Negotiation as the Art of the Deal

Universidad de los Andes, Bogota
Hugo Sonnenschein, University of Chicago

Coauthors: M. Jackson, H. Sonnenschein, Y. Xing, C. Tombazos, O. Al-Ubaydli

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Negotiation is a ubiquitous and consequential form of economic interaction. It is deal-making in the absence of a designer. We propose a theory of negotiation in which deals have many aspects. This leads to new results showing that efficient trade is possible even with substantial asymmetric information, which we show via both theory and experiments.

In a robust class of settings of asymmetric information, the benefits of identifying areas of mutual gain redirect agents away from posturing and manipulating their share of the pie towards growing the pie. We show that equilibria are efficient, with significant implications for applications.

What Does Game Theory Have to Say?

Nash Program

Rubinstein – Stahl

Efficiency and Determinacy : 1/1+d, d/1+d

Myerson-Satterthwaite

A Bayesian Exchange Problem

Buyer

Seller

	v = 40 .5	v = 200 .5
c = 160 .5		
c = 0 .5		

First Best Surplus = 70

Social Choice and Incentive Problems (cont.)

Buyer

Seller

	v = 40 .5	v = 200 .5
c = 160 .5	no trade	(5/6) p = 160
c = 0 .5	(5/6) p = 40	p = 100

Second Best

Surplus

= 70 – (10/3)

Most Efficient Direct Mechanism:

Myerson-Satterthwaite establishes necessary inefficiency

Loss is 10/3

Time Lost to Strikes in Various Countries

US:	about 20 minutes per worker/year.
Canada:	about 1/3 day per worker/year.
Spain:	less than 1/3 day per worker/year.

(Kennan 2005)

Contrast with: *Getting to Yes* (Fisher and Ury 2001)

- People want different things.
- Invent options for mutual gain.
- Get past the idea that there is a fixed sum.
- Think about a way to satisfy the other in a way that is good for you.
- Think about what you would like to walk out of the meeting with.
- Place multiple items on the table.
- Broaden your options and the options available to the other party.

Let's Think about

S: 40, 0, 40, 0, 40, 0, 40, 40, 0, 0, 40, 40

B: 50, 10, 10, 50, 50, 10, 10, 50, 50, 10, 50, 10

- Poor knowledge of what should be exchanged
- Better knowledge of overall gains from trade: approx known surplus

Building theories for this world

- We could trade one by one: highly inefficient!
- Jackson-Sonnenschein (2007) mechanism and knowledge

Known Surplus: A Simple Example

$$\begin{bmatrix}40 & 40 & 0 & 0\\ 50 & 10 & 50 & 10\end{bmatrix} \begin{bmatrix}40 & 40 & 0 & 0\\ 50 & 10 & 10 & 50\end{bmatrix} \begin{bmatrix}40 & 40 & 0 & 0\\ 10 & 50 & 50 & 10\end{bmatrix} \begin{bmatrix}40 & 40 & 0 & 0\\ 10 & 50 & 10 & 50\end{bmatrix}$$

$$\begin{bmatrix}40 & 0 & 40 & 0\\ 50 & 50 & 10 & 10\end{bmatrix} \begin{bmatrix}40 & 0 & 40 & 0\\ 50 & 10 & 10 & 50\end{bmatrix} \begin{bmatrix}40 & 0 & 40 & 0\\ 10 & 50 & 50 & 10\end{bmatrix} \begin{bmatrix}40 & 0 & 40 & 0\\ 10 & 10 & 50 & 50\end{bmatrix}$$

$$\begin{bmatrix}40 & 0 & 0 & 40\\ 50 & 50 & 10 & 10\end{bmatrix} \begin{bmatrix}40 & 0 & 0 & 40\\ 50 & 10 & 50 & 10\end{bmatrix} \begin{bmatrix}40 & 0 & 0 & 40\\ 10 & 50 & 10 & 50\end{bmatrix} \begin{bmatrix}40 & 0 & 0 & 40\\ 10 & 10 & 50 & 50\end{bmatrix}$$

$$\begin{bmatrix}0 & 40 & 0 & 40\\ 50 & 50 & 10 & 10\end{bmatrix} \begin{bmatrix}0 & 40 & 0 & 40\\ 10 & 50 & 50 & 10\end{bmatrix} \begin{bmatrix}0 & 40 & 0 & 40\\ 50 & 10 & 10 & 50\end{bmatrix} \begin{bmatrix}0 & 40 & 0 & 40\\ 10 & 10 & 50 & 50\end{bmatrix}$$

$$\begin{bmatrix}0 & 40 & 40 & 0\\ 50 & 50 & 10 & 10\end{bmatrix} \begin{bmatrix}0 & 40 & 40 & 0\\ 10 & 50 & 10 & 50\end{bmatrix} \begin{bmatrix}0 & 40 & 40 & 0\\ 50 & 10 & 50 & 10\end{bmatrix} \begin{bmatrix}0 & 40 & 40 & 0\\ 10 & 10 & 50 & 50\end{bmatrix}$$

$$\begin{bmatrix}0 & 0 & 40 & 40\\ 50 & 10 & 50 & 10\end{bmatrix} \begin{bmatrix}0 & 0 & 40 & 40\\ 10 & 50 & 50 & 10\end{bmatrix} \begin{bmatrix}0 & 0 & 40 & 40\\ 50 & 10 & 10 & 50\end{bmatrix} \begin{bmatrix}0 & 0 & 40 & 40\\ 10 & 50 & 10 & 50\end{bmatrix}$$

Demonstration of Jackson-Sonnenschein

$$\begin{bmatrix}\mathbf{0} & \mathbf{0} & \mathbf{40} & \mathbf{40}\\ \mathbf{10} & \mathbf{50} & \mathbf{50} & \mathbf{10}\end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 40 & 40 \\ 10 & 50 & 50 & 10 \end{bmatrix}$$

The Seller Offers <u>Two Deals</u>

He puts on the table:

- The first, second, and third good at price 75, and
- The first, second, and fourth goods at 75.

Alternatively

The Seller states his "type" and says that he will accept any deal (to be crafted by the buyer) that gives him surplus 35.

These are both share demanding 35 offers.
When one accounts for discounting, three goods (the right ones!) trade immediately and at a combined price of 40 + 70/(1+d).

HOW THE AGENTS NEGOTIATE MATTERS

What if the seller offers separate prices for each of the four goods? The other agent can accept on as many as she wants and counter, etc.

An inefficiency theorem in the style of M-S, but about manner of negotiation.

Simplest example: 0,0 meets 10, 50 or 50, 10 (equally likely), known surplus 60.

We first show that all equilibria are inefficient if the two parties negotiate item-by-item (as described in 2.1) and $\delta < .63$ and the seller makes the first offer.

First note that to guarantee trading in the first period of both goods, neither price can exceed 10, and so the seller's payoff would be at most 20. We show that the seller has another strategy whose expected payoff is strictly more than 20, and so efficiency is impossible.

In particular, let L_s be the seller's worst continuation payoff in any seller-offer period in any equilibrium (with both items remaining). We only need to show that $L_s > 20$.

The fact that L_s is the seller's worst continuation payoff implies that when the buyer makes an offer, he gets a continuation payoff of at most $\delta(60 - \delta L_s)$ since the seller can always reject on both items and get at least L_s in the continuation, which leaves at most $(60 - \delta L_s)$ for the buyer in terms of a continuation value.

So, consider seller offering some (p, p) in the first period, with some $p > 10$. The buyer rejects p on the value-10 item, and accepts p on the value-50 item for sure if $p < \tilde{p}$, s.t.

$$50 - \tilde{p} = \delta(60 - \delta L_s). \tag{1}$$

Therefore, with an offer of $(\tilde{p} - \epsilon, \tilde{p} - \epsilon)$ for any $\epsilon > 0$, the seller can always get an acceptance on the value-50 item, and so a payoff of at least

$$\tilde{p} - \epsilon = 50 - \delta(60 - \delta L_s) - \varepsilon.$$

Thus, since L_s is the lowest possible seller's continuation payoff, it must exceed the payoff from the above action $(\tilde{p} - \epsilon, \tilde{p} - \epsilon)$. This requires that

$$L_s \geq 50 - \delta(60 - \delta L_s) - \varepsilon. \tag{2}$$

Since ϵ can be arbitrarily small, it follows that

$$L_s \geq \frac{50}{1+\delta} - \frac{10\delta}{1-\delta^2} \tag{3}$$

As a result, $L_s > 20$ for any $\delta < 0.63$, as claimed. ∎

- L_s = seller's worst continuation payoff in any seller-offer period in any equilibrium
- When buyer makes an offer, he gets at most $d_b(60 - d_s L_s)$ in continuation payoff

Consider seller offer (p,p) with some p>10.

- Buyer accepts p on the 50-item, and rejects on the 10-item,

  if p < p* such that

$$50 - p^* = d_b(60 - d_s L_s)$$

Table 1: Design in Each Treatment

	Problem	Format	Number of Subjects
Treatment 1	1 (1 good)	Structured	94
Treatment 2	2 (4 goods)	Structured	96
Treatment 3	1 (1 good)	Free-form	76
Treatment 4	2 (4 goods)	Free-form	74

Table 2: Percentage Loss of Surplus

	1 good	4 goods	*p*-value
Structured	32.8%	14.3%	.013
Free-form	25.2%	7.9%	.014
p-value	.232	.043	

Table 4: Percent of Pairs of with Positive Surplus Trading by Rounds

	In period #								
	1	2	3	4	5	6	7	8	Not Trading
1 good Free-Form	24.6	19.8	12.0	10.2	7.2	3.6	2.4	7.2	13.2%
4 goods Free-Form	81.1	11.3	2.3	1.8	1.8	1.4	0.0	0.0	0.5%

Theorem 2 *If a negotiation problem with n items has a known surplus $\bar{S} > 0$ and if the negotiation game Γ is rich, then in all weak perfect Bayesian equilibria:*

- *agreement is reached immediately,*
- *the full surplus is realized, and*
- *the agents' expected payoffs equal to their Rubinstein shares; i.e., $\frac{\bar{S}}{1+\delta}$ for Alice, and $\frac{\delta\bar{S}}{1+\delta}$ for Bob.*

Known Surplus

Almost Known (refinement) J, S, X

Unknown

(0, 8) or (8, 0) meets (2, 10) or (10, 2)

	(2, 10)	(10, 2)
(0, 8)	Both at 12	First at 5
(8, 0)	Second at 5	Both at 12

Negotiation vs. Mechanism

Assumption 1 *If the initial offer is* (p, p) *with some* $50 \geq p > 10$*, and the buyer accepts on one item and rejects the other, then the posterior belief is such that the buyer has value* 50 *on the accepted item and* 10 *on the rejected item, and the continuation game that follows is as if it had commonly known valuations* 0 *and* 50.

5 Concluding Remarks

Although negotiations frequently involve several aspects of a contract or deal, traditional bargaining theory focuses on a situation in which there is a single aspect to be determined. We extend that theory to encompass negotiations, in which deals have many aspects. Our model is descriptive. Agents freely negotiate the terms of a deal with offers and counteroffers, and they do so in the absence of any mediation. Despite the fact that they intend to serve only their own self-interest, we define a robust class of meaningful situations in which outcomes are always socially efficient. This leads to a new perspective, which would appear to have some empirical relevance regarding the costs of asymmetric information. It is a tale about the reach of the invisible hand.

In both structure and technique, our theoretical analysis is an extension of Rubinstein (1982) to allow for deals with multiple aspects and asymmetric information. The new ideas concern the way in which we decompose the knowledge structure when deals are multi-aspect, as well as the manner in which we model strategic possibilities when the interactions between agents are more complex than in bargaining theory. The decomposition of knowledge into two parts: knowledge of the possible gains from trade and knowledge of where these gains are to be found, is demonstrated to be productive. Even when the gains from trade are not approximately known, we believe that the distinction between these two forms of knowledge will be useful, and its consequence is explored in further work.[15]

When the gains from trade are known, the manner in which agents negotiate is determined by the presence of powerful strategies, which we argue are available to thoughtful players. These strategies, in a sense dominate less efficient ones. They lead the parties to honestly reveal their private information and, when they possess the private information of a counterparty, to use it in a manner that promotes mutual gain. As a consequence, information is shared truthfully and an efficient deal is reached without delay.