Chapter 5: Bounded Rationality and Private Information

Any attempt to deal seriously with the study of economic organization must come to terms with the combined ramifications of bounded rationality and opportunism in conjunction with a condition of asset specificity. (O. Williamson).

• The goal of this Chapter is to examine Motivation. The “motivation problem” is to ensure the various individuals involved willingly do their own parts in the whole undertaking, both reporting accurately and acting as they are supposed to act.
Motivation

• Assuming (as anticipated in Chapter 2) that people will do only what they perceive to be in their own individual interest, we will discuss how arranging affairs so that, as far as possible, selfish individual actions take into account “group” interests.

• The idea is that people, recognizing their mutual interests “to cooperate”, can modify their behaviour by compacts that we will term “contracts” (regardless of their legal nature).
Contracts

• While being voluntary, these contracts can be crafted to suit individual needs and circumstances and, in spite of being sometimes unarticulated and even implicit, may perform in actual relationships functions similar to formal contracts.

• A perfect, complete contract, describing and determining behaviour in any possible circumstance (even when the contract itself is violated) could of course solve the motivation problem, enforcing an efficient plan.
**Complete contracting I**

- Accordingly, motivation problems arise only because some plans **cannot** be described in a *complete, enforceable* contract.

- Notice that to reach and enact a **complete contract** it is in principle *necessary* that:

  1. All parties are able to foresee all the relevant (future) contingencies upon which they might want to adapt contractually actions and payments.
Complete contracting II

All parties must also be able, ex ante, to describe accurately the previous circumstances, so to determine unambiguously the relevant possibilities and, ex post, to recognize which of them did materialize.

- All parties must be willing and able to agree upon an efficient course of action and the payments which accompany it.
- All parties must be happy to obey to the contract, once they have entered it.
Complete contracting III

• Condition 3 involves at least to aspects:
  A. Parties must not mutually desire to renegotiate the contract later, otherwise the contract would not be credible and thus able to guide behaviour;
  B. Each party must be able to determine freely whether the contract is being violated, and in the case must be willing and able to enforce the agreed performance.
Complete contracting IV

• Consider e.g. what would be required for a complete contract between you and the University: you should be able to foresee and describe the quality of future courses whose attendance you might be interested in, the price of food at the cafeteria, the condition of the labour market when you finish, and so on, in an infinite list. And you and your University should be able to agree on a credible (non renegotiable) behaviour contingent upon the previous circumstances!
Complete contracting V

• Interesting, this *complete contract* perspective resembles the one that would be implicit in the use of *complete* A-D (walrasian) *markets* for state-dependent commodities (which actually requires even more than that, because in addition markets will have to be competitive).

• This is obviously ridiculous (and sometimes, hopefully, also non necessary).
Actual contracting I

• Limited foresight, imprecise language, the costs of calculating solutions and writing down a plan (i.e., the bounded rationality of real people) imply that actual contracting is necessary incomplete.

• This implies that, when “unexpected” contingencies arise (in complicated relationships) the parties must find ways to adapt.
Actual contracting II

• As a consequence, the concrete possibility of opportunistic behaviour, including reneging, emerges.

• Think of your University changing course requirements, cancelling courses, or raising tuition fees…..

• But fear of opportunism may deter parties from trusting on one another as much as efficiency would command!

• Think of credit/debt contracts to finance innovative ideas.
Actual contracting III

• A general label (see Chapter 2) for this kind of problems (incomplete and unenforceable contracts) is imperfect commitment.

• In fact, there might be private information before the contract is signed that interferes with reaching efficiency.

• For instance, consider the problem of buying a used car, in which worthwhile deals might not occur. This source of inefficiency is called adverse selection, meaning that the market selection is in contrast with the buyers’ interest.
Actual contracting IV

• In addition, there might be insufficient information after the signing of the contract to tell whether the terms of agreement have been honoured, or acquiring that information may be costly.

• This open the way to ex post opportunistic behaviour, and the recognition of this moral hazard problem severely limits the contracts that can be enforced.
Actual contracting V

• Overall, individual interests are not properly aligned in incomplete contracts, and self-interested behaviour may thwart the realization of efficient plans.

• The motivation problem is then to overcome these difficulties, to the extent possible.

• This involves recognizing that what it can actually be accomplished is subject to incentive compatibility constraints, and designing organizational systems that make them looser and the available options richer.
Bounded rationality I

- Real people are boundedly rational, and they know it, meaning that they are aware of the possible arising of unforeseen contingencies, and that they understand that communication is costly and their computation ability severely limited.

- People then act in an *intentionally rational* manner, trying to do the best they can given the limitations under which they work, and they **do learn**.
Bounded rationality II

- Notice that unexpected contingencies may be unimportant.

- However, they might also have massive consequences: who among its trading partners would have expected the collapse of Lehman Brothers in 2008? Who would have bought the Treasury Bonds of Greece in 2006 knowing the situation in 2012?
Bounded rationality III

• Also notice that expected contingencies may appear so unlikely that it is not worthwhile to define the corresponding behaviour contractually.

• This is the case if they seem very improbable, or unlike to create large disputes if they should occur, or too costly to be described, or just difficult to tackle (“we will just see …”).

• Yet these calculations themselves are subject to error!
Bounded rationality IV

• For instance, the Gelmini Law (“art. 7, comma 1”) allows university teachers to spend up to 5 years (also continuous) outside their University (without being paid). The rationale (if any) of this rule was to permit scholar to spend a period in the industry, perhaps abroad.

• In practice, it allows a scholar to spend up to 10 years working for two universities, one in Italy and one abroad (notice that this cannot happen between two Italian Universities, without an ex ante special agreement among them: “art. 6 comma 11”)!
Bounded rationality V

• Another source of contractual incompleteness is that the natural languages are inherently imprecise.

• Ex: “Ad impossibilia nemo tenetur” is an ancient Latin sentence (“brocardo”) which is at the basis of the “commercial practicability” doctrine in contract law, by which a firm that signs a contract is required to perform as agreed only when performance is reasonably possible. On its basis Westinghouse repudiated a contract after a sharp rise in one (uranium) of its input prices. Of course its counterparts (electric power utilities) disagreed.
Bounded rationality VI

- Also notice that adding further specific provisions to cover behaviour in more distinct circumstances, by making the different cases closer to the boundaries among them, can make disputes even more likely.
- This suggests that a possibility is to use *inflexible contracts* with *blanket provisions* to apply very broadly.
- This minimizes the cost of describing eventualities and leaves little room for ex post uncertainty. In fact, it works well for *simple transactions* ("*spot market contracts*").
Bounded rationality VII

- However, for *complex transaction* that extend over time, those contracts are likely to be *too unresponsive* to changing conditions.

- An alternative is *relational contracting*, by which parties agree on goals and objectives, stipulating general provisions and criteria to be applied in deciding, on who has the power to acts and the bounds limiting the actions that can be taken, and on dispute resolution mechanisms. This can work remarkably well, at least when the potential conflicts are not too great and the parties do not incline too much towards opportunistic behaviours.
Bounded rationality VIII

• **Employment contracts** are a typical example of relational contracting.

• They delegate authority to the employer to direct the employee’s action, rather than describing in details the task of the latter. The expectation is that the employer will tell the employee what to do (within certain bounds that may be quite vaguely defined). The employee’s ultimate defence against unreasonable demands is to quit, and the employer’s defence against refusal to take orders is to fire the employee. *Clearly, all this economizes on contracting costs.*
Bounded rationality IX

- Relational contracts serve to structure a relationship, to set common expectations and to establish mechanisms to be used to decide allocations.

- The idea of agreeing on processes rather than on actions is mirrored in corporate charters, which specify procedures for selecting directors and officers and their power and range for decisions.

- The nature and role of contract and business law is similar, establishing a basis for expectation about what will be done in events not explicitly mentioned, and default provisions (also think of the role of national constitutions).
Implicit Contracts and Corporate Culture

• An important *addendum* to incomplete written contracts are the unarticulated but shared expectations that the parties have concerning the relationship.

• These commonly understood *implicit contracts* can be a powerful means of economizing on contracting costs.

• *Corporate culture*, seen as a shared set of values, ways of thinking and beliefs about how things should be done, is an example.
Implicit Contracts and Corporate Culture II

- Notice that to change implicit contracts may be very difficult, because it involves breaking old rules and establishing new ones without the benefit of explicit discussion.

- Also, they cannot be easily enforced in court of law, so they must rely for enforcement on other mechanisms (reputation and mutual benefits).
Commitment and Reneging I

- Contracts can be seen as mechanisms to achieve binding commitments that the parties can bank in their planning.
- Accordingly, incomplete imperfect contracts may prevent efficient agreement being reached in the first place, or limit the extent of feasible cooperation.
- Remember that achieving commitment can have a strategic value, by affecting others’ expectations and then their behaviour (the burning of ships by William the Conqueror and Hernán Cortés).
Commitment and Reneging II

• For example, Apple committed to the production of Macintosh computers by designing and building very specialized plants, and publicizing this fact heavily.

• This should have affected the behaviour of its employees, competitors and potential customers.
Commitment and Reneging III

- Notice that reneging on the deal is problematic under incomplete contracts, because what should then be done is in general ambiguous and open to interpretations.

- In particular, it might be very difficult for outsiders (e.g., a court) to establish who is misbehaving, and what successive behaviour is appropriate.

- Of course, when reneging takes the form of not carrying out an action, it may affect efficiency.
Commitment and Reneging IV

• However, if reneging concerns a payment and there are no wealth effects, this does not directly affect efficiency (it is just a distributive matter).

• Rather, the negative impact on efficiency can take place indirectly, if the fear of getting cheated prevent an efficient transaction in the first place.
Ex Post Renegotiation I

• A different problem arises if both parties find it advantageous to renegotiate once some actions have been taken or further information revealed.

• The problem here is that if parties anticipate such a possibility, the original contracts may lack of credibility.

• Ex: when stock options are used to motivate managers, the price at which the option can be exercised should not be too high with respect to the current price. If afterwards the stock price falls, the options are not any longer useful, and in similar circumstances many firms have re-issue new options. But why should then managers worry about the stock price?
Ex Post Renegotiation II

• Similar “reputational” problems concerns policies to prevent terrorism (kidnapping), or parenting.

• In both case, to prevent future misbehaviour, it may be necessary to commit not to bargain ex post, and to carry out threats of punishments which bring pain (to both parties, and thus reneging is attractive) without immediate gain.

• Notice that if hostages actually are taken, to stick to the commitment is particularly costly to democratic countries.
Ex Post Renegotiation III

- A complication arises if some of the parties insists on the inefficient completion of the contract.
- Thinks of a better outside option for one part which opens after the signing of the contract.
- In principle, that part could compensate the other (if there are no wealth effects), but it might be difficult to establish the proper amount of compensation if there are private information.
Investments and Specific Assets I

- The most serious problems of imperfect commitment arise when significant investments are required over an extended period of time.

- An *investment* is an expenditure that creates a potential flow of future benefits and services (an *asset*, which might be physical, financial or intangible: e.g., plants, bonds or *human capital*).
Investments and Specific Assets II

• Of course, the most problematic kind of investment is that in specific assets.

• A further possibility is that two assets are cospecialized if they are most productive when used together. Ex: coal-burning electric plants tend to be located near mines (or near cities), and special rail lines are built in order to ship out their coal from the mines. In such a case, the mine and the rail line (or the plant and the mine nearby) are cospecialized assets.
Investments and Specific Assets III

• Clearly, most of the value created by investments in cospecialized assets depends on the behaviour of the other owner, and ex-post opportunistic behaviour cannot be excluded (if contracts are not complete).

• The **hold-up problem** arises when a part worries that, once it has done a sunk investment, it might be later forced to accept disadvantageous terms.
Investments and Specific Assets IV

- Notice that a possible solution might be a long-term contract, for which, however, realistically too many circumstances should be foreseen to set adequately the relevant clauses.

- The message coming from the hold-up problem is that the owners of specific assets are vulnerable to opportunistic behaviour by their contracting counterparts (unless contracts are complete).
Investments and Specific Assets V

- Paul Joskow has empirically investigated the electric utility/coal supply contracts, finding that coal mines/plants are usually owned by the same owners of the utilities, and that in the other cases complex long-term contracts are used.
- Another example is provided by the well-known story (back to the 1920s) of the GM vertically integrating the Fisher Body company.
- Notice that the hold-up is an example of a *postcontractual* opportunism.
A mathematical example I

- Suppose that firms A and B, to exploit a business opportunity, both need to do a completely cospecialized investment with an individual cost of 2.
- The gross return from the investments is 8, yielding a net overall benefit of 4.
- We model the possibility of opportunistic behaviour by imagining that at an individual cost of 3 each firm can affect the distribution of profit (if the other keeps fair, i.e., uses the option “don’t”), for the sake of simplicity getting all the surplus (option “grab”).
- The situation is described in next Table (5.1, p. 138).
Table 5.1, p. 138

<table>
<thead>
<tr>
<th>Firm B</th>
<th>Firm A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grab</td>
</tr>
<tr>
<td>Grab</td>
<td>-1, -1</td>
</tr>
<tr>
<td>Don’t</td>
<td>-2, 3</td>
</tr>
</tbody>
</table>

The first entry in each cell refers to the row player, the second to the column player.
A mathematical example II

• The previous Table describes a Prisoners’ Dilemma-like game, whose obvious (Nash) equilibrium has both firms to “grab”, with the inefficient result (-1, -1).

• As a consequence, the firms will not invest, and a business opportunity will vanish.

• Notice that it may seem that a little bit of ‘business ethics’ could overcome this simple problem, but “in the rich setting of reality it is tempting for people to think that what serves their own interests is honest and fair, and it is very risky to rely on others to act consistently contrary to their own selfish interests”.

EOM: Chapter 5 (P. Bertoletti)
Achieving Commitment

• In some situations, concern with one’s reputation may be an effective (noncontractual) way to overcome the temptation to renege or renegotiate.

• In a world of costly and incomplete contracting, trust is crucial to realize many transactions.

• Thus, the concerns with getting a bad reputation that reduces future business opportunities works by removing the incentives for opportunistic behaviour through the creation of a long-term cost offsetting its short-term gains.
The role of reputation

• The value of reputation (Chapter 8) depends on how often it will prove useful.
• Accordingly, it is larger the more frequent the transaction is, the longer its horizon and the more profitable it is.
• As an implication, in relational contracting the discretion to direct activities in unforeseen events should be given to the party most damaged from losing its reputation (in the employment contract, this is likely to be the firm).
Precontractual Private Information

• The definition of the terms of a contract (also of an incomplete one) generally requires some sort of bargaining among the parties.

• If there are no wealth effects, the value maximization principle should determine the value-creating aspects of the agreement. But what is feasible, and thus what is efficient, depends crucially on the informational conditions.

• In other words, informational asymmetries can prevent parties from bargaining effectively, and the Efficiency Principle might not apply.
Bargaining over a sale I

• In fact, with private information, in general even when an agreement is reached it will not be typically efficient when judged by the standard of complete information, in particular when the parties have an option not to participate.

• To illustrate, consider the potential buyer and seller of one unit of some commodity, and assume that each is privately informed about the “reservation” value she places on having the good.

• In particular, the buyer (correctly) believes that the seller either values 2€ it (with probability 0,2) or nothing at all, while the seller (correctly) thinks that the buyer might value it either 3€ (with probability 0,8) or 1€.
Bargaining over a sale II

• Data are illustrated in the following Table (5.2, p. 141).

• Notice that efficiency would command a trade between these two parties in all situations different from having a value of 2€ for the seller and 1€ for the buyer, that is in the 96% of the time.

• And if the valuations were known to both, the efficient outcome would not be difficult to establish (the parties would just need to bargain on the payment required to share the gain from trade).
Table 5.2, p. 141

**Efficient Outcomes with Different Possible Valuations**

<table>
<thead>
<tr>
<th>Buyer’s Value</th>
<th>0€ Prob = 0,8</th>
<th>2€ Prob = 0,2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1€ Prob = 0,2</td>
<td>Trade</td>
<td>No Trade</td>
</tr>
<tr>
<td>3€ Prob = 0,8</td>
<td>Trade</td>
<td>Trade</td>
</tr>
</tbody>
</table>
Strategic Misrepresentation I

• With private information, however, the buyer might try to convince the seller that his valuation is 1€ (and thus that he would not be able to pay more than that), even if it is actually 3€, while the seller could pretend to evaluate 2€ the good (and thus that she could not be payed less than that), having instead a null valuation.

• In this way the parties run the risk to reach the conclusion that the trade would not create any value, event if it would, but it may be a risk worth taking, however.
Strategic Misrepresentation II

• To prevent misrepresentation, it is intuitively necessary that the parties do at least as well as by truthfully “revealing” their own valuation.

• In addition, of course, no party can be forced to trade (the latter being “voluntary” as usual).

• As a result, it can be proved that the set of feasible trade is constrained by the fact that the parties need to receive at least some minimum amount of surplus out of trade (this amount is sometimes called an informational rent, being an “excess return” due to private information).
Strategic Misrepresentation III

• The latter result implies that, if the informational rents are not large enough (they depend on the details of the bargaining situation) efficient trade might be prevented (because unfeasible).

• To illustrate, it is useful to take the point of view of a neutral mediator with the power to suggest the price that will apply to the exchange (if any).

• If it turns out to be impossible for such a mediator to ensure efficient trade, this will also be true a fortiori for the parties.
Strategic Misrepresentation IV

• The problem to be solved is to set prices for the possible valuation combinations in such a way to discourage parties from making “false claims”. These are sometimes called “incentive compatibility” (or “truth-telling”) constraints.

• Simultaneously, it is necessary to offer at each party at least her “reservation price”, otherwise she would not be willing to trade. These are said to be the “participation” (or “individual rationality”) constraints.
Strategic Misrepresentation V

- Together, they imply that $p(3, 2) = 2$, meaning with $p(3, 2)$ the price to be used if the buyer claims that his valuation is 3 and the seller claims an evaluation equal to 2.
- Similarly, $p(1, 0) = 1$.
- Thus, the problem reduces to finding a price $p = p(3, 0)$ which would induce truthful "revelations". This is illustrated in Table 5.3, p.142.
Table 5.3, p. 142

Incentive compatible and individually rational prices

<table>
<thead>
<tr>
<th>Buyer’s Value</th>
<th>Seller’s Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0€</td>
</tr>
<tr>
<td></td>
<td>Prob = 0,8</td>
</tr>
<tr>
<td>1€</td>
<td>1</td>
</tr>
<tr>
<td>Prob = 0,2</td>
<td></td>
</tr>
<tr>
<td>3€</td>
<td>p</td>
</tr>
<tr>
<td>Prob = 0,8</td>
<td></td>
</tr>
</tbody>
</table>
Strategic Misrepresentation VI

• Notice that truth-telling by the seller requires that what she gets by revealing her valuation of 0:
  \[ 1 \cdot 0.2 + p \cdot 0.8 = 0.2 + 0.8p \]
  is not less that what she might have got by claiming a valuation of 2:
  \[ 0 \cdot 0.2 + 2 \cdot 0.8 = 1.6. \]

  That is:
  \[ 0.2 + 0.8p \geq 1.6, \]

  i.e., \( p \geq 1.4/0.8 = 1.75. \)
Strategic Misrepresentation VII

- Similarly, truth-telling by the buyer requires that what he gets by revealing her valuation of 3:

\[(3 - p) \cdot 0,8 + (3 - 2) \cdot 0,2 = 2,6 - 0,8p\]

is not less than what he might have got by claiming a valuation of 1:

\[(3 - 1) \cdot 0,8 + 0 \cdot 0,2 = 1,6.\]

That is:

\[1 \geq 0,8p,\]

i.e., \[1,25 \geq p.\]
Strategic Misrepresentation VIII

• Accordingly, it is impossible to find a price \( p \) which satisfies both the incentive compatibility and the participation constraints.

• Since a remarkable result known as the “Revelation Principle” ensures that no alternative mechanism can improve upon one giving incentives to report truthfully, we conclude that, in the examined situation, efficient trading cannot be guaranteed in all circumstances.
Strategic Misrepresentation IX

• The intuitive reason for the previous result is that, in the example, the risk of making the trade to fail by reporting untruthfully is low.

• Suppose that, on the contrary, the distribution of evaluation is reversed as in next Table.

• It is easy to check that \( p = 1,5 \) satisfies the previous incentive compatibility constraints:
  
  \[
  S: \quad 0,8 + 0,2 \cdot 1,5 = 1,1 \geq 0,4
  \]

  \[
  B: \quad 0,2 \cdot 1,5 + 0,8 = 1,1 \geq 0,4.
  \]
Achieving efficiency: an example

**Incentive compatible and individually rational prices**

<table>
<thead>
<tr>
<th>Buyer’s Value</th>
<th>Seller’s Value</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0€ Prob = 0,2</td>
<td>2€ Prob = 0,8</td>
<td></td>
</tr>
<tr>
<td>1€ Prob = 0,8</td>
<td>1</td>
<td>No Trade</td>
<td></td>
</tr>
<tr>
<td>3€ Prob = 0,2</td>
<td>1,5</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

EOM: Chapter 5 (P. Bertoletti)
Incentive Efficiency

• Remember that efficiency is relative to a set of feasible outcome.

• In a setting with private information, it is standard to distinguish between full-information efficiency, and incentive efficiency.

• In particular, an outcome is incentive efficient if the incentive constraints are taken into account in defining the set of feasible results.

• A generalized version of the Efficiency Principle accordingly suggests that bargainers with private information should agree upon incentive-efficient mechanisms.
Incentive Efficient Bargaining: An Example

• Consider again the case of a potential buyer and a potential seller, with valuations given respectively by $B$ and $S$, uniformly distributed in the interval $[0, 1]$.

• It can be proved that an incentive efficient mechanism is the following:
  - The buyer and the seller simultaneously announces their proposed prices, $b$ and $s$;
  - if $b \geq s$, then the trade takes place with $p = (b + s)/2$;
  - if $b < s$, then there is no trade and they commit to walk away.
An Example: continuation

• It is clear that this mechanism induce \( b < B \) and \( s > S \) (in all cases in which the trade is expected to take place), and then that with positive probability a full-information efficient trade might not arise.

• For example, suppose that the buyer is expected to be forthright, and that the seller has \( S = 0.5 \).

• By using \( s = 0.5 \) she should expect:

\[
0 \cdot \Pr\{b < 0.5\} + E_{b \geq 0.5}[(b + 0.5)/2 - 0.5] \cdot \Pr\{b \geq 0.5\}
\]

\[
= [(0.75 + 0.5)/2 - 0.5] \cdot 0.5 = 0.0625.
\]
An Example: continuation

• By naming instead a little bit more, say $s = 0.52$ she should instead expect the larger amount:
  
- $0 \cdot \Pr\{b < 0.52\} + E_{b \geq 0.52}[(b + 0.52)/2 - 0.5] \cdot \Pr\{b \geq 0.52\}$
  
- $= [(0.76 + 0.52)/2 - 0.5] \cdot 0.48 = 0.0672$.

• The intuition is clear: by exaggerating a little bit her valuation, the seller increases only of 2% the probability that the trade does not take place (and in cases in which she would not have received a large price), while she enjoys an increase of 0.01 of the expected price in the 48% of the cases.
An Example: continuation

• Similar considerations applies to a buyer considering $b < B$.

• Indeed, it can be proved that in the Bayes-Nash equilibrium of the game induced by the previously described mechanism:
  
  - $b = 1/12 + 2/3B$,
  
  - $s = 1/4 + 2/3S$.

• Accordingly, the exchange will take place only if $B \geq S + 1/4$. 
An Example: conclusion

• The previous one is a typical pattern: *when incentive constraints are important in bilateral bargaining, trade takes place only if the gains from trade are sufficiently large.*

• Finally, in the example any other mechanism would have produced more losses with respect to potential gains, either in the forms of more disagreements or as costly delay before reaching an agreement.
Exercise 5, p. 165.

• A seller values a good either 0 with probability $x$, or 10 with probability $(1 - x)$.

• The buyer only knows that his valuation is 10 more than that of the seller. This implies that trade is always efficient.

• Show that a price of 10 is incentive compatible, no matter what value the seller announces.

• Notice that the buyer has a valuation of at least 10, so $p = 10$ is for him always individually rational.
Exercise 5, p. 165: continuation.

• Similarly, also for the seller to exchange for a price of 10 is always individually rational.

• Finally, notice that, since the price does not depend on the announcement made by the seller, she has no reason not to make a truthful revelation of his valuation.

• Notice that with $p = 10$ the seller receives an “informational rent” of 10 if $s = 0$ (and $b = 10$), while the buyer does receive all the gain from trade if $s = 10$ (and $b = 20$).
Exercise 5, p. 165: continuation.

• Now suppose that the buyer values the good only 5 more than the seller.

• Again, trade would always take place under full information since it is efficient.

• Is it possible to find incentive compatible and individually rational prices (as functions of the seller’s claimed value)?

• The situation is described in next Table.
Achieving efficiency: an example

*Incentive compatible and individually rational prices*

<table>
<thead>
<tr>
<th>Buyer’s Value</th>
<th>0€</th>
<th>10€</th>
</tr>
</thead>
<tbody>
<tr>
<td>5€</td>
<td>Prob = $x$ ( p(0) )</td>
<td></td>
</tr>
<tr>
<td>15€</td>
<td>Prob = $1 - x$ ( p(10) )</td>
<td></td>
</tr>
</tbody>
</table>
Exercise 5, p. 165: continuation.

• Notice that individual rationality of both the seller and the buyer implies that \( 15 \geq p(10) \geq 10 \), and \( 5 \geq p(0) \geq 0 \).

• Incentive compatibility requires that:
  
  \[ p(10) - 10 \geq p(0) - 10 \] 
  (i.e, \( p(10) \geq p(0) \)), and
  
  \[ p(0) \geq p(10) \],

• and thus requires \( p(0) = p(10) \).

• This is obvious, because the seller completely determines the price that she receives by her “revelation”, but it turn out to be inconsistent with individual rationality.
Exercise 5, p. 165: conclusion.

• In conclusion, in such a case of “adverse selection”, we should expect that:
  • in the case of $s = 0$ and $b = 5$ the trade will take place, for a price that need to belong to the interval $[0, 5]$;
  • in the case of $s = 10$ and $b = 15$ the commodity will not be traded.