Avoiding collusion and market power

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Auctioning carbon allowances in the ETS
DG Environment Brussels
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http://www.electricitypolicy.org.uk
The argument

• Markets to examine for market power
  – EUA market
  – electricity markets
  – gas markets

• EUA price affects electricity & gas prices
  – who has incentive to influence EUA price?
  – Who has ability to do so?

• Effect of quantity limit on gas market power
  => Stabilising EUA price desirable
Surplus EUAs collapse market


- Futures Dec 2007
- OTC Index
- Second period Dec 2008

Start of ETS

Second period

Euro/t CO2

1-Oct-04 31-Dec-04 1-Apr-05 1-Jul-05 30-Sep-05 30-Dec-05 31-Mar-06 30-Jun-06 29-Sep-06 29-Dec-06 30-Mar-07 30-Jun-07 28-Sep-07 28-Dec-07
Emission projections – large utilities
is there a risk of price collapse?

Electricity price rise higher than gas cost increase

Clean spark spread UK (50% efficient) monthly averages (profitable hours only)
Relevant markets and actors

- EUA: traders, speculators - too small
- Electricity wholesale market: generators
- Gas wholesale market: those controlling access to markets, gas suppliers, integrated gas+electricity companies

*Only relevant if actors have ability to influence relevant price*
Transit pipelines comprising the East-West and Benelux-Italy axes

100% booked until 2022

99% sold until 2015


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Brussels 22/2/08
Most congested pipelines: largely sold out until 2015

Transit pipelines deny access

Refusals of capacity left the pipeline under-used

Source: Energy Sector Inquiry 2005/2006 fig 27
Price formation in 6 EU countries 2003-5

![Chart showing price formation in 6 EU countries from 2003 to 2005.](chart)

- **BE**: Belgium
- **DE**: Germany
- **ES**: Spain
- **FR**: France
- **NL**: Netherlands
- **GB**: United Kingdom

The chart illustrates the price formation across these countries from 2003 to 2005, with different colors representing different components of the price structure.
Incentives in electricity market

• Allocation of amount (large) $E$:
  – generators benefit from raising EUA price $p_C$ :
  – $p_C \uparrow$ price of elec $p_e \uparrow \Rightarrow E p_C \uparrow$
  – Buy EUAs, burn coal, raise price of gas

• No allocation to ESI, full auctioning:
  – $p_C \uparrow$ benefits gencos with more infra-marginal fuel
    • Hydro, nuclear, gas if coal at margin, coal if gas at margin
  – $p_C \downarrow$ benefits gencos with less infra-marginal fuel

Evidence of more market power one way or other?
Impact on fuel choice

- CO$_2$ content of coal twice CCGT
- coal generation costs rise more than CCGT

*Does it matter?*
Fuel choices in UK electricity generation

- Gas cheaper than coal
- Coal 38%, gas 50%
- Coal cheaper than gas
- Coal 34%, gas 55%

- Gas price Euros/MWh
- Coal price Euros/MWh

- fuel +EUA
- Fuel post ETS
- fuel pre-ETS
Impact of ETS on gas pricing

• Suppose gas price increases
  – initially: demand falls (fuel switch gas => coal)
  => demand for EUAs rises => EUA price ↑
  => partially offsets advantage of coal
  => offsets some demand reduction for gas
  => reduces elasticity of demand for gas
  => increases market power of gas suppliers
  • EU Sector Inquiry finds gas market power
Demand for gas

Price of Gas $g$

Demand for gas if EUA price constant

Demand for gas if EUA price varies

EUA price rise induces some switch back to gas

Price rise

Initial demand fall (gas-coal)

Demand for gas in ESI
Impact of ETS on gas elasticity

• reduces absolute value of price elasticity of demand for gas

=> increases market power

• Lerner Index \( \frac{(p-c)}{p} = \frac{\alpha_i}{\varepsilon} \) where \( \alpha_i \) is market share of firm, \( \varepsilon \) is market demand elasticity (or \( \frac{(p-c)}{p} = \frac{1}{\varepsilon_{rd}} \) where \( \varepsilon_{rd} \) is elasticity of residual demand)
Policy implications

Fixing EUA quantity amplifies gas market power

=> delink EUA and gas prices

Stabilise \( CO_2 \) price

Can this be done by managing auctions?

Any other reasons for stabilising price?
Fixing prices or quantities?

- Aim is to mitigate climate change
  => improve efficiency & investment in low-C
- helped by stable CO$_2$ prices
- fixing quantities destabilises price
  => cost of errors higher if marginal cost of abatement steeper than marginal benefit

*Stabilise CO$_2$ price*
 Costs of errors setting prices or quantities

- Correct MC
- MC
- Best estimate of Marginal cost of abatement
- MB, Marginal benefit from abatement
- Efficiency loss from quota
- Efficiency loss from charge

£/tC

Q*
Q

Reductions in emissions
The case for price stabilisation

• CO$_2$ is a stock pollutant
  – CO$_2$ damage today effectively same as tomorrow
  => marginal benefit of abatement essentially flat
  – marginal cost of abatement rises rapidly
  – CCS, other renewables expensive now
  – support RD&D first, commercial deployment later
Auctions to stabilise price

- Decide on EUA price ceiling and floor
  - depends on cost of reducing CO$_2$
  - €15-20/t CO$_2$ for nuclear, wind?
- Set number EUAs to auction to achieve this
  - combined with banking and trading
  - allows ceilings and floors to be adjusted

ReQUIRES single centralised auction
Summary of interactions with gas

- present ETS imposes a quantity constraint
  - Destabilises CO$_2$ price
  - Makes gas demand less price sensitive
  => enhances market power of gas producers
- stabilising price better than fixing quantity
  - stock pollutant - damage insensitive to date
  => auction EUAs to stay within ceiling & floor
  - Stable predictable price good for investment
  - Delinks gas and CO$_2$ prices, reduces market power
Conclusion

• EUA market large, liquid, durable
  – Traders and speculators unlikely to be problem
• Some elec and gas co.s have market power
  – EUA price affects electricity price and gas WTP
• Some co.s may have incentive & ability to influence EUA price
  – Reduced by auctions for electricity
  – Reduced if EUA price delinked from gas price or gas market made more competitive
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Interactions between markets for electricity and CO$_2$

Let $\beta_i = \text{CO}_2$/MWh of firm $i$, 
$\beta =$ that of marginal price-setting firm 
$\beta_a = \text{CO}_2$/MWh of ESI 
$s =$ EUA price, $p$ be electricity price 
$q_i =$ output of firm $i$, $Q =$ total elec output 
$\alpha_i = q_i/Q$; $\varepsilon =$ elasticity of electricity demand 
$S(s) =$ supply of EUAs to electricity from other sectors $= \beta_a Q,$ 
$\varepsilon_s = (s/S)dS/ds$, elasticity of supply of EUAs to ESI
Interactions between markets for electricity and CO$_2$

Extreme case: Cournot assumptions

Max $\Pi_j = p(Q,s)q_j - C_j(q_j) - \beta_j q_j s$,

$$\frac{\partial \Pi_j}{\partial q_j} = 0 = p - MC_j - \beta_j s + q_j \frac{\partial p}{\partial Q} + q_j \frac{\partial p}{\partial s} \frac{ds}{dQ} - \beta_j q_j \frac{ds}{dQ}$$

$$p(1 - \alpha_j / \varepsilon) = \{MC_j + \beta_j s\} - \alpha_j Q(\beta - \beta_j) \frac{ds}{dQ}$$

$$MR = MC - \alpha_j s(\beta - \beta_j) / (Q \varepsilon_s)$$

$$p = MC / (1 - \alpha_j / \varepsilon) + \alpha_j s(\beta_j - \beta) / \{Q \varepsilon_s (1 - \alpha_j / \varepsilon)\}$$
Interactions between markets for electricity and CO\textsubscript{2}

\[
\text{Max } \Pi_j = p(Q,s)q_j - C_j(q_j) - \beta_j q_j s, \\
\frac{\partial \Pi_j}{\partial s} = q_j (\frac{\partial p}{\partial s}) - \beta_j q_j \\
= q_j (\beta - \beta_j)
\]