Climate-Conscious Consumers and the Buy, Bank, Burn Program

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- The paper I present today is published in 2009, Nature Climate Change, 9: 431 – 433
- Gerlagh & Heijmans, *Climate-conscious consumers and the buy, bank, burn program*

Motivation


European Commission
EU EMISSIONS TRADING SYSTEM
FOR CITIZENS, BUSINESS & THE CLIMATE
below 2°C
Paris COP21
Reducing emissions by
at least
40%
EU wide
in
-43%
EU ETS

EU ETS: Genesis

- Idea (back to Coase): the cheapest way to achieve a given amount of emission reduction is to let firms sort out who does what by trading abatement/emissions.
- Inspired (partly) by the US acid rain program, the EU decided to create an Emission Trading System, a market for CO_2 emission rights: EU ETS.
- EU ETS to date covers about 45% of European carbon emissions.
- Regulated firms can freely trade allowances in *two* dimensions:
  - Between firms
  - Over time – allowances not used today are stored in the 'Bank'

Meet a household

- A household (mom + dad + 2 kids) has flown from Tilburg to San Francisco
- Emissions due to this flight are 40 tonnes of CO_2
- The household is climate-conscious and wants to make up for these emissions
- What to do?

Costs and Trade-offs

- There are three ways to compensate for the emissions of the flight:
  1. Abate h at home against (perceived) cost of $c(h)$, e.g. install photo-voltaic cells;
  2. Buy offset f at some well-established project, at price ψ, e.g. let KLM plant trees.
  3. Buy and 'burn'(=write off) k allowances out of the ETS, so emissions by regulated industries decline. The price of allowances is p. In old EU ETS, total emissions E admit: $dE/dk = -1$.
- The household faces a simple program:

$$\min_{h,f,k} \quad c(h) + \psi f + pk \tag{1}$$

$$\text{s.t.} \quad h + f + k = 40. \tag{2}$$

- Solution: do as is cheapest.

Efficiency

The household faces a simple program:

$$\min_{h,f,k} \quad c(h) + \psi f + pk \tag{3}$$

$$\text{s.t.} \quad h + f + k = 40. \tag{4}$$

Solution: do as is cheapest.

Result

Competition between offset projects and the ETS lead to about equal marginal costs of abatement for offset projects and ETS-regulated firms: $\psi \approx p$.

Buy and Burn

- Suppose that $p = €20$ and our household decides buying allowances is the way to go
- Thus, 40 allowances have to be bought
- The household ends up paying $€800$
- The cost of installing pv cells would (including gains from lower electricity bills) would amount to roughly €8000 in the Netherlands – a factor 10 higher!

EU ETS: Early struggles

The EU ETS has been plagued by problems from its very starts

- Inefficiently low allowance prices (€5 per ton CO_2, or 1 cent per liter of petrol)
  - Provides no incentive to adopt clean technologies
  - (Partly caused by green EU subsidies)
- Extremely volatile allowance prices
  - Dis-incentive to invest in green technologies
- Huge Bank
  - By 2013, more than the yearly auctioned volume of allowances
  - Clear sign too many allowances in the market
- Waterbed effect
  - National climate policies completely ineffective

EU ETS: MSR first attempt

The EU realized something had to be done. It took a couple of measures. It created the

- Market Stability Reserve (MSR)
  - When bank too large (>833 $MtCO_2$), net year fewer permits are auctioned (24%, 12% of bank, as of May 2021) and instead placed in MSR.
  - In later years, when the Bank has shrunk (<400 $MtCO_2$), MSR-permits fed back into system (100 $MtCO_2$).

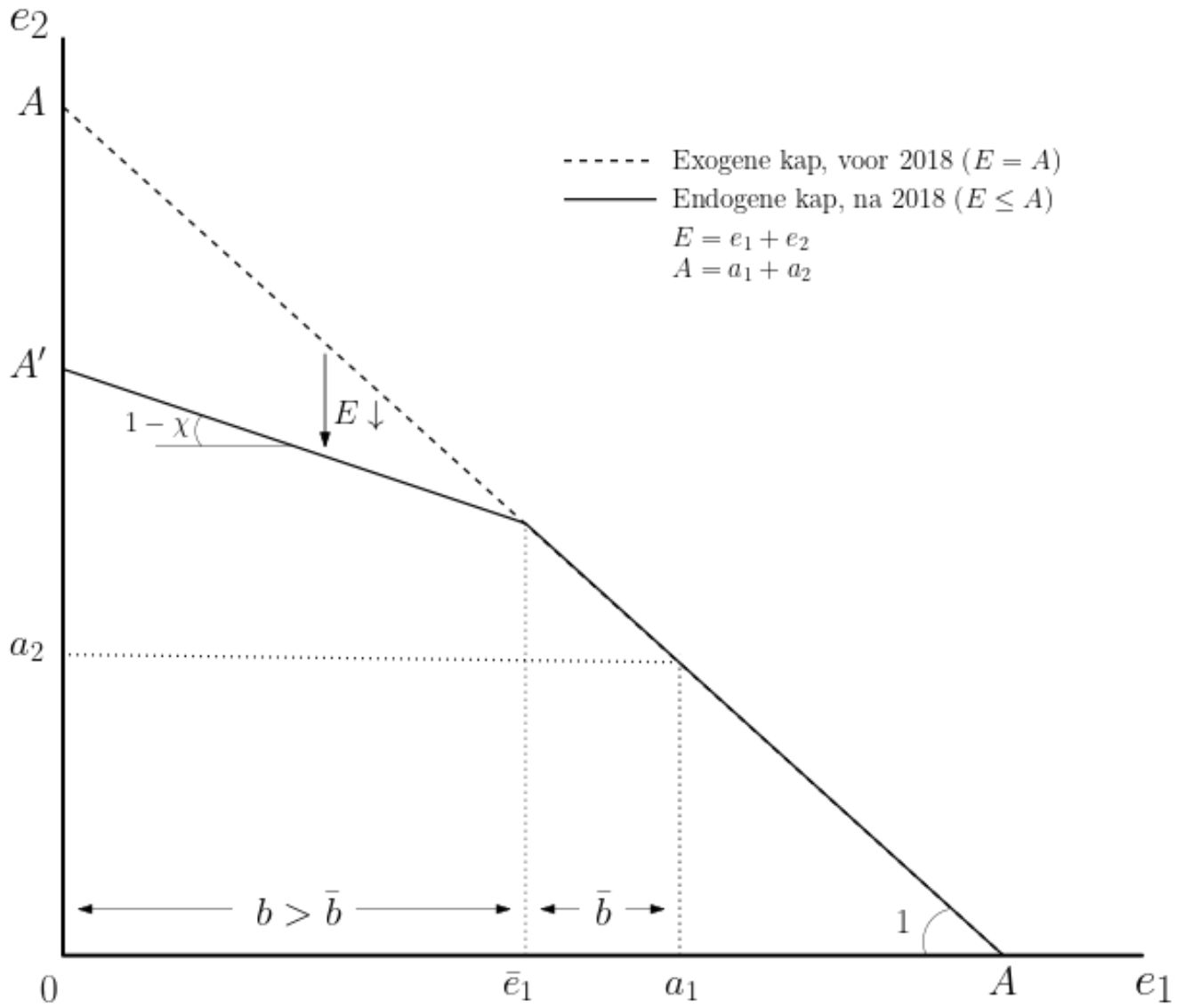
These measures clearly don't do much to resolve the existing issues; after all, cumulative supply is still fixed.

EU ETS: Exodus

The EU realized something better had to be done.
Approved Feb 2018 by EU parliament:

- When MSR becomes too large (larger than volume of auctioning in previous year), part of MSR will be canceled completely: forever gone.
- This way, supply *endogenous* to demand (in a downward direction)!

Simple graphical illustration (2 periods)



New (ETS) rules, new problems

- New mechanism constitutes a welfare gain (Gerlagh and Heijmans 2018)
  - It clearly resolves low and volatile price, waterbed effect, large bank
- In NCC paper, we show that the stabilization mechanism distorts the interaction between ETS regulated and non-regulated markets.
- In short: one problem solved, another created.

New Rules

- Under the new EU ETS rules, a Buy and Burn program is less effective:

$$\lambda \equiv -\frac{dE}{dk} : \lambda < 1. \tag{5}$$

- This is because burning an allowance is perceived by the system as an increase in *current* demand $\rightarrow$ banking of allowances goes down $\rightarrow$ fewer emissions enter MSR $\rightarrow$ fewer emissions are cancelled in MSR $\rightarrow$ more emission allowances are issued cumulative over time.
- Using estimates from Perino (2018), we can calculate the direct effect of increased demand on increased cumulative auctioning to be about 80%. The general-equilibrium effects are then a response of 65%.
- This means $\lambda = 1/3$
- What does that imply for the household?

Buy and Burn, Part II

- This changes the cost minimization program to:

$$\min_{h,f,k} \quad c(h) + \psi f + pk \tag{6}$$

$$\text{s.t.} \quad h + f + \lambda k = 40 \tag{7}$$

- If using the ETS, to compensate 40 tonnes of emissions, the household must now buy and burn $k = 40/\lambda = 120$ allowances

Decisions, Part II

- Suppose the allowance price is still $p = €20$.
- In order to reduce emissions in the ETS by 40 tonnes, the household now has to buy $40/\lambda = 120$ allowances!
- At $€20$ apiece, this implies a cost of $€2400$ to the household
- It may well decide to cut down on carbon burning!
- They may install some pv cells instead, or if that's too expensive, cut down on compensation altogether
- Competition between offset projects and the ETS imply $p < \psi \approx p/\lambda$
- The new rules distort abatement efforts: too much efforts in non-regulated projects

Buy, Bank, Burn

- Now imagine a situation where the household buys allowances but instead of being buried, these allowances are banked, and burnt in say 2030.
- Buy-Bank-Burn an allowance is perceived by the system as an increase in *future* demand $\rightarrow$ banking of allowances goes up $\rightarrow$ more emissions enter MSR $\rightarrow$ more emissions are cancelled in MSR $\rightarrow$ fewer emission allowances are issued cumulatively
- If k^* allowances are bought-banked-burnt, it can be shown that:

$$\lambda^* \equiv -\frac{dE}{dk^*} : \lambda^* > 1. \tag{8}$$

- Using Perino (2018)'s estimates we can derive $\lambda^* = 5/3$

Decisions, Part III

- This household's program is now as follows:

$$\min_{h,f,k} \quad c(h) + \psi f + pk \tag{9}$$

$$\text{s.t.} \quad h + f + \lambda^* k = 40 \tag{10}$$

- To remove 40 tonnes of emissions from the ETS, the household need now buy and burn $40/\lambda^* = 24$ allowances only!
- Again, we assume $p = €20$.
- This means the cost of compensation through the B^3 program are only $€480$.
- Competition between offset projects and the ETS imply $\psi < p \approx \lambda\psi$
- The new rules distort abatement efforts: too much efforts for regulated firms

Virtue at the Cost of Others

- How can it be the household need only buy 24 tons in allowances for a total reduction of 40 ton?
- Somebody else abates the remaining 16 ton!
- In this case, those are the regulated industries.
- These also pay the price of €320 for it.
- (Note that the regulated firms had nothing to do with this flight.)
- Our household is virtuous at the cost of others

Conclusions: distorted inside-outside ETS incentives

- New MSR rules imply that typical buy & burn is less effective for non-ETS agents who want to contribute to emissions reductions
- But that buy, bank & burn leverages the effect above 100%
- That is, new MSR rules will induce strategic carbon burning, and distort the ETS-non-ETS linkages.
- While firms in the ETS can reduce individual emissions at marginal costs p, those outside the ETS can reduce aggregate emissions at marginal costs $p/\lambda < p$.