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Airport time slots are currently awarded by historic use, with only small number reserved for new entrants. This hampers competition, promotes inefficient slot utilisation, and contributes to congestion. This column revisits the idea of carefully auctioning time slots at congested airports in order to foster competition by more flexibly allocating slots, as opposed to the current use-it-or-lose-it approach which favours the status quo.

The COVID-19 pandemic has led to a substantial drop in air travel. Valuable time slots at major airports in the EU and elsewhere are largely allocated based on a use-it-or-lose-it scheme. However, airlines currently cannot use the slots to a sufficient degree and are at the risk of losing them. This is perceived as a threat by incumbent airlines but as a opportunity by others who have been trying to get access to major airports for a long time. The European Commission recently adopted a proposal on airport slot relief for the summer 2021 scheduling season, which allows airports to retain their slots if they use them at 40% rather than the usual 80% minimum.

This is at a time when time slots from Lufthansa, Europe's largest airline by revenue, have been – for the first time – sold via auction.[1] Lufthansa got into financial trouble after the coronavirus pandemic unfolded in spring 2020 and will receive up to €9 billion in grants and loans from Germany's Economic Stabilization Fund. As a condition, Lufthansa agreed to give up 24 slots per day at each of the Frankfurt and Munich hub airports. Lufthansa held about one-half of capacity on average in summer 2019 and more than 75% at peak times at these hubs.

Before the coronavirus outbreak, the airports of Munich and Frankfurt were so congested that landing and take-off slots were in short supply. Munich Airport had filed a request for building a third runway. The requirements for Lufthansa receiving financial aid enable competitors to enter or expand which should lead to increased competition. In a state aid ruling, the European Commission proposed an auction to allocate the slots.

Slots can be very valuable to airlines. American Airlines paid $60 million for a pair of London Heathrow slots from SAS in 2015; Oman Air paid $75 million for a London Heathrow pair from Air France in 2016.[2] One estimate by The Guardian in 2004 showed British Airways' Heathrow slots could be worth up to £2.5 billion.[3] Yet, as mentioned earlier, slots are simply awarded by historic use. An airline operating a slot is given the same slot next year. Only a small number of slots are reserved for new entrants. This hampers competition, promotes inefficient slot utilisation, and contributes to congestion. Incumbents may continue to operate non-economic routes to avoid giving up the slots to a competitor. In the extreme, an airline may fly ghost flights without passengers to satisfy use-it-or-lose-it requirements.[4] With today's low air traffic, the use-it-or-lose-it rule causes even more problems, as can be seen by the ongoing debate about the European Commission's airport slot relief.

The idea of auctioning time slots at congested airports is not new (Rassenti et al. 1982, Cramton et al. 2002, Pellegrini et al. 2012). In 2009 the Federal regulator planned on auctioning 10% of the slots, i.e. 32-34 slots, at each of the three New York Airports. However, weeks before the first auction, Congress banned auctions after intense lobbying by incumbents.[5] This is not surprising. Auctions are pro-competitive, and incumbents do not like competition. This is why

the European Commission's state aid ruling is useful. It opens the door to more competition at Germany's most congested airports.

Without a periodic reallocation of slots, airlines do not have the incentive to provide the services that consumers want, or to maximise the utilisation of scarce airport capacity. A periodic reallocation via an auction enhances competition, by enabling a new or growing airline to obtain the slots it needs at congested airports. This is why the European Commission required auctions. Well-designed slot auctions are a means of allocating slots to the operators that value them the most and will therefore provide innovative and competitive services. Applying these concepts in Frankfurt and Munich will provide immediate relief where the need is the greatest and serve as a test of the approach for managing congestion throughout Europe. We note that this is a measured approach, since only a small percentage of the slots are being reallocated.

The European Commission's proposal to assign 48 Lufthansa slots via auction is a step in the right direction. But the auction design of airport time slots requires care. Some airlines may be willing to pay high prices for certain slots only because winning those slots hampers competition by other airlines. And there are various synergies between slots. Bidders wish to buy packages of arrival and departure slots to create a route that customers find attractive. So how can an auction achieve an efficient allocation of slots, while at the same time promoting competition and benefiting passengers and taxpayers to the greatest possible extent?

This is a complicated problem, but one that is solvable. Auction markets have been used around the world in similarly challenging environments, successfully allocating spectrum licenses, treasury bonds, electricity, wind farm capacity, and various commodities (Milgrom 2017, Legros and Cantillon 2007). Modern market design takes advantage of recent advances in economic modelling, computation, and algorithms to handle complex preferences and to include constraints to safeguard downstream competition. This year's Nobel Prize in economics was awarded to Paul Milgrom and Robert Wilson for developing new auction methods to distribute complex public assets (Gans 2020).[6]

The planned auction for New York City's airports in 2009 already addressed key requirements such as the need to bid on packages of slots (e.g. packages of arrival and departure slots). The designers suggested an ascending combinatorial clock auction with package bidding (Ball et al. 2007), a version of which is nowadays widely used for spectrum sales (Bichler and Goeree 2017). The allocation of slots at fully coordinated airports in the EU has to address larger problems with thousands of slots and large packages (flight series) that need to be allocated for a season of half a year following the IATA Worldwide Scheduling Guidelines. Considering the nested capacity constraints in these guidelines leads to a computationally hard flight scheduling problem (Ritter 2008). While such problems were considered intractable for realistic problem sizes 20 years ago, the computational speedups in algorithms and computers to solve such optimisation problems in recent years are stunning (Bixby 2012). Problems of up to 20% of the capacity of major airports can be allocated optimally in minutes. These computational advances allow for the implementation of a variety of successful auction designs that can be tailored to the setting.

The rules for the planned Lufthansa slot allocation, while unclear from the Commission's ruling, do not seem to make use of such recent developments in the science and practice of auction design. This is unfortunate. Yet, more importantly, the current low-demand situation induced by COVID-19 creates a unique opportunity for the regulator to reshape airport slot allocation that goes well beyond the one-off approach to the Lufthansa bailout. The International Air Transport Association expects demand to return to pre-COVID-19 levels in

2024.[7] This time of reduced pressure on the system allows devising, testing, and incrementally implementing a state-of-the-art auction market that puts scarce slots to their best use. If not now, when?

The air slot assignment problem is not as immense as it may seem initially. Only the busiest airports are congested and even at these airports only a fraction of the slots need be auctioned each year to create large value to buyers, sellers, and society. Suitable market designs and efficient tools are available. The Commission's ruling on Lufthansa air slots provides impetus for a discussion that is long overdue.

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Endnotes

1 https://ec.europa.eu/commission/presscorner/detail/en/IP_20_504

2 https://simpleflying.com/airport-slots/

3 https://www.theguardian.com/business/2004/apr/11/theairlineindustry.theobserver

4 https://www.mirror.co.uk/travel/news/london-heathrow-airport-sometimes-hosts-12952912

5 https://www.gao.gov/products/B-316796 and https://www.nytimes.com/2007/02/18/nyregion/18laguardia.html for some background information.

6 https://www.nobelprize.org/uploads/2020/09/advanced-economicsciencesprize2020.pdf

7 https://www.iata.org/en/iata-repository/publications/economic-reports/covid-19-outlook-for-air-travel-in-the-next-5-years/