

**Agreeing Now to Agree Later:
Contracts that Rule Out but do not Rule In**

by

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- **Motivating Example**

Key Assumptions

“Rule out”: Parties can commit not to renegotiate (i.e., they won’t reintroduce “old” issues)

Note that parties want to commit

“Not rule in”: No specific performance or mechanisms

Brief digression on foundations

- **Assumption that a contract does not rule in follows from two more primitive assumptions:**

(A) Each party can unilaterally prevent trade ex post by “not cooperating.” Moreover, it is impossible for an outsider to verify which party was responsible.

(B) In the short-run, each party can make credible threats.

Note that something like assumption (B) is sometimes appealed to as a justification for using cooperative game theory.

- **Implies no role for mechanisms.**

- **Worry: Are (A) and (B) consistent with our other key assumption, that a contract rules out (outcomes not on the list)?**

Yes. Parties can make long-run commitments not to renegotiate their contract – e.g., for social or legal or reputational (or possibly psychological) reasons. [“Norms”]

Outsiders would see if the parties were to deviate from their contract by choosing an outcome off the list. But outsiders cannot observe the internal shenanigans – the threats and counterthreats that fly between the contractual parties when they bargain over outcomes on the list.

“Smell” test

	Rule out	Don't rule out
Rule in	Contingent Contracting or Classical Mechanism design	Incomplete contracts
Don't rule in	This paper	No role for long-term contracts

A bit of personal history . . .

Model

- **Risk neutral buyer and risk neutral seller.**
- **Buyer wants service from seller ex post, at date 1.**
- **Use concert example: buyer is impresario arranging concert, seller is pianist.**
- **Ideal nature of seller's service -- musical program -- unclear ex ante, at date 0. Becomes clear at date 1.**
- **Buyer must invest i for concert to succeed (investment observable only to buyer).**

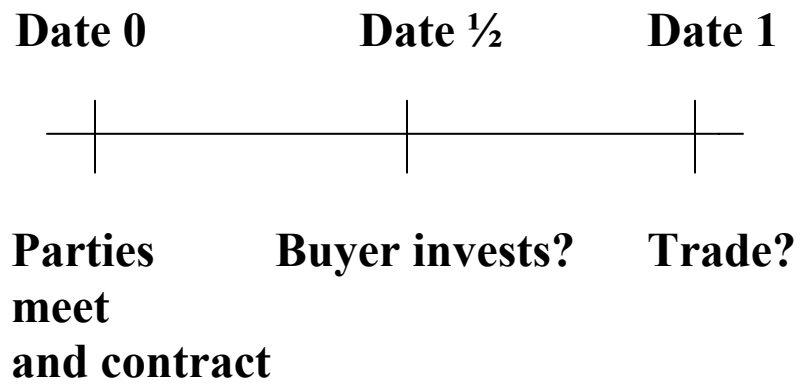
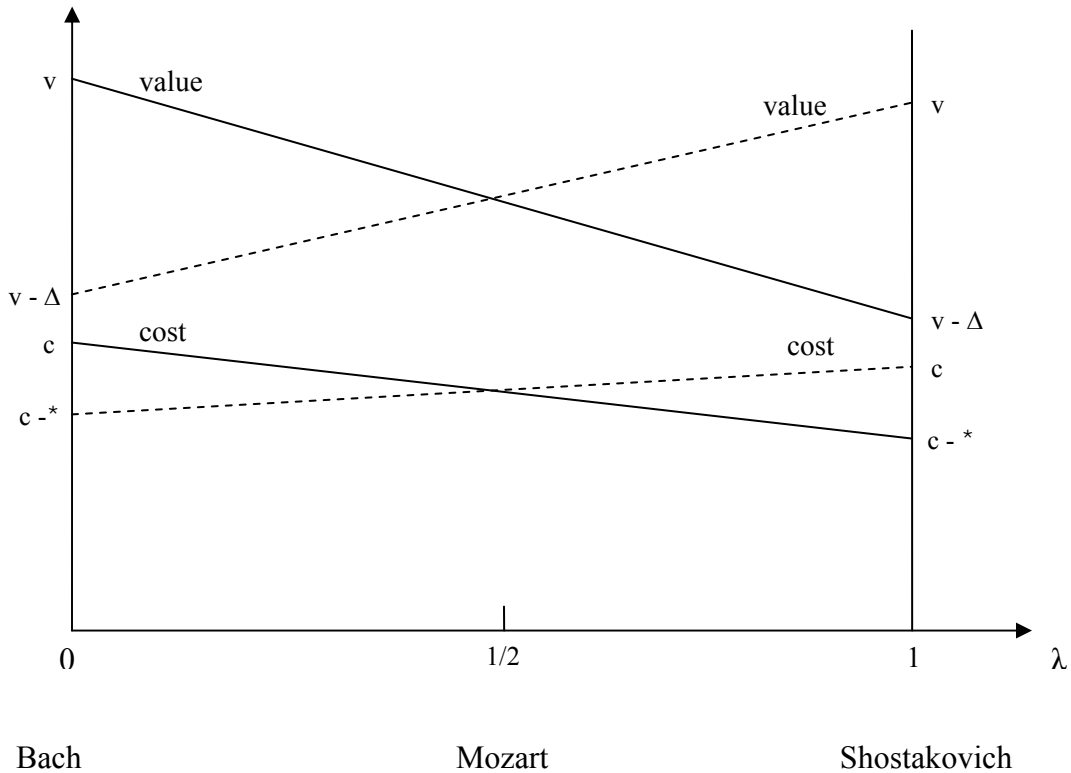


Figure 1

- **Identify musical programs with composers.**
- **Since we are interested in case of uncertainty, feasible set must contain at least two composers. Given convexity, this means that simplest case is where composers are represented by points λ on $[0,1]$.**
- **Refer to**
 - $\lambda = 0$ (Bach),
 - $\lambda = \frac{1}{2}$ (Mozart),
 - $\lambda = 1$ (Shostakovich).
- **Two possible ex post states of the world**
- **For simplicity $\pi_0 = \pi_1 = \frac{1}{2}$ (can relax)**

- **Provided buyer has invested, payoffs are as follows (otherwise zero)**



solid = state 0
dashed = state 1

Figure 2

- **Salient features of Figure 2:**
 - In state 0, value and cost maximized at Bach**
 - Value declines faster than cost as we move toward Shostakovich ($\Delta > \delta$)**
 - Everything reversed in state 1**

Numerical example

$$v = 20, c = 10, \Delta = 6, \delta = 2.$$

**In state 0: Bach has value 20, cost 10,
Shostakovich has value 14, cost 8.**

**In state 1: Bach has value 14, cost 8, Shostakovich
has value 20, cost 10.**

Mozart has value 17, cost 9 in both states.

First-best

Select ex post efficient music in each state.

**Bach in state 0,
Shostakovich in state 1.**

Ignore discounting:

$$\text{NPV} = v - c - i.$$

Assume this is positive.

Nonverifiability of the state

If the ex post state were verifiable, the first-best could be achieved for any i using contract:

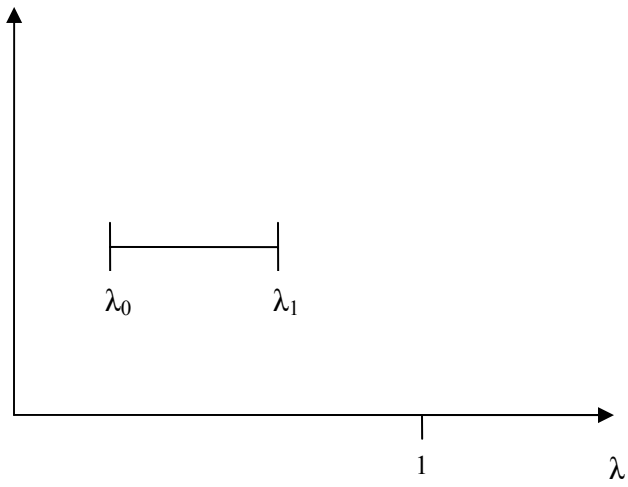
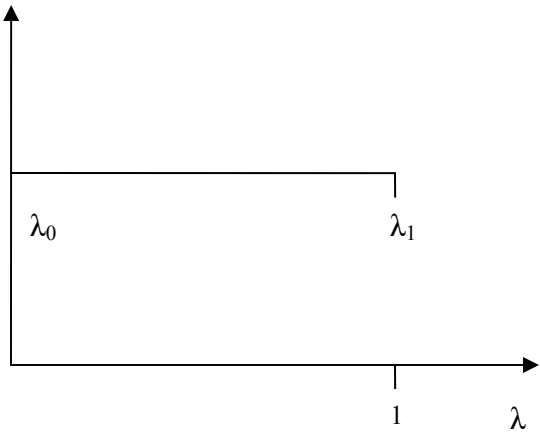
**Bach in state 0 at price c
Shostakovich in state 1 at price c .**

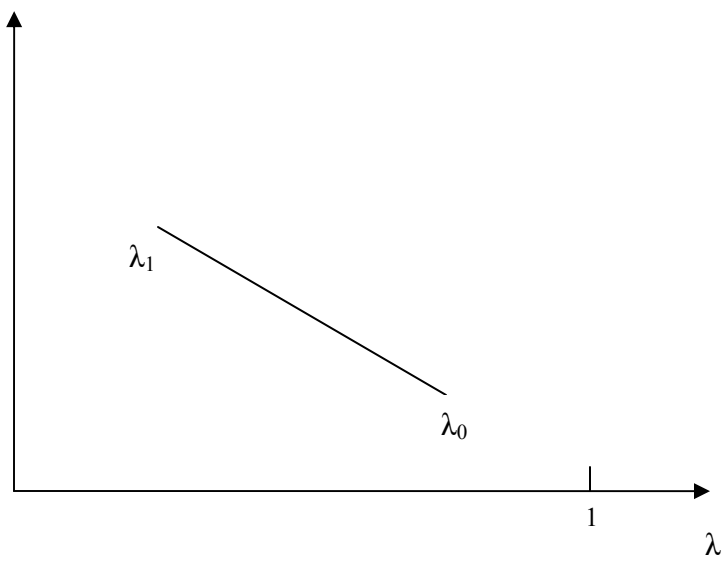
But we suppose that, even though each party observes the state and the other party's payoff (in effect, the seller can deduce whether the buyer has invested), none of these variables is verifiable.

Second-best

- At date 0 parties write a contract consisting of a list or set C of outcomes -- (λ, p) pairs – plus “no trade.” Since each party can trigger no trade unilaterally and unverifiably, wlog normalize no trade price to be zero.
- (• Of course, C is independent of the state of the world.)
- Given that parties can randomize (in fact, we suppose they can’t commit not to), extend C to its convex hull.
- At date 1 parties bargain over C with $(0, 0)$ as the disagreement point. Adopt symmetric Nash bargaining solution. Let (λ_0, p_0) be outcome in state 0, and (λ_1, p_1) in state 1.
- Note that no contract corresponds to case where C is unrestricted.

- **Simplification: Nash bargaining solution satisfies independence of irrelevant alternatives. So outcomes (λ_0, p_0) , (λ_1, p_1) will still emerge from the bargaining if we replace the original contract by a new contract consisting just of the pairs (λ_0, p_0) , (λ_1, p_1) , the line interval joining them, plus no trade.**
- **(λ_0, p_0) , (λ_1, p_1) must satisfy IR and IC constraints.**





Analyzing the Optimal Contract

- Write the buyer and seller's ex post payoffs in states 0,1 as b_0, b_1 and s_0, s_1 , respectively.
- Let total ex post surplus in the two states be $w_0 \equiv b_0 + s_0$, $w_1 \equiv b_1 + s_1$, respectively.
- Then we have

$$b_0 = v - \lambda_0 \Delta - p_0,$$

$$b_1 = v - (1 - \lambda_1) \Delta - p_1,$$

$$s_0 = p_0 - c + \lambda_0 \delta,$$

$$s_1 = p_1 - c + (1 - \lambda_1) \delta,$$

$$w_0 = v - c - \lambda_0 (\Delta - \delta),$$

$$w_1 = v - c - (1 - \lambda_1) (\Delta - \delta).$$

IR constraints

Given that each party can unilaterally force “no trade” (whose price is normalized to zero), it is necessary to ensure that the parties’ individual rationality (IR) constraints are satisfied:

$$\mathbf{c - \lambda_0\delta \leq p_0 \leq v - \lambda_0\Delta, \quad (\mathbf{IR}_0)}$$

$$\mathbf{c - (1 - \lambda_1)\delta \leq p_1 \leq v - (1 - \lambda_1)\Delta. \quad (\mathbf{IR}_1)}$$

IC constraints

It is also necessary to ensure that the parties will indeed bargain to (λ_0, p_0) in state 0 and to (λ_1, p_1) in state 1 (the “group incentive compatibility”, or IC, constraints).

In state 0, (b_0, s_0) must maximize the Nash product bs on the line joining $(v - \lambda_0\Delta - p_0, p_0 - c + \lambda_0\delta)$ to $(v - \lambda_1\Delta - p_1, p_1 - c + \lambda_1\delta)$:

$$\begin{aligned} & [p_0 - c + \lambda_0\delta] \{p_0 - p_1 + (\lambda_0 - \lambda_1)\Delta\} \\ & + [v - \lambda_0\Delta - p_0] \{p_1 - p_0 + (\lambda_1 - \lambda_0)\delta\} \\ & \leq 0, \end{aligned} \tag{IC_0}$$

Similarly, in state 1:

$$\begin{aligned} & [p_1 - c + (1 - \lambda_1)\delta] \{p_1 - p_0 + (\lambda_0 - \lambda_1)\Delta\} \\ & + [v - (1 - \lambda_1)\Delta - p_1] \{p_0 - p_1 + (\lambda_1 - \lambda_0)\delta\} \\ & \leq 0. \end{aligned} \tag{IC_1}$$

The (IR) and (IC) constraints are individually necessary and jointly sufficient for a contract to be feasible.

Optimal Contract

Choose (λ_0, p_0) and (λ_1, p_1) to maximize

$$\mathbf{E}w \equiv \pi_0 w_0 + \pi_1 w_1$$

subject to

$$\mathbf{E}b \equiv \pi_0 b_0 + \pi_1 b_1 \geq \mathbf{i}$$

and the (IR) and (IC) constraints.

Optimal Contract in Numerical Example

Start by observing that “no contract” yields ex post efficiency:

state 0: Bach at price 15 ($\lambda_0 = 0, p_0 = 15$)

state 1: Shostakovich at price 15 ($\lambda_1 = 1, p_1 = 15$).

That is, $E_w = 10$ (the maximum possible value)

and $E_b = 5$.

Hence, provided $i \leq 5$, “no contract” achieves the first-best.

Note that “no contract” is equivalent to the contract:

“any music at a price of 15.”

This contract is loose insofar as the music is not specified (although it is tighter than “no contract” since the price is specified).

From now on, assume $5 < i < 10$. The above contract does not work because the buyer will not invest: the seller is getting too much of the ex post surplus.

Other loose contracts

To maintain ex post efficiency, we need both Bach and Shostakovich on the contractual list – and hence every composer in between (because of randomization). So we need a contract that is loose in music.

Try “any music at price $p = 10$ ”

	Bach $\lambda = 0$	Mozart $\lambda = \frac{1}{2}$	Shostakovich $\lambda = 1$
b_0	$20 - 10 = 10$	$17 - 10 = 7$	$14 - 10 = 4$
s_0	$10 - 10 = 0$	$10 - 9 = 1$	$10 - 8 = 2$
w_0	10	8	6
b_0s_0	0	7	8

Symmetrically in state 1.

In fact, $\lambda_0 = 5/6$, $\lambda_1 = 1/6$ maximizes Nash product, which yields $E_w = 6.66$, $E_b = 5$. This is worse than “any music at $p = 15$ ” or “no contract.”

The problem with $p = 10$ is that the seller gets too little – in fact zero – from the efficient choice of music. To balance the division of surplus (and increase the Nash product), the parties bargain to a very inefficient outcome. The seller needs more of a cushion.

Try raising p from 10 to $12 \frac{1}{2}$

Contract: “any music at $p = 12 \frac{1}{2}$ ”

Bach	Mozart	Shostakovich
$\lambda = 0$	$\lambda = \frac{1}{2}$	$\lambda = 1$
$b_0 s_0 = 18 \frac{3}{4}$	$15 \frac{3}{4}$	$6 \frac{3}{4}$

Now $\lambda_0 = 0$ (Bach) maximizes the Nash product $b_0 s_0$ in state 0.

Equally $\lambda_1 = 1$ (Shostakovich) maximizes the Nash product $b_1 s_1$ in state 1.

Hence the contract achieves ex post efficiency:

$$E_w = 10, E_b = 7 \frac{1}{2}.$$

This particular loose contract “any music at $p = 12 \frac{1}{2}$ ” has a special claim to our attention. Call it **contract L**. Among the class of contracts that achieve ex post efficiency, L maximizes the buyer’s payoff.

If $i < 7 \frac{1}{2}$, we're done!

But suppose $7 \frac{1}{2} < i < 10$.

Might it make sense to reduce p and put up with some ex post inefficiency?

Unfortunately, “any music at $p < 12 \frac{1}{2}$ ” reduces E_b .

To see this, try $p = 11$.

Contract: “any music at a price of 11”

	Bach	Mozart	Shostakovich
	$\lambda = 0$	$\lambda = \frac{1}{2}$	$\lambda = 1$
$b_0 s_0$	9	12	9

Now Mozart maximizes the Nash product in both states.

Hence, for this contract $E_w = 8$, $E_b = 6$.

This is strictly worse than L!

Tight Contracts

Notice that the contract “any music at a price of 11” yields Mozart in both states.

However, there is a better way to implement Mozart: use a tight contract that fixes a price and the music:

“Mozart at a price of 9.”

Now the buyer gets all the surplus: $E_b = E_w = 8$.

There is a discontinuity!

The source of the discontinuity is that the (IC) constraints become vacuous in the limit when there is only one {music, price} pair in the contract (other than “no trade”).

This particular contract, “Mozart at a price of 9,” also has a special claim to our attention. Call it contract M.

Relative to contract L, contract M gives the buyer a higher expected payoff E_b . But of course the expected total surplus E_w is lower because Mozart is inefficient in both states.

Parties can use M to implement projects with $7 \frac{1}{2} < i \leq 8$ (in fact, parties will use a convex combination of L and M)

If $7 \frac{1}{2} < i \leq 8$, there is ex post inefficiency.

What about contracts that fix neither the price nor the music? Can they do better?

Given a weak assumption, Proposition 1 says no.

All this generalizes beyond the numerical example.

Note pecking order: As $i \uparrow$, fix price (over which diametrically opposed interests) first, and then quality (over which some congruence)

Can relax $\pi_0 = \pi_1 = \frac{1}{2}$. Now may introduce a third contract: “Bach at $p = 10$.”

Summary of Model

- **Trade-off between ex ante objectives and ex post efficiency**
- **Parties deliberately tie their hands ex post (not always a good idea for a pianist) by limiting what they can bargain over.**
- **Coase theorem fails by design even though symmetric information.**

Extensions and Applications

- **Relax “ruling out.” Allow for renegotiation if an objective change of circumstances (seller’s cost or buyer’s value rises). Maybe distinguish between “monetary” and “nonmonetary” renegotiations.**
- **Relax “no ruling in.” Allow other noncooperative outcomes than (0,0). Gives some role for specific performance and mechanisms.**
- **Going inside the firm Large amount of negotiation takes place on dimensions other than price.**
- **Theory falls somewhere between explicit contracts and implicit/relational contracts.**