Measuring Public Transport Fare Affordability

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Presented at
Thredbo 16 Conference
26 August 2019
Singapore
Outline

• Introduction

• Affordability Index – Methodology

• Main Findings
  • Fixed-Distance Concessionary Fares for Seniors & Students
  • Fare Affordability Index for a Representative Family in Second Quintile Group
  • Comparison of Fare Revenue per Passenger-Km

• Conclusions
Introduction

• Keeping fares affordable while ensuring the financial sustainability of the public transport system is a major challenge for most cities.

• Commissioned by Singapore’s Public Transport Council (PTC) in 2018, we conducted an international benchmarking study to understand the latest trends in public transport fares, which benchmarked Singapore’s public transport fares against 11 other major cities.

• This presentation focus on the methodological issues, concessionary fares, fare affordability index for a representative family in the second income quintile group, and fare revenue per passenger kilometre.
The Asian cities were selected as many of them have been expanding their PT services in recent years which may share similar operating characteristics as Singapore.

Cities in other major regions like Australia, Europe and North America were selected due to their established PT systems.
Affordability Index – Expenditure-Based Approach

• Affordability index for a particular income group $i$ ($AI_i$) is defined as the burden of public transport costs on an average household in a specific demographic group:

$AI_i = \frac{\text{Average Expenditure on PT for Group}_i}{\text{Disposable Household Income of Group}_i}$

• System-level affordability index ($AI$) is defined for the whole city:

$AI = \frac{\text{Average Expenditure on PT for the City}}{\text{Average Disposable Household Income for the City}}$

• This measure is very intuitive and makes sense to everyone as the same approach has been used in studying housing affordability.
  • But ....
Affordability Index – Expenditure-Based Approach: Data & Methodological Issues

• Household Public Transport Expenditure Data – A Big Challenge
  • Primary sources of expenditure data is from Household Expenditure Surveys (HES)
  • Singapore & Hong Kong: every five years
  • Sydney: every six years
  • Beijing, London, New York, San Francisco, Seoul, Taipei, Tokyo, Toronto: annual data
  • Paris: expenditure data not publicly available

• Methodological Issues – A Much Bigger Challenge
  • As the household income increases, the percentage of public transport non-users usually increases.
  • Using “average” PT expenditure for a demographic group will underestimate the affordability for PT users.
    • In order to improve the measurement accuracy, we need the modal-split data for different demographic groups, which is not available for all cities under the study.
Affordability Index – Representative Commuter-Based Approach

• In a World Bank sponsored study by Carruthers, Dick and Saurkar (2005): Affordability of Public Transport in Developing Countries.
  • On the monthly expenditure on public transport, it uses the cost of 60 10-km trips as a proxy for a representative full-time working adult who uses on the public transport on daily basis
  • Use per capita income for each quintile group and for the whole city
  • Eg, Singapore during 1995 - 2004:
    • AI for first quintile = 10%
    • System level AI = 2.4%
  
• Methodological issues:
  • Ignore monthly concessionary passes
  • Affordability at the household level

Table 6. Affordability Index Values for Twenty-Seven Cities.

<table>
<thead>
<tr>
<th>City</th>
<th>Per Capita Income USPPP</th>
<th>Bottom Quintile Income As Percent of Average</th>
<th>Fare for 10km Travel (PPP US cents)</th>
<th>Affordability Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairo</td>
<td>7,117</td>
<td>43.0%</td>
<td>26.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Brussels</td>
<td>22,106</td>
<td>50.0%</td>
<td>39.3</td>
<td>0.3</td>
</tr>
<tr>
<td>London</td>
<td>53,057</td>
<td>30.5%</td>
<td>116.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Prague</td>
<td>32,757</td>
<td>52.0%</td>
<td>88.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Bangkok</td>
<td>20,386</td>
<td>31.0%</td>
<td>32.2</td>
<td>0.4</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
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<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Affordability Index – Representative Family-Based Approach

• To better capture the affordability issue at the household level and to take into consideration of concessionary passes, in our benchmarking study, we decided to use a representative family to derive the public transport expenditure as follows:
  • **Representative family consists of 2 adults and 2 schooling children.**
  • The expenditure is computed based on **10 km average trip fares multiplied by 60 trips or concession pass prices (whichever is lower)** for each of the family member.

• The **household disposable income** was based on that of **the second quintile household income group** as this group is most likely to depend on public transport regularly.
  • Disposable income data is from **Euromonitor**.

• Major methodological challenge
  • **Derive consistent fixed-distance fares**
## Fare Structure Summary

<table>
<thead>
<tr>
<th>Fare Structure</th>
<th>Flat fare</th>
<th>Distance-based</th>
<th>Zones-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asia Pacific</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Seoul</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Beijing</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Sydney</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Taipei</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tokyo</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paris</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>London</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Americas</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>San Francisco</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Toronto</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

- **Singapore** had one of the more equitable fare structures with fares pegged to the distance travelled and charged in a granular manner.
- **Singapore** was one of the four cities that had implemented a fully integrated public transport fare structure. The other three cities were New York, Seoul and Toronto.

### Definitions of Fare Structure:

1. **Flat Fare** denotes fare that is fixed regardless of distance or zone traveled.
2. **Distance-based** denotes fare that is charged based on distance traveled. The type of fare includes step-up fares where a flat fare is charged for each distance range specified and increases by distance.
3. **Zone-based** denotes fare that is charged based on zones traveled, regardless of actual distance traveled.

- **San Francisco’s Train** includes Muni (flat fare) and BART (distance-based).
- **Taipei Bus** - Depends on routes/zones crossed.
- **Tokyo Bus** - Flat fare only if traveling on same bus, to pay again if changing to another.
- **Paris Bus & Train** - Flat fare across the Zones 1-2 on Metro & RER Zone.
- **Flat fare is not applicable for RER and Noctilien Nightbus if crossing zones 3 onwards**.
- **London Bus** - Flat fare but if transferring to another bus must be within one hour from boarding first bus to the subsequent bus.
The comparison of fares is done across the 12 cities on the minimum, mean and maximum fare at each distance group, i.e. 5KM, 10 KM, 15KM and 20KM.

The fare structure of each city is considered, these can largely be clustered as Distance-based, Zone-based and Flat Fare. For the distance based and zone based fare structures where the minimum and maximum fare per distance group are likely to differ, the mean fare is computed by averaging the minimum and maximum fare.

In this benchmarking study, single mode BUS fares and single mode TRAIN fares, without bus to bus and train to train or bi-mode transfers, are used.

To make comparisons across all cities, the collected fares were adjusted using PPP by Private Consumption in Singapore Dollars.
- London, Singapore, and Sydney’s eligibility age were the lowest at 60 years old
- In contrast, it was 65 years old in Beijing, Hong Kong, New York, Paris, San Francisco, Seoul, Taipei and Toronto.
- Tokyo had the highest eligibility rate of 70 years old
- Top three cities with the lowest bus and train fares (60 year old senior citizen): London, Singapore, Beijing
Fixed-Distance Direct Train/Bus Fares for Students (PPP Adjusted)

- Top three cities with the lowest student train fares: Singapore, Seoul, Hong Kong
- Top three cities with the lowest student bus fares: London, Beijing, Singapore
- New York student bus fares were the highest as they had to pay full adult fares.

- The age of eligibility for student concessionary fares also differs from city to city.
- For the purpose of comparison, fares were based on students at secondary level with actual fares charged.
In terms of a monthly PT expenditure for a family of four and for the second income quintile, Singapore ranked 2nd; while Tokyo was the worst. On average, 2nd quintile representative family (which represents typical PT users) in SG spent 4.8% of their disposable income on public transport.

While San Francisco’s second quintile household’s PT expenditure is about 28% higher than Singapore, their household’s disposable income is about 48% higher than Singapore.
### Fare Revenue per Passenger-KM in 2016 PPP-SGD

<table>
<thead>
<tr>
<th>City</th>
<th>Fare Revenue per Passenger-KM (2016) – SGD (PPP adjusted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>0.11</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>0.14, 27% higher than Singapore</td>
</tr>
<tr>
<td>Sydney</td>
<td>0.15, 33% higher than Singapore</td>
</tr>
<tr>
<td>Toronto</td>
<td>0.16, 41% higher than Singapore</td>
</tr>
<tr>
<td>New York</td>
<td>0.17, 55% higher than Singapore</td>
</tr>
<tr>
<td>San Francisco</td>
<td>0.18, 60% higher than Singapore</td>
</tr>
<tr>
<td>London</td>
<td>0.19, 71% higher than Singapore</td>
</tr>
</tbody>
</table>

- Singapore’s fare revenue per passenger-km is $0.11 for the entire PT system in 2016.
- Singapore’s fare revenue per passenger-km is the lowest across the cities compared.
- Hong Kong, ranked the second, about 27% higher than Singapore, at SGD 0.14.
- For London, commuters are charged SGD 0.19 or SGD 0.08 higher per pax-km when compared with Singapore.

If Singapore’s fares were charged, it would result in Hong Kong and London making a loss of $713 million and $2.16 billion in fare revenue respectively.
Conclusions

• Fully integrated fare structure not commonly found among cities
  • New York, Seoul, Singapore, and Toronto

• Singapore had one of the most granular distance fares structure

• London, Singapore, and Sydney’s eligibility age for senior citizen were the lowest at 60 years old
  • London most generous; free travel, followed by Beijing and Singapore

• Top three cities with the lowest student train fares: Singapore, Seoul, Hong Kong

• Top three cities with the lowest student bus fares: London, Beijing, Singapore

• In terms of fare affordability, Singapore is the second most affordable city
Conclusions

• Balancing Affordability/Concessions and financial sustainability is a constant struggle for all cities

  • London provides free travel but highly cross-subsidised by other commuters (highest fare revenue collection of SGD 0.19 pax-km)

  • Singapore affordable fares and low fare revenue per passenger kilometre (SGD 0.11) come at a cost to tax payers

  • Increasing subsidy and falling cross recovery ratio for Singapore’s PT system over the years

• In view of the global trend of increasing cost to provide public transport services, a continuing divergence will result between fare revenues and the costs incurred to deliver the services

• Hence, a greater balance needs to be attained between fare affordability and financial sustainability for a more self-sufficient system

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Conclusions

• Affordability and financial sustainability of the public transport systems are important to all stakeholders, especially for the policy makers.

• There are no regular or recurrent study on this matter at global scale.

• I am here making a call for a collaborative effort on this important issue:
  • Methodological developments
  • Data collection & a global database
  • Model calibration
  • Global benchmarking on regular basis
Thank You!

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