The ups and downs of a public transport reform: the case of Transantiago

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Motivation

- Transantiago was (and is still) a controversial and problematic reform
- It originally generated a great disruption to public transport users and unseen social and political unrest
- Why did this happen?
- How could this have happened in a country noted for otherwise good public policies?
Overview

- The public transport system before the reform
- The original design of Transantiago and its problems:
  - Design
  - Contracts and incentives
  - Fares and subsidies
- What was done since 2007?
- Current challenges and wider lessons for public transport reform in developing countries (SITP)
1) The system pre-TS

- Tendered but competitive bus system
  - No competition in fares, only frequency

- Low quality of buses
  - Noise
  - Air pollution

- Excess supply in low demand hours
System pre-TS

- Transit chaos
  - Congestion
  - Accidents

- Informality
  - 2,1 bus per owner
System pre-TS

- Drivers
  - Informal labor relations
  - Worked 14 to 16 hours per day

- Rents or inefficiencies
  - Owners of tendered contracts
  - Driver wages included a “premium”
System pre-TS

- Important fall of public transport in modal split:
  - 1991: 70%
  - 2006: 50%

- Growing congestion due to rising car ownership
However:

- Very good coverage:
  - “where there is demand there is supply”
  - More than 300 services

- Point to point services:
  - Private solution to “fare integration”
  - Less than 10% of users changed modes or bus services to complete trip
Metro

- Modern, efficient and high quality

- Covered operational cost and 1/3 of investments

- But:
  - Underutilized (Metro “Boutique”)
Regional experience

- Optimism regarding public transport reform possibilities:
  - Transmilenio in Bogotá
  - Curitiba

- Private infrastructure concessions in Chile
  - Same professional teams
2) General description of TS

- Trunk-feeder design:
  - City split into 10 local service zones for feeder services (exclusive franchise)
  - 5 trunk route services
  - Plan for exclusive bus corridors (225 kilometers by 2025, modal exchange stations (bus-metro)
Reform description I

- Fare integration:
  - Not complete, connections had a cost, but less than two full fares

- Electronic payment mechanism
  - Non-contact pre-paid electronic card
Reform description II

- Financial Administrator (AFT):
  - Revenue collection from public and pay operators according to contract conditions
  - Establish a network of charging points (including Metro) for pre-payment cards
  - Equip buses with payment validations equipment, GPS, fleet management system, passenger count equipment, cameras and video recorder, emergency button, etc.
Reform description III

- Fleet renovation
  - Only for some trunk services
  - Euro III and Euro IV technology
  - Articulated buses (160 passengers)

- Eliminate competition in the streets
  - 90% of payment to operators fixed
  - Prohibition to pay drivers according to passengers transported
Reform description

- Self-funding (at average fare of the old system). Had to pay:
  - Bus operator contracts
  - Metro
  - AFT
  - SIAUT
  - PPP infrastructure projects
- Design fleet reduced to a minimum (4,500)
3) The “Big Bang” (10/2/2007)

- February 10\textsuperscript{th} 2007
  - This stage had already been postponed 6 months
  - All services were reorganized
  - Fare card payment was supposed to be introduced
  - New contracts came into operation
State of the system in 10/2

- Infrastructure
  - 16 of 225 kms of exclusive corridors operational
- “Clearing” system was not operating
  - Pay operators according to “reference” demand
- Fleet management system inexistent
  - how to monitor and enforce service requirements?
- Few charging points for card
- Fare fixed at $380 (except Metro at peak)
Consequences I

- CHAOS!!
  - Few buses operating
  - Articulated buses reduced frequency
  - High congestion in Metro due to:
    - New route design
    - Reliability compared to buses
    - Cheaper than before the reform
    - Recharge payment card
Consequences II

- Access, waiting and in vehicle travel times increased
- Trip experience (quality) in public transport deteriorated
- Social and political crisis (spontaneous riots)
4) What were the main mistakes?

- To answer this we need to clarify what determines users’ welfare in public transport.

- And then see what the original design had to offer to users.
Welfare: generalized cost of travel

\[ W = \alpha - p - CA - CE - CV - E \]

- **Mode constant:**
  - Service quality (comfort)
  - Fleet renovation

- **Financial cost:**
  - Fares

- **Access time cost:**
  - Coverage

- **Waiting time cost:**
  - Frequency
  - Connections required to complete trip

- **Externalities:**
  - Fleet quality
  - Incentive structure

- **In vehicle time cost:**
  - Infrastructure
4.1) What was the result for each of these elements?

- Mode constant (comfort)
  - Congestion increased in buses and metro
  - Scarce fleet renovation (T1, T2 y T4)
  - New buses uncomfortable (few seats and difficult to move around)

- Fare was to increase for the majority
  - Average fare of old system (only 10% gained)
  - Subsequently fare was fixed (deficit)
Results for each element I

- Access time costs: original network design (centrally planned) increased this cost

- Waiting time cost
  - 70% of trips had to make connections
  - Low frequency of services:
    - Articulated buses
    - Fleet level design too low (4.500)
    - Few buses operating (incentives)
Results for each element II

- In-vehicle time cost:
  - For people who could now use the Metro this time fell (but it is worth 1/3 of waiting time)
  - For others it probably remained fairly constant
    - Lower average speed of articulated buses (infrastructure planned to be completed in 2025!!)
    - Higher respect for transit laws and regulation
    - Higher boarding speed (electronic card)
Results for each element III

- Externalities:
  - Reduced
    - Noise
    - Air pollution
    - Accidents, injuries and fatalities

- However, did the majority value this? Did they relate it to the reform?
Net effect of original design

\[ W = \alpha - p - CA - CE - CV - E \]

Initially

\[ W = \downarrow \quad \downarrow \quad \downarrow \]

Conclusion: original design and implementation never offered very much to users (when infrastructure was not in place)
Example: connections

- Trunk-feeder scheme makes sense when the time savings in the trunk service more than compensates for the connection cost:
  - Metro
  - BRT (Transmilenio)
  - Transantiago, no (only 16 kms of corridors in February 2007)
Towards a solution I

- **Mode constant:**
  - Increase fleet (Pullman buses in 2007; regular fleet increased from 4,500 to 6,100 buses)
  - More fleet renovation (T5; new contracts)
  - Bus stop infrastructure (> 10,000 by 2009)

- **Infrastructure (in-vehicle time):**
  - Accelerate construction of exclusive corridors
  - More than 70 kms built during 2007-2009
  - Network had 90 kms by early 2010
Towards a solution II

- **Financial cost:**
  - Freeze the fare (small rise in February 2009)

- **Access time cost:**
  - Increased coverage
  - Number of services increased from 222 to 333

- **Waiting time cost:**
  - More fleet, more frequency and less connections
  - MAKE SURE OPERATORS COMPLY WITH OPERATIONAL PLAN!
4.2) Contracts and incentives

There are only two options:

- **Carrots**
  - Market incentives, link income to demand

- **Stick**
  - Fines, monitoring and enforcement
Carrot

- Payment to operators hardly depended on demand
  - 90% of payment fixed (referential demand)
  - 100% during first few months before the “clearing” system was operational
**Stick**

- **Fines were very low:**
  - Fines when frequency was below **60%** of plan
  - 200 UF for each occurrence (US$ 10,000)
  - Required monitoring
  - No payment associated with pax-km supplied

- **Un credible threat:**
  - 6,000 UF in fines in a 12 month period required the authorities to but an end to the contract (US$ 258,000)
Consequences

- Worst case scenario:
  - No stick and no carrot
  - Operators had no incentives to comply with the operating plan
Solutions

- First contract renegotiation:
  - Middle of 2007
  - Increase from 10% to 35% income linked to demand
    - But with hindsight this may still be too low when operators do not compete
  - Change payment formula:
    - Real payment = ICPH * Payment due by contract
    - ICPH: Index of seat supply per hour
ICPH

- Measured every half hour (capacity “in movement”/ capacity required by plan)
- It was enough for a bus to be moving 5 minutes in half an hour for its seats to count
  - There was no way to monitor that the bus in “movement” was in route
- 94% flexibility for peak hours
ICPH

- Worked in the short-run
- But:
  - Operators started gaming the system:
    - Abuse 94% of flexibility during peak hours
    - Change buses within half an hour
    - Bus in movement but outside route
    - No incentives to control driver rest time
What happened in 2008?

- A provisional fleet management system was introduced
  - Each bus could be monitored in each route
- IADB credit with which the system was being subsidized was declared unconstitutional
  - In October of that year Constitutional emergency funds began being used
New control mechanisms

“Discounts” to payments for non-compliance of:
- Frequency (ICF)
- Regularity (ICR)

One contract was taken away and another operator was put in place.

Operational figures improved notoriously in the second semester of 2008.
Renegotiation 2009

- Introduced ICPKH
  - Meeting this index was the same as complying with ICF
  - Simplify payment formulas
- Requirement to take away contract after 6,000 UF of fines was changed
- Fleet renovation mechanism
  - Almost 100% of the fleet is now renovated
Incentive problems persist

- Meeting ICPKH can be done without stopping at bus stops

- Exclusivity or competition?
- More demand risk?
- Fines or monitoring?
- World class fleet management system?
4.3) Financing

A BETTER LIFE IS POSSIBLE.....

BUT ITS SURELY MORE EXPENSIVE!
Financing

- Self-financing the reform at the average fare of the old system was not viable
  - Forced too low a fleet size in the original design
- Fleet renovation, new technology (GPS, electronic card), formalize drivers, all implied higher costs
  - Solution to overcome crisis showed this
Non-payment

- Drives do not have incentives to control non-payment (fixed wage)
- Neither do operators (ICPKH)
- Non-payment is close to 20% in buses
  - Solution: more demand risk to operators?
  - Allow driver’s income to depend on passengers?
Monthly operational deficit (US$ million)

Source: CGTS
Are subsidies justified?

- Theory:
  - Mohring effect
  - Second best argument

- Practice:
  - Europe: 50% of operational costs
  - EEUU: 65% of operational costs
  - Small and Parry (2009): subsidies should be even higher
The case of Santiago

- Subsidizing public transport is progressive

- There was a cross-subsidy in fares
  - Student fare 1/3 of adult fare
  - Works like a tax on public transport fares for adults
How was the deficit funded?

- 2007: law 20.206
- 2008: IADB credit and Constitutional funds
- 2009: Constitutional funds and law passed in August
- 2010: Subsidy law
  - Transitory subsidy (increased in 2010)
  - Permanent subsidy (US$ 210 million)
  - Expert panel sets fares
Fare increase 2010-2011

- Fare increased from $400 to $500 from March 2010 to December 2010
- Further $40 increase during early 2011
- Affecting image of TS and government popularity
  - Fares are due to rise further as transitory subsidy declines
- Should subsidies be maintained?
5) Lessons I

- It's risky to "mess" with public transport systems
- Political consensus are a pre-requisite
  - regulate by law not contracts
  - Institutional checks and balances
- Detailed design issues are crucial, trial and error are necessary, gradual reform instead of "Big Bang"
Lessons II

- Technology and infrastructure must be operational before reform
  - Ask: what are the benefits offered to users from the reform?

- Incentive issues are crucial (non-payment and operational consequences)
  - Complex in developing countries

- Subsidies need to be carefully considered for ambitious reforms
Lessons III

- SITP in Bogotá?
  - non-payment
  - What benefits are users being offered?
Accidents (2004-2005)

<table>
<thead>
<tr>
<th></th>
<th>Siniestros</th>
<th>Fallecidos</th>
<th>Lesionados</th>
<th>Total lesionados</th>
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<tbody>
<tr>
<td></td>
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<td>Graves</td>
<td>Menos graves</td>
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<tr>
<td>2004</td>
<td>7,164</td>
<td>118</td>
<td>594</td>
<td>557</td>
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<tr>
<td>2005</td>
<td>6,366</td>
<td>112</td>
<td>533</td>
<td>481</td>
</tr>
</tbody>
</table>
Accidents 2004-2010

Accidentes involving urban buses (Gran Santiago)

- 2004: 7,164
- 2005: 6,366
- 2006: 4,951
- 2007: 3,406
- 2008: 3,291
- 2009: 3,047
- 2010: 2,937
Fatalities 2004-2010

Fatalities in accidents involving urban buses (Gran Santiago)

- 2004: 118
- 2005: 112
- 2006: 71
- 2007: 73
- 2008: 80
- 2009: 58
- 2010: 83
Injuries 2004-2010

People injured in accidents involving urban buses (Gran Santiago)

- 2005: 4,409
- 2006: 3,854
- 2007: 3,061
- 2008: 2,704
- 2009: 2,242
- 2010: 2,248
Air pollution

- Fall of 5.86 micrograms of average PM10 concentration levels
- Each microgram is worth between US$80 and US$150 million of health benefits
Motorized trips, working day 2006

<table>
<thead>
<tr>
<th>Mode or combination of modes</th>
<th>Trips</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private (auto or motorcycle)</td>
<td>3,664,221</td>
<td>36%</td>
</tr>
<tr>
<td>Bus only</td>
<td>3,962,023</td>
<td>38%</td>
</tr>
<tr>
<td>Bus – Bus</td>
<td>239,176</td>
<td>2%</td>
</tr>
<tr>
<td>Bus – Metro</td>
<td>203,119</td>
<td>2%</td>
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<tr>
<td>Bus – Other</td>
<td>613,065</td>
<td>6%</td>
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<tr>
<td>Metro only</td>
<td>625,811</td>
<td>6%</td>
</tr>
<tr>
<td>Metro – Other</td>
<td>201,017</td>
<td>2%</td>
</tr>
<tr>
<td>Taxi (shared and regular)</td>
<td>645,100</td>
<td>6%</td>
</tr>
<tr>
<td>Other motorized mode</td>
<td>164,495</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,318,027</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

*Source: own calculations based on Origin-Destiny survey 2006, Sectra.*
General Scheme
En Agosto se firmaron nuevos contratos