Sustainable Urban Transport Financing from the Sidewalk to the Subway
Capital, Operations, and Maintenance Financing

Arturo Ardila-Gomez,
Adriana Ortegón-Sanchez

World Bank
## Financing needs: an approximation

### Table 1.1 City Sizes and Associated Transport Infrastructure

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>BRT</th>
<th>Metro</th>
<th>Local roads</th>
<th>Express roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>(blocks)</td>
<td>(km)</td>
<td>(km)</td>
<td>(km–lane)</td>
<td>(km–lane)</td>
</tr>
<tr>
<td>Medium</td>
<td>50 X 50</td>
<td>25</td>
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<td>2,000</td>
<td>40</td>
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<tr>
<td>Large</td>
<td>250 X 250</td>
<td>150</td>
<td>50</td>
<td>50,000</td>
<td>600</td>
</tr>
<tr>
<td>Mega</td>
<td>500 X 500</td>
<td>400</td>
<td>250</td>
<td>200,000</td>
<td>1,500</td>
</tr>
</tbody>
</table>

*Source: Authors based on model analysis.*

*Note: BRT = Bus Rapid Transit.*
Financing needs

Figure 1.1 Typical Pattern of Capital, Operation, and Maintenance Expenditures for Transport

- **Annual cost**
- **Operation**
- **Routine maintenance**
- **Capital investment**
- **Preventive maintenance (every 5 years)**
- **Network evolution**

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Financing needs: an approximation

Figure 1.2  Total Estimated Costs (Capital, Operation, and Maintenance) for Medium, Large, and Mega Cities over 20 Years

<table>
<thead>
<tr>
<th></th>
<th>Medium</th>
<th>Large</th>
<th>Mega</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRT</td>
<td>2,505</td>
<td>15,030</td>
<td>40,080</td>
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<tr>
<td>Metro</td>
<td>0</td>
<td>41,750</td>
<td>208,750</td>
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<tr>
<td>Local roads</td>
<td>8,350</td>
<td>208,750</td>
<td>835,000</td>
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<tr>
<td>Express roads</td>
<td>2,672</td>
<td>40,080</td>
<td>100,200</td>
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</table>

Source: Authors based on model analysis.
Note: BRT = Bus Rapid Transit.
Financing needs: an example

Figure 1.3  Infrastructure Needs (a) and Estimated Total Cost of Capital and Maintenance (b) for Bogota’s Road Network over 20 Years

<table>
<thead>
<tr>
<th>Road network</th>
<th>Cost, US$MM</th>
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</thead>
<tbody>
<tr>
<td>BRT</td>
<td>895.4</td>
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<tr>
<td>Arterial</td>
<td>6383.5</td>
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<tr>
<td>Intermedia+local</td>
<td>11978.5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Investment to complete network</th>
<th>Maintenance over 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRT</td>
<td>258.3</td>
</tr>
<tr>
<td>Arterial</td>
<td>5992.8</td>
</tr>
<tr>
<td>Intermedia+local</td>
<td>2654.1</td>
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</table>

Source: Ardila-Gomez and Ortegon-Sanchez 2013.
Note: BRT = Bus Rapid Transit.

Updated for network conditions and planned works up to 2010
Figure 1.4 Schematic Representation of a City’s Underfunding Trap based on Empirical Data for the Bogota Transport System

Source: Ardila-Gomez and Ortegon-Sanchez 2013.
The underfunding trap

Figure 1.1  Typical Pattern of Capital, Operation, and Maintenance Expenditures for Transport

Annual cost

Operation
Routine maintenance
Capital investment
Preventive maintenance (every 5 years)

Year

Network evolution

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Underfunding Trap: structural causes

Low revenues due to inefficient pricing and economic distortions that create unbalance in favor of unsustainable modes

Low investment causes construction and maintenance lag vicious cycle and deterioration

Imbalance in investment responsibilities and financial capacity at the city level

Institutional complexity: diverse levels (global, national, local) and sectors (public, private)

Periodicity mismatch between revenue and expenditure

Underfunding Trap: structural causes
Low revenue - Implicit subsidies

Figure 1.5 Total Costs (Explicit and Implicit) and Benefits of Cars and Public Transport

Source: Authors.
Low revenue - Implicit subsidies

PUBLIC TRANSPORT

- Stigma
- Explicit Subsidies
- Pocket costs

PRIVATE CARS

- Political Support
- Status
- Implicit Subsidies
- Pocket costs
The framework addresses the following elements:

- **Economic distortions and institutional complexity** through application of the “**Who Benefits Pays**” principle based on the identification of beneficiaries (general public or direct and indirect beneficiaries)

- The need for **wiser investments**, which can reduce the financing gap in the long term
• Match periodicity of revenue and expenditures, specifically for capital, operation, and maintenance expenses.
Escaping the underfunding trap

A comprehensive multi-level financial strategy that corrects structural causes from revenue and expenditure side.
Analytical framework to assess and design urban transport financing

Standardized Assessment of 24 urban transport financing instruments with respect to

- **FINANCIAL SUSTAINABILITY** (Innovative financing)
  - stability, political acceptance, and administrative ease of instrument implementation

- **TRANSPORT SUSTAINABILITY** (Wise investment)
  - economic efficiency, social equity, and environmental impact
## Financing Instruments Assessment: General Beneficiaries

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Rev Level</th>
<th>Stability</th>
<th>Public Accept</th>
<th>Admin Ease</th>
<th>Efficiency</th>
<th>Equity</th>
<th>Environ. Impact</th>
<th>Cost</th>
<th>Period</th>
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<tbody>
<tr>
<td>Public transport subsidies</td>
<td>M/O</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>M/O</td>
<td></td>
</tr>
<tr>
<td>Property tax</td>
<td>C/M/O</td>
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<td></td>
<td>C/M/O</td>
<td></td>
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<tr>
<td>National and international loans and grants</td>
<td>C/M</td>
<td></td>
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<td>C/M</td>
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<tr>
<td>Carbon market</td>
<td>C/O</td>
<td></td>
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<td></td>
<td>C/O</td>
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<td>Global Environment Facility</td>
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<td>C/O</td>
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<td>Clean Technology Fund</td>
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<td></td>
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<td>C</td>
<td></td>
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<tr>
<td>PPPs for public transport</td>
<td>C/M/O</td>
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<td></td>
<td></td>
<td>C/M/O</td>
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</table>

### Financial Sustainability
- **Stability**: Represents the financial stability of the instrument.
- **Public Accept**: Indicates the level of public acceptance.
- **Admin Ease**: Reflects the ease of administration.

### Transport Sustainability
- **Efficiency**: Measures the efficiency of the transport system.
- **Equity**: Evaluates the equity impact.
- **Environ. Impact**: Assess the environmental impact.

### Cost and Period
- **Cost**: Indicates the cost level of the instrument.
- **Period**: Refers to the period the instrument is expected to operate.

**Symbols**:
- ▲: Upfront
- ▲: Recurrent
- ▲: Both
- ☢: High
- ☢: Average
- ☢: Low

**Note**:
- The table values are indicative and may vary based on specific circumstances.

**Source**: World Bank Group

**Page**: 16
## Financing Instruments Assessment: General Beneficiaries

<table>
<thead>
<tr>
<th>FINANCING INSTRUMENT</th>
<th>REV LEVEL</th>
<th>STABILITY</th>
<th>PUBLIC ACCEPT</th>
<th>ADMIN EASE</th>
<th>EFFICIENCY</th>
<th>EQUITY</th>
<th>ENVIRON. IMPACT</th>
<th>COST</th>
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<td>C/M</td>
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<td>C/M/O</td>
<td>▲</td>
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</tbody>
</table>

- ▲ Upfront
- ▼ Recurrent
- △ Both

**Legend:**
- **High**
- **Average**
- **Low**
## Financing Instruments Assessment: Direct Beneficiaries

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Rev Level</th>
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<th>Public Accept</th>
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<th>Efficiency</th>
<th>Equity</th>
<th>Environ. Impact</th>
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<td></td>
<td></td>
<td></td>
<td>C/M/O</td>
<td></td>
</tr>
</tbody>
</table>

- **REV LEVEL**: Upfront, Recurrent, Both
- **Task**: C/M/O, O/M
- **P**: Assessment scale: High, Average, Low

**FINANCIAL SUSTAINABILITY**
- **Stability**: High, Average, Low
- **Public Accept**: High, Average, Low
- **Admin Ease**: High, Average, Low

**TRANSPORT SUSTAINABILITY**
- **Efficiency**: High, Average, Low
- **Equity**: High, Average, Low
- **Environ. Impact**: High, Average, Low

**Note**: The assessment is based on the direct beneficiaries of each financing instrument.
## Financing Instruments Assessment: Indirect Beneficiaries

<table>
<thead>
<tr>
<th>Financing Instrument</th>
<th>Rev Level</th>
<th>Financial Sustainability</th>
<th>Transport Sustainability</th>
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<td>Joint Development (PPP)</td>
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<td>Air Rights</td>
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</table>

### Financial Sustainability
- **Stability**
- **Public Acceptance**
- **Admin Ease**

### Transport Sustainability
- **Efficiency**
- **Equity**
- **Environ. Impact**

### Rev Level Indicators
- **Upfront**
- **Recurrent**
- **Both**

### Benefit Indicators
- **High**
- **Average**
- **Low**
Possible uses for the Financing Instruments

General Beneficiaries

Figure 4.2  Use of Financing Instruments for Different Elements of the Urban Transport System

- Public Transport Subsidies
- Property Tax
- Loans and Grants
- Carbon Market
- Global Environment Facility
- Clean Technology Fund
- PPPs for Public Transport

- Urban highways
- Institutions
- Education and enforcement
- Maintenance
- Notmotorized and public transport
- Traffic management and ITS
- Technology
Possible uses for the Financing Instruments

Direct Beneficiaries
Possible uses for the Financing Instruments

Indirect Beneficiaries
Conclusions

- Link urban transport planning and operations with urban planning.
- Combine revenue sources to ensure financial sustainability using the Who Benefits Pays principle.
- Consider the effect of instruments on transport demand. Not only the choice of transport investment but also the choice of instrument will affect the use and demand for transport systems in a city: Wise Investments
Conclusions

- Ensure appropriate use of public subsidies. Subsidies should be coupled with regulations, such as contract and quality performance indicators, to guarantee high-quality sustainable public transport.

- Allow cities financial autonomy and capacity. A property tax can be an important tool as it is a cost-effective way to raise critical revenue to cover the capital, maintenance, and operation costs for elements of the transport system, such as, mass transit, and neighbourhood roads and sidewalks.
Conclusions

- Allow a role for national governments and international funding in light of climate change and the need to invest in projects that contribute to the global benefit of reducing emissions from the transport sector.

- Understand the need for a gradual introduction of user charges.
Conclusions

- Consider land value–based financing instruments but be aware of transaction cost and political work behind.

- The framework guides the assessment of revenue options and helps cities use instruments strategically to not only fund needed transport investment but also actually achieve their larger sustainable urban transport and development objectives.
Epilogue

PUBLIC TRANSPORT

- Political support
- Status/Pride
- Subsidies
- Pocket costs

CARS

- Status/Pride
- User charges
- Pocket costs
Download the book here

- **Sustainable Urban Transport Financing from the Sidewalk to the Subway**
- or here:
- https://openknowledge.worldbank.org/handle/10986/23521
Thank you