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# Public Transport Subsidies and Affordability in Mumbai, India

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November 2007

## Abstract

This paper describes the role of public transport and the nature and incidence of transport subsidies in Mumbai, India. Mumbai has an extensive rail and bus network, and public transport is used for over 75 percent of all motorized trips in Greater Mumbai. Both rail and bus fares in Mumbai are subsidized: BEST, which operates public buses in Mumbai, is also an electric utility, and subsidizes bus fares from electricity revenues. We analyze the incidence of these subsidies, and their effect on mode choice, using data from a survey of households in Greater Mumbai. In Mumbai, as in many cities, the middle class is more likely to use public transport for travel than the poor. The poor, however, also use public transit, and their expenditure on public transit constitutes, on average, a larger share of their income than it does for the middle class. It is, therefore, the case that the poor benefit from transit subsidies in Mumbai, as well as the middle and upper-middle classes; however, the poorest 27 percent of the population receives only 19 percent of bus subsidies and 15.5 percent of rail subsidies. Indeed, 26 percent of the lowest income households surveyed do not use rail, while 10 percent do not use bus, implying that they receive no transit subsidies.

Expenditure on transport accounts for 16 percent of income in the lowest income category (<5000 Rs./month), with 10 percent of income, on average, spent on bus and rail fares. This percentage, however, is not evenly distributed: it is much higher than 10 percent for households in which workers take the bus or train to work, and lower for households in which the main earner walks to work. Even in these households, however, 12.5 percent of income is spent on transportation.

Expenditure on public transport would be even higher if bus fares in Mumbai were not subsidized. In 2005-2006, transport revenues of BEST fell below total costs by 30 percent and below operating costs by 20 percent. Rail fares, which are much lower than bus fares per km traveled, officially covered operating costs and almost covered depreciation expenses.

This paper—a product of the Sustainable Rural and Urban Development Team, Development Research Group—is part of a larger effort in the department to examine the consequences of economic and social policies. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at mcropper@worldbank.org.

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# PUBLIC TRANSPORT SUBSIDIES AND AFFORDABILITY IN MUMBAI, INDIA

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# PUBLIC TRANSPORT SUBSIDIES AND AFFORDABILITY IN MUMBAI, INDIA

## I. Introduction

This paper describes the role of public transport and the nature and incidence of transport subsidies in Mumbai, India. Mumbai has an extensive rail and bus system, and public transport is used for over 75% of all motorized trips in Greater Mumbai. Both rail and bus fares in Mumbai are subsidized: BEST, which operates public buses in Mumbai, also is also an electric utility, and subsidizes bus fares from electricity revenues. The Central and Western railways (part of Indian Railways) operate rail services in suburban Mumbai. Although rail fares cover operating costs, they do not fully cover capital costs; hence there is an implicit supply-side subsidy to rail fares in Mumbai.

We analyze the incidence of these subsidies, and their effect on mode choice, using data from a survey of households in Greater Mumbai conducted in the winter of 2003-2004 (Baker et al., 2005). In Mumbai, as in many other cities, the middle class is more likely to use public transport for travel than the poor. The poor, however, also use public transit, and their expenditure on public transit constitutes, on average, a larger share of their income than it does for the middle class. It is, therefore, the case that the poor benefit from transit subsidies in Mumbai, as well as the middle and upper-middle classes; however, the poorest 27% of the population receives only 19% of bus subsidies and 15.5% of rail subsidies.[1] Indeed, 26% of the lowest income households surveyed do not use rail, while 10% do not use bus, implying that they receive no transit subsidies.

The remainder of the paper is organized as follows. The second section presents an overview of Greater Mumbai and its rail and bus services. Section 3 describes the travel patterns of households in Greater Mumbai. In section 4 we present information on household expenditure on transport and discuss the structure of rail and bus fares. Section 5 discusses the magnitude of transit subsidies and section 6 their incidence and the impact on mode choice. Section VII concludes.

## II. Background

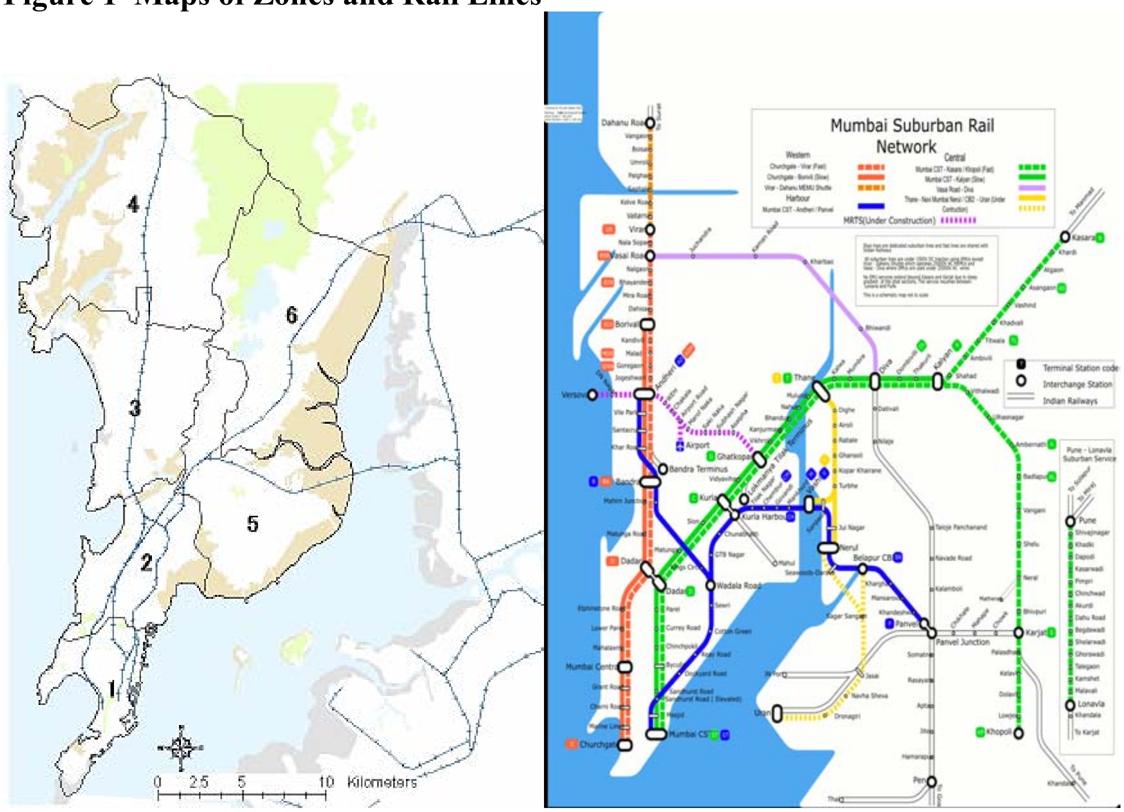
Greater Mumbai, the focus of this study, constitutes the core of the Mumbai Metropolitan Region (MMR). Greater Mumbai, with a population of 11.9 million people in 2001, occupies 468 sq. km. This makes Mumbai one of the most densely populated cities in the world. During the decade 1991-2001 the population of Greater Mumbai grew at a rate of approximately 1.8 percent annually—less than the national average. This reflects a declining rate of migration into the city and the more rapid growth of the Mumbai Metropolitan Region (MMR), one of the world's largest with a population in 2001 of 18 million. The city faces enormous challenges with shortages of land, housing,

[1] In Baker et al. (2005) the lowest income group studied consists of households earning less than Rs. 5,000 per month. They constitute 26.6% of the sample of 5,000 households surveyed.

infrastructure, and social services that have not kept up with the growing demands of the city. An estimated 50 percent of the city's population lives in slums, many located along railway tracks. Some of Asia's largest slums, including Dharavi, with a population of over one million, are located in Mumbai.

Mumbai is located on the Arabian Sea. Greater Mumbai extends 42 km north to south and has a maximum width of 17 km. The Municipal Corporation of Greater Mumbai has divided the city into 6 zones, each with distinctive characteristics (see Figure 1). The southern tip of the city (Zone 1) is the traditional city center. Zone 3 is a newly developed commercial and employment center, and Zones 4, 5 and 6, each served by a different railway line, constitute the suburban area. While the majority of jobs are concentrated in Zones 1-3, there has been some dispersion in the distribution of jobs to the suburbs. Urban development and urban transport are managed by the Mumbai Metropolitan Regional Development Authority (MMRDA) a regional planning agency under the Department of Urban Development.

**Figure 1 Maps of Zones and Rail Lines**




Mumbai's public transport system is comprised of a suburban rail system and public bus system, as well as private taxis and auto-rickshaws.[2] The urban transport network is linear along the peninsula. The city's main arterial roads run linearly, north to south, with east-west links less developed. There are two national rail lines serving

[2] Auto-rickshaws are motorized three wheeled scooter taxis, a cheaper alternative to taxis.

Mumbai (the Western Railway (WR) and Central Railway (CR))[3] that provide suburban commuter rail services. The suburban rail network carries about 6.4 million passengers every day. Public buses, which are operated by the Brihanmumbai Electric Supply and Transport Undertaking (BEST), carry over 4 million passengers each day.

### A. Bus Service in Mumbai

Public buses in Mumbai are run by BEST, which also supplies electricity to parts of the city.[4] In 2005-06, BEST's fleet of 3,400 buses carried approximately 4.1 million passengers per day over 354 separate routes.[5] BEST buses run every 5 to 30 minutes. The average speed of buses on ordinary routes is 12 km/hr, but is 16 km/hr on limited routes, with fewer stops. Bus capacity varies from 74 to 90 passengers. Heavy delays, especially on feeder routes to suburban railway stations, result in waiting times up to 30 minutes, and force many commuters to walk 1.5 to 2 km to their destinations (Shrivastava and Dhingra, 2006).

As part of the Mumbai Urban Transportation Project, BEST replaced 644 used or over-aged buses with newer EURO III compliant, single decker buses[6]. Older buses were upgraded to EURO II standards. BEST also procured 600 CNG buses and 30 low floor buses to accommodate the disabled. These procurements were part of BEST's response to a Bombay High Court order, issued in December 2003, to phase out buses that were 15 years or older by January 2006. This meant that BEST had to replace 1,300 buses by retro-fitting 250 buses with Euro-II engines during 2004-05, 300 buses in 2005-06, 350 during 2006-07 and 400 buses in 2007-08, incurring an additional cost of about Rs. 3 billion. A contactless prepaid smart card system for paying fares was introduced in 694 buses. New bus terminals, stations and depots as well as some dedicated bus lanes were also introduced.

Details of BEST's operations, for selected years, appear in Table 1. With fleet strength increasing by half over the last fifteen years, the occupancy ratio has decreased from 97 percent in 1990-91 to 58 percent in 2005-06. Fleet utilization has increased by about 10 percent over the same period. As a result of phasing out of buses older than 15 years and replacing older buses with CNG or Euro II and Euro III compliant ones, depreciation costs have more than doubled in the last five years.

It is clear from Table 1 that BEST buses operate at a loss: total revenues fall short of operating costs plus depreciation (total costs). In fact, revenues fall short of operating

[3] The Harbor Line which connects Greater Mumbai to the Navi Mumbai area is considered a part of the Central Railway.
[4] BEST is a state undertaking that is overseen by the Municipal Corporation of Greater Mumbai (MCGM) but operates autonomously.
[5] Recently, BEST has introduced air-conditioned buses and low floor buses that are equipped with facilities to accommodate the disabled. A complete fare schedule appears in the Appendix.
[6] These buses were funded by a World Bank loan of Rs. 1.18 billion and a Rs. 70 million BEST counterpart fund.

costs. The shortfall is made up in part from electricity revenues.[7] In 2005-2006 fares would have had to be raised by 29.6% for BEST transport operations to break even.

**Table 1. Operating Characteristics, Revenues and Costs of BEST Buses**

| | 1990-91 | 1995-96 | 2000-01 | 2005-06 |
|---|---|---|---|---|
| Fleet Strength | 2,143 | 3,057 | 3,432 | 3,391 |
| Annual Bus Km (Million) | 163.4 | 230.1 | 244.1 | 240.3 |
| Km/Bus/Day | 208.9 | 206.2 | 212.0 | 214.1 |
| Fleet Utilisation (%) | 82.0 | 94.1 | 91.9 | 90.7 |
| Occupancy Ratio (%) | 97.1 | 87.2 | 55.1 | 58.3 |
| Employees/Bus | 14.1 | 12.6 | 12.0 | 11.2 |
| Accidents Per 1,000 Km | 214 | 67 | 45 | 35 |
| Km per Liter (HSD) | 3.1 | 3.0 | 3.0 | 3.3 |
| Buses Purchased | 270 | 89 | 185 | - |
| Total Earnings (Rs. Million) | 1,792.2 | 4,142.5 | 6,961.0 | 8,476.6 |
| Earnings/km. (Rs.) | 11.0 | 18.0 | 28.5 | 35.3 |
| Total Cost (Rs. Million) | 2,280.7 | 4,910.7 | 8,697.7 | 10,982.3 |
| Cost per km (Rs.) | 14.0 | 21.3 | 35.6 | 45.7 |
| Profit/Loss (Rs. Million) | -488.6 | -768.3 | -1,736.7 | -2,505.7 |
| Depreciation (Rs. Million) | 235.4 | 237.0 | 313.5 | 768.5 |

Source: Ramasaamy (2006)

### B. Rail Service in Mumbai

The suburban railway system in Mumbai is one of the most intensively utilized rail networks in the world. It carries over 6 million passengers daily in five corridors that are managed by two different subdivisions of Indian Railways—the Western Railway and the Central Railway. The services are spread over 303 km of tracks—149 km of mass transit tracks and 154 km of tracks that are shared with long distance trains.

Two of these corridors, operated by the Western Railway, run north from Churchgate terminus parallel to the west coast of the city and cover a route of about 60 km. These corridors, shown in orange and red in Figure 1, are popularly known as the Western Line. Two of the corridors operated by the Central Railway and popularly

[7] In 2003-2004, 2004-2005 and 2005-2006, BEST earned a profit from electricity supply; however, the profit fell short of transport operating losses. See Table A.4 in the Appendix.

known as the Central Line are shown in green in Figure 1. The fifth corridor, also operated by the Central Railway, and known as the Harbor Line, appears in blue.

Train service runs from 4:00 am to 1:00 am at intervals of 3 minutes during peak hours and between 5 to 10 minutes during other hours of operation (except late at night, when the headway is about 20-30 minutes). There are also fast trains that do not stop at all stations. The suburban services are currently run by electrical multiple units (EMUs) which are operated using a 1500 Volt DC power supply using overhead centenary. The Western and Central Railways together operate about 2,067 daily one-way trips using 184 rakes (train sets) of 9-cars and 12-cars. The 12-car EMU rakes are utilized mostly during peak rush hours.

Passengers have an option of traveling in first-class or second-class compartments. Women and men travel in separate carriages. Due to high demand, there is serious overcrowding in second-class compartments, with as many as 5,000 passengers traveling per 9-car train during peak rush hours.[8] This can result in 14-16 standing passengers per square meter of floor space.

The two corridors of the Western Railway and three corridors of the Central Railway carried approximately 6.5 million passengers each day in 2004-2005 and 6.2 million in 2003-2004 (see Table 8).[9] Revenues and costs for suburban rail operations in Mumbai in 2005-2006 (the same period used for computing bus subsidies), appear in Table 3. According to official figures, suburban rail operations posted a loss of Rs. 123.8 million, implying a subsidy of 1.2% of fares.

**Table 2. Annual Passenger Volumes and Revenues on Mumbai Suburban Railways**

| Mumbai Suburban Railway | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Western Railways** | | | | | **Central Railway** | | | | |
| **Year** | **No. of Passengers** *(in Millions)* | | | **Lead** *(in Km.)* | **Earnings** *(Rs. Million)* | **No. of Passengers** *(in Million)* | | | **Lead** *(in Km.)* | **Earnings** *(Rs. Million)* |
| | **Ist Class** | **IInd Class** | **Total** | | | **Ist Class** | **IInd Class** | **Total** | | |
| 2003-04 | 109 | 1,037 | 1,146 | 27.1 | 4,140 | 80 | 1,020 | 1,100 | 30 | 4,790 |
| 2004-05 | 112 | 1,043 | 1,155 | 29.1 | 4,270 | 80 | 1,080 | 1,160 | 30 | 5,070 |

Source: Vivek Sahai (2006)

[8] The peak rush hours are 7:00 AM –11:00 AM and 4:00 PM- 9:00 PM. http://www.mrvc.indianrail.gov.in/intr.htm

[9] The figures in Table 2 apply to all the rail lines pictured in Figure 1. These extend beyond Greater Mumbai to cover the entire Mumbai Metropolitan Region (MMR).

**Table 3. Revenues And Costs, Mumbai Suburban Railways**

| (Million Rs.) | **2005-06** |
|---|---|
| Passenger Revenues | 9936.7 |
| | |
| Operational Expenses | 8949.6 |
| Depreciation | 701.7 |
| Interest on Capital | 409.2 |
| Total Cost (Million Rs.) | 10060.5 |
| | |

Source: S.K. Singh, Executive Director, Economics & Statistics, Ministry of Railways, India (personal communication).

## III. Travel Patterns in Mumbai

In Mumbai, as in other developing country cities, the journey to work constitutes the largest fraction of household trips in terms of distance traveled, accounting for approximately two-thirds of miles traveled (Takeuchi, Cropper and Bento, 2007). Table 4 describes the modal shares of workers in Mumbai, based on data in Baker et al. (2005). These data come from a random sample of 5,000 households in Greater Mumbai who were surveyed in the winter of 2003-2004. Commuting patterns are based on the usual commutes of the first and second principal earners in the household.[10]

Table 4 describes the 'main mode' used on a typical commute trip. The main mode is defined to be the mode that takes the longest time, with the exception of "on foot" and "bicycle," which are counted as the main mode only if they are the only mode used on the trip. Table 4 indicates that 45% of commuters walk to work, 22% rely on rail or rail+bus as their main mode, while 22% ride a bus to work—either as a main mode (14%) or to connect with rail.[11] The modal shares for private vehicles are much smaller—approximately 3% each for bicycle and car and 8.4% for two-wheelers.[12] Of commuters who take motorized transport to work, 70% take either rail or bus or both.

The respective modal shares are somewhat different for the poorest income group in the survey, defined as households with a monthly income below Rs. 5,000: 63% of the workers in these households walk to work, 6% ride a bicycle, 15% take the train (or train+bus) and 16% ride the bus (either alone or in conjunction with the train). However, of those workers who use motorized transport, 84% take either rail or bus or both.

As household income goes up, the modal shares of bus and motorcycle increase for short to medium commutes, while the share of trips made on foot declines. (See

[10] For details on the sampling protocols and questionnaire used in the survey, see Baker et al. (2005).
[11] In Table 6, these shares, based on travel diaries are, respectively, 46% walking, 21% rail and 15% bus.
[12] The shares based on the travel diaries are 3.5% for bicycle, 3.2% for own car and 8.6% for own two-wheeler.

Table 5.[13]) Rail remains the choice for long distance commutes, especially for households with incomes between Rs. 7,500 and 20,000 per month: One-quarter of commuters in this income range report rail as their main commute mode. Indeed, it is commuters in the Rs. 7,500-20,000 income range who are the largest users of public transit. In the highest income category (Rs. 20,000 or more), the share of walking declines to 15% and is replaced by motorcycles and cars. For commuters in the highest income category, the modal shares are 20% for two-wheeler and 24% for car.

The modal share for bus is highest for commutes between 3 and 10 km. For motorcycles, the share is highest for trips of 5 km or less. The relationship between income and mode choice is what one would expect: The poor rely heavily on walking (61% for commuters in households earning less than Rs. 5000) but take rail for long distances (5 km or more) and bus for intermediate distances (3-10 km). Overall, the modal shares for rail and bus are 16% and 15% for the poor; however, these shares are higher in the suburbs than in zones 1-3 (see Annex Table A.1).

**Table 4. Main Mode to Work**

| Transport Mode | Total | | Income <Rs. 5k | |
|---|---|---|---|---|
| | Freq. | Percent | Freq. | Percent |
| On foot | 2649 | 45.32 | 796 | 62.68 |
| Bicycle | 175 | 2.99 | 76 | 5.98 |
| Rail | 832 | 14.23 | 127 | 10.00 |
| Public Bus | 813 | 13.91 | 143 | 11.26 |
| Rail + Bus | 462 | 7.90 | 63 | 4.96 |
| Auto-Rickshaw | 101 | 1.73 | 16 | 1.26 |
| Taxi | 8 | 0.14 | 0 | 0.00 |
| Own Two-Wheeler | 488 | 8.35 | 10 | 0.79 |
| Own Car | 153 | 2.62 | 1 | 0.08 |
| Other's car | 12 | 0.21 | 2 | 0.16 |
| Other | 152 | 2.60 | 36 | 2.83 |
| **Total** | **5845** | **100.00** | **1270** | **100.00** |

Source: Authors' calculations

[13] In Table 5, "rail" refers to "rail" and "rail+bus." The samples used to construct Tables 4 and 5 differ slightly; hence modal shares differ slightly between the two tables.

**Table 5. Main Mode to Work by Commute Distance and Income**
(% within distance/income category who take each mode)

| | Distance | <5k | 5k-7.5k | 7.5k-10k | 10k-20k | >20k | HH Avg. |
|---|---|---|---|---|---|---|---|
| Walk | 0-1km | 84.6 | 80.1 | 83.2 | 61.1 | 40.6 | 77.4 |
| | 1-2km | 84.6 | 80.3 | 68.1 | 60.2 | 36.7 | 72.2 |
| | 2-3km | 72.4 | 68.1 | 60.0 | 36.0 | 26.9 | 58.3 |
| | 3-5km | 36.6 | 29.8 | 20.5 | 15.1 | 6.0 | 24.0 |
| | 5-10km | 9.9 | 6.3 | 1.7 | 0.0 | 1.7 | 4.0 |
| | 10-15km | 0.0 | 0.0 | 5.1 | 0.9 | 0.0 | 1.5 |
| | Dist. Avg. | 60.8 | 50.2 | 40.7 | 30.5 | 15.2 | 43.8 |
| Rail | 0-1km | 0.7 | 0.9 | 0.5 | 1.7 | 0.0 | 0.9 |
| | 1-2km | 0.3 | 0.5 | 3.6 | 2.2 | 1.3 | 1.6 |
| | 2-3km | 1.6 | 3.0 | 5.6 | 5.0 | 3.8 | 3.6 |
| | 3-5km | 9.0 | 13.5 | 8.1 | 7.2 | 8.0 | 9.5 |
| | 5-10km | 51.4 | 42.2 | 41.6 | 41.0 | 11.7 | 40.6 |
| | 10-15km | 69.6 | 82.4 | 72.0 | 61.5 | 26.0 | 66.8 |
| | 15-20km | 96.9 | 89.6 | 91.8 | 87.3 | 50.0 | 86.0 |
| | 20-30km | 95.3 | 96.2 | 98.4 | 96.1 | 81.3 | 94.9 |
| | >30km | 100.0 | 100.0 | 100.0 | 96.0 | 100.0 | 98.9 |
| | Dist. Avg. | 16.1 | 22.8 | 26.4 | 26.0 | 20.8 | 22.7 |
| Bus | 0-1km | 5.7 | 7.5 | 4.7 | 6.3 | 3.1 | 6.1 |
| | 1-2km | 7.2 | 6.8 | 10.5 | 9.7 | 6.3 | 8.3 |
| | 2-3km | 17.2 | 15.9 | 20.0 | 21.1 | 15.4 | 18.1 |
| | 3-5km | 37.3 | 42.7 | 46.0 | 30.9 | 14.0 | 37.8 |
| | 5-10km | 30.6 | 40.6 | 38.7 | 35.3 | 26.7 | 36.1 |
| | 10-15km | 23.2 | 12.6 | 12.7 | 18.3 | 22.0 | 16.4 |
| | 15-20km | 3.1 | 6.3 | 4.1 | 3.6 | 3.6 | 4.2 |
| | 20-30km | 2.3 | 0.0 | 0.0 | 1.3 | 0.0 | 0.7 |
| | Dist. Avg. | 14.5 | 16.5 | 18.3 | 16.3 | 12.4 | 16.2 |
| Motor Cycle | 0-1km | 0.4 | 2.8 | 7.4 | 21.7 | 28.1 | 7.1 |
| | 1-2km | 0.6 | 3.7 | 11.7 | 19.3 | 26.6 | 9.1 |
| | 2-3km | 0.0 | 4.7 | 10.0 | 26.7 | 21.2 | 10.2 |
| | 3-5km | 1.5 | 4.5 | 15.5 | 28.8 | 36.0 | 14.0 |
| | 5-10km | 1.8 | 3.6 | 13.3 | 12.2 | 20.0 | 9.0 |
| | 10-15km | 1.8 | 3.4 | 5.1 | 11.0 | 8.0 | 6.0 |
| | 15-20km | 0.0 | 2.1 | 4.1 | 3.6 | 7.1 | 3.4 |
| | 20-30km | 0.0 | 2.5 | 0.0 | 2.6 | 12.5 | 2.7 |
| | Dist. Avg. | 0.7 | 3.6 | 9.8 | 17.9 | 20.4 | 8.5 |
| Car | 0-1km | 0.0 | 0.6 | 0.5 | 1.7 | 15.6 | 1.1 |
| | 1-2km | 0.0 | 0.0 | 0.3 | 3.3 | 21.5 | 1.9 |
| | 2-3km | 0.0 | 0.0 | 0.0 | 3.7 | 25.0 | 2.4 |
| | 3-5km | 0.0 | 0.6 | 0.0 | 9.4 | 26.0 | 4.1 |
| | 5-10km | 0.0 | 0.0 | 0.0 | 7.2 | 35.0 | 4.6 |
| | 10-15km | 0.0 | 0.0 | 0.0 | 1.8 | 32.0 | 4.0 |
| | 15-20km | 0.0 | 0.0 | 0.0 | 3.6 | 35.7 | 5.1 |
| | 20-30km | 0.0 | 0.0 | 0.0 | 0.0 | 6.3 | 0.7 |
| | >30km | 0.0 | 0.0 | 0.0 | 4.0 | 0.0 | 1.1 |
| | Dist. Avg. | 0.0 | 0.2 | 0.2 | 4.0 | 24.4 | 2.6 |

Source: Baker et al. (2005)

Table 6 provides modal splits for all adult trips, by trip purpose.[14] The modal shares of work trips differ slightly from Table 4, as they reflect the work trips of all adults in the household, based on travel diaries.[15] The modal shares for other trips reflect the travel behavior of adults 16 years of age and older.

**Table 6. Percentage Distribution of Trips by Mode, for Each Trip Purpose**

| | Work | Shopping | School | Social Visit | Entertain-ment | Health Care | Personal Business | HH Avg. |
|---|---|---|---|---|---|---|---|---|
| On foot | 45.1 | 82.2 | 55.5 | 52.4 | 51.6 | 66.9 | 47.9 | 52.5 |
| Bicycle | 3.5 | 0.4 | 0.4 | 0.4 | 0.0 | 0.8 | 1.2 | 2.2 |
| Rail | 20.9 | 1.5 | 15.3 | 13.8 | 3.5 | 1.2 | 13.2 | 15.4 |
| Public Bus | 15.1 | 6.2 | 22.3 | 13.1 | 16.0 | 12.8 | 18.3 | 14.6 |
| Auto-Rickshaw | 2.1 | 5.4 | 3.3 | 7.6 | 7.0 | 13.2 | 6.7 | 4.3 |
| Taxi | 0.3 | 1.4 | 0.1 | 6.3 | 3.5 | 3.1 | 0.8 | 1.1 |
| Two-Wheeler | 8.6 | 2.5 | 2.3 | 3.1 | 8.0 | 1.2 | 8.3 | 6.4 |
| Own Car | 3.2 | 0.4 | 0.3 | 1.6 | 4.3 | 0.4 | 3.3 | 2.4 |
| Other's car | 0.4 | 0.2 | 0.1 | 1.5 | 6.2 | 0.4 | 0.4 | 0.6 |
| Other | 0.8 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.5 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Baker et al. (2005)

The shares of rail and bus in total trips remain high. Train is used for 15% of school trips (for students 16 years of age and older) and also for social visits. Public bus has a significant modal share for school trips and also for personal business, entertainment and social visits.

## IV. Affordability of Transport

### A. Household Expenditure on Transport

The fact that a high percent of trips—including work trips—are made on foot does not imply that expenditures on transport are low, even for households where the primary earner walks to work (see Table 7). As Table 7 indicates, in poor households where the principal wage earner walks to work, 12.5% of family income is spent of transport. The figure is even higher in households where the main earner takes the bus or train to work: in households where the main earner takes the train to work 16.8% of household income is spent on transportation; the percent spent on transport is 19.4% for households where the main earner takes the bus to work.

[14] As in Table 5, in Table 6 "rail" refers to "rail" and "rail+bus."

[15] Baker et al. (2005) administered travel diaries to the principal earner in each household, a randomly chosen adult over 21 and a randomly chosen person between 16 and 21.

**Table 7. Share of Household Expenditure on Transportation by Income and Commute Mode of Principal Earner**

| | Walk | Train | Bus | MTW | Car |
|---|---|---|---|---|---|
| <5k | 12.5% | 16.8% | 19.4% | 28.5% | NA |
| 5-7.5k | 8.6% | 9.3% | 9.9% | 19.8% | NA |
| 7.5-10k | 7.8% | 8.3% | 8.7% | 16.0% | NA |
| 10-20k | 7.6% | 9.0% | 8.4% | 14.4% | 20.0% |
| >20k | 7.8% | 6.8% | 5.8% | 11.6% | 14.2% |

Source: Baker et al. (2005)

**Table 8. Mean Monthly Household Expenditure (Rs.) on Transportation and its Share in Income, by Income Group**

| | <5k | 5k-7.5k | 7.5k-10k | 10k-20k | >20k | HH Avg |
|---|---|---|---|---|---|---|
| Bus | 151 | 195 | 221 | 286 | 275 | 210 |
| Rail | 89 | 124 | 165 | 227 | 296 | 152 |
| Taxi | 91 | 121 | 165 | 287 | 397 | 169 |
| School Bus | 3 | 5 | 13 | 50 | 59 | 18 |
| Fuel | 59 | 160 | 200 | 589 | 1545 | 301 |
| Bicycle Repair | 1 | 2 | 2 | 2 | 7 | 2 |
| Vehicle Repair | 6 | 31 | 39 | 96 | 300 | 54 |
| Transportation expenditure (fare & fuel only) | 393 | 605 | 764 | 1439 | 2572 | 850 |
| Total transportation expenditure (incl. maintenance) | 400 | 638 | 805 | 1537 | 2879 | 906 |
| Share in Income (fare & fuel only) | 15.7% | 9.7% | 8.7% | 9.6% | 10.3% | 10.0% |
| Share in Income (total transportation expenditure incl. maintenance) | 16.0% | 10.2% | 9.2% | 10.2% | 11.5% | 10.7% |

Source: Authors' calculations

Table 8 shows mean total household expenditure on transport, by category of expenditure. Average household expenditure on rail increases with income; as does average expenditures on buses—until the highest income category, when it decreases slightly. The percent of income spent on public transport is, however, highest for the lowest income group.

The figures in Table 8 foreshadow some results regarding the incidence of transit subsidies. As long as the transit subsidy is a constant percentage of the fare for all income groups, the subsidy in Rs. will increase with household expenditure on transit. Hence, transit subsidies will increase with income for rail and also for bus (up to the highest income group). The transit subsidy as a percent of income will, however, be highest for the lowest income group, which spends the highest proportion of income on transit.

### B. Fare Structure

The fact that all but the highest income households spend more per month on bus than on rail (see Table 8) reflects the fact that bus fares are higher, per kilometer traveled, than rail fares. Table 9 shows the current bus fares in Mumbai.[16] A person commuting 15 km each way to work paid a fare of Rs. 18 per day or Rs. 450 per month, assuming 25 workdays per month. Although BEST has recently introduced monthly passes, they did not exist at the time of the Baker et al. survey or during the period 2005-2006, for which we compute transit subsidies.

Monthly and quarterly passes are available for rail. Table 9 shows the cost of a second-class monthly rail pass as well as the cost of one-way fares, by distance traveled. The cost of travel by rail, per kilometer, is lower than the cost by bus, even if no monthly pass is purchased. The availability of monthly passes makes calculating the marginal cost of travel by rail difficult; however, the average cost of rail travel, computed from information on revenues and passenger kilometers traveled (see Table 2) is approximately 13 paise per kilometer, or Rs. 4.1 for a 30 km trip.

**Table 9. Cost of Rail (Second Class) and Bus (Regular Service)**

| | Rail Fare | | Bus Fare | |
|---|---|---|---|---|
| Distance (km) | Monthly Pass (Rs.) | One Way (Rs.) | Monthly Pass (Rs.) | One Way (Rs.) |
| 1 - 3 | 60 | 4 | 180 | 3 |
| 3 - 5 | 60 | 4 | 210 | 4 |
| 5 - 7 | 60 | 4 | 240 | 5 |
| 7 - 10 | 60 | 4 | 390 | 6 |
| 11 - 15 | 75 | 5 | 480 | 9 |
| 16 - 20 | 90 | 6 | - | 10 |
| 21 - 25 | 105 | 7 | - | 11 |
| 26 - 30 | 105 | 7 | - | 12 |
| 31 - 35 | 120 | 8 | - | 13 |
| 36 - 40 | 135 | 9 | - | 15 |
| 41 - 45 | 150 | 10 | - | 17 |
| 46 - 50 | 165 | 11 | - | 19 |
| 51 - 55 | 180 | 11 | - | 21 |
| 56 - 60 | 195 | 12 | - | 23 |

Source: Indian Railways and BEST Undertaking.

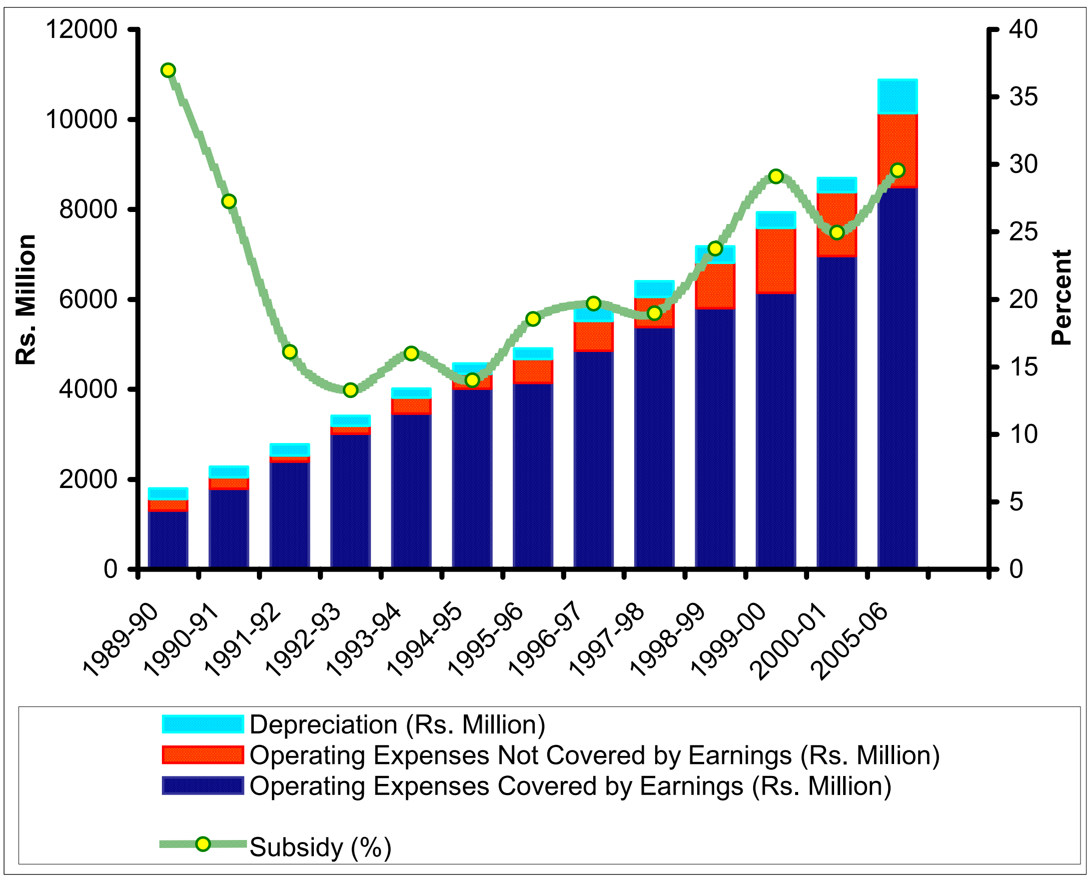
[16] A more complete listing of fares appears in Appendix Tables A.2 and A.3.

V. Transit Subsidies

A. Public Buses

As suggested in Table 1, the Transport division of BEST has historically operated at a loss. In fact, as illustrated in Figure 2, revenues have not covered operating costs for any of the years pictured. The fare subsidy shown in Figure 2 ranges from 12 to 30 percent for the last fifteen years. Parts of BEST's transport losses are covered by the profits made by its electricity supply division. However, borrowing and government subsidies have been needed since, as Appendix Table A.4 indicates, the undertaking has operated at a net loss for the past three years. In computing bus subsidies we use figures from 2005-2006, which imply that fares would have to rise 29.6% to cover costs.

**Figure 2. Costs, Revenues and Subsidies, BEST, Selected Years**



### B. Suburban Railways

Table 3, which shows revenues and costs for Mumbai suburban rail, suggests a loss of Rs. 123.8 million for the year 2005-06, implying that fares would have to be raised 1.2 percent to cover costs. The ratio of depreciation to operating costs (0.078) is, however, much lower than the ratio for other rail services around the world, including 0.105 for VIA Rail Canada to 0.194 for Amtrak.

The calculations below also suggest that the depreciation allowed in Table 3 may understate economic depreciation and hence the subsidy implicit in rail fares. Indian Railways currently uses 2 to 4 percent of the value of fixed assets at the beginning of the year to calculate depreciation (Indian Railways, 2006; ADB, 2002). The fixed assets of Mumbai Suburban rail include the 184 EMU rakes (train sets), the rails, buildings, etc. The official value for the life of an EMU for the purpose of calculating depreciation is 25 years, indicating a depreciation rate of 4% using the straight line method. The old rakes cost Rs. 120 million per 9-car rake. At this price, the total value of the 184 rakes is Rs. 22.08 billion. Straight line depreciation on the rakes alone is Rs. 883.2 million each year, which is greater than the depreciation quoted in Table 3. If one also accounts for the value of other fixed assets, then depreciation should be even larger. Thus, if Mumbai suburban rail were to calculate depreciation values based on the guidelines provided in Indian railways documents, its losses from current operations would increase, implying a greater level of actual subsidy to passengers.

## VI. Incidence of Subsidies and Impact on Mode Choice

### A. Incidence of Bus and Rail Subsidies

In 2005-2006, bus riders in Mumbai received a subsidy equal to 30% of bus fares. According to official figures the subsidy to rail fares was only 1.2%; however, it is possible that this understates the actual subsidy received by train passengers. This section examines the incidence of these subsidies. Table 10 shows average monthly household expenditure on bus and rail, as well as the average monthly household subsidy for bus and rail, by income group.

Table 11 and Figures 3 and 4 show the percentage of total subsidy benefits going to each income group, as well as the percent of households in each income group who receive any subsidy. Because the bus and rail subsidies are a percent of fares, the share of each subsidy going to income group *i* equals the share of income group *i*'s expenditure on bus (rail) in total expenditure on bus (rail) and is thus independent of the percent of the fare that is subsidized. Formally,

$$S_{ij} = \frac{x_{ij} \cdot n_i}{\sum_i x_{ij} \cdot n_i} \qquad (1)$$

where $S_{ij}$ is the share of total subsidy accruing to income group *i* from travel mode *j*, $x_{ij}$ is the average monthly expenditure by a household belonging to income group *i* for travel mode *j* and $n_i$= fraction of households in income group *i*. The incidence figures in Table 11 thus apply to any level of bus and rail subsidies that are a percent of the fare.

**Table 10. Bus and Rail Expenditures and Subsidies, by Income Group**

| Income Group | Percent of Sample | Monthly Average Household Expenditure (Rs.) | | Monthly Average Household Subsidy (Rs.) | |
|---|---|---|---|---|---|
| | | Bus | Rail | Bus (29.6%) | Rail (1.23%) |
| <5K | 26.6 | 151.4 | 89.2 | 44.8 | 1.1 |
| 5001-7500 | 27.8 | 195.2 | 123.6 | 57.7 | 1.5 |
| 7501-10000 | 21.9 | 221.5 | 165.2 | 65.5 | 2.0 |
| 10001-20000 | 17.8 | 285.8 | 226.6 | 84.5 | 2.8 |
| >20K | 5.9 | 274.6 | 295.7 | 81.2 | 3.6 |

**Table 11. Incidence of Bus and Rail Subsidies, by Income Group**

| Income Group | Percent of Sample | Percent of Total Subsidy Benefits | | Percent of Households Who Receive Subsidy | |
|---|---|---|---|---|---|
| | | Bus | Rail | Bus | Rail |
| <5K | 26.6 | 19.1 | 15.5 | 90.0 | 73.9 |
| 5001-7500 | 27.8 | 25.8 | 22.5 | 93.6 | 83.2 |
| 7501-10000 | 21.9 | 23.1 | 23.8 | 94.3 | 90.8 |
| 10001-20000 | 17.8 | 24.2 | 26.5 | 92.3 | 87.6 |
| >20K | 5.9 | 7.8 | 11.6 | 81.8 | 79.4 |

**Table 12. Errors of Inclusion and Exclusion of Subsidy**

| Percentage of Households….. | Poor (< 5K) | Non-Poor |
|---|---|---|
| Receiving Bus Subsidy | 90.00 | 92.55 |
| Not Receiving Bus Subsidy | 10.00 | 7.45 |
| Receiving Rail Subsidy | 73.94 | 86.23 |
| Not Receiving Rail Subsidy | 26.06 | 13.77 |

An equal distribution of subsidy benefits implies that the percentage of subsidy benefit received by an income category equals its share in the population. Our findings indicate that while the poorest households constitute 27 percent of total households in the sample, they receive only 19 and 15.5 percent, respectively, of bus and rail subsidies. The wealthiest households, who constitute less than 6 percent of the total sample, receive

**Figure 3: Distributional Incidence of Public Bus Subsidy in Mumbai**

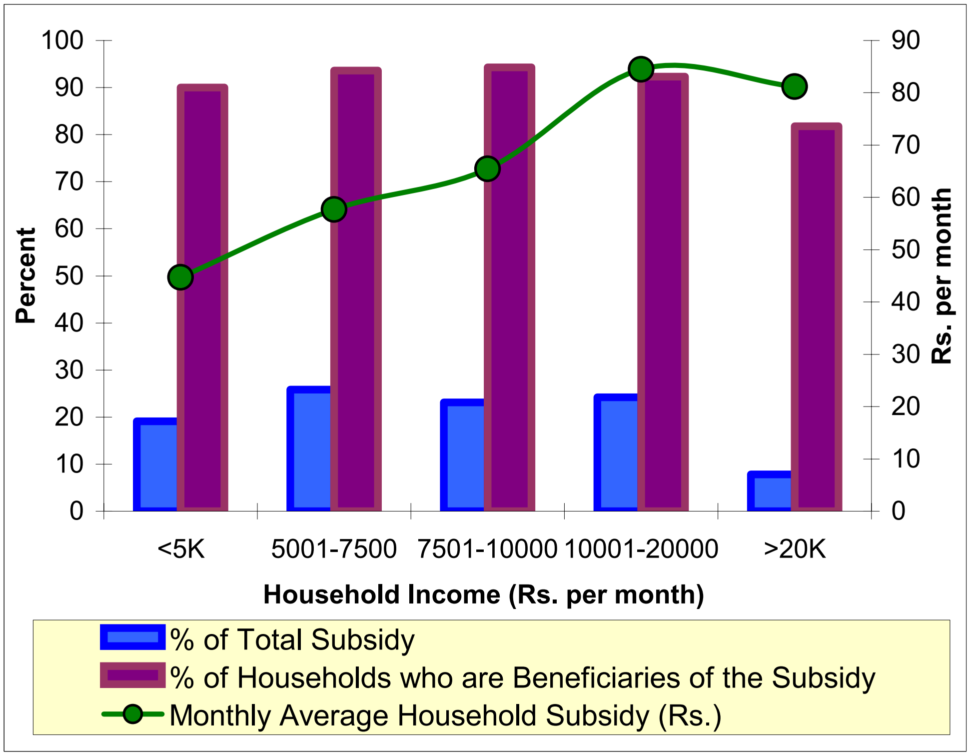
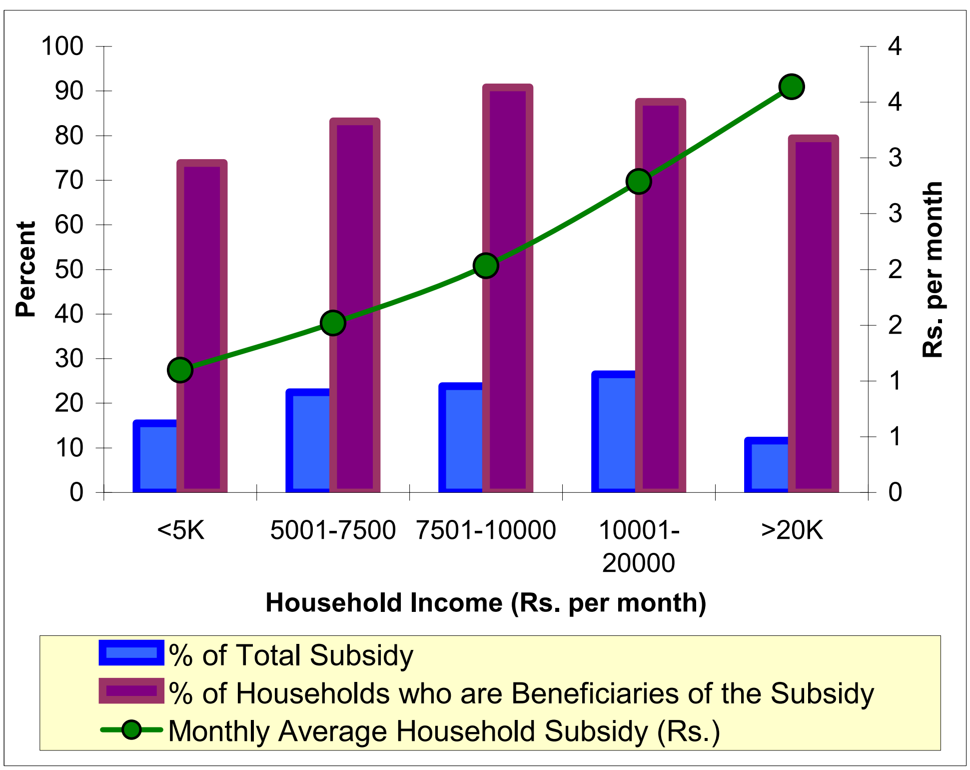



**Figure 4: Distributional Incidence of Rail Subsidy in Mumbai**

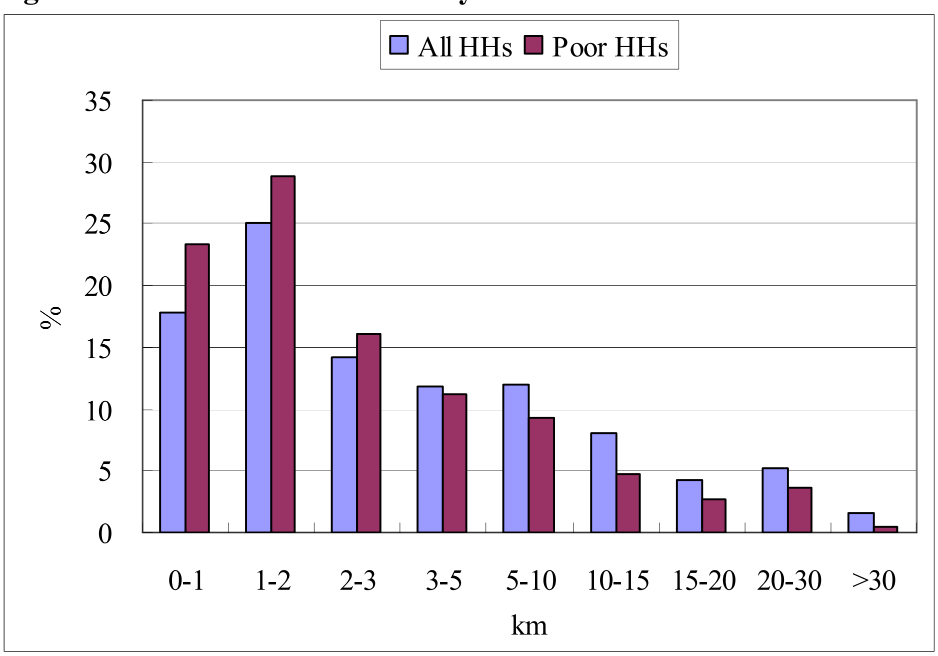


bus subsidies that are about 30 percent larger than their equal share, and about twice the rail subsidy benefits than they would receive under a uniform distribution of the subsidy across income groups. The middle income group, earning 7,500-10,000 Rs. per month receives subsidy benefits from both bus and rail in roughly equal proportion to their share in the population.

If subsidy benefits should be targeted at the poor, then the percentage of the poor not receiving subsidy benefits is an error of exclusion (Foster, 2004) and the percentage of non-poor receiving subsidy benefits would constitute errors of inclusion. For simplicity of calculation, we assume here that all users of public bus and rail receive subsidy benefits. Table 12 shows the errors of inclusion and exclusion for both the rail and bus subsidies. Errors of exclusion are 10 and 26 percent for bus and rail respectively, while errors of inclusion are 93 and 86 percent for bus and rail respectively. In our case, the errors of exclusion for the poor are higher for rail than bus. This reflects the fact that a larger fraction of persons in the lowest income group do not use rail (as opposed to bus) in spite of lower fares for rail.

The low usage of rail by the poorest income group may be attributed to the fact that households in the lowest income group live farther away from rail stations than persons in the higher income groups. However, this in turn reflects the decisions made by households regarding where to live and work. The distribution of commute distances for workers in the < 5K income group lies to the left of the distribution of commute distances for workers in all households (see Figure 3). This may reflect the fact that it is

**Figure 5. Distribution of One-Way Commute Distances**




Source: Baker et al. (2005)

easier for these workers to find jobs close to home and/or to the fact that it is more expensive to live near railway stations; i.e., that proximity to rail is capitalized into land values.

### B. Impact of Subsidies on Mode Choice

A bus subsidy equal to 30% of fares, if removed, would likely have a significant effect on mode choice. In this section we evaluate the impact of an increase in bus and rail fares on ridership based on the commute mode choice models reported in Takeuchi, Cropper and Bento (2007).[17]

Table 13 presents own and cross-price elasticities for bus and rail from the commute mode choice models estimated by Takeuchi, Cropper and Bento (2007) using data collected by Baker et al. (2005). In these models rail+bus is distinguished as a separate mode choice from taking rail or bus alone. Price elasticities differ slightly depending on the form of the mode choice model estimated. However, own price elasticities are always higher for bus than for rail, and an increase in bus fares reduces ridership more for bus-only users as opposed to users of rail+bus.

If the elasticities in Table 13 are weighted by the share of bus commuters taking bus-only (64%) v. rail+bus (36%), the elasticity of bus commuters with respect to the bus fare ranges from -0.36 to -0.32. This implies that removal of the bus subsidy (i.e., a 30% increase in fares) would reduce bus commuters by 10-11%. To which modes would these commuters switch? Most would switch to rail only; however, some would switch to walk only, and some would switch to a car or two-wheeler.[18]

**Table 13: Own and Cross-Price Elasticities of Rail and Bus Use for Journey to Work**

| Estimation Model | Increase in Rail Fare on | | | Increase in Bus Fare on | | |
|---|---|---|---|---|---|---|
| | Rail Users | Rail+Bus Users | Bus Users | Rail Users | Rail+Bus Users | Bus Users |
| Multinomial Logit (Cost/Wage) | -0.08 | -0.07 | 0.06 | 0.26 | -0.19 | -0.45 |
| Multinomial Logit ln(Hicksian bundle) | -0.07 | -0.07 | 0.05 | 0.25 | -0.17 | -0.42 |
| Mixed Logit ln(Hicksian bundle) | -0.07 | -0.07 | 0.04 | 0.25 | -0.26 | -0.35 |

Source: Takeuchi, Cropper and Bento (2007)

[17] The money cost used in this analysis is based on the lowest fares, i.e. second-class rail fares and ordinary bus fares.

[18] Specifically, the elasticity of walking with respect to bus fare ranges from 0.06 to 0.08, of rail, from 0.25 to 0.26, of two-wheeler, from 0.03-0.04. The elasticity of car usage with respect to bus fare is 0.03.

In contrast, the impact of an increase in rail fares is much smaller. An increase of 1 percent in rail fares causes a loss in workers who commute by rail ranging from 0.07 to 0.08 percent, the majority of whom switch to bus. It should also be noted that raising rail fares by one percent reduces the numbers of workers who commute by rail+bus by 0.07 percent.

If one is willing to assume that the elasticities computed in Table 13 for commute mode choice apply to all trips, then Table 13 can be used to estimate the impact of fare increases on passenger volumes and revenues. This is done for separate increases in bus and rail fares in Table 14 and for joint increases in bus and rail fares in Table A.5 of the Appendix, using the elasticities for the Multinomial Logit (Cost/Wage) model in Table 13.

**Table 14: Impact of Fare Increases on Passenger volume and Revenue**

| Impact of… | Change in Passenger Volume | | | | Change in Revenue | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Bus | Rail | Bus | Rail | Bus | Rail | Bus | Rail | Bus+ Rail |
| | (Percent) | | (Million) | | (Percent) | | (Rs. Million) | | |
| **Bus fare increase** | | | | | | | | | |
| 1% | -0.36 | 0.10 | -5.37 | 2.30 | 0.64 | 0.10 | 54.44 | 9.87 | 64.32 |
| 2% | -0.71 | 0.20 | -10.75 | 4.60 | 1.27 | 0.20 | 108.28 | 19.74 | 128.03 |
| 3% | -0.71 | 0.30 | -10.75 | 6.90 | 2.27 | 0.30 | 192.67 | 29.62 | 222.29 |
| 4% | -1.42 | 0.40 | -21.50 | 9.20 | 2.52 | 0.40 | 214.14 | 39.49 | 253.63 |
| 5% | -1.78 | 0.50 | -26.87 | 11.50 | 3.13 | 0.50 | 266.17 | 49.36 | 315.53 |
| 10% | -3.56 | 0.99 | -53.74 | 23.00 | 6.09 | 0.99 | 517.21 | 98.72 | 615.93 |
| 15% | -5.34 | 1.49 | -80.62 | 34.50 | 8.86 | 1.49 | 753.13 | 148.08 | 901.21 |
| 20% | -7.12 | 1.99 | -107.49 | 46.00 | 11.46 | 1.99 | 973.92 | 197.44 | 1171.37 |
| 25% | -8.90 | 2.48 | -134.36 | 57.50 | 13.88 | 2.48 | 1179.60 | 246.80 | 1426.40 |
| 30% | -10.68 | 2.98 | -161.23 | 69.00 | 16.12 | 2.98 | 1370.14 | 296.16 | 1666.31 |
| **Rail fare increase** | | | | | | | | | |
| 1% | 0.01 | -0.08 | 0.20 | -1.77 | 0.01 | 0.92 | 1.10 | 91.70 | 92.80 |
| 2% | 0.03 | -0.15 | 0.39 | -3.54 | 0.03 | 1.84 | 2.20 | 183.24 | 185.44 |
| 3% | 0.04 | -0.23 | 0.59 | -5.31 | 0.04 | 2.76 | 3.30 | 274.63 | 277.93 |
| 4% | 0.05 | -0.31 | 0.78 | -7.08 | 0.05 | 3.68 | 4.40 | 365.87 | 370.27 |
| 5% | 0.06 | -0.38 | 0.98 | -8.85 | 0.06 | 4.60 | 5.50 | 456.96 | 462.46 |
| 10% | 0.13 | -0.76 | 1.95 | -17.69 | 0.13 | 9.16 | 11.00 | 910.13 | 921.13 |
| 15% | 0.19 | -1.15 | 2.93 | -26.54 | 0.19 | 13.68 | 16.50 | 1359.50 | 1375.99 |
| 20% | 0.26 | -1.53 | 3.91 | -35.39 | 0.26 | 18.17 | 22.00 | 1805.07 | 1827.07 |
| 25% | 3.24 | -1.91 | 48.85 | -44.23 | 3.24 | 22.61 | 274.95 | 2246.84 | 2521.80 |
| 30% | 0.39 | -2.29 | 5.86 | -53.08 | 0.39 | 27.02 | 32.99 | 2684.82 | 2717.81 |

Source: Authors' calculations

In Table 14 it is clear that raising bus fares by 30% would not be sufficient to cover BEST's 2005-2006 loss, given the associated drop in ridership. A 30% increase in fares raises revenues by slightly over 16%. Assuming that the elasticities in Table 13 remain constant, fares would have to rise by over 50% to make up the 2005-2006 loss of Rs. 2.5 billion and by over 40% just to make up operating losses. Clearly, given the impact on household budgets and the political repercussions, such a drastic increase in bus fares is unlikely.

Rail fares in Mumbai would need to rise by less than 2 percent to cover the official 2005-2006 loss on suburban railways of Rs. 123.8 million.[19] Raising rail fares in excess of this would provide a surplus for future capital investment. The impact of possible fare increases are shown in Table 14. Due to low price elasticities of rail service, a 10% increase in rail fares raises revenues by over 9%. This increase would, however, result in only a modest increase in bus revenues: although an increase in rail fares increases bus-only riders, it reduces bus-plus rail riders.

The impact of simultaneously increasing bus fares and rail fares is shown in Table A.5. Results differ only slightly from those in Table 14.

## VII. Conclusions

According to Carruthers, Dick and Saurkar (2005), Mumbai ranks sixth among 27 cities for which indices of public transport affordability have been calculated. That is, Mumbai is the sixth most expensive city. The figures presented in this paper bear this out. Expenditure on transport accounts for 16% of income in the lowest income category (<5000 Rs./month), with 10% of income, on average, spent on bus and rail fares. This percentage, however, is not evenly distributed: it is much higher than 10% for households in which workers take the bus or train to work, and lower for households in which the main earner walks to work. Even in these households, however, 12.5% of income is spent on transportation.

Expenditure on public transport would be even higher if bus fares in Mumbai were not subsidized. In 2005-2006, transport revenues of BEST fell below total costs by 30% and below operating costs by 20%. Rail fares, which are much lower than bus fares per km traveled, officially covered operating costs and almost covered depreciation expenses.

If one asks who benefits from bus subsidies in Mumbai, the answer is clear: Households with incomes below Rs. 5,000 per month, who constitute 27% of the population, receive 19% of bus subsidies while households with incomes above Rs. 10,000 per month, who constitute 24% of the population, receive 31% of bus subsidies. Ten percent of households in the below-Rs. 5,000 group do not use bus services and thus receive no subsidy.

[19] It is interesting to note that, due to cross-price elasticities, raising bus fares by 15% would increase rail revenues enough to make up the loss of Rs. 123.8 million.

Although the magnitude of current rail subsidies is low, the incidence of a rail subsidy that is a constant percent of fares is less pro-poor than the bus subsidy. This is because 26% of households in the below Rs. 5,000 group do not use rail services at all. In the case of rail, households in the below Rs. 5,000 group receive only 15.5% of total rail subsidies.

An important issue for the poor is not only how current transport subsidies are distributed, but whether they will continue. Transport losses for BEST have been increasing over time and are no longer covered by profits from electricity supply. In the medium to long term BEST will have to find other sources to cover transport losses, reduce costs or increase bus fares.

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## APPENDIX

..**Table A.1. Main Mode to Work by Residential Location and Income**

| | Zone | <5k | 5k-7.5k | 7.5k-10k | 10k-20k | >20k | HH Avg. |
|---|---|---|---|---|---|---|---|
| Walk | 1 | 64.5 | 56.2 | 38.6 | 27.5 | 5.2 | 41.2 |
| | 2 | 55.6 | 48.5 | 37.7 | 28.8 | 14.8 | 40.2 |
| | 3 | 62.2 | 56.1 | 47.2 | 31.3 | 13.3 | 46.6 |
| | 4 | 59.0 | 46.3 | 46.6 | 32.5 | 15.9 | 43.4 |
| | 5 | 66.8 | 53.8 | 38.1 | 34.2 | 20.7 | 50.5 |
| | 6 | 55.7 | 42.3 | 33.9 | 30.5 | 24.1 | 39.9 |
| | Zone Average | 60.7 | 50.0 | 40.6 | 30.4 | 15.1 | 43.6 |
| Rail | 1 | 9.9 | 11.1 | 19.3 | 14.7 | 10.3 | 13.6 |
| | 2 | 13.1 | 23.2 | 25.7 | 27.4 | 16.7 | 22.9 |
| | 3 | 11.0 | 16.7 | 23.0 | 19.5 | 5.6 | 16.6 |
| | 4 | 17.6 | 27.4 | 24.0 | 39.0 | 35.4 | 27.5 |
| | 5 | 17.0 | 20.0 | 26.8 | 19.7 | 13.8 | 20.6 |
| | 6 | 25.1 | 32.1 | 37.1 | 33.2 | 33.3 | 32.1 |
| | Zone Average | 16.0 | 22.7 | 26.3 | 25.8 | 20.6 | 22.6 |
| Bus | 1 | 16.5 | 21.0 | 18.6 | 12.7 | 8.6 | 16.2 |
| | 2 | 20.9 | 16.9 | 18.7 | 23.0 | 14.8 | 19.3 |
| | 3 | 15.7 | 14.6 | 15.1 | 13.7 | 11.1 | 14.5 |
| | 4 | 10.2 | 13.2 | 17.6 | 12.5 | 13.3 | 13.3 |
| | 5 | 12.6 | 18.5 | 24.7 | 21.1 | 10.3 | 18.3 |
| | 6 | 13.8 | 16.7 | 15.8 | 17.1 | 14.8 | 15.9 |
| | Zone Average | 14.4 | 16.5 | 18.2 | 16.2 | 12.3 | 16.1 |
| Motor Cycle | 1 | 0.8 | 4.9 | 20.7 | 36.3 | 29.3 | 18.8 |
| | 2 | 0.0 | 4.0 | 12.1 | 19.0 | 18.5 | 9.9 |
| | 3 | 1.2 | 4.8 | 11.9 | 17.6 | 22.2 | 9.8 |
| | 4 | 1.2 | 3.6 | 4.5 | 7.0 | 15.9 | 5.2 |
| | 5 | 0.0 | 1.9 | 5.2 | 18.4 | 31.0 | 4.9 |
| | 6 | 0.5 | 2.6 | 6.8 | 8.6 | 13.0 | 4.8 |
| | Zone Average | 0.7 | 3.6 | 9.8 | 17.9 | 20.4 | 8.5 |
| Car | 1 | 0.0 | 0.0 | 0.0 | 4.4 | 34.5 | 4.2 |
| | 2 | 0.0 | 0.0 | 0.0 | 0.4 | 31.5 | 1.9 |
| | 3 | 0.0 | 0.7 | 0.4 | 9.0 | 40.0 | 5.4 |
| | 4 | 0.0 | 0.4 | 0.0 | 2.5 | 11.5 | 1.8 |
| | 5 | 0.0 | 0.0 | 0.0 | 5.3 | 20.7 | 1.3 |
| | 6 | 0.5 | 0.0 | 0.5 | 2.1 | 9.3 | 1.0 |
| | Zone Average | 0.1 | 0.2 | 0.2 | 4.0 | 24.4 | 2.6 |

Source: Baker et al. (2005)

## Table A.2: Public Bus Fares in Mumbai

**THE BRIHANMUMBAI ELECTRIC SUPPLY AND TRANSPORT UNDERTAKING**

**BUS FARE STRUCTURE W.E. FROM : 25/01/2005**

| KMS | ORDINARY | | LIMITED | | AIR CONDITIONED |
|---|---|---|---|---|---|
| | REGULAR FARE (RS) | CONCESSIONAL FARE (RS) | REGULAR FARE (RS) | CONCESSIONAL FARE (RS) | REGULAR FARE (RS) |
| 3 | 4 | 1 | 4.5 | 1 | 13 |
| 5 | 4.5 | 2 | 5 | 3 | 17 |
| 7 | 5 | 3 | 6 | 3 | 19 |
| 10 | 7 | 3 | 8 | 4 | 25 |
| 15 | 9 | 4 | 10 | 5 | 29 |
| 20 | 11 | 5 | 12 | 6 | 33 |
| 25 | 13 | 6 | 15 | 7 | 37 |
| 30 | 14 | 7 | 16 | 8 | 41 |
| 35 | 15 | 7 (Maximum) | 18 | 9 (Maximum) | 45 |
| Above 35 Kms | Rs.2 for every addl. 5 Kms or part thereof | | Rs.2 for every addl. 5 Kms or part thereof | | Rs.5 for every addl. 5 Kms or part thereof |

Source: http://www.bestundertaking.com/transport/index.htm

## Table A.3: Fares for Suburban Trains in Mumbai (2004-05)

| Distance (Kilometers) | One-Way Ticket | | Monthly Season Ticket | | Quarterly Season Ticket (3 Months) | |
|---|---|---|---|---|---|---|
| | Second Class (Rs.) | First Class (Rs.) | Second Class (Rs.) | First Class (Rs.) | Second Class (Rs.) | First Class (Rs.) |
| 1 - 5 | 4 | 16 | 60 | 240 | 165 | 650 |
| 6 - 10 | 4 | 16 | 60 | 240 | 165 | 650 |
| 11 - 15 | 5 | 20 | 75 | 300 | 205 | 810 |
| 16 - 20 | 6 | 24 | 90 | 360 | 245 | 975 |
| 21 - 25 | 7 | 28 | 105 | 420 | 285 | 1135 |
| 26 - 30 | 7 | 28 | 105 | 420 | 285 | 1135 |
| 31 - 35 | 8 | 32 | 120 | 480 | 325 | 1300 |
| 36 - 40 | 9 | 36 | 135 | 540 | 360 | 1460 |
| 41 - 45 | 10 | 40 | 150 | 600 | 405 | 1620 |
| 46 - 50 | 11 | 44 | 165 | 660 | 450 | 1785 |
| 51 - 55 | 11 | 44 | 180 | 720 | 490 | 1945 |
| 56 - 60 | 12 | 48 | 195 | 780 | 530 | 2110 |

Source: http://www.indianrail.gov.in/mst_fares_km.html

**Table A.4: Balance sheet for BEST Undertaking** *(Rs. million)*

| | Electric Supply | Transport | Whole Undertaking |
|---|---|---|---|
| **2003-04** | | | |
| Income | 16,486.0 | 7,715.1 | 24,201.1 |
| Expenditure | 15,049.1 | 9,465.1 | 24,514.3 |
| +Surplus/-Deficit | +1,436.9 | -1,750.0 | -313.2 |
| | | | |
| **2004-05** | | | |
| Income | 15,142.2 | 8,391.8 | 23,534.0 |
| Expenditure | 13,634.0 | 10,520.4 | 24,154.4 |
| + Surplus/-Deficit | +1,528.2 | -2,128.6 | -620.4 |
| | | | |
| **2005-06** | | | |
| Income | 15,179.7 | 8,476.6 | 23,656.3 |
| Expenditure | 14,463.5 | 10,982.3 | 25,445.8 |
| +Surplus/-Deficit | +716.2 | -2505.7 | -1789.5 |

Source: BEST (2006): http://www.bestundertaking.com/finance0506.pdf (2005-06)
BEST (2005): http://www.bestundertaking.com/finance.asp (2003-05)

**Table A.5: Impact of Joint Fare Increases for Bus and Rail on Passenger Volumes and Revenues**

| Impact of Fare Increase… | | Change in Passenger Volume | | | | Change in Revenue | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bus | Rail | Bus | Rail | Bus | Rail | Bus | Rail | Bus | Rail | Bus+ Rail |
| | | (Percent) | | (Million) | | (Percent) | | (Rs. Million) | | |
| 2% | 2% | -0.69 | 0.05 | -10.36 | 1.06 | 1.30 | 2.05 | 110.53 | 203.38 | 313.91 |
| 2% | 5% | -0.65 | -0.18 | -9.77 | -4.25 | 1.34 | 4.81 | 113.89 | 477.69 | 591.59 |
| 5% | 5% | -1.71 | 0.11 | -25.90 | 2.65 | 3.20 | 5.12 | 271.94 | 508.79 | 780.73 |
| 5% | 10% | -1.65 | -0.27 | -24.92 | -6.19 | 3.27 | 9.71 | 277.71 | 964.43 | 1242.14 |
| 8% | 10% | -2.72 | 0.03 | -41.04 | 0.71 | 5.06 | 10.03 | 430.49 | 997.00 | 1427.49 |
| 10% | 10% | -3.43 | 0.23 | -51.79 | 5.31 | 6.23 | 10.25 | 529.31 | 1018.72 | 1548.03 |
| 10% | 15% | -3.36 | -0.15 | -50.81 | -3.54 | 6.30 | 14.82 | 535.36 | 1473.03 | 2008.38 |
| 10% | 17% | -3.34 | -0.31 | -50.42 | -7.08 | 6.33 | 16.64 | 537.78 | 1653.69 | 2191.46 |
| 10% | 20% | -3.30 | -0.54 | -49.84 | -12.39 | 6.37 | 19.36 | 541.41 | 1923.53 | 2464.94 |
| 15% | 20% | -5.08 | -0.04 | -76.71 | -0.89 | 9.16 | 19.95 | 778.42 | 1982.77 | 2761.19 |
| 20% | 25% | -6.79 | 0.08 | -102.60 | 1.77 | 11.85 | 25.10 | 1006.92 | 2493.65 | 3500.56 |
| 20% | 30% | -6.73 | -0.31 | -101.63 | -7.08 | 11.92 | 29.60 | 1013.52 | 2941.49 | 3955.01 |
| 25% | 25% | -8.57 | 0.57 | -129.48 | 13.26 | 14.28 | 25.72 | 1213.97 | 2555.35 | 3769.31 |
| 30% | 10% | -10.55 | 2.22 | -159.28 | 51.31 | 16.29 | 12.44 | 1384.44 | 1235.91 | 2620.35 |
| 40% | 10% | -14.11 | 3.21 | -213.03 | 74.30 | 20.25 | 13.53 | 1721.27 | 1344.50 | 3065.77 |
| 50% | 10% | -17.66 | 4.20 | -266.77 | 97.30 | 23.50 | 14.62 | 1997.60 | 1453.10 | 3450.69 |

Source: Authors' calculations