LIFE COASE

POLICY BRIEF

LIFE COASE – Collaborative Observatory for ASsessment of the EU ETS

Comparison of ex-ante modelling assessments of emissions trading - 2023

Highlights

- This policy brief synthesises the results from the first annual workshop on ex-ante assessment of emissions trading. It focuses on models assessing the schemes in the EU, UK, China, California, and Québec.
- At a time when emissions trading systems (ETSs) are increasing in number and face similar issues, only a few comparisons of ex-ante models exist.
- The models show considerable heterogeneity. The differences stem from the specific aim, design, scope, ambition and maturity of each market modelled.
- Regarding modelling assumptions, there is an overall reliance of models on Marginal Abatement Cost Curves (MACCs) and a strong impact of parameters such as the discount rate on the assessments.
- In terms of predicted prices, an overall increasing trend is observed

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across jurisdictions, with predicted prices of non-EU ETSs remaining at a lower level than EU prices. This divergence is due to uncertainty regarding abatement costs, scope, maturity, and overlapping policies.

- There is a growing interest in capturing market imperfections and investor behaviour. Evaluation of carbon leakage, which still requires extensive modelling work, is also identified as relevant future model extensions.
- There is a need for discussion on model comparison to include industry feedback, share experiences and improve the robustness of modelling assumptions.
- Closing the loop between the policy process and modelling work is necessary to enhance the predictability of carbon markets and to showcase the consequences of different policy and design choices. Models may also be useful to attribute certain effects to either ETS policies or other policies. This can ultimately improve our understanding of carbon markets in an increasingly dynamic policy landscape.

Introduction

At a time when emissions trading systems (ETSs) are increasing in number and face similar issues, only a few comparisons of ex-ante models exist. This policy brief presents the main takeaways and insights from the first annual workshop on ex-ante assessment of emissions trading which took place on Monday 5 June 2023[1] and which was organised under the framework of the LIFE COASE project.[2] The goal of this workshop was to step up the benefits of knowledge sharing and mutual learning by collecting scientific evidence from different emissions trading systems worldwide.

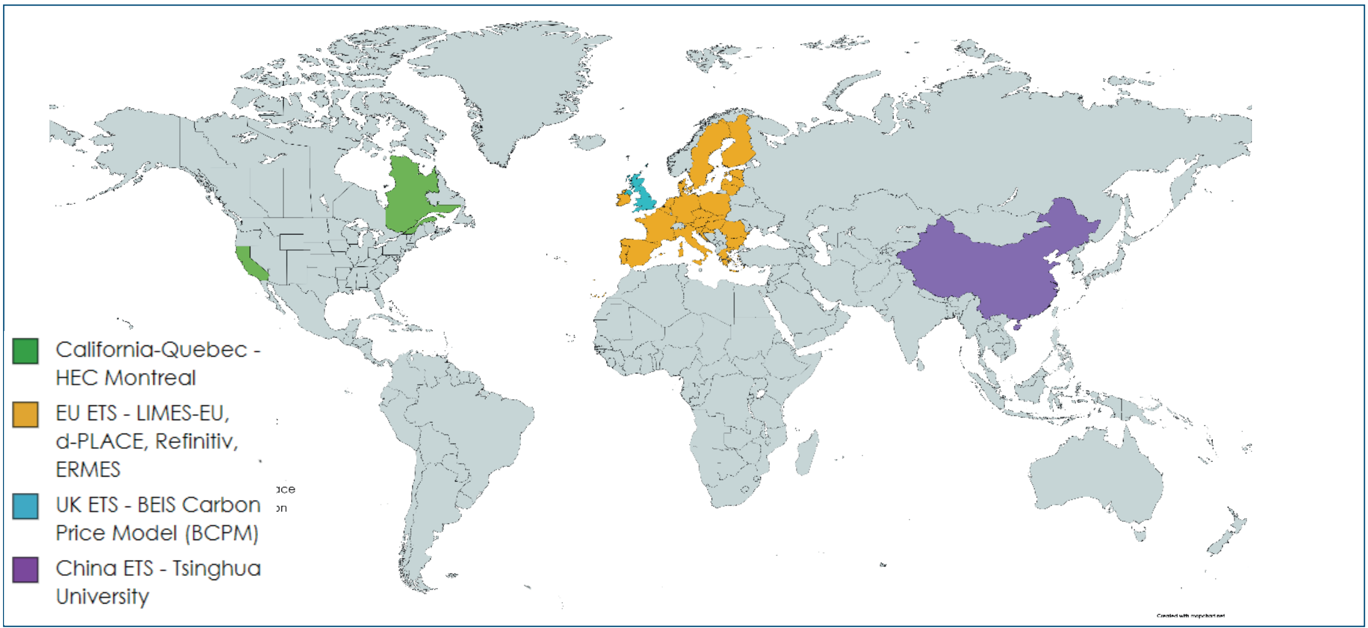
The workshop was devoted to the comparison of selected macro-economic models simulating the development of the European Union Emissions Trading System (EU ETS) and other major emissions trading systems. It convened experts from five organisations that operate carbon market models – academic institutions as well as carbon market analysts. The regions covered by the carbon markets which they analyse are shown in Figure 1.

The workshop discussed the model types, implementation details, and core assumptions employed in the analysis of carbon prices from models around the world. More specifically, it took stock of the diversity of approaches, provided insights on the operation, and expected challenges of the respective carbon markets, and identified the main drivers affecting the price dynamics of carbon prices until the end of this decade and beyond. In preparation for the workshop, all participants took part in a survey and provided a short model fact sheet, information about future carbon prices, and an assessment of what they view as the main price drivers in 2030/2050, depending on the model focus.

1 The programme and other details of the workshop may be found at https://fsr.eui.eu/event/workshop-on-ex-ante-assessments-of-emissions-trading/ . A first version of this policy brief, including the replies to a questionnaire sent beforehand to selected modellers, can be found in the following deliverable of the project LIFE COASE: https://fsr.eui.eu/wp-content/uploads/2023/10/Deliverable-5.1_Summaries-of-Workshop-and-Conference-2023.pdf

2 Details about the LIFE COASE project can be found here: https:lifecoase.eui.eu

Figure 1: Models presented or reviewed[3] at the workshop with their corresponding institutions and carbon markets covered.



The carbon markets coverage of ex-ante models

The models presented during the workshop can be divided into those which focus on the EU ETS and those that study non-EU carbon markets, namely, the California and Québec Cap-and-Trade (C&T), China ETS and UK ETS. The five regions' emissions account for 17.4 $GtCO_2$, i.e., 46% of the world's total emissions. The range of emissions covered by each of the carbon markets by its jurisdiction vary between 28 and 74%, while the emissions covered altogether represent 17% of the world's total CO_2 emissions (ICAP, 2023).

The two models covering the EU were LIMES-EU and d-PLACE[4] Despite the differences in their approach, both models have a very clear policy focus to assess the most recent reforms implemented by the European Commission, particularly those related to the EU Green Deal. The presentation of the d-PLACE model included an analysis of the potential impact of new sectors within the EU ETS, e.g., the option of having an ETS that covers all sectors of the economy. The analysis of the LIMES-EU model focused on the role of the Market Stability Reserve (MSR) in further tightening the EU ETS cap and the required sharp decrease in emissions. This approach highlights the objective of the power sector being almost fully decarbonised by 2030, while decarbonisation of the energy-intensive industry would become more important after 2030. Both studies emphasised the urgency of exploring alternative policy designs for the EU ETS after 2030 as the models predict that the last allowances would be issued by 2040. This implies that the EU ETS will see important structural changes in the next decade. The system could be jeopardised due to the risk of illiquidity and price distortions. In that sense, the scenarios evaluated with d-PLACE already provide some insights on the effects of expanding the EU ETS by, for instance, merging it with the EU ETS2 for buildings and road transport.

The smaller or less mature carbon markets outside the EU face different challenges compared to the EU ETS. A common issue stands out across non-EU systems: the overallocation or excess of allowances in these markets. In the case of the California and Québec C&T, the initial coverage planned during the early stages of the market was used for the allocation of allowances. This initial coverage was however more ambitious than the implemented

3 In the case of the EU ETS, the answers to the questionnaire for the models Refinitiv and ERMES were reviewed prior to the workshop although these models were not presented during the event.

4 Contributions from two EU models (Refinitiv, ERMES), which were not presented at the workshop but answered to the survey, are also included in this document.

coverage, leading to overallocation. Another factor reinforcing overallocation in the California-Québec system is the presence of offsets (up to 4% of emissions in Québec and 8% in California). The UK ETS, created after Brexit, also faces overallocation due to its too generous cap. This cap was set by taking the UK's share in phase IV of the EU ETS. Besides not being in line with the UK's net-zero strategy, this cap has recently proven to be excessive as emissions in 2022 (111 $MtCO_2$) were already below the 2030 cap (117 $MtCO_2$). Although it is not possible to assess ex ante whether the Chinese ETS, with a proposed tradable performance standard (TPS), will also face overallocation, a 'typical' C&T system could lead to abatement at lower costs. A TPS system implicitly subsidises output (Fischer, 2001), which compromises cost-effectiveness relative to C&T.

Besides the particularities of each system, the models also highlighted different main features and approaches. The differences between the models were revealed by the responses to the survey questionnaires.

In terms of methodology, all the models except for the California-Québec model are single agent optimisation models, and most of them follow mainly a top-down approach. Although optimisation models following a top-down approach constitute an efficient tool for long-term planning and provide high-level policy assessment, they generally struggle to capture market dynamics. This can be tackled by complementing such models with bottom-up approaches, but the implications of assuming a single agent and a perfectly rational central planner still constitute a limitation to analyse markets with such a wide range of heterogeneous actors.

Linkage to other carbon markets is not yet within the features of the models presented. The only one considering a linkage is LIMES-EU, which assumes that the EU and UK ETS will be linked in the short-term. Until recently, both systems showed a remarkable consistency, which might indicate very similar abatement costs as well as investors' hedging behaviour. However, the UK Allowance (UKA) price has recently dropped significantly. This might hinder a linkage in the short-term, despite the EU and UK agreement for cooperation. In other systems, such as those in California-Québec and China, potential linkage between existing systems is currently not under consideration.

Depending on the model's main purpose, either perfect or limited foresight is assumed. Assuming complete information for the long-term is a useful but limiting simplification. Indeed, carbon and energy markets both face increasing uncertainty, not only from market dynamics (e.g., fuel prices), but also from regulatory and policy developments. Traditionally, there is a tendency among organisations developing benchmark scenarios (i.e., computing the theoretically optimal prices to drive the energy transition) to assume perfect foresight. However, recently, there has been an increasing interest in capturing market imperfections and investors' behaviour, thus in assuming limited foresight. All the optimisation models presented, except the California-Québec model, have at least this feature as an alternative model configuration. The debate remains on the appropriate time horizon to apply. There is also a discussion on the extent of the impact of an increase in environmental policy stringency on policy credibility and, ultimately, on actors' farsightedness.

Besides addressing the particularities of the different systems (e.g., unlike typical cap and trade systems, the Chinese carbon market relies on TPS), the models cover different sectors of the economy. In some cases, the sector comprised is not included within the respective carbon market studied. For instance, the d-PLACE model covers all sectors of the economy. It follows a top-down approach based on a CGE model coupled with a detailed energy sector model (MEESA). This allows the evaluation of the impact of the EU ETS on other sectors of the economy and associated differences in the impacts on them.

Assessing carbon leakage impacts, e.g., resulting from the implementation of the CBAM in the EU, requires more extensive and substantial modelling as regions beyond the scope of the carbon market need to be included.

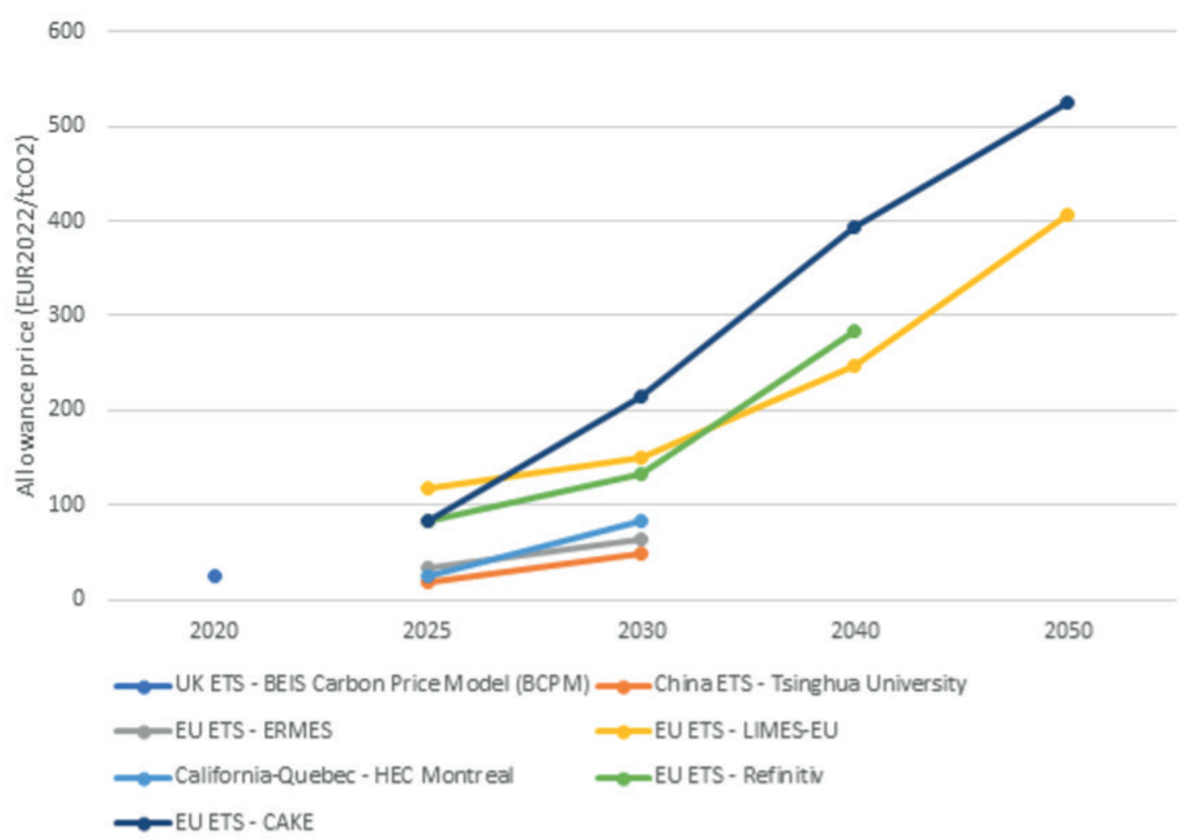
Carbon price forecast

In terms of predicted prices, the survey further revealed an overall increasing trend across jurisdictions, with predicted prices of non-EU ETSs remaining at a lower level than EU prices (see Figure 2). European Union Allowance (EUA) prices increase from 84-117 EUR/tCO_2 in 2025 to 407-526 EUR/tCO_2 by 2050. The price range increases as a result of the uncertainty regarding abatement costs, EU ETS coverage scope and overlapping policies. The price in non-EU jurisdictions also follows an increasing trend, but at a substantially lower level: from 19-25 EUR/tCO_2 to 48-84 EUR/tCO_2. The UKA prices will increase from 13 to 31 EUR/t between 2021 and 2024.

It is difficult to identify the main factor explaining such price differences. Differences might stem from the systems' scope. Although all of them comprise the power sector and at least a substantial part of industry, non-European systems have a larger scope, as they include buildings and road transport. A larger coverage makes it more difficult to estimate an appropriate cap. In addition to differences in scope, the overallocation of allowances keeps prices at a low level (e.g., during the EU ETS phase III, prices were below 10 EUR/t from 2013 to 2017, which may stem from its larger coverage).

Another explanation for the differences in projected prices is the lack of maturity of some of the carbon markets. A special case is the UK ETS, which covers the same sectoral scope as the EU ETS but does not have a market stability mechanism. Despite having the experience of being part of the EU ETS, it seems to be currently going through a transition period after Brexit. The very large cap with respect to current emissions appears to be having an effect on UK allowance prices. This lack of ambition is highlighted by the BCPM model results.

Figure 2: Carbon prices in each model and jurisdiction. [Note: the BEIS estimation of the UK allowance price is an average of the price between 2021 and 2024.]



Conclusion

Further improving ex-ante models is an important exercise for academia and policymakers alike. While the models might not be able to reliably predict future carbon prices, they already play an important role in understanding the effects of different policies and design changes.

The models discussed not only showed a wide heterogeneity in approach but also highlighted the different carbon market scopes, maturities, and ambitions. Moreover, there is a growing interest in capturing market imperfections and investor behaviour. On the modelling assumptions, there is a deep reliance of models on MACCs and a strong impact of parameters such as the discount rate on model predictions. This underlines the need for discussion fora, with the inclusion of industry feedback, to continue the comparison of ex-ante modelling, share experiences, and improve the robustness of modelling assumptions and approaches. With the exception of the BCPM model, the extent to which these research models can influence policy-decision making is difficult to measure, but closing the loop between the policy process and modelling work is necessary to enhance the predictability of carbon markets and ultimately improve their credibility in an increasingly dynamic policy landscape.

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The Florence School of Regulation

The Florence School of Regulation (FSR) was founded in 2004 as a partnership between the Council of the European Energy Regulators (CEER) and the European University Institute (EUI), and it works closely with the European Commission. The Florence School of Regulation, dealing with the main network industries, has developed a strong core of general regulatory topics and concepts as well as inter-sectoral discussion of regulatory practices and policies.
Complete information on our activities can be found online at: fsr.eui.eu

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