Prospects and challenges for the EU-ETS in the years to come?

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Context

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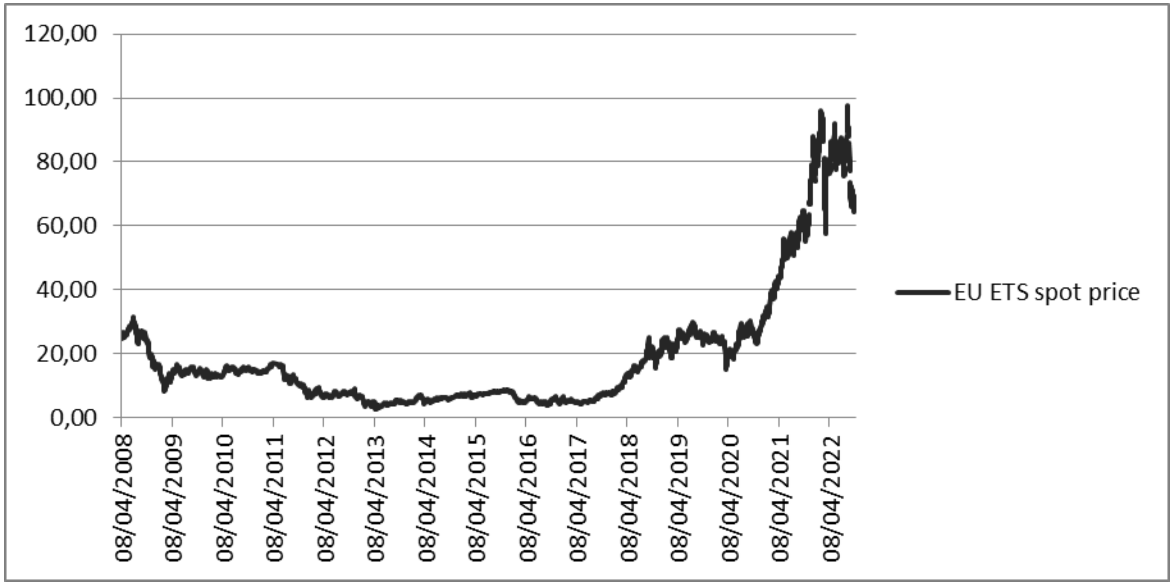
- The rationale of the EU-ETS is that of a carbon budget
  - The aim is to avoid reaching a tipping point above which irreversible drastic damages are expected to occur
  - The idea is thus to cap the cumulated GHG emissions at a time horizon where, without corrective policies, the tipping point would be reached
- As a result
  - When GHG are emitted does not matter, only their cumulative amount does
    - Time flexibility in abatement decisions is socially optimal…
    - … but implies that the current price is highly sensitive to the expected intertemporal cap (plus other unexpected shocks) and its time path is dependent on the interest rate
      - Detailed in the dynamic analysis of ETS (Rubin, 1996, Schennach, 2000…)
      - Sensitivity of the current price to regulation changes that affect the overall cap (and/or under specific conditions that affect the intertemporal allocation of allowances)

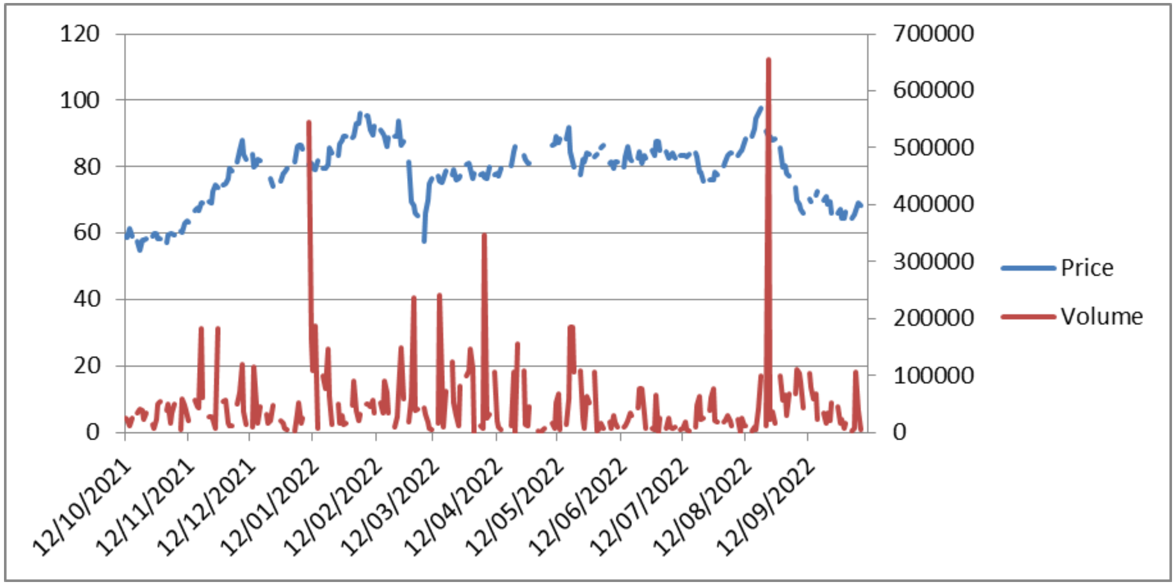
Context

- The carbon price on the EU-ETS has sharply increased over the last four years
  - In spite of two major recent shocks (the pandemic and the invasion of Ukraine)
  - Backloading and then the inception of the MSR largely explain this surge



Context

- The current price seems to be stabilizing around €70 per ton of CO_2 during the last twelve months

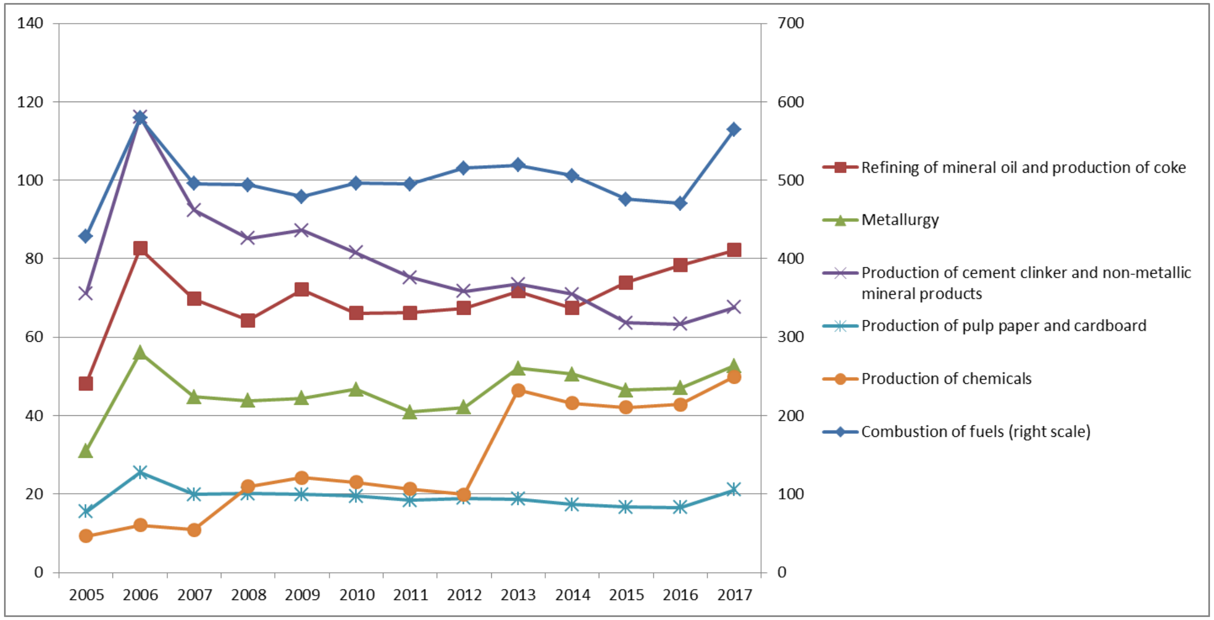


Context

- The European Green Deal, presented by the EU Commission on 11 December 2019, sets the goal of making Europe the first **climate-neutral** continent by 2050.
  - As regards the EU-ETS, The fit for 55 EU program launched in July 2021 has the following specific objectives
    - Strengthening the EU ETS in its current scope in order to provide the appropriate contribution to an overall target of at least -55 % GHG emissions compared to 1990;
    - Ensuring continued effective protection for the sectors exposed to a significant risk of carbon leakage while incentivising the **uptake of low-carbon technologies**.
  - In practice, this implies
    - Progressive phasing out of the free allowance system and switching to full auctioning
    - Limiting carbon leakage with a Carbon Border Adjustment Mechanism (CBAM)
    - Recycling auction revenues to favor low carbon innovation and address redistributive impacts

Context

- The objective to incentivise the uptake of low carbon technologies may look like a paradox
  - **Does this mean that after more than 17 years of existence, the EU-ETS would not have succeeded in inducing a transition towards low carbon technologies?**
  - Seems to be confirmed by the dynamics of the **carbon intensity** of the main sectors covered by the EU-ETS (source: author from EEA data on ETS and KLEMS database of the University of Gröningen)



Context

- This is also confirmed by more in depth econometric tests based on micro level data
  - Calel, R., 2020. "Adopt or Innovate: Understanding Technological Responses to Cap-and-Trade", *American Economic Journal: Economic Policy*, 12(3), pp. 170-201
- Suggests that only short term abatements have been implemented
- => the distinction between short term and long term abatements is key to analyse the decarbonisation of the economy
  - Short term abatements are obtained by **adjusting the production** level with an **unchanged technology and are reversible**
    - consistent with **textbooks' concept of MAC**
  - Long term abatements are obtained by **switching to a low-carbon technology and are irreversible**
    - consistent with **Mc Kinsey concept of MAC**

*The observed carbon intensity does not allow to disentangle the two => there is a **need for a more elaborated measure***

A relevant measure of carbon intensity

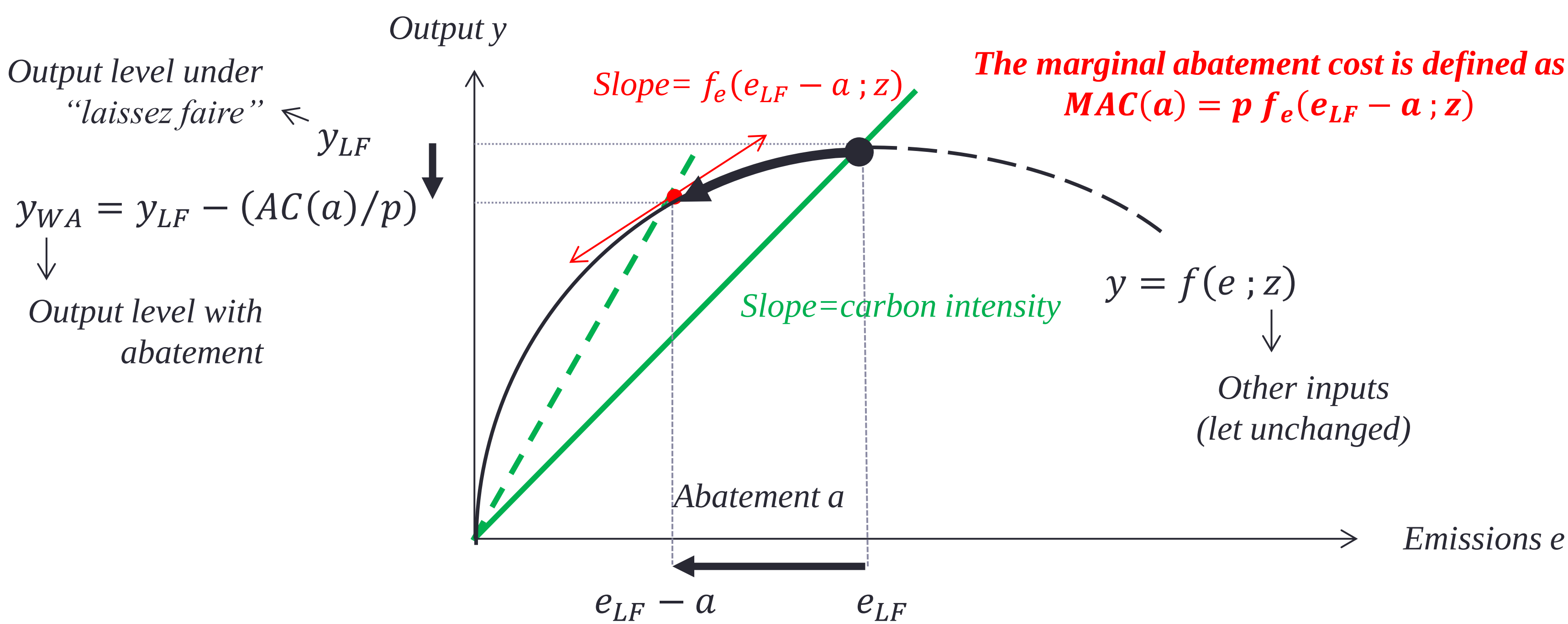
A relevant measure of carbon intensity

- Disentangling short term and long term abatements requires an in depth analysis of the dynamics of the technological frontier
  - Consider the technological constraint $y = f(e\,;z)$ that links the quantity of output y which can be produced to a level of pollutant emissions e.
    - This emission level is often considered as a free access input, at least until an environmental policy is put in place.
      - Usual production function with one noticeable difference: there is a threshold e_{LF} above which marginal returns are decreasing (characterises the “laisser faire” situation)
    - An alternative is to consider we are facing a multi-output technology with y as the « good » output and e as the « bad » -undesirable- output.
      - It is not possible to produce the desired output y without undesirable output e and more of one implies more of the other at least up to a threshold level e_{LF} (characterises the “laisser faire” situation)
  - The low-carbon nature of the technology can be characterised on the basis of the « laisser faire » emission level and the associated carbon intensity.

A relevant measure of carbon intensity

An abatement level a is defined as a reduction of emissions imposed directly (command and control policy) or indirectly (incentive policy) to the firm

- To comply with this abatement level a, the firm must slide to the left along the technological frontier
- This implies a drop in the level of output that amounts to $y_{LF} - y_{WA}$ with unchanged amounts of inputs except emissions
- The abatement cost $AC(a)$ is defined as the resulting loss of value $p\,(y_{LF} - y_{WA})$

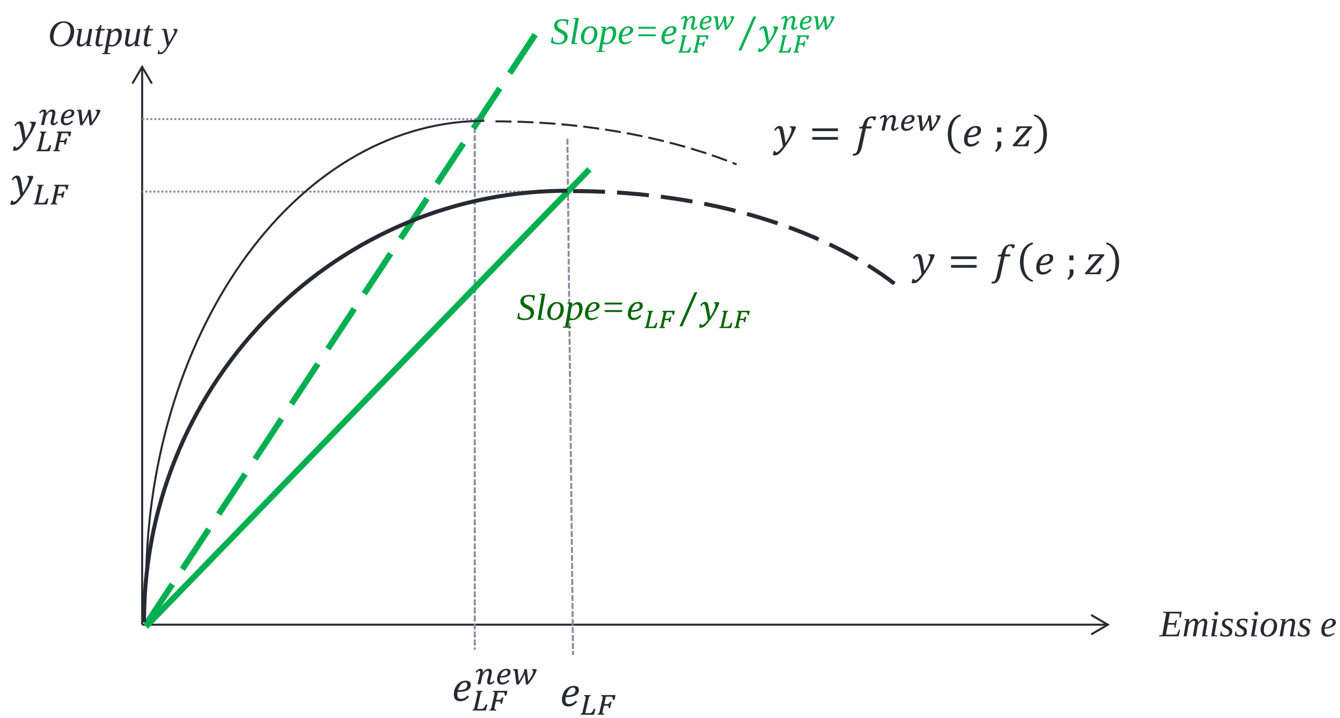


The regulation induces a drop in carbon intensity for an unchanged technology

A relevant measure of carbon intensity

Technological change implies an upward shift of the technological frontier

- May be qualified as **« green » technical change** if the new "*laisser faire*" situation associated with the new technology results in both a lower emission level and a lower emission intensity $e_{LF}^{new}/y_{LF}^{new}$ of the desirable output.



A relevant measure of carbon intensity

Nevertheless an upward shift of the technological frontier (technical progress TC) can also lead to an increase of the "*laisser faire*" emissions (baselines) and/or an increase of the carbon intensity!

- This leads to a typology of the nature of technical change depending on how the baseline emissions on the one hand, and the carbon intensity at "laisser faire" on the other hand change
- See Baudry and Faure (2021)

	Carbon intensity increases	Carbon intensity decreases
Baseline emissions increases	*Non (green) directed TC*	*Weakly (green) directed TC*
Baseline emissions decreases		*Strongly (green) directed TC*

Some illustrative results

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- Based on Baudry and Faure (2021)
  - Sample of regulated firms from 2013 to 2017 (Phase III of the EU-ETS)
  - Data on verified emissions from the EU transaction log at the site level
    - Consolidated at the firm level
  - Data on firms' output and input (labor, capital, energy) from Amadeus database
  - 4-digit NACE rev. 2 codes to identify the sector
- The multi-output distance function approach (Färe *et alii*, 2005) is used to calibrate a quadratic form production frontier with one "good" output and one "bad" output
  - Irreversibility in technical change is captured by implementing the calibration on industries' sequential production possibility sets, namely using observations from the initial date up to time t (Oh & Heshmati, 2010).

Some illustrative results

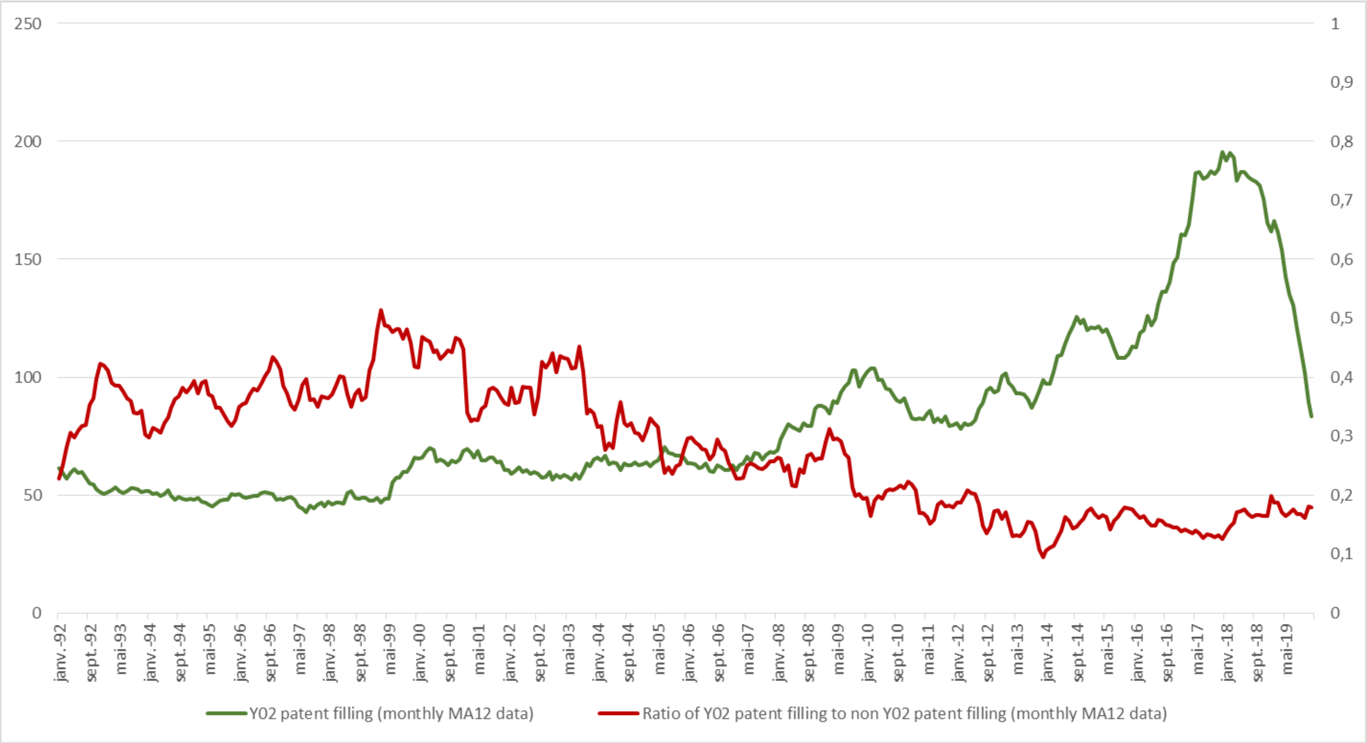
Table 4: Nature of technological progress

Industry	Carbon intensity	$CI^{LF}_{I,2017}/CI^{LF}_{I,2013}$	%Δ in baseline emissions	Nature of T.P.
Baked clay	0.4	0.96	+10.6 %	*weakly directed*
	3.6	0.52	-4.8 %	*strongly directed*
Cement	5.1	1.16	+45.9 %	*non-directed*
Chemicals	0.3	0.74	-8.5 %	*strongly directed*
Electricity	1.1	0.98	+6 %	*weakly directed*
Metallurgy	0.1	1.04	+15.7 %	*non-directed*
	0.5	1.03	+21.7 %	*non-directed*
Paper	0.1	0.93	+1.4 %	*weakly directed*
	0.5	0.61	-7.2 %	*strongly directed*
	1.1	0.49	-45.6 %	*strongly directed*
Plaster	2.8	1.03	+14.5 %	*non-directed*

Note: %Δ corresponds to the percentage change between 2013 and 2017.

Some illustrative results

- For sectors that exhibit non-directed TC, results can be double checked by looking at patent data
  - More specifically, when can look at the dynamics of the share of “green” (Y02 CPC class) patents filled by regulated firms of the sector
    - Example of the cement industry (Jan. 1992 to Dec. 2020)
    - Source: Patstat, data extracted and retreated by Y. Liu under the supervision of the author



Can ongoing reforms address the problem?

Can ongoing reforms address the problem

- The **switch from free allocation to full auctioning** is a step in the right direction
  - It modifies the trade-off between short term abatements and long term abatements in favour of the latter
    - Firms that are short of allowances with free allocation and rely on short term abatements will have to pay more
    - => in average the burden of the regulation will increase and this increase is amplified if a more stringent cap is adopted

- A **CBAM** can alleviate the burden of the regulation
  - Although there is no strong empirical evidence of carbon leakage on past data, the recent surge in the price may change the game

Can ongoing reforms address the problem

- But a **CBAM** has uncertain effects on innovation
  - It reduces the competitive pressure on EU regulated firms
    - => positive effect on innovation (Shumpeter's view) or negative effect (Arrow's view)?
    - May depend on the sector under consideration
  - It is a substitute for regulation in foreign countries with less stringent carbon pricing if the EU is an important market for their firms
    - => boosts low-carbon innovation in these countries (weak Porter's hypothesis)
    - may induce an innovation race with EU firms?

Calls for a more in-depth analysis of the consequences of a CBAM on innovation

Can ongoing reforms address the problem

- Irreversible investments in low-carbon technologies do not depend only on expected returns
  - The **EU-ETS price volatility** is also a key factor in investment decisions
    - Direct application of the real option theory (Dixit and Pindyck, 1994)
    - A higher volatility implies a higher "irreversibility premium" in the trigger price for investment

- Argues in favour of **"*rules rather than discretion*"** in the EU-ETS regulation
  - <u>Good example</u>: the innovation fund financed by tagging the revenues from a pre-defined amount of allowances (450 millions)
  - <u>Bad example</u>: financing the Repower EU program by selling allowances put in the MSR in contradiction with its automatic functioning
    - Any discretionary use of the MSR as a "deep pocket" to finance public policies increases the uncertainty surrounding the total cap and thus increases the price volatility and impedes low-carbon investments
    - It would be a better idea to frontload auctions of allowances without modifying the total cap

Can ongoing reforms address the problem

- Discretion in the regulation may favours speculative behaviours by (unregulated) financial actors operating on the EU-ETS
  - Speculative behaviours/positions are alleged to amplify price volatility…
  - … but financial actors are essential as counterparts in derivatives contracts
    - They help risk hedging by regulated firms

Calls for a more in-depth analysis of the role and behaviour of financial actors on the EU-ETS

- Argue in favour of a day-to-day regulation than can thwart speculative behaviours rather than a ban of (or a limitation of transaction by) financial actors
  - Put in in place a "**central bank of carbon**", independent in its day-to-day actions but whose long-term objectives are set by climate policy (long term decarbonization of the regulated sectors)?
    - In the spirit of economic constitutionalism
  - Could also replace the current MSR!

Thank you for your attention