It is observed that some of the airport operators set discount airport fees to airlines in order to attract airlines to add their airports as one of final destinations. For example, Kansai International Airport (hereafter, KIX) has started the discount program for the airlines starting the new flights from KIX. As a result of this discount program, during the subsequent five years from 2009, KIX has experienced a significant increase in the numbers of flights, passengers, and cargo. Furthermore, in 2014, FedEx sets KIX as its hub for Northern Pacific region. In addition to these discount programs, several hub airport operators introduce the price discrimination between the departing and the transit passengers. Namely, the hub operators impose the high fees on departing passengers whereas they offer the low fees on those who transit. For example, for transit passengers, the most of the hub airports in the Middle East set zero fees whereas those in Western Europe impose positive fees on the transit tickets. Consequently, the more travelers from other continents to Europe choose to transit their flights at the hubs in the Middle East rather than at the hubs within Europe. As claimed by Graham (2008), these phenomena indicate that the airport operators’ choices on their airports’ fees are one of the fundamental factors when airlines determine their network configurations. This paper evaluates the welfare effects of the price discrimination by airport operators between the departing and transit passengers. Specifically, we address the problem how the price competition of airports in transit market affects the airline’s network choice. We also deal with the problem whether the competition distorts the network choice.

Even though several literatures deal with the airline’s network formation, they pay less attention on the effect of the pricing policies of airports compared to on other topics such as the competition among airlines or alliances. Furthermore, the pricing policy at airports itself is another topic drawing an attention. The literatures dealing with the pricing policy mainly concern about the airport congestion, and its direct effect on the hinterland’s welfare. The pricing policy, however, may indirectly affect the economic welfare through the change in the airline’s network. For example, suppose that an airport reduces its fee for airlines. Although this drop in the airport fee may have a positive impact on the hinterland’s economic welfare by the trip cost reduction, it may have a negative impact through the change in the airline’s choice on its network configuration. Namely, a drop in the airport fee may cause the change in the position of other airports in some airlines’ networks from the regional hub to a spoke. As a result, the hinterland users of these airports face the increase in their trip costs.

Teraji and Morimoto (2014) deals with the distortion of price competition on the airline’s network choice. They show that the price competition may make the airline choose the airport in a relatively small city or country as its hub. Their model, however, have some shortcomings: i) the trip cost is just
equal to the airfare; ii) they focus on the specific type of the scale economy of forming the hub-spoke network. In order to overcome these shortcomings, Teraji (2017) extends the model of Teraji and Morimoto (2014) by adding the scheduling cost into the trip cost. By introducing the scheduling cost, which is dependent on the number of flights along the route, Teraji (2017) studies the effect of the price competition on the airline’s network in a more generalized situation. It has shown that the airport in the smaller city always becomes the airline’s hub when the price competition is present although hubbing at the smaller city always augments the cost for connecting flights.

This result stems from the following two setups of Teraji (2017). First, the airport operators cannot distinguish each traveler’s type, a departing or transit passenger. Consequently, the operators impose the same airport fee on both departing and transit passengers. Under this setup, since the discount in the airport fee always results in the decrease in the airport fee revenue, the operator of the airport in the larger city choose to exploit the rent from its departing passengers rather than to offer a discount to transit passengers. As a result, the operator of the smaller airport engages in the price competition more aggressively, and the airline sets its hub at the smaller airport. However, once allowing the price discrimination between departing and transit passengers, the operators can exercise their market power against the departing passengers. Therefore, the revenue from the departing passengers becomes independent from the price competition. In such situation, each operator chooses to discount the transit fee based on criteria whether the discount augments the number of its airport users and consequent airport fee revenue.

Second, Teraji (2017) assumes that the flight frequencies at both departing and transit airports affect the trip costs of each traveler. Under this setup, the flight frequencies are determined from the total traffic volume rather than the number of departing passengers. In most cases, the flight frequencies affect the trip cost when departing, but the waiting time becomes a significant factor for the trip costs when transiting. Furthermore, if the flight frequencies do not affect the choice of transit passengers, airlines may choose to provide service by using the large fleet rather than by increasing the flight frequencies. In such situation, even when the airport in the smaller city has no geographic advantage, there exists a possibility such that hubbing at such airport is socially preferred to hubbing at the large airport.

By incorporating these factors, we extend the model of Teraji (2017) by the following manner: i) we allow the operator’s price discrimination between departing and transit passengers; and ii) flight frequencies affect the trip cost only at the origin of trips. By using the setup of Teraji (2017), we develop a model consisted from multiple points. Among these points, one of them is an outside destination, and other two points represent the regional hubs of an airline, for example Charles de Gaulle and Amsterdam Schiphol. These two airports in the same region have services to other domestic airports. They differ in the hinterland’s population, the distance to the outside destination, and the
The trips are generated from each of all airports to the rest, and each traveler incurs the trip cost consisted from the airfare, the scheduling cost, and the transit cost. Specifically, the scheduling cost declines as the flight frequency at the origin of trips increases whereas the transit cost monotonically increases as the number of transit increases. The airline chooses whether to provide the direct flight service to the outside destination at two hubs or to one of two hubs. When choosing to provide the service to one of two hubs, the airline can save the operating cost to the other airport while it faces the increase in the operating cost for connecting flights. Taking the airline’s choice into account, each hub operator determines the levels of the airport fees for both departing and transit passengers. In order to evaluate the distortion induced by the price competition in the transit market, we compare the equilibrium network choice with the optimum.

Based on this setup, it is shown that all three networks, serving to both hubs or serving to one of the hubs, may become the optimal network configuration even when the two hubs are equidistant from the outside destination. Especially, under the equidistant situation, although Teraji and Morimoto (2014) and Teraji (2017) have shown hubbing at the small airport never emerges at the optimum, we show this is socially preferred to other two network configurations when the distance to the outside destination is moderate. This is because hubbing at the smaller airport allows the airline to utilize the larger fleet, and the usage of the large fleet reduces the social cost most significantly.

By comparing with the optimal network configuration, the price competition in transit market distorts the airline’s network choice less than the results obtained in Teraji and Morimoto (2014) and Teraji (2017). Under the absence of transit market as in these two papers, it is reported that the price competition of airports distorts the airline’s network choice in the following manner. First, even though there are no advantages, the airline sets its hub at the small airport. Second, due to the market power of airport operators, the airline becomes more easily to choose the point-to-point network. Since under this setup, the discount in the fee automatically implies the decrease in the airport fee revenue from the departing passengers, the operator of the large airport chooses to exercise their market power against its departing passengers rather than to discount its fees.

Our results show that the competition in transit market may replicate the efficient network choice. Since the hub operators can exercise their market power against their departing passengers, they choose to discount the transit fees only when they can increase their revenues. In such situation, whether to engages in the price competition depends on the airline’s cost structure. That is, the hub operator with the cost disadvantage must discount more than its competitor if its operator wants to become the airline’s hub. In such situation, however, even if the operator offers the zero transit fee, its competitor can become the airline’s hub by setting some positive fee on transit. This implies that the socially
preferred airport operator engages in the price competition more aggressively; therefore, the inefficiency of the price competition becomes less significant compared to the case of no price discrimination.

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