

# Developing A Practical Pricing Method for Airport Infrastructures

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## **Abstract**

The paper aims to explore the optimal pricing of airport parking facilities, taking into account the amortization of construction costs for old airports. The paper applies a benefit-cost model to price the parking lot of Mehrabad Airport in Tehran, which is an old airport that has been operating since 1938. The paper collects data from the airport management on the annual costs and income of the contractors who rented the parking lot, and calculates the current profit and the equilibrium price of the parking services. The paper finds that the contractors have a high profit margin of 40% from the airport parking, which is unfair to the customers and the airport authority. The paper suggests some policy implications for the airport sector managers, such as regulating the quality and profit of parking services, adjusting the pricing to reflect the traffic conditions, and increasing the annual expenses and rent for the contractors. The paper concludes that these policies can improve the management and performance of the airport parking sector and align with the interests and expectations of the stakeholders.

**Keyword: Airport, Parking Pricing, Transportation Infrastructure, Benefit to Cost**

## 1. Introduction

The pricing of transportation infrastructure is a critical issue that impacts the efficiency, equity, and sustainability of transportation systems. Among the various types of transportation infrastructure, parking facilities, particularly at airports, play a vital role as they generate significant revenues for airport authorities (Mahpour et al., 2024). With the growing demand for air travel, the use of airport parking has also increased (Becken & Carmignani, 2020). However, determining the optimal pricing for airport parking depends on several factors, such as demand, supply, location, and the quality of parking services (Love et al., 2014). One important question in this context is whether the same pricing strategy should be applied to airports that have long been established and have a solid market position, compared to those that are newly built or still under construction.

Airport parking projects that are currently under construction or have recently begun operations incur various costs, including construction, overhead, and investment expenses (Liu, 2003). Several methods can be employed to establish the optimal pricing for these projects. These methods include analyzing the supply and demand function, comparing similar infrastructures in different countries, and utilizing techniques such as linear regression or benchmarking (Straker, 2006). However, understanding the supply and demand function and determining the equilibrium price can prove to be challenging (Xie et al., 2017). Therefore, a more practical approach is to use linear regression to gather relevant data from multiple countries and then apply a transferability method to adjust the pricing for airport parking accordingly (Mamdoohi et al., 1393).

Due to the long lifespan of older transportation infrastructure, costs such as construction expenses and interest rates have been amortized. Therefore, it would be unfair to consider only the construction costs in evaluating such projects (Jones et al., 2014). Various methodologies can be used to determine the pricing of aging airport parking facilities. These include the benchmark method employed by established airports, the benefit-to-cost method, and multiple linear regression (Fan, 2004; Io Storto, 2017). This paper aims to price the parking services at Mehrabad Airport in Tehran, Iran, using the benefit-to-cost method. Mehrabad Airport, which began operations in 1938, currently has 6 terminals, 15 active airlines, and 4 parking lots.

In the next section of the study, we will discuss the review of previous literature on pricing. The third section will explain the methods of data collection, data analysis, and the methodology, focusing on the benefit-to-cost. The fourth section will present the results of the study, followed by a discussion and conclusions in the fifth section.

## 2. Literature review

Numerous studies have been conducted on parking pricing in various locations. For instance, Mark Friesen and colleagues examined dynamic pricing in Europe. They concluded that in order to

effectively implement dynamic pricing on a larger scale, private parking operators currently using a fixed pricing model should follow three essential stages: understanding, evaluation, and communication (Friesen & Mingardo, 2020). Moreover, researchers examined data from 14 garages participating in the SF-park program in San Francisco. They found that by implementing price management for parking, public usage of the garages could increase by over a third. Additionally, this approach helped reduce the average costs for drivers while maintaining a stable revenue stream for the city (Pierce et al., 2015).

Hao Wang and colleagues conducted a study analyzing field data collected over four time periods, both before and after the implementation of a new parking pricing policy in Nanning. Their findings indicate that as parking prices increase, the duration of parking time decreases. This relationship demonstrates an elasticity effect, which suggests that the responsiveness of parking circulation may fluctuate based on the influence of vehicle ownership (Wang et al., 2020). The pricing of parking lots has a significant effect on the amount of demand and the quality of services, and more studies have been conducted in this field (Mo et al., 2021; Nourinejad & Roorda, 2017; Ottosson et al., 2013; Pierce & Shoup, 2013; Shu et al., 2021).

Various studies focused on airport parking pricing. For instance, Andreas Papayiannis introduced innovative methodologies to develop recommended pricing structures based on parking capacity and the time remaining until departure. Within the field of airport parking sales, three main revenue management methods have been analyzed: Stochastic Multi-Resource (SMR), Stochastic Single-Resource (SSR), and Deterministic Single-Resource (DSR). These methods aim to assess the expected marginal values of parking spaces, which can then be used to regulate bid prices in an ongoing experimental framework (Papayiannis et al., 2019).

Litman conducted an investigation into determining the most effective pricing for various types of parking services, taking into account several factors that influence the final cost (Litman, 2018). This study recommends that parking services should be priced based on the costs associated with land acquisition or rental, construction, maintenance, and operations. This includes the expenses for utilities such as water, electricity, and gas. Additionally, another study examines how the maximum daily fee charging strategy has impacted the quality of parking services at Hongqiao International Airport, using automated transaction data from before and after the strategy was implemented (Cheng & Qi, 2019). The estimation results indicate that the new pricing method will significantly decrease the demand for long-term parking and enhance the availability of airport parking facilities, particularly during extended vacations. As a result, both throughput and revenue at the airport have seen substantial increases, though there are additional time costs associated with vehicles departing. Furthermore, the price elasticity for parkers with varying parking durations was estimated. The findings revealed that price sensitivity is relatively inelastic but varies depending on the parking duration.

In the absence of a comprehensive pricing method for airport parking, it is imperative to consider a multitude of additional factors. These may encompass the supply and demand dynamics of transportation at the airport, as well as various socioeconomic factors (A Mahpour, A Baghestani, 2024)(Keefe, 2014). Research has indicated that the characteristics of airports and air transportation, as well as the socioeconomic attributes of countries and cities, could exert an influence on the pricing and revenue of services (Iyer & Jain, 2019; Zuidberg, 2017).

A significant amount of research has focused on airport parking pricing; however, it is uncommon to find studies that exclude depreciated costs or reference outdated airports in their pricing analysis, particularly when using the benefit-to-cost method. Therefore, this issue represents a research gap that deserves more attention in order to establish fair pricing practices.

### **3. Methodology**

In this section, the method of data collection is described and the collected information is described. In addition, the method used in the study is explained.

#### **3.1. Data**

The data on the parking information for terminals 1, 2, 4, and 6 of Mehrabad Airport were obtained with the cooperation of the airport management. The parking lots of the airport are rented annually to two contractors. The data were collected in two sections. The first section includes the annual costs of the contractor, such as annual rent, number of staff, general expenses, salaries of employees, insurance costs, maintenance costs, and equipment costs. The second section includes the income information of the contractor, such as the number of vehicles exiting with less than 24 hours of parking and more than 24 hours of parking, the entrance fee, the parking fee per day or hour, the average parking time of less than 24 hours and the average parking time of more than 24 hours.

#### **3.2. Benefit-to-Cost**

In this study, a benefit-cost model was utilized to evaluate the current profitability of Mehrabad airport's parking lots and to project future pricing for these lots. Initially, we calculated the current costs and annual rent associated with the parking areas. Following this, we determined the annual revenue generated from the parking lots. This allowed us to establish the current annual profit. Subsequently, we estimated the equilibrium price in relation to costs. The annual profit was calculated using equation 1, while the annual profit rate was derived from equation 2:

$$\text{Annual Profit} = \text{Annual Income} - \text{Annual Cost} \quad (1)$$

$$\text{Annual profit rate} = (\text{Annual Profit} / \text{Annual Cost}) * 100 \quad (2)$$

## 4. Results

The costs associated with Mehrabad Airport are detailed in Table 1. The total number of parking staff across all shifts is 99 individuals and the average monthly salary of each staff member is 65 million IRR. Also, the majority of the contractor's expenses for one year are attributed to the annual rent for the parking lots, which amounts to 21,000 million IRR<sup>1</sup>, along with the salary of all staff members totaling 77,220 million IRR, and insurance costs totaling 18,000 million IRR.

Additionally, the general expenses amount to 500 million IRR per month. The monthly costs for building maintenance are 300 million IRR, while the monthly expenses for equipment maintenance and repair are 200 million IRR. Therefore, the total annual expenditure for general expenses, building maintenance costs, and equipment maintenance costs is 12,000 million IRR. In total, the annual expenses for the parking lots at Mehrabad Airport, which include maintenance, equipment costs, and general expenses such as water, electricity, and gas, reach 317,220 million IRR.

**Table 1. Mehrabad airport parking cost**

<b>Detail</b>	<b>Amount (Million IRR)</b>	<b>Month/ Year/ Person</b>	<b>Total Cost (Million IRR)</b>
Terminal 4 and 6 parking lot rental (total capacity: 1700)	70,000	1 year	70,000
Terminal 1 and 2 parking lot rental (total capacity: 3220)	140,000	1 year	140,000
Monthly general expenses (water, electricity, gas, telephone, etc.)	500	12 Month	6,000
Monthly insurance	1,500	12 Month	18,000
Monthly building maintenance	300	12 Month	3,600
Monthly equipment maintenance	200	12 Month	2,400
Average monthly salary of each staff member	65	12 Month * 99 Person	77,220
Total cost (Per 1 year)			317,220

The income characteristics of contractors are outlined in Table 2. Parking for drivers is available in two formats: daily stops (lasting more than 24 hours) and hourly stops (lasting less than 24 hours). The parking lot experiences a departure of 3,500 cars for hourly stops, while 1,500 cars leave for daily stops. The average stopping time for hourly stops is 4 hours, whereas daily stops average 2 days. Consequently, the revenue generated from hourly parking amounts to 76,650 million IRR, while the revenue from daily parking totals 558,450 million IRR. Overall, the total revenue from Mehrabad Airport parking is 635,100 million IRR.

<sup>1</sup> 500,000 IRR is equal to 1 Dollars in Jan 2024

**Table 2. Mehrabad airport parking income**

<b>Parking</b>	<b>Departure</b>	<b>Average stop</b>	<b>Income price</b>	<b>Hourly or daily price</b>	<b>Amount (Million IRR)</b>
Hourly stops	3500	4 hours	20,000 IRR	10,000 IRR	76,650
Daily stops	1500	2 days	20,000 IRR	500,000 IRR	558,450
Total income					635,100
Adjusted Total Income (Correction factor = 0.7)					444,570

Given that the full parking capacity may not be available throughout the year due to factors such as maintenance or seasonal fluctuations in demand, this study applies a correction factor of 0.7 to the annual revenue. Consequently, the total corrected annual revenue amounts to 44,570 million IRR. The results show that in order for the amount of income and cost to be equal, drivers must pay 24,142 IRR for each hour of parking, which is equal to the equilibrium price. Considering the cost and income obtained, the amount of profit calculated for the contractor is 127,350 million IRR per year, and the annual profit rate is 40.15%.

## **5. Policy and Conclusion**

This paper addresses the issue of pricing for outdated transportation infrastructure, arguing that it is unfair to factor in construction costs that have already been amortized. It proposes a benefit-cost model for pricing the parking lot at Mehrabad Airport in Tehran, which is an older airport, explicitly excluding construction costs from the calculations. This paper gathers annual cost and income data from the contractors who lease the parking lot from the airport management and analyzes the profitability of the parking business. The findings indicate that the contractors generate a net profit of 40.15% from the airport parking operations.

This paper offers policy recommendations for airport sector managers based on the findings of a benefit-cost analysis of parking lot pricing. It suggests that airport service department managers should closely monitor and regulate both the quality of parking services and the profit margins of contractors who operate the parking lots. Addressing these issues can enhance customer satisfaction and loyalty, as well as increase demand for parking services (Nourinejad & Roorda, 2017)(Qin et al., 2022).

Additionally, the paper recommends that parking lot pricing be adjusted to reflect the traffic conditions surrounding the airport, contributing to an overall improvement in traffic flow (Jakob & Menendez, 2020). Furthermore, it suggests increasing the annual fees and rent for contractors to ensure a fair and reasonable profit margin while preventing excessive profiteering in the parking business. In conclusion, these policies can enhance the management and performance of the airport parking sector, aligning them with the interests and expectations of stakeholders.

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