

# Efficient Market Adaptation to Climate Change

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**IAEA**

International Atomic Energy Agency

# Overview

1. Introduction - typology
2. Efficient market adaptation
3. Market failures and regulation
4. Fostering efficient market adaptation
5. Conclusions

# 1. Introduction - typology

	Efficient	Non-efficient
Market	***	**
Non-market		

# 1. Introduction - typology

Sector	Human intervention	Market dom.
Agriculture	Very strong	Strong but reg
Forestry	Strong	Mixed but reg
Health	Very strong	Mixed: PH-priv dec
Water	Very strong	Mixed: flood-market
Settlements, industries	Very strong	Strong, but reg (energy sector)
Ecosystem	Weak	Non-exist – weak
Coastal Z	Varies (Dvd-Ding)	Varies
GeophysS	Non-existent	Non-existent

## 2. Efficient market adaptation

A - Step 1 – back to basics

Static deterministic firm model: single product, fixed price, NR + other variable inputs:

Prod fn:  $y = f(x_k, x_j)$

Output, price  $P$ , from  $x_k$  variable input (labour, fertilizer, ...),  $x_j$  flows from nat.res (land, water,..)

Positive, non-increasing marginal product

Direct profit fn:  $\pi$

$$\pi = Pf(x_k, x_j) - v_k x_k - c_j x_j ;$$

factor price  $v_k$ , resources input flow cost:  $c_j$

## 2. Efficient market adaptation

Profit max – first order conditions:

$$\frac{\delta\pi}{\delta x} = 0 \rightarrow P \frac{\delta f(.)}{\delta x_k} = v_k ; P \frac{\delta f(.)}{\delta x_j} = c_j$$

CC: affects prod fn  $\rightarrow$  adjust input use to restore FOCs to maximize profits;

Cost of CC to firm =  $\pi$  after -  $\pi$  before

Simple framework, can be extended to include:  
joint products, externalities, capital stock, etc.

## 2. Efficient market adaptation

A - Step 2: But firms: multiple products

Profit function:

$$\pi = \sum_i P_i f_i(x_{ik}, x_{ij}) - \sum_i v_k x_{ik} - \sum_i c_j x_{ij}$$

Subject to:  $\sum x_{ij} \leq b_j$  for all  $j$

CC: affects all prod.functions  $\rightarrow$  adjust portfolio of outputs to maximize  $\pi$ ;

CC damage to firm:  $\pi$  before  $- \pi$  after

So far: firms face exogenous prices

## 2. Efficient market adaptation

A - Step 3: Indirect adaptation

all farmers/firms adapt → domestic prices change

Firms respond to new relative prices:

tatonnement → new domestic arrangements

Model: national FAgMs; partial equilibrium

A - Step 4: Indirect adaptation – 2

CC impacts in other countries:  $Q_s + P_s$  change

→ [depending on trade regime] imports/exports:

→ response by domestic farms/firms

Model: internat/global FAgMs; PA (IIASA:BLS)

Point: even if no direct CC affect, need to adapt

## 2. Efficient market adaptation

B Consumers – in steps 3 and 4 of A

+ Rel. prices change (CC, Adapt) → demand ch

+ Changes: tastes, preferences, lifestyles, trendy

= additional factors for farms/firms to respond to

Model: GE framework; but: prod.fn very simple

So far: EffMarketAdapt (prod/cons max; GE)

Reality: no perfect markets;

esp. in climate-sensitive sectors (ag, water,

health)

### 3. Market failures and regulation

C In A:

- externalities (pollute) + policies to control them: standards, taxes, markets (tradable quotas)
- public goods (food sec) + policies to encourage
- socecon objectives: farm employmt, rural devt subsidies (crop, land, lump sum, anything)

Local-national-internat (EU CAP): subsidies  
(NAM+EU: USD 1Bn/day, closer to 2Bn today)

→ divert rel.prices from market → firms to follow

### 3. Market failures and regulation

D In A Step 4: trade distortions

Tariffs, quotas: further rel.price distortions →  
firms to adjust

Doha round: outcome still uncertain, but:  
it will affect trade flows → conditions for adaptat.

Point: CC + other drivers will change  
→ complex DM: need models to assess:

Prod.fn-sector-nation-internat-global:

Possibly drawing on each other:



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reduced form up; constraints down

### 3. Market failures and regulation

E) Real complexities:

Ag in mitigation: soil carbon, biofuels →  
twin products; larger prod.portfolio but also:  
deeper interaction with energy markets

So far: models explore biofuels and crop interactions, but ignore CC impacts and adaptation

## 4. Fostering efficient market adaptation

Existing policy distortions: limit EffMa-adaptation

Public policy: understand impacts + desirable adaptation → change current policies to increase room for EfMa adaptation

Others:

- information about CC, impacts, options (also reduces inequity), observed responses
- public good assets: know-how (agronomic techniques), varieties (if private insufficient)

## 4. Fostering efficient market adaptation

**Sectoral** policies: ag. incomes, employment, resource protection, env. quality, etc.

**National** objectives: food security - self-sufficiency; export earning, rural development

**Internat.** agreements: bilateral, regional (EU, NAFTA), global – trade, environmt (water, CC):

CC impacts will affect policies—policies will affect CC adaptation options, costs, efficiency

E.g., EU: post-2013 budget + CAP reform;

E.g., Doha and beyond: boundary conditions for private A – EffMarket A → models needed

## 5. Conclusions

Leave to markets all adaptations that they can handle efficiently

Create new markets where they are missing for effective adaptation

Correct market failures in A: equity, externalities  
Regulate adaptations where markets fail or cannot be created

Mixed cases (most): rely on markets to achieve regulatory objectives in adaptation

Provide public goods: information, R&D, etc.

**Thank you ...**