**TOPIC 3**

1. **R&D COOPERATION AND SPILLOVERS**
2. **Motives for collaboration**
* Internalizing knowledge spillovers within the consortium
* Greater efficiency of R&D
* Greater amount of financial resources available
* Sourcing of complementary know-how
* Elimination of wasteful duplication in efforts
* Not only larger, but also more risky projects may become feasible
1. **Cooperation between**
* Horizontal
	+ Competing firms
	+ Non-competing firms
* Vertical
	+ Customers and suppliers
* Universities and public research centers
1. **Innovative environment**
* Ideas are common knowledge
* R&D investments result immediately and for sure into an innovation
* R&D investments are a form of strategic commitment
* R&D leads to spillovers which benefit other firms
* Firms may cooperate on R&D decisions to internalize spillovers
1. **D’apresmont / Jacquemin**

Situation

* 2 firms compete a la Cournot in a 2nd stage of a game
* In the first stage they can decide to invest in R&D and how much
	+ if they invest => MC decreases
	+ Spillovers => competitor benefits also

Goal of the model

* Compare 2 situations
	+ Firms behave completely non-cooperative
	+ Firms are allowed to collaborate on R&D, but still compete on product market
* Question
	+ What with total R&D in economy?
	+ What with equilibrium profits and output

Calculations

* Inverse demand function

*D-1 = p = a - bQ = a - bq1 - bq2, with a, b > 0*

* Cost function

*Ci (qi, xi, xj) = [A – xi – β xj] qi,
 with 0 < A < a, 0 < β < 1; xi + β xj ≤ A, Q <* $\frac{a}{b}$

* + β = External effect = benefits from R&D of firm j that flow without payment to firm i.
* cost of R&D

*γ* $\frac{x12}{2}$

* + γ ≥ 1
* Profit function of firm 1

*π1 = [a - bq1 - bq2] q1– [A- x1 – β x2] q1 – γ* $\frac{x12}{2}$

* Non-cooperative behavior
* Firms are symmetric => q1\* = q2\*
	+ Solve to profit
* With simplification :

*π1\*=* $\frac{1}{9b}$ *[(a-A) + (2- β) x1 + (2β -1)x2]² – γ* $\frac{x12}{2}$

x1\* = $\frac{(a-A) (2- β)}{4.5 bγ– (2- β)(1+ β)}$

* Industry Output Q\* = q1\* + q2\*

*Q\* =* $\frac{2(a-A)}{3b}$ *[*$\frac{4.5 b γ}{4.5 b γ – (2- β)(1+ β)}$*]*

* Joint profits

$\hat{π}$ *= π1\* + π2\*
 =* $\frac{1}{9b} \sum\_{i=1}^{2}\{[(a-A)+(2 – β) xi  + (2β – 1) xj]²– γ \frac{xi2}{2}\} $

* $\hat{x} $= x1 = x2

$\hat{x} $*=* $\frac{(β +1) (a-A)}{4.5 b γ– (β + 1)²}$

 $\hat{Q}= \frac{2(a-A)}{3b} $*[*$\frac{4.5 b γ}{4.5 b γ – (1+ β)²}$*]*

Conclusion

* When firms can collaborate on R&D , they internalize the external effects through joint decision on R&D investment
* Comparison between x\* and $\hat{x}$ shows that for large spillover , $β $> 0.5, the level of R&D increases when firms cooperate ($\hat{x}$ > x\*)
	+ Also $\hat{Q}$ > Q\*
* Higher industry output means lower consumer prices and higher consumer surplus
* R&D investment



* Industry Output



1. **Summary**

R&D activities with spillovers create 2 externalities

* R&D affects overall industry profits
	+ Externality increases with level of spillovers
	+ Ignored when firms choose R&D separately
	+ Internalized when firms choose R&D cooperatively
* R&D affects a firm’s competitive advantage
	+ Externality decreases with level of spillovers
	+ Present when firms choose R&D separately
	+ Internalized when firms choose R&D cooperatively

🡺 When firms behave strategically, R&D cooperation leads to more (less) R&D when spillovers are large (small)

1. **INNOVATION AND COMPETITION POLICY**
* Agreements between firms that contribute to technological progress may be permitted under EU competition law
* Block exemption for R&D cooperation if
	+ The combined market shares of the firms involved <25%
	+ No contractual restrictions on independent R&D
	+ No restrictions on the use of jointly generated knowledge
* What if R&D cooperation promotes tacit collusion in the post-innovation market
* Threat to break up R&D collaboration could be part of a punishment strategy that creates incentives for firms to restrict output
1. **R&D cooperation and product market collusion**
* What if firms extend cooperation to the product market
	+ R&D cooperation and information sharing should not necessarily be permitted
		- Public policy trade-off between market power and efficiency
		- Not clear how this trade-off balances out
* Antitrust authorities must make sure that cooperation is limited to R&D activities