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Environmental Trading Game

Introduction

- Emissions trading is a market mechanism used to control the amount of pollution being emitted.
- Emissions trading schemes are in action worldwide, the largest is the European Union ETS.
- New Zealand's ETS currently includes foresters, industrial emitters, fuels, and energy generators.

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Introduction – New Zealand's ETS

- New Zealand's ETS currently includes foresters, industrial emitters, fuels, waste, and energy generators.

- Agricultural emitters (farmers) are planned to be included from 2015.

- The point of obligation is currently planned to be at the processor level, but ideally will be at the farmer level.

Introduction

- This game was developed to give people an understanding of the basic concepts behind nutrient trading.

- It demonstrates a simplistic textbook trading system where the economy consists of one sheep/beef farm and one dairy farm.

- It demonstrates how the ETS would work if the point of obligation was at the farm level.

Format

- In each period, you will need to decide on a production level that will maximise your profit given the regulatory state.

- Three possible regulatory states:
  - No nutrient regulation
  - Nutrient limits
  - Nutrient trading

Game Setup Basics

- Please form small groups of two or three people.
- Sheep/beef farm please pair up with a dairy farm.
- Please keep the handout information within your own group - don’t show the sheet to the other group.

Assumptions

- Your farms are the only sources of pollution in the economy.
- Your goal is to maximise profit by choosing how much to produce, while complying with regulations.

The Production Schedule (1)

- Your handout has a production schedule similar to this one.
- This is an example, whose numbers are different from your schedule.

Meat produced	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Profit from meat production	-$10	$0	$9	$12	$20	$22	$24	$23
Nutrients	0	2	3	4	5	6	7	8

The Production Schedule (2)

- If you reduce production from 3 to 2, your profit reduces $12-$9=$3, and your farm's pollution reduces by one.
- If you increase production from 3 to 4, your profit increases $20-$12=$8, and your farm's pollution increases by one.

Meat produced	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Profit from meat production	-$10	$0	$9	$12	$20	$22	$24	$23
Nutrients	0	2	3	4	5	6	7	8

Comparison

- We will use this table to compare the three regulatory states.

	Total profit	**Sheep/beef nutrients**	**Dairy nutrients**	**Total nutrients**
No regulation				
Nutrient limits				
Nutrient trading				

Scenario 1

- Decide on your production level under no regulation.

Under no regulation	**Meat produced**	**Profit**	**Nutrients**

Scenario 1

- To maximise profit:

Farm type	Production	Profit	Nutrients
Sheep/beef	8 units	$27	7 units
Dairy	8 units	$27	11 units
Total	--	$54	18 units

Comparison: After Scenario 1

	Total profit	**Sheep/beef nutrients**	**Dairy nutrients**	**Total nutrients**
No regulation	$54	7 units	11 units	18 units
Nutrient limits				
Nutrient trading				

Scenario 2

- Decide on your production level with regulations in place to reduce pollution from nutrients.
  - Each farm may emit 6 nutrient units.
- Trading is not allowed.

With regulation limiting nutrients	Meat produced	Profit	Nutrients

Scenario 2

- To maximise profit:

Farm type	Production	Profit	Nutrients
Sheep/beef	7 units	$26	6 units
Dairy	3 units	$14	6 units
Total	--	$40	12 units

Comparison: After Scenario 2

	Total profit	**Sheep/beef nutrients**	**Dairy nutrients**	**Total nutrients**
No regulation	$52	7 units	11 units	18 units
Nutrient limits	$40	6 units	6 units	12 units
Nutrient trading				

Scenario 3

- Trading system introduced.
  - Farms are allocated 6 allowances each.
- Please start negotiating with your pair farm.
  - Work out how much you are willing to pay to buy allowances and how much you would need to be paid to sell allowances.
- Note: Be sure to compare your profit before and after the trade before finalising the trade.

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Example trade

- If this farmer were producing 6 units a year and allocated 3 allowances, she would make $5 more profit from production by buying an extra allowance. She would be better off if the allowance cost less than $5.
- In what circumstances would the allowance seller also be better off?

Meat produced	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Profit from meat production	-$12	-$1	$8	$14	$19	$24	$28	$26
Nutrients	0	1	2	3	4	5	6	7

Scenario 3

- Decide on your production level with a nutrient trading system in place.

Under a nutrient trading system	Meat/ milk produced	Allowances bought/sold	Allowance cost/revenue	Profit	Nutrients

Discussion

- Who managed to undertake a trade?
- Who was the buyer/seller?
- How many allowances did you trade?
- How much did you increase your profit by?

Scenario 3 (Again)

- The world starts afresh with the same conditions as before.
- Trade again with another group. Can you increase overall profit?

Under a nutrient trading system	Meat/ milk produced	Allowances bought/sold	Allowance cost/revenue	Profit	Nutrients

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Discussion

- Who managed to undertake a trade?
- How many groups who didn't made a trade last round achieved a trade this time?
- How many groups didn't trade this time when you did last round? Why?
- How much did you increase your profit by relative to the nutrient limit case?
- Who made more profit than last round?

Scenario 3

- The optimal trade occurs when sheep/beef farmers sell 2 allowances to dairy farmers.

Farm type	Production	Profit	Nutrients
Sheep/beef	5 units	$29*	4 units
Dairy	5 units	$17*	8 units
Total	--	$46	12 units

* Exact profit split depends on individual negotiations.

Comparison: After Scenario 3

	Total profit	**Sheep/beef nutrients**	**Dairy nutrients**	**Total nutrients**
No regulation	$54	7 units	11 units	18 units
Nutrient limits	$40	6 units	6 units	12 units
Nutrient trading	$46	4 units	8 units	12 units

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Important Lessons

- Trading itself does not affect environmental outcomes.
- Limiting nutrients can improve environmental outcomes but reduce profitability.
- Trading can reduce the costs of meeting a target.

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Extensions

- What are some of the problems of shifting this type of system into the real world?
- How does allowance trading affect firms' inclinations to invest in more environmental friendly technology relative to non-trading regulation?
- Could limiting nutrients allow a business to continue as usual, or perhaps become more profitable? Could nutrient trading?