Information, contracts and competition - Applications to financial markets

Chapter I
An introduction to mechanism

This part of the course introduces the idea of Mechanism, generalizing prices, in a very simple example. We first look to the Aghion Bolton mechanism, and then we introduce broadly contracts in financial economics.

Contract Theory

In economics, an accepted definition of contract theory studies how economic actors can and do construct contractual arrangements, generally in the presence of asymmetric information.

However, as we will see, contractual arrangements, particularly the use of mechanism can be made without the presence of asymmetric information : the key ingredient is that one agent has some commitment power.

This course will then investigate the use of mechanism in simple frameworks, first, without asymmetric information, then, following the literature, studying the case of adverse selection and of moral hazard.

Mechanism and prices - non linear pricing

Definition

A mechanism is a bilateral arrangement between two agents, that fix many details of a transaction, and particularly, in case of a traded good, the unit price and the quantity traded. (See for instance Guesnerie (1992) and Hammond (1978))

- At the very beginning of the literature, people understood that the use of contracts was similar to posting non linear pricing, a practice that is very familiar to consumers

Roadmap

0) Introduction

1) An example of mechanism, acting as a Market Barrier

2) Prices, strategic interaction and mechanism in economics

1. An example of mechanism, acting as a Market Barrier

From - Aghion, P., & Bolton, P. (1987). Contracts as a Barrier to Entry. *The American Economic Review*, 77(3), 388-401.

Dynamic Competition on a market with an uncertain entry

Let consider a non divisible good, two sellers, 1 and 2, one buyer. The buyer buys at least one good. Her reservation price is 1. Seller 1 's cost is t $c_1 = 1/2$ while Seller 2 's cost is uniformly distributed in $[0, 1]$, and only known at period 2.
We study this economy from three view points :

- optimizing social welfare
- Analyzing the market, when there is no possible commitment between the buyer and Seller 1
- Analyzing the market, when this is possible to write a contract in period 1 between the buyer and Seller 1, concerning period 2 's trade

Uncertain cost of a future competitor : the welfare analysis

A simple and strong statement : the good should be sold at period 2 by the seller which cost is the lowest.The good is always sold because the reservation price of the seller is greater than the cost, whatever it will be.
We do not need to precise the price of the transaction, to compute the surplus. We compute at this stage an *ex ante* expected surplus.

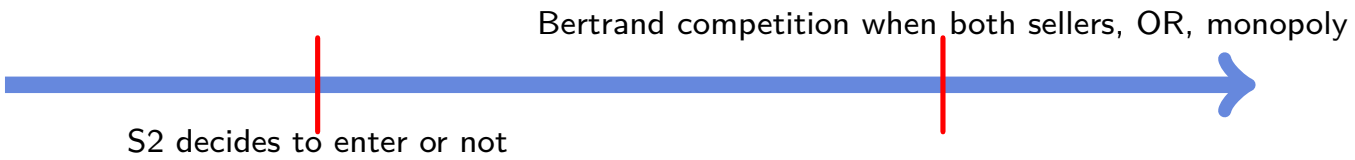
Then, Seller 2 enters the market with probability $1/2$,

The total surplus of the economy (at period 2) is

$$E[S^T] = E[1 - C] = \frac{1}{2}(1 - 1/2) + \frac{1}{2}(1 - 1/4) = \frac{1}{4} + \frac{3}{8} = \frac{5}{8}$$

Uncertain cost of a future competitor, how works the market ?

How works the market at period 2 ? We analyze two decisions,



In a forward looking way. It is clear that $S2$ enters when its characteristics is better than S1 's characteristics

$$c_2 \leq P - P_0 \tag{1}$$

- When S2 does not enter, (when $c_2 \geq c_1$), S1 is free to propose any price : then $p = 1$. In that case $NS1 = 1/2$, $NS2 = 0$, $NB = 0$.
- When S2 enters (when $c_2 \leq c_1$), the best wins ... and the price is the cost of the lowest : $p = 1/2$. In that case $NS1 = 0$, $NS2 = 1/2 - c_2$, $NB = 1/2$.

Ex ante, the mean surplus of S1, S2 and B are :

$$E[NS1] = \frac{1}{2}1/2+0 = 1/4 \quad E[NS2] = 0+\frac{1}{2}*1/4 = 1/8 \quad E[NB] = 0+\frac{1}{2}*1/2 = 1/4$$

Contract as an Entry barrier

Aghion and Bolton argue that incumbents faced with entry may enter into long-term contracts with buyers so as to prevent the entry of some, but not all, lower cost producers.

Let define a contract $c = \{P, P_0\}$ being a period 1 commitment between S1 and B, on the term of period 2 trade, *before uncertainty on S2 cost has disappeared*. P is the price of the good in period 2 if there is an effective transaction between S1 and B, while P_0 is the penalty that the buyer should pay to $S1$ if he decides to buy the good to S2.

$\Rightarrow$ **Describe the situations in which S2 has still room to enter the market, and the effective prices. Compute then the surplus of** $S1$, $S2$ **and** B. **Follow up**

Looking for the optimal contract

You will in turn,

for a given contract $c = \{P, P_0\}$,
- write a condition for c_2 such that S2 can enter the market
- compute the probability that S2 enters the market
- compute the surplus of S1, S2 and B in the two cases

Then,
- analyze the objective of S1, its choice variables, its constraints
- write the program for the optimal contract
- solve the program

Then conclude your study,
- compute the *ex ante* surplus, given the optimal contract
- compare the surplus with the case without contract
- conclude in intuitive words

The conditions of entry, given $c = \{P, P_0\}$

Let suppose that the contract $c = \{P, P_0\}$ is signed (enforced)

A transaction with S2 is still possible at price p if $p + p_0 \leq P$, that is if $p \leq P - P_0$, Then S2 can enter the market if her cost is lower than this cutoff

$$c_2 \leq P - P_0 \tag{2}$$

Notice that here the entry condition of $S2$ does not depend on the cost of S1, but on the characteristics of the contract.

S2 will enter with probability $P - P_0$ proposing the maximum price $P - P_0$

Surplus
- Profit of S1 is P_0 when S2 enters, and $P - 1/2$ if she trades with B
- Buyers pays P any case, and its surplus is $1 - P$
- Surplus of S2 is $P - P_0 - c_2$, while entering

S1 's Program

The contract is designed in order to maximize the *ex ante* surplus of S1, given the participation constraint of B

- The variables of choice : P and P_0
- The *ex ante* objective of S1 : $(P-P_0)P_0+(1-(P-P_0))(P-1/2)$
- The participation constraint : $1-P \geq 1/4$, where $1/4$ is B's expected surplus without commitment.

S1 's Program is then

$$\begin{array}{rl} \max_{P,P_0} & (P-P_0)P_0+((1-(P-P_0))(P-1/2) \\ s.c. & 1-P \geq \frac{1}{4} \end{array}$$

Solving the program

First, is the constraint binding ? No clear answer a priori, the derivative of the objective function being not intuitive. Then, we follow the Lagrange 's way.

The lagrangean is :

$$\mathcal{L} = (P - P_0)P_0 + \Big(1 - (P - P_0)\Big)(P - 1/2) + \lambda(\frac{3}{4} - P)$$

which derivatives are :

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial P} &= P_0 - (P - 1/2) + \Big(1 - (P - P_0)\Big) - \lambda = 2(3/4 - P) + 2P_0 - \lambda \\ \frac{\partial \mathcal{L}}{\partial P_0} &= P - 2P_0 + (P - 1/2) \end{aligned}$$

If the constraint does not bind, then, $\lambda = 0$ and $\frac{\partial \mathcal{L}}{\partial P} > 0$, as $\frac{1}{2}\frac{\partial \mathcal{L}}{\partial P} = P_0 + (\frac{3}{4} - P) > P_0 \geq 0$, a contradiction. Then $P = 3/4$.

It follows $\frac{\partial \mathcal{L}}{\partial P_0} = 1 - 2P_0$. FOC is $P_0 = 1/2$.

$\frac{\partial U_2}{\partial P} / \frac{\partial U_2}{\partial P_0} = \frac{.75 - P + P_0}{P - P_0 - .25}$, when P increases and P_0 decreases, the MRS decreases, which is sufficient to conclude that the objective function is quasi-concave, and that $(PP, P_0) = (3/4, 1/2)$ is the solution.

Surplus

The following table compares surplus with and without the barrier :

Agents	S. without B.	Surplus with Barrier
S1	1/4	$E^2[NS1] = (3/4 - 1/2)1/2 + 3/4 * (3/4 - 1/2) = 1/8 + 3/16 = 5/16$
S2	1/8	It's probability to enter is 1/4. His expected profit, $E^2[NS2] = \frac{1}{4}(\frac{1}{4} - E[c_2\|_{c_2 \leq 1/4}]) = \frac{1}{4}\left(\frac{1}{4} - \frac{1}{8}\right) = \frac{1}{32}$.
B	1/4	$E^2[NB] = 1 - 3/4 = 1/4$, unchanged
Total	5/8=20/32	(10+1+8)/32=19/32

As we see, the barrier evicts S2 when $c_2 \in [1/4, 1/2]$, its surplus has decreased while S1 surplus has increased.

The total surplus has decreased.

discussion on the effect of contracts

The model developed above supports the argument that contracts between buyers and sellers in intermediate good industries may have significant entry-prevention effects and that such contracts may be bad from a welfare point of view.

This point is subject too many discussions. For instance,

For instance, in the case of a very complex leasing habits from United Shoe Machinery Corporation (US), Posner says

> *The point I particularly want to emphasize is that the customers of United would be unlikely to participate in a campaign to strengthen United's monopoly position without insisting on being compensated for the loss of alternative and less costly (because competitive) sources of supply"*

Mechanism depicted

- the social cost comes from the fact that sometimes they block the entry of firms that may be more efficient
- the contract sets an entry fee p_0 ;
- the contract is a coalition between S1 and B

However some question about this model could raise, particularly about the structure of the dynamics that have been developed here.

Is that Second Best ?

Definition

Optimal allocations are said second best when there are additional constraints, different from participation or ressource constraints in the economy, (like in MH or AS)

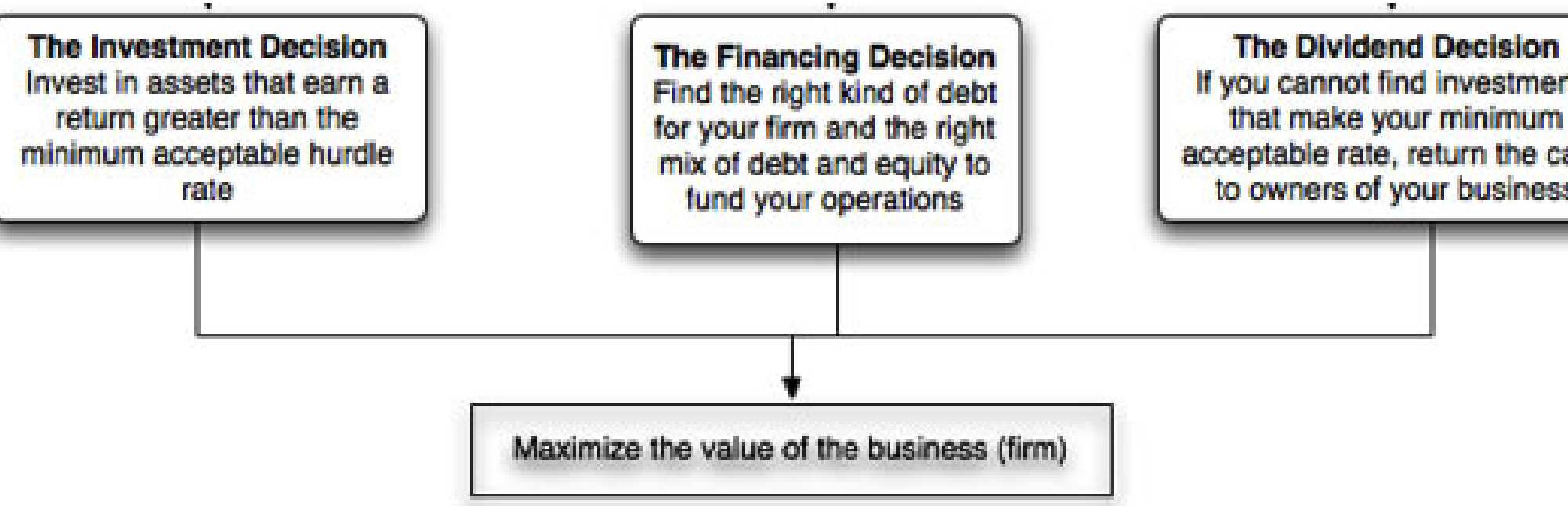
Here, we could say that the introduction of the fee, P_0 is a constraint, which is not participation neither ressource.

Another way : the second seller does not control the constraint of the economy, but second best

2. Prices, strategic interaction and mechanism in economics
How do we frame the problem ?

Projects

Any project has three steps : deciding the investment, financing the investment, the repayment for investors



Financial contracts and timing

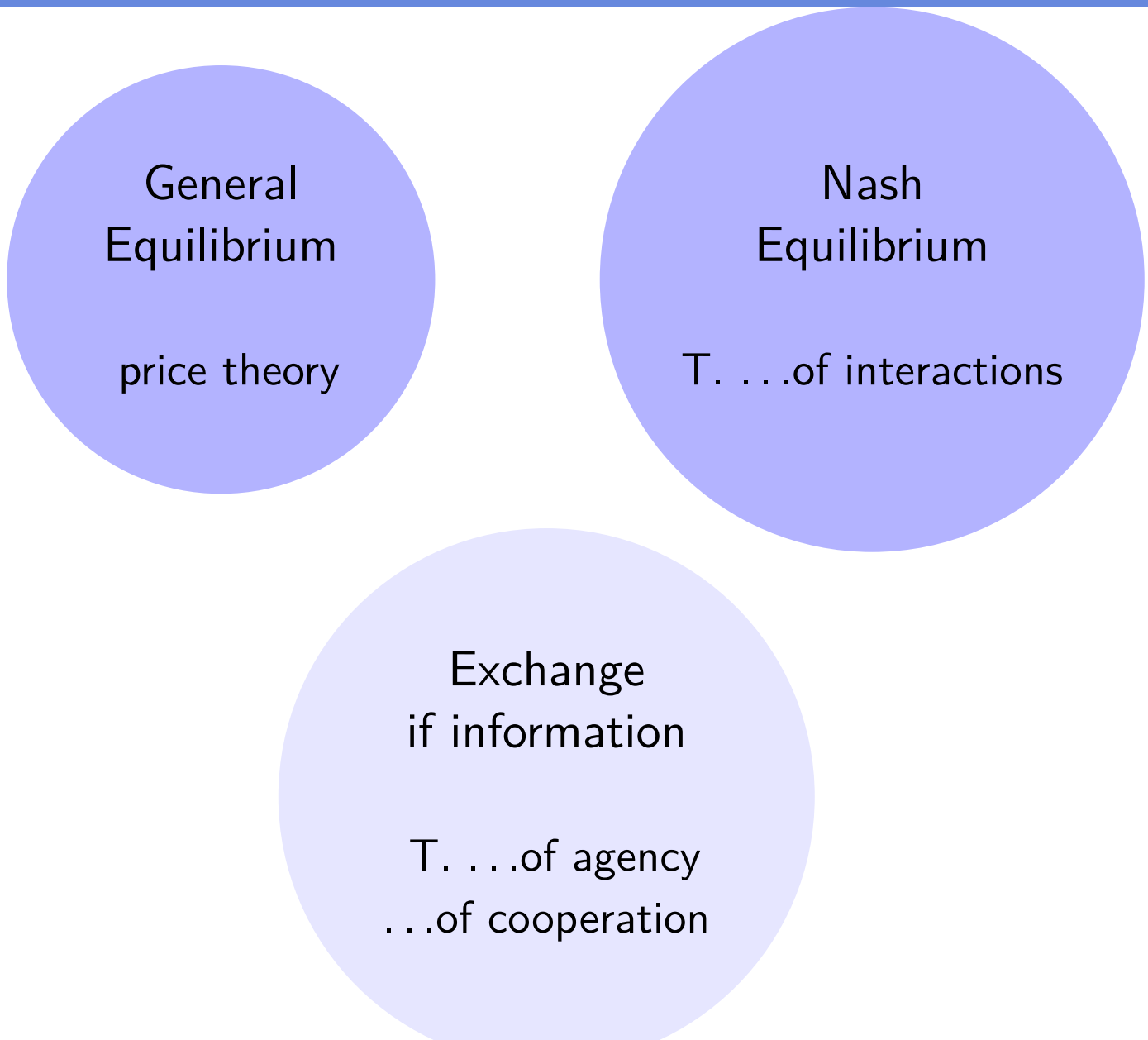
As we have seen in the example, when using contracts, the details, the way of writing contracts matters.

- What is a financial contract ?
  - a financial contrat is some commitment about one or more of the three steps of a project
- What are the determinants of financial contracts, what are the assumption about the agents ' rationality ? more precisely
  - what is the interaction between economic agents ?
  - what is the anticipations and informations that agents gather

Coming back to rationality in economics

- man behaves rationally and in a efficient way
  - Taking into account her constraints, the individual chooses the best possible objective
- *Equilibrium* describes the interaction between rational agents
  - the analysis depends on the anticipations capacities that the agents have on the rest of the economy
  - anticipations and information

Three branchs of Economis



Equilibre général

- On fait l'hypothèse en équilibre général que les décideurs poursuivent des objectifs bien définis et qu'ils prennent en compte leurs anticipations qui concernent les prix présents et à venir dans l'économie.

- On dit qu'on est à l'équilibre quand les prix sont "stables", cad quand l'offre égale la demande.

  - la valeur des actifs est celle qui équilibre les marchés
  - on considère l'équilibre sur tous les marchés (marchés des biens ET marchés financiers)
  - en particulier, il n'y a pas d'arbitrage possible $\Rightarrow$ différents moyens de financement sont équivalents
  - les prix (et les valeurs des actifs) intègrent seulement les fondamentaux du marché : les caractéristiques

Théorie des jeux

- On fait l'hypothèse en théorie des jeux que les décideurs poursuivent des objectifs bien définis et qu'ils prennent en compte leurs savoirs et leurs anticipations concernant les décisions des autres joueurs.

- On dit qu'on est à l'équilibre quand aucun agent n'a intérêt à dévier de ses choix, *de manière unilatérale*

  - c'est la définition de l'équilibre de Nash
  - 'à distinguer de toute considération d'efficacité)
  - le recours à la théorie des jeux suppose des interactions stratégiques entre les agents
  - ces interactions stratégiques apparaissent quand on prend en considération des ingrédients de l'économie autres que les fondamentaux

Anticipations, informations exogènes et endogènes

- Les décisions des joueurs dépendent des informations dont ils disposent. Quand les agents disposent d'information différentes, on distinguera généralement trois temps de cette information :

- *ignorance*	- *ex ante*	- *ex post*
Derrière le *voile de l'ignorance*, l'info. est symétrique, $\theta \in F(\theta)$	Un agent qui a un *avantage informationnel* apprend son info, θ	Le marché réagit, et souvent, conduit à *révéler* cette information privée

- Typiquement, *ex ante* les agents peuvent avoir une information privilégiée exogène, mais ils perdent cet avantage *ex post* à l'équilibre économique. L'info devient publique ou endogène.