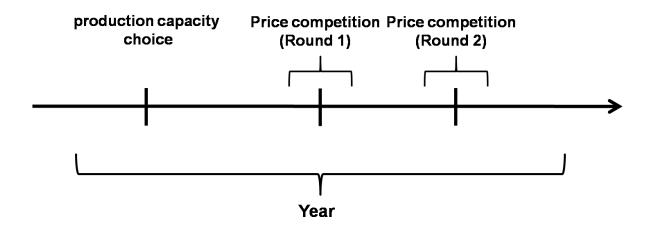
Competition Game: Price and quantity competition and CO₂ environmental policies (quotas, taxes and emission permits)

You are responsible for managing a firm selling a good whose production emits CO₂. You will play the same game against the same players on 4 completely separate markets: Actions on one market do not have any direct impact on the other markets. You can see these markets as parallel universes in which demand and production costs are the same, but environmental policies are different (this will be useful to compare outcomes of these policies). Note in particular, that goods produced on one market cannot be sold on other markets.



The timeline is separated into years. At beginning of a year, you have to choose how much to produce. Then, once every firm has decided how much to produce, production takes place and you have to choose the price at which you will sell your goods.

For pedagogic reasons and to allow you to correct potential pricing mistakes, you will play the "sales part" twice (but this does not correspond to any real-world situation). We call rounds these two sales sequences (for each round, the maximum quantity you can sell is equal to the total quantity you selected at the production stage).

Note that goods are perishable: what is not sold at the end of a round is lost.

Finally, your shareholders only leave enough cash in your firm to let you produce a maximum of 1200 goods per round on each market (note that this does not mean that producing 1200 goods is a good idea!). This constraint applies market by market.

Let's first talk about the general structure of the game and we will present the data later. Do not hesitate to play a game alone (one player, one universe) to prepare for the real game.

The Game Structure

1st year

Production choice

On the first screen, you must select production on each market.

Score *Player 1 (1)	€50,000		uction Choice -		Robot 4 (4))	
Robot 2 (2) Robot 3 (3)	€50,000 €50,000	Goods	Technology	Production Cost (€)	Production + Distribution Cost (\bigcirc)	CO2 emissions (tons) by Round
Robot 4 (4)	€50,000	1200 🖨	Techno1 -	12000	48000	132
		Market	2 , "80€ CO2 unit tax"	· · ·	S: Robot 2 (2) Robot 3 (3) Robot 4 (4	
		Market	2 , "80€ CO2 unit tax" Technology	Production Cost (€)	Production + Distribution Cost (€)	CO2 emissions (tons) by Round
				Production Cost	Production + Distribution Cost	
		Goods	Technology	Production Cost (€)	Production + Distribution Cost (€)	CO2 emissions (tons) by Round

Enter your choice, validate and check your competitors' decisions on the next screen:

airECON	lsim				Results Edit Profile	*Player 1 (1) Logout
		Production	n Choice			
Scores *Player 1 (1)	€50,000	Year 1				
Robot 2 (2)	€50,000	Market 1				
Robot 3 (3)	€50,000					
Robot 4 (4)	€50,000	Team	Production by Round	Techno	CO2 Emissions by Round	CO2 cost by Round
		*Player 1 (1)	1200	Techno1	132	€0
		Robot 2 (2)	1055	Techno1	116.05	€0
		Robot 3 (3)	1206	Techno1	132.66	€0
		Robot 4 (4)	1247	Techno1	137.17	€0
		Production each RG *Player 1 (1) Robot 2 (2) Robot 3 (3) Robot 4 (4)	ound (Total 4708 goods)	1055	1200 - Technol - Technol 1206 - Technol 1247 - Technol	
		Market 2 , "80€	€ CO2 unit tax"			
		Team	Production by Round	Techno	CO2 Emissions by Round	CO2 cost by Round
		*Player 1 (1)	1000	Techno1	110	€8,800
		Robot 2 (2)	1162	Techno1	127.82	€10.226

Sales Round

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On the next page	, you are invited to se	elect your price or	n each market:
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airECONsim				file *Player 1 (1)	
	Price Choice				
Scores *Player 1(1) €50,000	Round 1/2				
Robot 2 (2) €50,000 Robot 3 (3) €50,000	Market 1				
Robot 4 (4) €50,000	Price				
	58	0			
Market					
🌩 Market 1	Total: 4708 / Remaining: 4708 goods				
🏟 Market 2	*Player 1 (1)		1200		
🏟 Market 3	Robot 2 (2) Robot 3 (3)		1055 1206		
	Robot 4 (4)		1247		
			imeters		
		*Player 1 (1)	Robot 2 (2)	Robot 3 (3)	Robot 4 (4)
	Available Goods	1200 (Techno1)	1055 (Techno1)	1206 (Techno1)	1247 (Technol)
	Distribution Unit Cost (variable, not paid yet)	€30	€30	€30	€30
	Production Unit Cost (fixed, already paid)	€10	€10	€10	€10
		*Player 1 (1)	Robot 2 (2)	Robot 3 (3)	Robot 4 (4)
	Fixed Costs over the Round (excluding CO2)	€20,000	€18,550	€20,060	€20,470
	CO2 Fixed Cost over the Round	€0	€0	€0	€0
	CO2 emissions (tons)	132	116	132.7	137.2
	CO2 emissions by good (tons)	0.11	0.11	0.11	0.11

Enter your prices Check your sales results. Remember that goods are perishable: unsold goods are lost (here, 128 goods for team 1).

airECONsim				rofile *Player 1 (1) Logout
*Player 1 (1) €105,520	Round 1/2				
Robot 4 (4) €93,633 Robot 3 (3) €84,071 Robot 2 (2) €81,985	Market 1				
	Total: 4716 / Unsold: 128 goods				
Back To Previous Decision	*Player 1 (1)	1072	(€70)		128
	Robot 2 (2)		1201 (€55)		
Market	Robot 3 (3)		1184 (€60)		
🌣 Market 1	Robot 4 (4)	Resul	1131 (€60)		
🌣 Market 2		*Player 1 (1)	Robot 2 (2)	Robot 3 (3)	Robot 4 (4)
Market 3	Price	€70	€55	€60	€60
Warket 5	Sales	1072 / 1200	1201 / 1201	1184 / 1184	1131 / 1131
	Sales at "halftime"	411	710	583	569
	Total Production	1200 (Techno1)	1201 (Techno1)	1184 (Technol)	1131 (Technol)
		*Player 1 (1)	Robot 2 (2)	Robot 3 (3)	Robot 4 (4)
	Revenue since beginning of Round (excluding CO2 and exceptional)	€75,040	€66,055	€71,040	€67,860
	Fixed Costs over the Round (excluding CO2 and exceptional)	€20,000	€20,010	€19,840	€19,310
	CO2 Fixed Costs over the Round	€0	€0	€0	€0
	Variable Costs over the Round	€32,160	€36,030	€35,520	€33,930
	CO2 emissions (tons)	132	132.1	130.2	124.4
	Profits over the Round (excluding CO2, slots and excentional)	€22,880	€10,015	€15,680	€14,620

2nd sales round

We start a new round and play the sales phase once more (understand that we are only doing once more exactly what we did in the previous round. This is not supposed to represent any "real-world" phenomenon, it is just intended to allow you to correct potential mistakes) \rightarrow once again, you have as many goods to sell on markets as you had in the beginning of the 1st round.

Note that you can find all the past results, by clicking on "results" in the topbar.

airECONsim				rofile *Player 1 (1) Logout	
*Player 1 (1) €105,520	Kounu 2/2					
Robot 4 (4) €93,633						
Robot 3 (3) €84,071	Market 1					
Robot 2 (2) €81,985	Price					
	70	0				
Back To Previous Decision						
Market	Total: 4716 / Remaining: 4716 goods					
Market	*Player 1 (1)		1200			
🍄 Market 1	Robot 2 (2)		1201			
🌣 Market 2	Robot 3 (3) Robot 4 (4)		1184			
🌣 Market 3	Parameters					
		*Player 1 (1)	Robot 2 (2)	Robot 3 (3)	Robot 4 (4)	
	Available Goods	1200 (Techno1)	1201 (Technol)	1184 (Techno1)	1131 (Techno1	
	Distribution Unit Cost (variable, not paid yet)	€30	€30	€30	€30	
	Production Unit Cost (fixed, already paid)	€10	€10	€10	€10	
		*Player 1 (1)	Robot 2 (2)	Robot 3 (3)	Robot 4 (4)	
	Fixed Costs over the Round (excluding CO2)	€20,000	€20,010	€19,840	€19,310	
	CO2 Fixed Cost over the Round	€0	€0	€0	€0	
	CO2 emissions (tons)	132	132.1	130.2	124.4	
	CO2 emissions by good (tons)	0.11	0.11	0.11	0.11	

2nd year of the game

For each market, you have information displayed, reminding you about previous year's productions, prices, sales and profits (green bars).

airECONsim				*Player 1 (1) Logout
Robot 3 (3) €138,488	Goods Technology	(€)	(€)	Round
Robot 2 (2) €112,222	1200 🖈 Techno1 -	12000	48000	132
Back To Previous Decision	Last Year Capacities and Sales Round 1 (Total 4716 / Unsold : 128 good:	5)		
	*Player 1 (1) Robot 2 (2)		1072 (€70)	128
	Robot 2 (2) Robot 3 (3)		1201 (€55) 1184 (€60)	
	Robot 4 (4)		1131 (€60)	
	Profit on the market (no market or CO2 cost)			
	*Player 1 (1) €30,880 Robot 2 (2) €18,015 Robot 3 (3) €23,680 Robot 4 (4) €22,620			
	Round 2 (Total 4716 / Unsold : 247 good	s)		
	*Player 1 (1)		1134(€70)	66
	Robot 2 (2)		1201 (€56)	
	Robot 3 (3)		1101 (€71)	83
	Robot 4 (4)		1033 (€72)	86
	Profit on the market (no market or CO2 cost)			
	*Player 1 (1) €33,360			
	Robot 2 (2) €19,216			
	Robot 3 (3) €33,301 Robot 4 (4) €32,076			
				-

The game is repeated and lasts 3 years.

Game Data:

Demand

If you and each of your competitor all set the same price on a market, each firm will sell, on average, about:

Price	40	45	50	55	60	65	70	75	80	85	90
Sales/firm	762	727	694	663	633	603	575	548	522	496	471

Demand is proportional to the number of firms in the game (and is the same as in the other competition games on economics-games.com. Be careful, the game has common features with other games you can find on our other site, lud.io, but demand is quite different).

As you will see, products are slightly differentiated and customers have different brand preferences... (There is also some random in the customer's characteristics): The cheapest firm will usually not get the whole demand.

Consequently, because of price differentiation, demand estimates displayed above can only be used to get information about orders of magnitude.

Costs

A firm must pay ≤ 15 for each good produced, and then ≤ 4 for each good sold. Each good produced « emits » 0.5 tons of CO₂ (CO₂ emissions are hence completely determined by choices at the production phase).

Unit production cost, c1	Unit distribution cost, c ₂	CO ₂ emissions (tons) per good produced
€15	€4	0.5

Environmental policies

Finally, note that environmental policies differ on each market.

- Market 1 is a benchmark market, there is no environmental policy.
- On market 2, there is a CO₂ environmental tax equal to €40 for each ton of emitted CO₂
- On market 3, there are (non-tradable) quotas. A firm cannot emit more than 300 tons of CO₂ by round (or 600 tons by year)
- Market 4 is regulated with CO₂ emissions permits. Each year, each firm receives 600 permits for free (that is, 300 permits for each round). With a permit, a firm can emit one ton of CO₂ at no cost. If a firm emits more CO₂ than it has permits, it must buy permits at a price of €40 for each exceeding ton of CO₂. If it emits less CO₂ than it has permits, it will be able to sell unused permits at a price of €40 each.

Note that for a ≤ 40 unit tax for each ton of CO₂, producing 1000 goods costs $\leq (15+0.5*40)*1000$, i.e. ≤ 35000 . If firms all decide to produce 1000 goods, they will find themselves in the same situation as in one of the markets of the first competition game of economics-games.com (Impact of fixed costs and capacity constraints on price and profits, with differentiated goods).