Fare Policy, Structure, and Technology

- Policy objectives
- Issues that agencies face
- Fare structure
- Demand response to fare changes
- Fare technology

Fare Policy Objectives

- Fund operations (at least partially)
  - fare recovery ratios (based on 2014 NTD data)
    - 0.14 - 0.78 (average 0.42) for heavy rail
    - 0.13 - 0.56 (average 0.27) for light rail
    - 0.01 - 1.50 (average 0.18) for bus
- Keep transit affordable and promote social equity
- Support growth of demand for transit
- Make fare structure easy to communicate
- Reduce fare system costs
  - fare collection
  - maintenance of equipment
  - customer service

Fare Policy Intersects With Other Areas

- Finance
  - funding operational expenses
- Operations
  - fare technology affects dwell times, cycle time, reliability
  - some fare structures require fare inspection
  - maintenance of equipment
- Public Support
  - politicians may promise not raising fares
  - difficulty gathering support to raise fares to improve service quality
  - labor’s push for higher wages may require raising fares
- Administration
  - fare technology
  - fare policy and equity analysis
  - revenue sharing across jurisdictions (funding formula)
- Marketing
- Customer Service
  - fare structure and technology are among the first things a customer has to learn before taking transit

Issues that Agencies Face

- Fare recovery ratios
  - typically one third of operating costs, but it varies
  - rare to make a profit systemwide
- How often to raise fares
  - reactive
  - annually, with inflation
- Gathering and maintaining political support
- Raising base fares vs. changing the relative cost of passes and discounted fare products
- Investing in new fare technology

Fare Structure (Market Segmentation)

Flat Fare

Differentiated Fare

- Spatial
  - Zonal
  - Distance-based
- Temporal
  - Peak surcharge / off-peak discount
- Service
  - Bus vs. rail
  - Regular bus vs. express bus
- Socioeconomic
  - Students
  - Seniors
  - Disabled
  - Social Programs (needs-based subsidy)
- By willingness to pre-pay
  - Daily, weekly, 3 day, monthly passes

Fare Elasticities

- Fare elasticities can range from -1.0 to 0.0, but are more often closer to -0.40 or -0.30.
  - Rail elasticity is about half of bus, e.g. -0.20 or -0.15.
  - Off-peak elasticity is about double of off-peak, e.g. -0.50.
  - Demand for work trips is much less elastic, e.g. -0.10
  - There is higher demand for free transit than for very cheap transit.
- Raising fares is an effective instrument for increasing revenues, but not to increase demand.
- From a microeconomics perspective, fares should be higher for
  - longer trips
  - trips in more convenient, reliable, comfortable, and frequent modes
  - peak period trips
  - trips when other modes are inconvenient or costly
  - trips subsidized by third parties (government, businesses)

Transfer Pricing and Policy

- Full fare
- Reduced price
- Free
- Time-based

Pay-as-you-go, Passes, and Capping

- Pay-as-you-go
  - cash
  - tickets and smartcards with balance
- Passes give a discount to frequent users
  - some fare revenue is derived from pass sales from customers that do not break even
- Passes increase convenience and reduce saliency
- Passes are sometimes subsidized
  - employers
  - universities
  - government (pre-tax benefit)
  - social programs, e.g. access to jobs
- Capping
  - pay-as-you-go up to daily, weekly, or monthly limit
  - best price guarantee
  - simplifies customer communication

Fare Policy Demand Analysis

- Traditional 4-step modeling not usually appropriate
  - insufficient spatiotemporal resolution
  - total demand does not change much in a relatively short planning horizon
- Fare elasticity analysis is usually simplistic
  - Multiple simultaneous considerations
    - mode alternatives
    - fare products - pass vs. pay-as-you-go
    - costs - not just in absolute terms, but relative to all alternatives
  - Exogenous factors are not controlled for
    - fuel prices
    - employment and residential development
    - tax policy
    - sociodemographics
    - new modes, e.g. transportation network companies (TNCs)

Communication of Fare Policy

- To the public
  - agency website
  - near fare vending machines
  - customer service booths
- For a fare change
  - agency website
  - flyers and posters
  - public hearings
- Via APIs or standard feeds, for trip planners
  - some standards exist, but they are not widely adopted
    - GTFS fare_attributes and fare_rules tables
    - some agency's fare rules are complex and cannot be described with existing standards
  - no standard API for determining price of a hypothetical trip

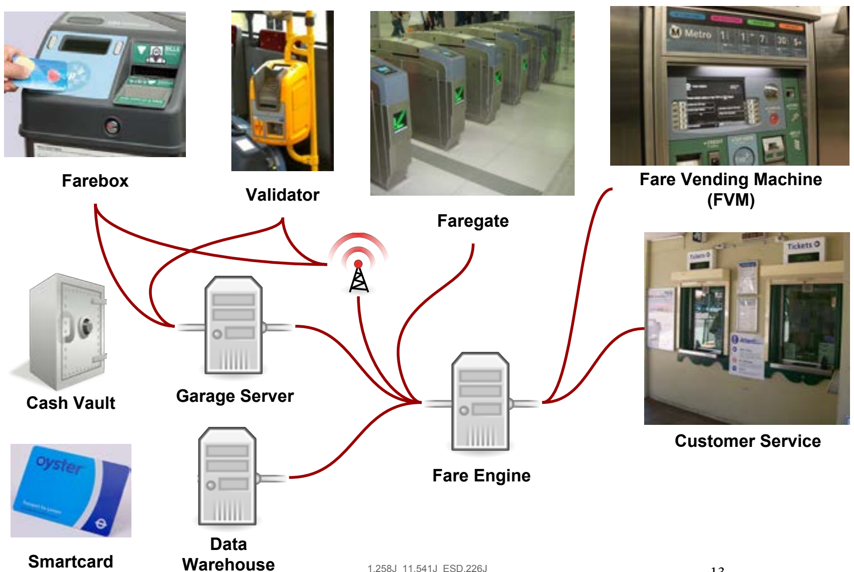
Partnerships

- Employer partnerships - MIT AccessMyCommute
  - Charlie chip embedded in employee badge
  - Marketed as an unlimited use pass
  - Billed on a unit cost per ride
  - Reduces parking cost (capital, maintenance) for employer
- Other transportation providers - Chicago Transit Authority
  - PACE - regional bus
  - Metra - commuter rail
  - Divvy - bike share
- Mobility as a Service (MaaS)
  - monthly payment for a bundle of transportation options
    - e.g. unlimited use transit pass, 5 bike rides, 5 TNC rides

Fare Control

- Tap In
- Tap In + Tap Out
  - may require internal fare vending machine
  - may require additional station attendants
  - may allow negative balance
  - useful for zonal systems or for revenue sharing across agencies
- Proof of Payment
  - requires significant inspection
  - higher fare evasion rate

Fare Technology



Fare Media

Cash

Ticket
(magnetic stripe)

Mobile Ticketing

Token

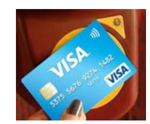
Smartcard

Contactless Bank Card

Smartcards

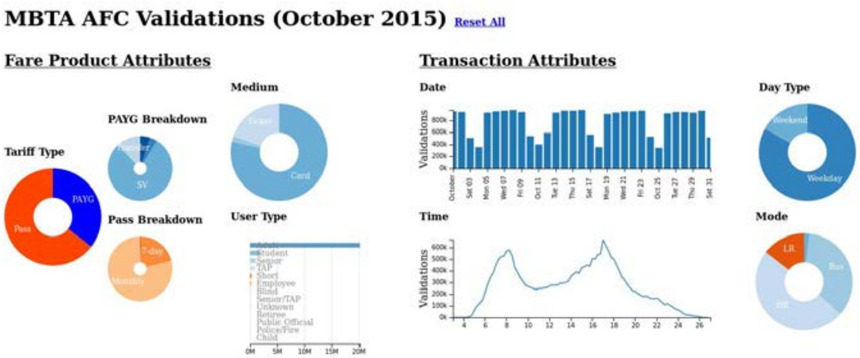
- Small computer inside each card
- Harder to break security
- Enables more complex fare structures
- Faster boarding and higher gatebank throughput
- Account registration
  - balance protection
  - autoload
- Better data for analysis and planning
- Embeddable in employee / student badges
- More expensive than tickets
  - smart tickets are cheaper
- Proprietary systems, multiple standards
  - move towards open-source hardware and specifications
- Integration across agencies of a region is possible but challenging
- Enables retail payment. Examples in Japan and China.

Contactless Bank Cards (Open Payment)



- Transit agencies would prefer not having to deal with the complexities and costs of fare collection
  - outsource to banks and credit card companies
- Credit card companies specialize in payment
- Contactless bank cards are secure
- Cards can be used directly for payment or as tokens
  - compatible with complex fare structures
- Also enables payment with NFC smartphones
- Reduces fare collection cost
  - simplifies customer communication, even for tourist and occasional user
  - relies on open standards, so there is more competition in the market
  - outsources some aspects of customer service to banks
  - eliminates costs of creating and distributing smartcards
- Equity issue: access to the unbanked
  - agency can issue cards with pre-loaded balance
  - banks can offer free accounts
  - cards must be obtainable at many locations

Fare Analytics



Source: Andrew Stuntz, MST Thesis, 2018.

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