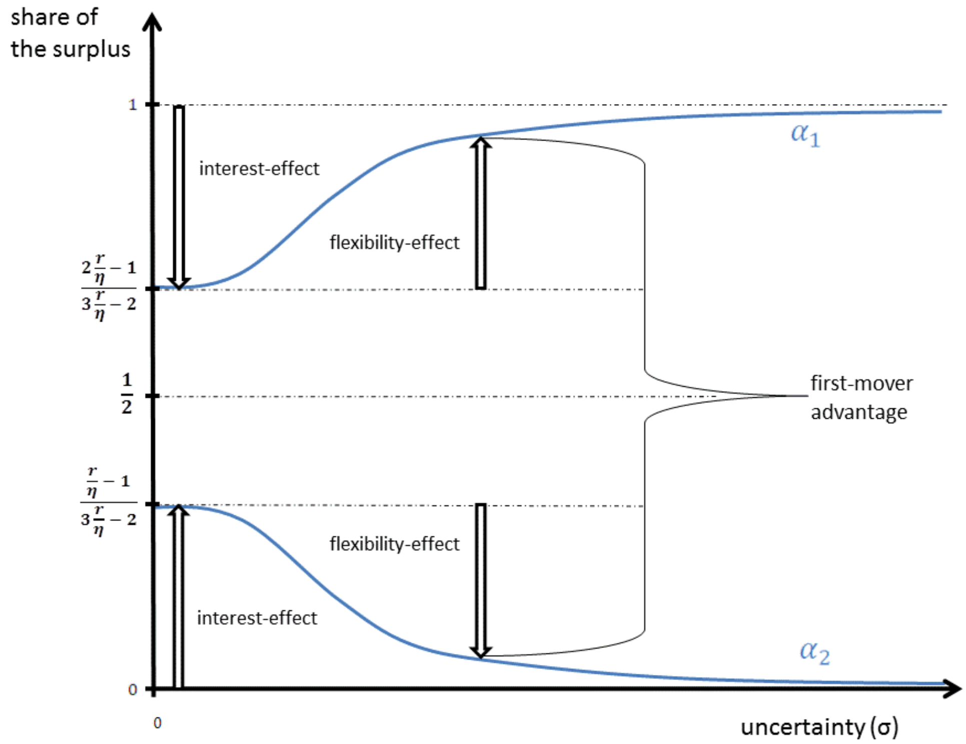

Figure 1: The shares of the surplus of the offering party (α_1) and of the non-offering party (α_2) depending on the amount of uncertainty.

As uncertainty becomes infinitively large, the uneven distribution of profits reaches its maximum. Here, the offering party receives hundred percent of the value generated while the reacting party does not participate from the gains generated, i.e. $\alpha_1 = 1$ and $\alpha_2 = 0$. Without an interest effect, i.e. $r = \eta$, and without uncertainty, i.e. $\sigma = 0$ the model is equal to the solution of the ultimatum game with sub-game perfect equilibrium. The sharing rule is calculated by $\lim_{r/\eta \to 1} \alpha_1 = 1$. Hence the ultimatum game can be seen as a special case of the presented model.

Moreover, the results raise the question if and under which conditions the distribution of the surplus between the parties will be shared equally. Under the assumption that $r > \eta$ it is easy to show that $\alpha_1 > 2/3$ and that if $= 0$

$\lim_{r/\eta\to\infty}\alpha_1 = 2/3$. Hence, the offering party will always get more than twice of the gain generated by the reacting party.

Proposition 4: *In a cooperative framework, i.e. the parties act as a central planer, the optimal timing threshold is* $V_{\text{opt}}^{*} = \frac{\beta}{\beta-1}\frac{2A}{(\theta-1)}$. *Therefore, the sale of the asset happens inefficiently late if it is determined sequentially by the two parties.*

Proof: See Appendix.

As a consequence the generated surplus is lower than the optimal possible surplus ($G < G^*$). Figure (2) demonstrates this fact and furthermore shows that the difference $G^* - G$ increases with uncertainty.

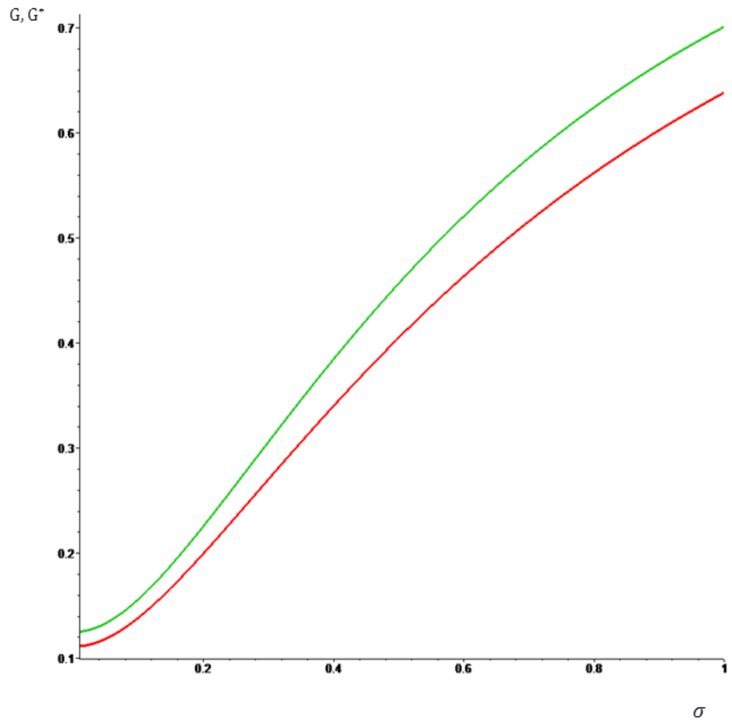

Figure 2: The generated surplus G (red) after sequential bargaining and the optimal generated surplus G^* (green) after cooperative bargaining, both depending on the amount of uncertainty. The variables are chosen as follows: $\mu = 0.05,\ r = 0.1,\ V_0 = 1,\ A = 1,\ \theta = 2.$

Given a framework where both parties act cooperatively as a central planer the surplus is shared between the two parties in dependence of the exogenous bargaining power γ_1. Party 1 gets $\gamma_1 G^*$ and party 2 gets $\gamma_2 G^*$, with $\gamma_2 := 1 - \gamma_1$. Figure (3) compares the gains of the two parties in the cooperative framework in dependence of γ_1 with the gains in the sequential framework. If the bargaining power of the stronger party (which would be the first mover in the sequential framework) is only a bit higher than the other party's bargaining power (Region I) the stronger party would gain more in the sequential framework than in the cooperative framework, while the weaker party would gain more in the cooperative framework. If in contrast the stronger party has almost the whole bargaining power (Region III) it would gain more in the cooperative framework than in the sequential framework, while the weaker party would gain more in the sequential framework. For a small range (Region II) of values of the bargaining power γ_1 the stronger party as well as the weaker party will gain more in the cooperative framework than in the sequential framework.

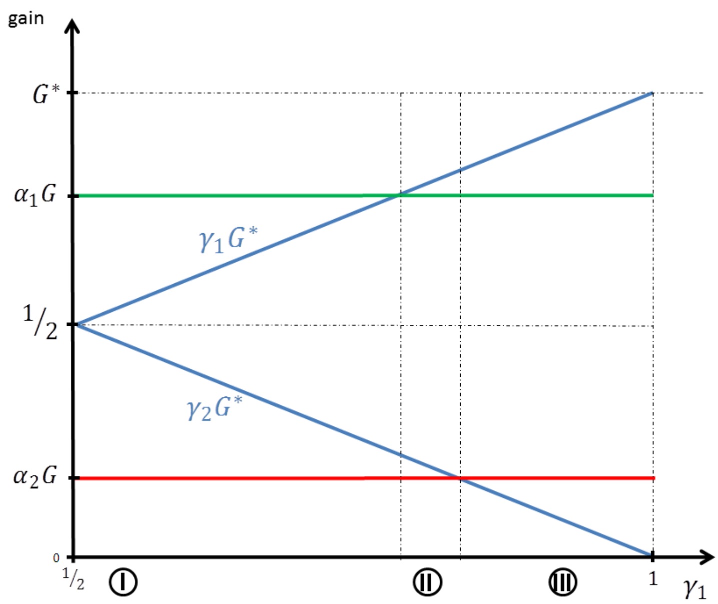

Figure 3: Comparison of the gains of the two parties in the sequential and in the cooperative framework.

3. Conclusion

In general, asset sales raise the question how the generated surplus is shared among the parties. In a sequential framework a first-mover advantage usually prevails. In this paper, we demonstrate the impact of managerial flexibility on the first-mover advantage in a sequential game under uncertainty. The findings reveal that the first-mover advantage is reduced by an uncertainty-independent interest effect and reinforced by a flexibility effect that is increasing with uncertainty. Additionally we compare the results of sequential bargaining with the results of cooperative bargaining and show that their prevalence is dependent on the bargaining power of the negotiating parties.

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A. **Appendix**

The offering party chooses $\psi \in (0, \infty)$ to maximize $(c(\psi)V^*(\psi) - A)\left(\frac{V_0}{V^*(\psi)}\right)^{\beta}$ while the reacting party is maximizing $\Omega(\psi)\big(V(t)\big)^{\beta}$by choosing the threshold $V^*(\psi)$ contingent on ψ. Here Ω is given by the following system of equations which represents the value-matching and smooth-pasting condition:[4]

$$\left|\begin{array}{ccc} \Omega(\psi)\big(V^*(\psi)\big)^{\beta} & = & a(\psi)V^*(\psi) - A \\ \beta\Omega(\psi)\big(V^*(\psi)\big)^{\beta-1} & = & a(\psi) \end{array}\right|. \tag{A.1}$$

For the offering party we get:

$$\max_{\psi\in(0,\infty)}\left[\left(c(\psi)\frac{\beta}{1-\beta}\frac{-A}{a(\psi)} - A\right)\left(\frac{V_0}{\frac{\beta}{1-\beta}\frac{-A}{a(\psi)}}\right)^{\beta}\right]. \tag{A.2}$$

Consequently, we find ψ by solving the following equation:

$$0 = \frac{\beta}{1-\beta}\frac{c(\psi)a'(\psi) - c'(\psi)a(\psi)}{a(\psi)} + \left(\frac{\beta}{1-\beta}\frac{-c(\psi)}{a(\psi)} - 1\right)a'(\psi)\beta. \tag{A.3}$$

If the seller is the offering party, we have that $a(\psi_S) = \theta - \psi_S$ and $c(\psi_S) = \psi_S - 1$ resulting to $\psi_S = \frac{\beta\theta+\beta-1}{2\beta-1}$ and $V_S^* = \frac{\beta}{(\beta-1)^2}\frac{2\beta-1}{\theta-1}A$. If the buyer is the offering party then we have $a(\psi_B) = \psi_B - 1$ and $c(\psi_B) = \theta - \psi_B$. Hence, we get $\psi_B = \frac{\beta\theta+\beta-\theta}{2\beta-1}$ and $V_B^* = \frac{\beta}{(\beta-1)^2}\frac{2\beta-1}{\theta-1}A$.

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[4] Dixit & Pindyck (1994, p. 141).

The timing decision of the central planer is equivalent to the optimal exercise of a perpetual call option, i.e. $\mathrm{V}_{\mathrm{opt}}^{*}=\frac{\beta}{\beta-1}\frac{2A}{(\theta-1)}$.[5] Upon rearranging we get:

$$\mathrm{V}_{\mathrm{opt}}^{*}=\frac{\beta}{\beta-1}\frac{2A}{(\theta-1)}=\frac{A}{(\theta-1)}\frac{\beta(2\beta-2)}{(\beta-1)^{2}}<\frac{\beta}{(\beta-1)^{2}}\frac{2\beta-1}{\theta-1}A=V^{*}. \tag{A.4}$$

[5] Dixit & Pindyck (1994, p. 142).

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