Transportation Research Part B 104 (2017) 483–500

Contents lists available at ScienceDirect

Transportation Research Part B

journal homepage: www.elsevier.com/locate/trb

How to mix per-flight and per-passenger based airport charges: The oligopoly case☆

Achim I. Czerny[a,*], Simon Cowan[b], Anming Zhang[c]

[a] Department of Logistics and Maritime Studies, Hong Kong Polytechnic University, Hong Kong
[b] Department of Economics, University of Oxford, UK
[c] Sauder School of Business, University of British Columbia, Canada

ARTICLE INFO

Article history:
Received 9 September 2016
Revised 10 April 2017
Accepted 12 April 2017
Available online 6 May 2017

JEL classification:
D40
H20
H40
L93
R48

Keywords:
Airports
Airlines
Slots
Schedule delays
Congestion

ABSTRACT

While airport aeronautical charges are traditionally aircraft-weight related, currently an increasing share of aeronautical airport revenues is derived from passenger related charges. This paper compares the optimal mix of per-passenger and per-flight based (cost recovering) airport charges from the carriers' and the social viewpoints when carrier markets are oligopolistic. We show that positive per-passenger charges might be able to support the implementation of monopoly fares at slot-constrained airports. They can also mitigate strategic frequency reductions at uncongested airports, leading to an increase in both carrier profit and welfare relative to a charging scheme that fully relies on per-flight charges.

1. Introduction

"Once an efficient level of costs has been duly justified through a meaningful consultation, the collection of these costs through passenger-based airport charges would provide increased transparency on what passengers pay for the use of airport facilities and services. They are the best charging method for sharing the risks and benefits of air traffic development between airport operators and airlines." (International Air Transport Association, IATA. Undated position paper on passenger-based airport charges.)

Joseph E. Stiglitz, who received the Nobel Memorial Prize in Economic Sciences in 2001 and was chief economist of the World Bank, pointed out that the supply of infrastructure at reasonable prices is crucial for the economic development of nations (Stiglitz, 1998). The present paper addresses this challenge and deals with the question of how reasonable infrastructure prices can be characterized from the social viewpoint and the viewpoint of infrastructure users. In the case of a

☆ We thank Leo Basso, Markus Reisinger, Sun Yiqiao, the participants of the Economics Lunch seminar at the WHU – Otto Beisheim School of Management, the seminar participants at Hong Kong Polytechnic University, and especially the Associate Editor Robin Lindsey as well as two anonymous referees for their helpful comments and suggestions.

* Corresponding author.
E-mail addresses: achim.czerny@polyu.edu.hk (A.I. Czerny), simon.cowan@economics.ox.ac.uk (S. Cowan), anming.zhang@sauder.ubc.ca (A. Zhang).

http://dx.doi.org/10.1016/j.trb.2017.04.005
0191-2615/

simple infrastructure pricing scheme, the answer may be rather straightforward: Reduce infrastructure prices as long as they ensure sufficiently high revenues to cover infrastructure cost. Cost recovery is of policy importance because public funding is almost always limited and infrastructure supply is therefore conditional on cost recovery. However, infrastructure prices are typically not one-dimensional. Consider airports as an example (other examples would be sea ports or rail stations). Here infrastructure prices can roughly be divided into two groups. The first group contains infrastructure prices that are related to vehicle (i.e., aircraft) weight, while the second group contains infrastructure charges that are related to passengers. In fact, the International Civil Aviation Organization (ICAO), a specialized agency of the United Nations that represents 191 member states, proposes that landing charges as well as parking and hangar charges should be based on aircraft-weight formulae (ICAO, 2012). On the other hand, airports worldwide derive today as much aeronautical revenues from per-passenger based charges as from aircraft related charges (ACI, 2008; ATRS, 2012). Airports often charge passengers for airport infrastructure development and/or debt repayment (Zhang, 2012). For instance, the construction cost for Hong Kong airport's third runway will partly be covered by an increase in the per-passenger based airport charges. Yet, IATA (International Air Transport Association), the trade association for the world's airlines, seems to propose to further move away from aircraft-weight related airport charges towards passenger based charges.

In a previous study, Czerny and Zhang (2015a) showed that the very fact that airlines express a preference for a zero aircraft-weight related charge can signal that the airport charges structure proposed by airlines is also optimal from the social viewpoint. The social viewpoint does capture airline profits but also the passengers' surplus derived from flying. This is a useful policy result, which they show to hold for both uncongested and congested airports, because it suggests that conflicts of interest between the airlines' and the social viewpoints can be easily detected by the airlines' statements on their preferred airport charges structure.[1] Thus, there may be no need for policy makers to invest much effort to come up with their own judgment on airport charges structures as long as carriers have a preference for zero aircraft-weight related airport charges. However, Czerny and Zhang's results are based on a monopoly airline market. This view can be justified by the observation that many routes are indeed served by a single airline (e.g., Lazarev, 2013). Still, there is no doubt that many of the, perhaps, economically more important flight connections are offered by several airlines in parallel. This means that there is significant oligopolistic competition for passengers in the airline business.

That infrastructure charges can matter for competition between service providers that make use of the infrastructure has been found by Armstrong (1998) and Laffont et al. (1998a). They concentrated on fixed and customer related access charges for telecommunication networks and showed that telecommunication firms can approach the monopoly outcome by an increase in the customer related infrastructure charges. Thus, if policy makers would let telecommunications firms choose their infrastructure charges without restrictions, this could essentially eliminate the expected positive economic effects of competition between telecommunication firms. This raises the concern that a move from aircraft-weight related charges towards passenger based charges could be a concern for policy makers once airline competition is taken into account.

However, the results derived by Armstrong (1998) and Laffont et al. (1998a) are not directly applicable to air transport markets. Among the reasons are the following two, which will be addressed in the present paper. The first is related to the vertical structure of the air transport industry. While the mentioned analyses of telecommunication markets assumed that firms are vertically integrated in the sense that each company owns part of the overall telecommunication network, airline and airport markets are largely unintegrated (e.g., Basso and Zhang, 2007a and Basso and Zhang, 2007b). This slightly complicates the analysis because airlines cannot directly choose airport charges but have to "convince" airports to implement their preferred airport charges structure. The second is related to service quality. In the case of airlines, flight charges can be considered as a fixed cost only if flight frequencies are fixed. Airline frequencies may indeed be fixed in the short run because airlines typically change their flight schedules every half year and because vehicle fleet expansions can take many years because of backlogs in the aircraft manufacturers' production plans.[2] Fixed frequencies may also occur at slot-constrained airports (e.g., in Europe, Asia, and two major airports in the US), where slots limit the maximum number of flights that can be operated at an airport in a certain time interval (e.g., one hour) and the airlines' slot demands exceed the available number of slots throughout the day.[3] Especially in the case of slot-constrained airports, which are common in Europe and Asia, an increase in flight frequencies may be difficult to implement (e.g., Czerny et al., 2015, 2016b). London Heathrow and Hong Kong International Airport can serve as examples. But, it is not generally true (e.g., most airports in the US are not slot-constrained). This is relevant because frequencies determine service quality in two ways: First, an increase in frequency can reduce schedule delays, which measure the extent of whether passengers can travel at their preferred times (e.g., Douglas and Miller, 1974; Brueckner, 2004 and Brueckner, 2010). Second, an increase in frequency can increase congestion in the case of scarce runway capacity. Furthermore, while airline fares often change on a daily basis, flight schedules typically hold for a minimum of half a year. Thus, airlines may choose flight frequencies in order to strategically influence

[1] We consider an airport to be uncongested if its capacity is large enough to ensure that delays are zero for all relevant traffic volumes. On the other hand, capacity shortages lead to positive traffic delays at congested airports.

[2] The growing importance of aircraft leasing arrangements may gradually increase schedule and fleet planning flexibilities but is unlikely to fully eliminate the inflexibilities. This is due, in part, to the fact that in general leasing is costly relative to airlines' purchasing/owning aircraft (e.g., Oum et al., 2000; Allonen, 2013; Vasigh et al., 2015; Bourjade et al., 2017).

[3] Use-it-or-lose-it rules force airlines to use their slots at least 80 percent of the time because otherwise they might not be able to retain them in the future. This may create some flexibility for airlines to change flight numbers even in situations where slot demands exceed slot numbers throughout the day. We thank an anonymous referee for pointing this out to us.