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Including aviation in the European emissions trading scheme: Impacts on the industry, CO_2 emissions and macroeconomic activity in the EU

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ABSTRACT

In July 2008, motivated by the expected high growth of aviation and the related impacts on climate change, the European Parliament adopted a directive to include airlines in the European Emissions Trading Scheme. This paper discusses possible impacts of this inclusion on the aviation industry in terms of CO_2 emissions and the macroeconomic activity in the EU. The analysis uses the Energy–Environment–Economy Model for Europe, a dynamic simulation model to investigate impacts of the European Emissions Trading Scheme on air transport.. The impacts on air transport output and the macroeconomic effects are estimated to be small. This was robust to varying the carbon price. However, air transport CO_2 emissions were expected to decrease by up to 7.4%, which is more than that estimated previously and stems mainly from the supply-side reaction of the industry.

1. Introduction

Aircraft emissions contribute to climate change by increasing the concentrations of greenhouse gases (GHGs) in the atmosphere (Intergovernmental Panel on Climate Change, 1999). Carbon dioxide (CO_2) emissions from international aviation comprised about 3% of global and EU inventories in 2004 (Enerdata, 2009). Growth in CO_2 emissions from international aviation in EU countries showed 85% growth from 1990 to 2004 (European Environment Agency, 2007). In addition, aircraft contribute to climate change by emitting nitrogen oxides, sulphur dioxide, soot and water vapour. Less well understood warming effects attributed to aircraft emissions include the formation of contrails and cirrus clouds.

There are no binding policies in place to tackle the climate change issues related to international air transport. For example, the 1997 Kyoto Protocol targets do not include aviation emissions from international flights. The EU has decided to tackle the problem unilaterally and in July 2008 it was decided to include the aviation industry (all domestic and international flights) in the European Emissions Trading Scheme (EU ETS) from 2012. Hence the EU ETS will also cover the CO_2 emissions from aviation industry that are currently not covered by the Kyoto Protocol.

A binding emissions trading scheme (one with significant allowance price) has the potential to reduce CO_2 emissions. This kind of scheme has the potential to induce behavioural changes in the short and medium term and technological changes in the longer term by sending price signals to the aviation industry. Whether or not the inclusion of the aviation sector in the EU ETS has broader impacts on the EU's aviation industry depends on the scope of the final rules (e.g., does it apply to non-EU based companies?), the price impacts on airline tickets, and the extent by which carriers that are not covered by the scheme are able to gain market share.

This study examines possible impacts of proposed policy on the aviation industry (output), on CO_2 emissions, and macroeconomic activity in the EU. It will not discuss legal aspects of aviation emission trading; neither are impacts on other industries (e.g. tourism, etc.) discussed. It studies the impacts of the proposed policy using an integrated multisectoral approach, The Energy–Environment–Economy Model for Europe (E3ME). The air transport industry is intimately connected to other sectors in the economy and therefore these connections should not be omitted – for example, the feedbacks between the air transport industry and GDP (via other sectors, such as tourism) should be included in the model.

2. Aviation in the EU ETS

In an emissions trading scheme (ETS) the aggregate amount of emissions by market participants is limited to, or capped at, a certain level. Allowances are created corresponding to the cap and distributed to the companies covered by the scheme. Trading of these allowances in the market creates a price for a unit of emissions. An ETS provides an incentive for those with lower marginal abatement

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costs to reduce their emissions and to sell their allowances to those with higher abatement costs. This approach is especially suitable for uniformly distributed greenhouse gases such as CO_2 where the location of emission reductions does not matter.

The EU ETS is currently the world's largest ETS and the first that crosses country borders. It came into operation on 1 January 2005 and is the centrepiece of the current European climate change policy and its second phase that started in 2008. Phase 1, from 2005 to 2007, failed to deliver a substantial carbon price – the price was close to zero in 2007. However, it can be seen as a learning period for the EU ETS. The EU ETS includes CO_2 emissions from energy intensive industries in the European Union (Directive 2003/87/EC, 2003). In December 2006, the EC released a proposal on including the airline industry in the EU ETS (Proposal for amending Directive 2003/87/EC, 2006). On 9 July 2008 the European Parliament had a final vote on inclusion of aviation in the EU ETS. The EC Directive (Directive 2008/101/EC) foresees the following important design elements:

1. All airlines operating within the EU will be included in the EU ETS as trading entities from 2012. This also includes third country airlines landing at and departing from the EU airports.
2. An EU-wide emissions cap for aviation will be implemented based on historical CO_2 emissions (i.e. using the 'grandfathering' approach). In 2012 the number of carbon allowances allocated to airlines will be capped at 97% of average greenhouse gases emitted in 2004–2006. This cap will then be lowered to 95% for 2013.
3. Allowances will be distributed to individual airlines in proportion to tonne-kilometres flown within the reference year (the benchmark period). The benchmark will be calculated by dividing the EU-wide cap for air transport by the total tonne-kilometres flown over the benchmark period by all airlines included in the EU ETS. The first benchmark period will be 2010. Thereafter, the benchmark period will be the calendar year ending 24 months before the start of each subsequent trading period.
4. The allocation methodology is to be the same (i.e. harmonised) across all Member States. A certain percentage of allowances will be granted for free, and the rest which accounts for 15% will be auctioned.
5. Certified emissions reductions (CERs[1]) and emission reduction units (ERUs[2]) from the Clean Development Mechanism and the Joint Implementation of the Kyoto Protocol may be used up to an amount equaling 15% of an airline's EU ETS allocation in 2012. From 2013 onwards the usage of these credits is unclear.
6. An open trading system is proposed – i.e. the airline sector can trade with all other sectors covered by the EU ETS. The only restriction will be that airlines cannot sell their allowances to the trading sectors other than the air transport sector itself. This is because the allowances that are issued for airlines under the EU ETS are not considered within the Kyoto allowances nor included in the Kyoto targets.
7. A special reserve consisting of 3% of allowances will be established for new entrants and fast growing airlines.

These figures could be subject to change as part of the ongoing review of the EU's general Emissions Trading Scheme for the third phase 2013–2020 (European Commission, 2008). Including aviation in the EU ETS will only be a part of a comprehensive package of measures to tackle the climate change impact of aviation. The other measures proposed by European Community include operational and technological measures (Directive 2008/101/EC). Under the directive, the costs of inclusion will differ between airlines as fuel consumption, per flight by route, differs between airlines according to the fuel efficiency of the aircraft used, operational practices and the level of passengers and freight carried (European Commission, 2006). More efficient airlines will face lower costs when compared to less efficient counterparts.

3. Methodology

3.1. Motivation

The E3ME (Cambridge Econometrics, 2009) is a hybrid post-Keynesian macroeconomic dynamic simulation model. It is designed to assess short and medium run (up to 2020) GHG mitigation policies, including emissions trading schemes (Köhler et al., 2008; Barker et al., 2007). The model is a combination of time-series econometric relationships (estimations are based on data covering 1970–2004) and cross-section input-output relationships. It can simulate the interactions between air transport and 41 other industrial sectors in a particular region (e.g. an EU member state) and in a group of regions (the EU). This kind of model structure allows feedbacks between sectors in response to a particular policy imposed on one industry, or a group of industries. For example, if demand for air transport decreases, then the money that is not spent on flying is spent elsewhere. This can feed back to air transport through increased demand for air transport in these sectors, and partly offset the initial decrease in demand.

This integrated approach is distinguished from spreadsheet models (i.e. simple calculations on Excel spreadsheets) and multi-model approaches. For example, Ernst and Young (2007) and Frontier Economics (2006) use static spreadsheet models that do not incorporate influences from other changes in the economy (e.g. changes in incomes, developments in other transport sectors). Similarly, static spreadsheet models are also used to estimate the impacts of the EU ETS on selected passenger airlines (Scheelhaase and Grimme, 2007) and to observe the effects of allocation methods (Morrell, 2007) on selected routes of named airlines.

E3ME has the following advantages:

1. Model disaggregation: The detailed nature of the model allows the representation of fairly complex scenarios, especially those that are differentiated according to sector or country. Similarly, the specific impact of any policy measure can be represented in a detailed way.
2. Data-driven: The model is driven by detailed historical data combined with state-of-the-art econometric forecasting techniques. This data-driven approach improves the forecasting performance in the short to medium run.
3. It provides information that allows for dynamic responses to changes in policy linkages: E3ME is a hybrid model. The ability to model interactions between the economy, energy demand/supply and environmental emissions provides an advantage over models that may either ignore the interaction completely or only assume a one-way causation. For example, the EU ETS includes a cap on CO_2 emissions: the model can be used to solve different CO_2 allowance prices, allowing for effects on prices and demand, as well as on macroeconomic variables.

The main disadvantage of using E3ME for assessing policy impacts on a particular industry is that it analyses the industry at an

[1] A CER is equal to 1 metric ton of CO_2-equivalent emissions reduced or sequestered through a Clean Development Mechanism project, calculated using Global Warming Potentials (Intergovernmental Panel on Climate Change, 2007).

[2] ERU (Emissions Reduction Unit) is equal to 1 metric ton of carbon dioxide emissions reduced or sequestered arising from a Joint Implementation (defined in Article 6 of the Kyoto Protocol) project calculated using global warming potential (Intergovernmental Panel on Climate Change, 2007).