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Introduction

Topics: Bus Operation Reform in Seoul

- **What to do?**
  Increase Bus Demand & Minimize Bus subsidy
  Increase Bus Service (speed & frequencies)

- **How to do it?**
  Entire Route Redesign by grouping into 4 types
  Fare Integration with subway and so on

- **Who to do it?**
  Organization of Bus System Reform Citizen Committee (BSRCC)

- **Bus Reform contributed to Bus Service Increase?**
Theoretical review on Bus industry

◆ Economy of Scale

- Minimize operation cost by Optimizing Bus firm size
- Depends on function type (cost vs production), Output (revenue vs Bus*Km)
- Uncertain for EOS existence

◆ If EOS exist, is large firm really more cost-efficient?
### Some Research Results

<table>
<thead>
<tr>
<th>Author</th>
<th>Nation</th>
<th>Function type</th>
<th>EOS existence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>GB</td>
<td>Cost/ Linear</td>
<td>Yes</td>
</tr>
<tr>
<td>Kosal</td>
<td>India</td>
<td>Cost/ Linear</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Berechman</td>
<td>USA</td>
<td>Cost/Exponential</td>
<td>Yes</td>
</tr>
<tr>
<td>Obeng</td>
<td>USA</td>
<td>Translog</td>
<td>Bus·km (Y)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Passenger (N)</td>
</tr>
<tr>
<td>Thiry</td>
<td>Belgium</td>
<td>Translog</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Results for Seoul Bus firms (2003, SDI)

<table>
<thead>
<tr>
<th>Bus Type</th>
<th>EOS for Bus-Km by Bus type</th>
<th>Economy of Scale(EOS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Express</td>
</tr>
<tr>
<td>Total Buses</td>
<td>0.390</td>
<td>0.724</td>
</tr>
<tr>
<td></td>
<td>(19.562*** )</td>
<td>(85.975** )</td>
</tr>
<tr>
<td>Upper class 20%</td>
<td>0.409</td>
<td>0.710</td>
</tr>
<tr>
<td></td>
<td>(20.590*** )</td>
<td>(87.800*** )</td>
</tr>
<tr>
<td>Lower Class 20%</td>
<td>0.331</td>
<td>0.769</td>
</tr>
<tr>
<td></td>
<td>(15.092*** )</td>
<td>(86.407*** )</td>
</tr>
<tr>
<td>Urban</td>
<td>$-0.184$</td>
<td>$-$</td>
</tr>
<tr>
<td></td>
<td>(3.421*** )</td>
<td></td>
</tr>
<tr>
<td>Urban+Feeder</td>
<td>$-0.084$</td>
<td>$-$</td>
</tr>
<tr>
<td></td>
<td>(2.265** )</td>
<td></td>
</tr>
</tbody>
</table>
- Competitive Tendering System
  - Deregulation for Entry, Fare and Bus Size
  - To stimulate Service competition
  - To minimize bus operating cost

**Research Results in GB**

<table>
<thead>
<tr>
<th>City</th>
<th>Type</th>
<th>NPH</th>
<th>PH</th>
<th>All day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiltshire</td>
<td>GC</td>
<td>0.37</td>
<td>1.65</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>MS</td>
<td>0.38</td>
<td>0.78</td>
<td>0.73</td>
</tr>
<tr>
<td>Sussex</td>
<td>GC</td>
<td>0.56</td>
<td>0.65</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>MC</td>
<td>0.89</td>
<td>0.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

- In Seoul, route tendering plan was refused by bus firms.
EOS for company size with level of contract

- Diseconomies of scale for all agencies size with all level of contracting (TR part A42, 2008)
The “third way” : Semi-public Bus Operation

- Retain private firm but leave route, schedule and fare decisions to city government
- Entire redesign of bus network by city
- Fare revenue management by City
- Rewards for bus company by level of service offered
Bus Operation Reform in Seoul

1. Causes of Bus Operation Reform in Seoul

- Large numbers of private bus firms (89)
- No governmental controls on routes, schedules except fare level
- No coordination among the different bus routes
- Many routes were highly circuitous, overlapping, not adequately integrated with subway lines
Figure 4: Numbers of Bus Companies, Registered Buses and Passengers

Source: Seoul Metropolitan Government
Bus Industry began to decline

- 'Golden periods' until the late 1980s
  - Lower level of car ownership
  - Monopolized Bus Service
- Financial difficulties began from early 1990s
  - Faced with competition for Subway and Cars
  - Bus service was degraded by inefficient bus lines, lower speed
- Decrease of bus demand
Vicious circle of Bus industry

- Increase Income
- Increase car ownership
- Subway Construction
  - More road congestion
  - Less mileage per bus
  - Increase Operating cost
  - Reduce Service (frequency, speed)
  - Reduce bus demand

Financial difficulties
Changes of Public Transport Modal Share

Year


Bus
Metro
Taxi

Passengers (millions)

0 500 1,000 1,500 2,000 2,500 3,000
Key Problems of Seoul Bus Industry

- Each bus companies have exclusive right for operating their licensed line
- Private bus firm try only to maximize its profits
- Every bus company has profit & non-profit lines
2. Seoul Bus Reform: Program & Characteristics

- Reform of Bus Network
- Exclusive median bus lanes
- Bus management System
- High Quality Bus
- Transit Transfer Center
- Bus operating System
- Integrated fare system
- New Smart Card System

Transit-oriented city
◆ reorganization of bus route

- Redesign of bus route to integrate different buses
- Grouping into 4 types
  - Red Bus, Blue Bus, Green Bus, Yellow Bus
Regional connection to suburbs
Feeder to trunk lines and subways
Local lines within the downtown area
Express connection to satellite cities
Integration of fare system

Before the reformation

- Independent fare system
- Bus-Bus, Bus-Subway
- Revenue managed by firm

After the reformation

- Integrated fare system
- Distance-based fare system

Subsidy
- Yr 2003: 10.0 billion $
- Yr 2005: 26.0 billion $

Revenue Management by City
Fare Revenue managed by city

Distance based fare

Subway single trips: distance-traveled
Bus single trips: flat fare

Free for transfer fare

basic fare up to 10km
extra fare for every additional 5 km
3. Who & How to do it?

- **Bus System Reform Citizen Committee (BSRCC)**
  4 Seoul Bus Transport Association and Bus Trade Union
  4 Civil groups, 8 professional groups and NGO

- **Activities**
  Total 28 meetings since First meeting on Aug 2003
  Review the hot issues and resolved the conflicts

- **Role as urban governance**
  Formation of partnership and network
  Interaction and social capital
  Co-operation and consensus
• Bus Management System

**Interval Management**

**Route Management**

**Revenue Management**

**Demand Distribution**

**Route Planning**

**Evaluation Index**
- ridership (revenue)
- overlap
- curve
- congestion

**Veh/Km Computation**

**Operation Schedule**

**Cost of Transport Payment**
<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average mileage per line (Km)</td>
<td>37.9</td>
<td>36.7</td>
</tr>
<tr>
<td>Daily mileage per Bus (Km)</td>
<td>262</td>
<td>237</td>
</tr>
<tr>
<td>Average speed (Km/h)</td>
<td>18.6</td>
<td>23.7</td>
</tr>
<tr>
<td>Driver per bus</td>
<td>2.137</td>
<td>2.189</td>
</tr>
<tr>
<td>Machinery per bus</td>
<td>0.168</td>
<td>0.172</td>
</tr>
<tr>
<td>Revenues per Km (1000won/Km)</td>
<td>2.412</td>
<td>2.967</td>
</tr>
<tr>
<td>Passengers per Km</td>
<td>1.919</td>
<td>2.456</td>
</tr>
</tbody>
</table>
## Punctuality

<table>
<thead>
<tr>
<th>Line</th>
<th>Dist (km)</th>
<th>T-time (min)</th>
<th>Deviation from Schedule (Bus_min)</th>
<th>Deviation from Schedule (Car_min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dobong Corridor</td>
<td>15.2</td>
<td>44.3</td>
<td>2.7</td>
<td>15.3</td>
</tr>
<tr>
<td>Susack Corridor</td>
<td>6.8</td>
<td>18.1</td>
<td>1.2</td>
<td>15.6</td>
</tr>
<tr>
<td>Kangnam Corridor</td>
<td>4.8</td>
<td>16.7</td>
<td>1.3</td>
<td>4.6</td>
</tr>
</tbody>
</table>

## Ridership

![Ridership Chart]

## Speed

![Speed Chart]
Which factors affected inefficiency?

- Using Tobit regression
- **Speed improvement by installing median bus line** increase productivities
- **Reduction of maintenance staff** increase productivities

<table>
<thead>
<tr>
<th></th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0276</td>
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<tr>
<td>No. of Bus line (Km)</td>
<td>0.0028</td>
</tr>
<tr>
<td>Speed (Mileage per bus)</td>
<td>-0.0018***</td>
</tr>
<tr>
<td>Driver per bus</td>
<td>0.1603</td>
</tr>
<tr>
<td>Maintenance staff per bus</td>
<td>1.0232**</td>
</tr>
<tr>
<td>CNG bus</td>
<td>-0.1256</td>
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<tr>
<td>Log likelihood</td>
<td>20.6473</td>
</tr>
<tr>
<td>R square</td>
<td>0.2228</td>
</tr>
</tbody>
</table>
Urban governance played a key role to implement the Bus Operation Reform.

Bus Reform was required vast financial supports.

Bus Reform contributed not only to increase bus services (speed, frequency) but also to reduce bus operating cost.

Bus productivity was increased by Bus Reform.