Dataset Description

1. Introduction

This dataset supports the experimental testing for the study entitled "A Mechanism for Bilateral Airport Slot Trading in the Secondary Market", co-authored by Kamyar Kargar, Konstantinos G. Zografos and Stefanos Mouzas. It includes information regarding the slot valuations for both the seller and buyer from the perspective of an intermediary.

Each trading scenario in the dataset involves a pair of slots (arrival and departure) currently held by an airline looking to sell, and another airline interested in buying them. For the selling airline, we compute the present value of the slot based on the income the seller would earn if it continues to operate the slot. Similarly, for the buying airline, the present value of the slot is calculated based on its potential future income if the buyer acquires it. These estimations use the Discounted Cash Flow (DCF) approach, a valuation method that estimates the present value of an investment based on projections of how much income the investment will generate in the future.

The basic formula for slot valuation using the DCF model is as follows:

$$\text{Slot Value} = \sum_{t=1}^{n} \frac{\text{Average net cash flow}_t}{(1+d)^t} \qquad (1),$$

where, ***d*** is discount rate, ***t*** is the time period and ***n*** is total number of periods (years).

To estimate the average Net Cash Flow (NCF) per season, as used in Equation (1), we require the average values of several parameters: profit per passenger per flight (*P*), load factor per flight (*L*), number of seats per flight (*S*), and the number of flights per season (*F*). Therefore, the average value of the NCF is calculated as follows:

$$Average\ (NCF) = Average\ (P) \times Average\ (LF) \times Average\ (S) \times Average\ (F) \qquad (2)$$

The average values for each parameter we used in generation of our instances and their sources, are given in the Table 1 as below:

Parameter	Average Value	Explanation
P	£4.8	Average worldwide airline net post-tax profit per passenger in 2019 was reported to be $6.12 (£4.8) by (IATA, 2019a).
LF	82.5%	Average worldwide airline passenger load factor in 2019 was reported to be 82.5% by (IATA, 2020).
S	Varies by scenario	The number of seats per flight for each scenario and each seller or buyer is selected based on the seating capacities of real aircraft models. This ensures that our simulations reflect realistic airline operations.
F	170	The calculation is based on slot trade statistics at Heathrow during the Spring Season of 2019, as sourced from ACL. More details can be found at ACL's completed slot trades page (https://www.acl-uk.org/completed-slot-trades/).
d	7.3%	We use weighted average cost of capital (WACC) for the worldwide airline industry as the discount rate (IATA, 2019b).

Table 1. Parameter settings for the slot valuation approach

We also assume the horizon time of 15 years in our analysis, the life of a loan for airplanes- the amortization period- is typically 15 or 20 years (AOPA Finance, 2024).

The data consists of 50 instances, divided into three main categories based on the percentage difference between seller and buyer valuations: high (H), medium (M), and low (L) profitability cases. In the high category, which includes 15 instances, the difference between the seller's and buyer's valuations ranges from 10% to 15%. The medium category has 20 instances with a valuation difference of 5% to 10%, and the low category includes 15 instances with a difference ranging from 1% to 5%. The case study statistics are summarized in Table 2.

Category	Valuation Difference Range	Number of Instances
High	(10%-15%)	15
Medium	(5%-10%)	20
Low	(1%-5%)	15

Table 2. Summary of instance categories by valuation difference range and count.

2. Data Structure

Each record in the dataset represents a unique trading instance and is detailed by the following columns:

- **Instance:** Identifier for the trading scenario.
- **Trade Type:** Classifies the category of the scenario as high, medium, or low.
- **Seller Aircraft:** Type of aircraft used by the seller.
- **Seller Seats:** Number of seats available in the seller's aircraft.

- **Seller Profit per Passenger Arrival (£):** Profit per passenger for the arrival leg from the seller's perspective.
- **Seller Profit per Passenger Departure (£):** Profit per passenger for the departure leg from the seller's perspective.
- **Seller Load Factor Arrival:** Load factor for the seller on the arrival leg.
- **Seller Load Factor Departure:** Load factor for the seller on the departure leg.
- **Seller NPV Arrival (£):** Net Present Value (NPV) of the arrival slot from the seller's viewpoint.
- **Seller NPV Departure (£):** NPV of the departure slot from the seller's viewpoint.
- **Total Valuation Seller (£):** Combined NPV of both slots for the seller.

The dataset also includes parallel columns for the buying airline:

- **Buyer Aircraft:** Type of aircraft used by the buyer.
- **Buyer Seats:** Number of seats available in the buyer's aircraft.
- **Buyer Profit per Passenger Arrival (£):** Profit per passenger for the arrival leg from the buyer's perspective.
- **Buyer Profit per Passenger Departure (£):** Profit per passenger for the departure leg from the buyer's perspective.
- **Buyer Load Factor Arrival:** Load factor for the buyer on the arrival leg.
- **Buyer Load Factor Departure:** Load factor for the buyer on the departure leg.
- **Buyer NPV Arrival (£):** NPV of the arrival slot from the buyer's viewpoint.
- **Buyer NPV Departure (£):** NPV of the departure slot from the buyer's viewpoint.
- **Total Valuation Buyer (£):** Combined NPV of both slots for the buyer.

Lastly, the dataset provides financial differences between the seller's and buyer's valuations:

- **NPV Difference (£):** The absolute difference in total valuation between the seller and buyer.
- **NPV Difference as % of Seller NPV:** The percentage difference relative to the seller's NPV.
- **NPV Difference as % of Buyer NPV:** The percentage difference relative to the buyer's NPV.

3. Acknowledgment

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