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Analysis of a proposed mechanism for carbon-neutral growth in international aviation

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ABSTRACT

In October 2013, the International Civil Aviation Organization (ICAO) announced that it would put in place a market-based mechanism to cap net greenhouse gas emissions from international civil aviation at 2020 levels. This paper analyses the obligations that would be placed on real airlines under an initial draft "Strawman" proposal that was originally formulated as a starting point for discussions within ICAO, and the extent to which such a proposal would succeed in keeping emissions at or below the desired level. The provisions of the ICAO proposal were then applied to more than 100 existing airlines. In order to protect commercial sensitivities, we used hierarchical cluster analysis to identify groups of different types of airlines. We report the results for these groups rather than for individual airlines. While ambiguities in the Strawman proposal complicated the analysis, we found that, depending on their size and rate of growth, airlines will be required to offset very different proportions of their emissions from international flights. A system of *de minimis* exemptions, as currently proposed, would benefit some rich countries as well as poor ones. Targeting such exemptions more narrowly would raise practical difficulties, which we describe. We conclude by recommending that ICAO design and implement a much simpler system; and propose one alternative.

Introduction

In October 2013, the International Civil Aviation Organization (ICAO) resolved to finalize, by its October 2016 Assembly, a market-based measure (MBM) to address greenhouse gas emissions from international civil aviation (ICAO, 2013a). ICAO's Council, a 36-member Executive Body, has formed a subsidiary Environmental Advisory Group (EAG) to consider, among other issues, options for the structure of the MBM. In May 2014 an initial "Strawman v.1.1" document (hereinafter referred to simply as "the Strawman")[1] was circulated outlining one possible structure for the MBM; various nations are in the process of formulating their own proposals. The Strawman and the various national proposals provide alternatives for structuring a mechanism in which airlines would offset their emissions in such a way that "net" sectoral[2] emissions (actual emissions less offsets) would remain capped at 2020 levels.

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[1] This text of this document is available from: http://clacsec.lima.icao.int/Reuniones/2014/GEPEJTA33/NE/NERstgd/33GENE18.pdf.

[2] In this case, the "sector" is defined as international civil aviation, including passenger and freight transport. The Strawman defines international flights as those "departing from an airport of a State and arriving at an airport of another State."

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The purpose of the Strawman is to generate "discussion on advantages and disadvantages of its design elements and allowing for the improvements of the Strawman" (ICAO, 2014a). Such an "iterative" approach is meant to "ensure the full engagement of States and other stakeholders, taking into account inputs from different sources" (ICAO, 2014b, p. 3). It is in this spirit of providing inputs into an iterative process that the present analysis was undertaken during an internship, in summer 2014, at the Environmental Defense Fund, which – through the International Coalition for Sustainable Aviation (ICSA) – participates as an observer in the ICAO's Committee on Aviation Environmental Protection (CAEP).

This analysis estimates the volume of offsets (in kilotonnes of carbon dioxide) that a large number of real airlines are likely to have to procure during the years 2021–35 if the MBM as described in the Strawman were to apply. The text of the Strawman indicates that as a structural matter, it aims to preferentially lower the offset obligations of airlines that are new, particularly efficient, or growing very fast. The latter accommodation is made, presumably, in order to address the special circumstances in which, depending on the structure of the MBM, capping emissions at 2020 levels might place a larger offset burden on fast-growing but historically underserved developing regions of the world (ICAO, 2010, pp. I–70). Our analysis of airline obligations examines whether and to what extent, the Strawman's presumed objectives would be met by the current proposal.

Due to commercial sensitivities, in this analysis, airlines have been anonymized; pseudonyms such as A_1 and A_2 will be used to refer to them. Hierarchical cluster analysis is used to identify airline types. The characteristics (e.g., size and growth rate) and offset obligations of different clusters of airlines are then compared to study the systematically different obligations that different *types* of airlines would face under the provisions of the Strawman.

Finally, we will propose alternatives to certain aspects of the Strawman.

Methods and analysis

Description of Strawman v1.1

The Strawman Version 1.1 text (under Section 4, Quantities of Offset for Each Operator) and accompanying sample calculations describe the method by which the offset obligations of an airline would be calculated in any given year.

The Strawman defines *de minimis* exemptions in the following way.

(a) States are listed in increasing order from the lowest to the highest amount of emissions generated by all international flights to and from individual States.
(b) Flights to and from the States in this list are exempted from the top State down to the State where the cumulative amount of emissions reaches [a currently undefined] y% of global emissions in the reference year.
(c) This list is established in the first year of application, and revised after 5 years.
(d) The exempted emissions are not included in the reference year and in the current year.

We discuss the implications of this *de minimis* exemption in terms of how it would affect the coverage of the mechanism; that is, what proportion of current global emissions would be exempt for different values of "*y*". We do not attempt to forecast how this would affect individual airlines going forward because doing so would require forecasts at the level of individual airlines and routes.

The Strawman as currently drafted would also exempt emissions from airlines whose flights collectively emit less than 10 kilotonnes of carbon dioxide each year, aircraft with a maximum take-off mass of less than 5.7 tonnes, as well as humanitarian, medical and fire-fighting operations. These are called "technical exemptions."

For the rest of the sector, the Strawman begins by defining reference year emissions as the average of emissions in 2018, 2019, and 2020. This number is calculated for the sector, as well as for individual airlines.[3] For the sector, the difference between reference year emissions and 2020 emissions is held as a notional reserve. This reserve is defined at the start of the mechanism's implementation period (that is, by the end of 2020) and does not change throughout its life.

In the first instance, the reference year emissions are treated as a "cap". Each year, an airline's offset obligations are calculated as the average of (a) the airline's percentage share of sectoral emissions in a particular year times the absolute growth in sectoral emissions since the reference year, and (b) the absolute growth in the airline's own emissions relative to the reference year.

New entrants are exempt from having to offset their emissions for a period of five years after they begin operations, or until their annual emissions reach a certain, as yet undefined, fraction of the global emissions in the reference year.[4] The Strawman explicitly says that other exemptions (e.g., the *de minimis* exemptions listed above) are not included in the sectoral

[3] For an airline that does not exist in these years, reference emissions are zero for the first five years of its existence, after which "reference year" emissions are assumed to be the average of the airline's fourth and fifth year emissions.

[4] The Strawman text does not make it clear whether this threshold will be set for *all* new entrants at a given time (i.e., the total exemptions granted to new entrants in a particular year cannot exceed x% of the reference year emissions) or for *each* new entrant.