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Publication Date

1995-01-05

**VARIATIONS IN FARE PAYMENT AND PUBLIC SUBSIDY
BY RACE AND ETHNICITY:
AN EXAMINATION OF THE LOS ANGELES
METROPOLITAN TRANSPORTATION AUTHORITY**

WORKING PAPER

UCLA INSTITUTE OF TRANSPORTATION STUDIES

5 January 1995

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I. OVERVIEW

Transit agencies often pursue ostensibly race-neutral policies that, given both the cost structure of public transit and the systematic variations in ridership patterns by race/ethnicity, have racially disparate effects. This analysis explores this issue by examining whether the policies and practices of one agency -- the Los Angeles County Metropolitan Transportation Authority (MTA) -- have disparate effects on minority and white passengers. Using data either collected or reported by the MTA, this analysis finds that, as a group, minority riders pay substantially more for MTA services and receive lower average taxpayer subsidies than do white riders. Specifically this analysis shows that:

1. ***Minorities pay a higher fare per mile for transit service than white patrons.*** Because (1) most MTA fares do not vary with distance and (2) minority passengers have shorter average trip lengths than white passengers.
2. ***The average public subsidy per minority MTA passenger is less than the average subsidy per white passenger.*** Because minority passengers, as a group, use fewer expensive-to-provide express and rail transit services and more inexpensive-to-provide local bus service than white passengers, the average taxpayer subsidy of minority passengers is lower than for white passengers.

As this study will show, these racial disparities stem largely from MTA policy decisions to (1) expand relatively expensive rail and commuter express services that serve a disproportionately white clientele and (2) adopt a generally flat fare structure that causes minority riders, who are more likely to make shorter trips on local buses, to cross-subsidize white riders, who are more likely to make longer trips on express buses and rail lines.

II. BACKGROUND TO THIS ANALYSIS

A two-step process is required to determine whether current Los Angeles MTA services affect white passengers and minority passengers differently. First, the cost of providing various types of service (express and local, peak period and off-peak, etc.) must be determined. Second, the ridership patterns of white and minority riders must be disaggregated by type of service used. For example, it costs the MTA more to carry a passenger ten miles than it does to carry a passenger one mile. Because all local bus and MTA rail passengers pay the same flat fare regardless of distance traveled, passengers who take long trips receive higher subsidies per trip than passengers taking short trips. Thus if white passengers, as a group, average longer trips than minority passengers, as a group, then the average subsidy to white MTA riders is higher than the average subsidy to minority MTA riders. The analysis here is similar to that employed by Hodge in his 1988 study of fiscal equity in urban mass transit systems;¹ the two parts of this analysis -- the dimensions of transit costs and the demographic patterns of transit ridership -- are outlined below.

Subsidies and the Four Dimensions of Transit Costs

To remain solvent, urban public transit systems require substantial public subsidies. While many specialized transit services such as taxicabs, airport shuttles, and tour buses are self-supporting, urban public transit systems are not. Nationally, taxpayers subsidize approximately

¹Hodge, David C. 1988. "Fiscal Equity in Urban Mass Transit Systems: A Geographic Analysis," *Annals of the Association of American Geographers*, 78(2): 288-306.

two-thirds (65.3%) of total public transit costs. In other words, for each dollar collected in fares, advertising, and other income, transit systems require approximately two dollars in local, state, and federal subsidies to operate. Nationwide, close to 90 percent of transit capital costs (expenses associated with the purchase of such items as vehicles, equipment, and real estate) are subsidized; and over half (58%) of transit operating costs (ongoing expenses such as employee salaries and fuel) are subsidized.² By comparison, in fiscal year 1993, over two-thirds (70%) of MTA operating costs were subsidized.³

Such aggregate data, however, can mask the highly variable nature of transit costs that, among other factors, are affected by:

1. **Peak versus off-peak travel.** It is more expensive to operate transit vehicles during the morning and afternoon rush hours than during mid-day, evenings, or weekends, even though ridership is higher during peak. The fact that operating a crowded bus during peak travel times requires more public subsidy than operating a half-full bus during the middle of the day may seem counter-intuitive; however, this relationship has been confirmed by numerous studies and is well-understood by transit managers.⁴ Peak travel

²Author's calculations from American Public Transit Association data published in: American Public Transit Association. 1990, 1991, 1992, 1993, 1995. *199_ Transit Fact Book*. Washington, D.C.: American Public Transit Association.

³Author's calculations from data published in: Federal Transit Administration. 1994. *Transit Profiles -- The Thirty Largest Agencies: For the 1993 National Transportation Database Section 15 Report Year*. Washington, D.C.: U.S. Department of Transportation.

⁴See, for example, Fielding, Gordon J. 1987. *Managing Public Transit Strategically: A Comprehensive Approach to Strengthening Service and Monitoring Performance*. San Francisco: Josey-Bass; Black, Alan. 1995. *Urban Mass Transportation Planning*. New York:

costs are higher because of the differences in marginal costs between the peak and off-peak travel. During the off-peak, service is well-below maximum system capacity; the marginal cost of adding extra service is low because extra vehicles and trained drivers are already on hand. During the peak, however, most of the available vehicle fleet is already in service. Adding additional vehicles during peak travel times often requires purchasing additional vehicles and hiring and training additional drivers. The high marginal costs of peak-hour service are exacerbated by driver work rules which limit the number of part-time drivers that can be used (as is the case with the MTA⁵) and can require that many of the drivers needed only in the peak be paid full-time wages.⁶

2. **Peak direction versus backhauls.** Transit demand varies directionally as well as temporally. The demand for transit service tends to be highest heading into downtown and other activity centers in the morning and away from these centers in the afternoon. As a result, demand often exceeds capacity during peak hours in the peak direction, but is often well below capacity during the peak hours in the off-peak direction. The principle

McGraw-Hill, Inc.

⁵The MTA labor agreement strictly limits the use of part-time operators; the agency is permitted to employ a maximum of 15 part-time operators for each 100 full-time operators by division (Telephone interview with Thomas Rubin, 29 September 1995).

⁶The peaking problem is described by Jones as an "...extreme temporal imbalance. The imbalance of transit traffic -- heavy use during the rush hours and sharply lower patronage during the midday and on weekends -- contributes significantly to the industry's impaired earning power. Scaling the capacity of systems to service the peak imposes a significant financial burden on transit properties because much of the labor and equipment necessary for the rush hour cannot be used productively during the rest of the day." Jones, David W. 1985. *Urban Transit Policy: An Economic and Political History*. Englewood Cliffs, N.J.: Prentice-Hall.

of marginal costs applies here as well: the marginal costs of adding service in the peak direction is high, because this additional service will be underutilized when the transit vehicle makes its "backhaul" in the off-peak direction. This directional peaking is particularly strong among express bus lines and commuter rail lines (like MetroLink). Thus, the peaking problem in public transit makes serving peak period and peak direction trips -- like downtown commute trips -- more expensive to serve than other types of transit trips.

3. **Trip length.** The relationship between trip length and costs is quite straightforward. Longer trips are more expensive to serve than shorter trips.⁷ This is especially important for systems like the MTA that, except for express bus service, charge bus and rail passengers a flat fare -- a fee that does not vary whether the passenger rides two blocks or ten miles.
4. **Transit Mode.** Outside of densely developed, congested corridors like those found in Manhattan, Mexico City, Hong Kong, and Tokyo, buses are generally less expensive to purchase and operate than rail transit; this is especially true in Los Angeles given the highly dispersed nature of regional development. A 1994 analysis of the MTA showed that in fiscal year 1992 11.3 million passengers were carried on the Los Angeles-Long Beach Blue Line at a total cost of \$128.1 million; that same year 183.6 million passengers were carried on seventeen of the MTA's twenty-two busiest lines for the same total cost of \$128.1 million. Further, this analysis calculated the subsidy per passenger at

⁷Though there are some "fixed" costs associated with each transit trip -- starting and stopping the vehicle, loading and unloading passengers, and collecting fares -- that do not vary with distance.

\$1.17 for buses, \$2.92 for the Red Line, \$11.34 for the Blue Line, and \$21.02 for the MetroLink commuter rail.⁸

Taken together, these four cost dimensions -- peak time, peak direction, trip length, and travel mode -- influence the cost of providing transit service dramatically. A long peak hour, peak direction trip on rail -- such as a commute trip from Long Beach to downtown Los Angeles on the Blue Line -- is far more expensive to serve than a five block mid-day trip on the 20 Wilshire or 204 Vermont lines. Because fares do not vary proportionally to the cost of providing service, subsidies per passenger vary significantly as well.

Transit Ridership Patterns by Race and Ethnicity

These differences in per passenger subsidies are particularly relevant here because white and minority transit patrons have ridership patterns that vary systematically along these four cost dimensions and, as a result, white riders on the MTA are more heavily subsidized, on average, than minority MTA riders; white riders, as a group, consume more expensive transit services (peak-hour, peak-direction, longer trips, and rail service) than do minority riders. Thus a careful analysis of transit ridership that disaggregates transit patronage by (1) race/ethnicity and (2) time, length and direction of travel, and travel mode is central to the question of whether transit policies and practices produce disparate impacts between whites and racial/ethnic minorities.

Previous studies of transit ridership by income, race, and ethnicity show, as we would expect, that the poor, the elderly, and racial/ethnic minorities make a significantly higher

⁸Rubin, Thomas. 1994. *A Look at the Los Angeles Metropolitan Transportation Authority*. Los Angeles: LA MTA. January.

proportion of their trips by public transit than does the general population of metropolitan areas.⁹ Indeed, a study of the few “profitable” bus routes in the U.S. found them to consistently be the lines with the highest concentrations of non-whites.¹⁰ A study of transit subsidies in Seattle found that suburban residents received substantially larger per passenger subsidies than did central city residents.¹¹ The transit dependent urban poor, the majority of whom are non-white and cannot afford a private automobile, are considered a captive market of “transit dependents” by transit planners. Although blacks and Hispanics represented less than 20 percent of the 1980 U.S. urban population, they accounted for a disproportionately large share of transit riders nationally: 40 percent of bus riders, 42 percent of subway riders and 37 percent of taxis users.¹²

Transit rider demographics also vary significantly by transit mode. In their 1981 study of transit riders, Pucher *et.al.* found that minorities and the urban poor comprise a much higher percentage of bus ridership than of subway ridership, and a higher percentage of subway ridership than of commuter rail ridership. Thus, non-whites are most dependent on the least subsidized mode of transit and least dependent on the most subsidized mode of transit. Pucher

⁹Pucher, John, Chris Hendrickson, and Sue McNeil. 1981. “Socioeconomic Characteristics of Transit Riders: Some Recent Evidence,” *Traffic Quarterly*, 35(3): 461-483.

¹⁰Cervero, Robert. 1990. “Profiling Profitable Bus Routes,” *Transportation Quarterly*, 44(2): 183-201.

¹¹Hodge, David C. 1995. “My Fair Share: Equity Issues in Urban Transportation,” in *The Geography of Urban Transportation*, second edition, Susan Hanson, Editor. New York: The Guilford Press. Pages 359-375.

¹²Pucher, John, Chris Hendrickson, and Sue McNeil. 1981. “Socioeconomic Characteristics of Transit Riders: Some Recent Evidence,” *Traffic Quarterly*, 35(3): 461-483.

et.al. also found that, relative to whites and higher income patrons, minority and poor transit riders tend to make relatively more trips for purposes other than the journey to work, such as educational, medical, religious, and social purposes. This occurs because people with cars available tend to use transit only for commuting to work, while transit dependent riders must use transit for all purposes. Since commuting trips tend to be expensive peak-hour, peak-direction, longer, and more likely by rail than other types of transit trips, “discretionary” transit users, as a group, are more heavily subsidized per trip than “transit dependents.” And, because transit dependents are disproportionately non-white, minority transit users receive lower taxpayer subsidies per trip than white transit users.

The purpose of this analysis, then, is to examine current MTA ridership demographics to test whether the systematic race/ethnicity patterns in transit ridership found by Pucher *et.al.* during the early 1980s hold on MTA buses and trains during the 1990s.

III. METHODOLOGY AND DATA

The MTA does not collect and/or estimate all of the data needed to fully calculate the average subsidy of white versus minority passengers across all four of the significant transit cost dimensions. The analysis below calculates the differences in trip length and travel mode between white and minority passengers. Ridership and cost data by race/ethnicity for peak hour versus off-peak and for peak direction versus off-peak are not available and are not analyzed. The analysis below, therefore, represents only a partial analysis of the disparate subsidy of white versus minority transit patrons.

The ethnicity data used in each of the following analyses were garnered from the MTA’s

On-board Origin-Destination Surveys for 1991, 1992, and 1993.¹³ According to the data, the MTA's ridership profile is approximately 76 percent minority, 22 percent white, and 2 percent other.¹⁴ Because the surveys were distributed in only two languages, English and Spanish, there may be several sources of bias in the survey responses. First, the experiences of the many non-English and non-Spanish speaking transit users are excluded from participation in the survey. Los Angeles County has a large and growing population whose first language is something other than English or Spanish. Over 10 percent of the Los Angeles County population, for example, is Asian, and the share of MTA riders who are Asian is likely much higher. Because the MTA survey was distributed in only English and Spanish, the ridership experiences of Asian immigrants are likely excluded from the survey.¹⁵

¹³These three years of MTA surveys were used because they were the three most recent years available when the analysis was undertaken. We assumed that actual ridership demographics were consistent over this three year period and combined these three years' worth of MTA surveys into a single data base of 16,021 respondents who chose to identify their race/ethnicity.

¹⁴The MTA survey did not formally differentiate race and ethnicity and, in a single question, asked respondents to self-identify as either white, Hispanic, black, American Indian, or other. This creates the possibility that some Latino survey respondents to the MTA survey self-reported as white rather than Hispanic. A recent study by the U.S. Census, however, examined this very issue with regard to the 2000 U.S. Census and found that Latinos self-reporting as white was very low outside of south Florida and cities and towns straddling the U.S./Mexico boarder (Interview with UCLA Professor Leobardo Estrada on 3 January 1996).

¹⁵A U.S. Census Bureau report noted a systematic undercounting of Asians due to lower than average response rates in the 1990 Census (Hogan, Howard, *The 1990 Post-Enumeration Survey: Operations and Results*, Bureau of the Census, Washington, DC, July 1991), and a second report found low response rates among Los Angeles County Asians due specifically to the fact many Asian respondents "had no or very little knowledge of English" (de la Puente, Manuel, *Why are People Missed or Erroneously included by the Census: A Summary of*

Second, Los Angeles is home to a very large number of undocumented residents. Many of these relatively low-income residents are likely MTA riders and many are very wary of government-sponsored data collection efforts. Thus, it is likely that a second, large, non-white subset of the MTA's ridership was largely excluded from the data analyzed below.

Third, we noted above that research by Pucher *et.al.* (1981) found that minority transit patrons are more likely to make shorter transit trips than white transit riders. Those passengers routinely making shorter trips are probably less likely to complete ridership surveys simply because these short trippers spend less time on-board. Thus, it is likely that the MTA surveys undercount the number of passengers making shorter trips in favor of those who make longer trips.

Evidence of a potential trip length bias is found in the survey data. These data indicate that the average MTA trip in 1991-1993 was 8 to 9 miles door-to-door "as the crow flies."¹⁶ In 1993, the MTA reported to the Federal Transit Administration an average unlinked trip distance

Findings from Ethnographic Coverage Reports, U.S. Census Bureau, Center for Survey Methods Research, May 1993, page 29). In addition, a recent study of California households receiving Aid to Families with Dependent Children (UC Data, *California Work Pays Demonstration Project: Survey, 1993-1994*, Data Archive and Technical Assistance, University of California, Berkeley, 1995) found that surveys distributed in English and Spanish only resulted in an under sampling of Asians. As a result of this under counting, follow-up surveys in several Asian languages were performed. The population surveyed in this AFDC study is likely to have demographic characteristics (relatively low incomes, low levels of auto availability, etc.) similar to transit dependents on MTA buses and trains (Interviews with Professor Paul M. Ong, Chair, Department of Urban Planning, UCLA, 28 September 1995 and 3 January 1996).

¹⁶Measured as a straight line from the MTA-coded point of origin to MTA-coded point of destination. Such a straight line measurement is shorter than the actual distance traveled along the street network by transit riders.

of 3.9 miles. Assuming that the average transit trip involves 0.65 transfers¹⁷ and a quarter mile walk to each stop and from each stop, the average linked transit trip was 7.0 miles through the street network. Thus, the FTA reported figure is one to two miles less than the straight-line (“crow flies”) distance in the reported survey data. From this we can presume that the survey underrepresents short distance transit users.¹⁸

In sum, these three factors suggest that the MTA surveys may significantly undercount minority passengers; and the results reported below may be biased, therefore, against transit-dependent, minority passengers. Thus, the actual differences between whites and minorities may actually be greater than those revealed in these analyses due to systematic biases in the data.

Methods of Analysis

The three sections which follow examine the ridership experiences of white and minority MTA passengers using two methods. Disparate impacts between minority and white passengers are analyzed first on a system-wide basis, and second by comparing the experience of riders on the 25 MTA transit lines having the highest proportion of minority passengers with the situation on the 25 transit lines having the lowest percentage of minority passengers. The goal of each method is to test whether the subsidy and experience of the typical minority MTA passenger differs from the experience of the typical white MTA passenger.

For Title VI analyses, the MTA currently defines each transit line as either a “minority” or a “non-minority” line based on the racial/ethnic composition of the areas surrounding each

¹⁷Telephone interview with Thomas Rubin, 29 September 1995.

¹⁸Author’s calculations from the Los Angeles County Metropolitan Transportation Authority’s Section 15 Report for Fiscal Year 1993, Form 406. The average trip distance was computed by summing all reported passenger miles

line.¹⁹ Specifically, a “minority transit route (line) [is] a route that has at least 1/3 of its total route mileage in a minority census tract(s)²⁰ or traffic analysis zone(s).”²¹ Such a definition, however, has inherent weaknesses that can produce misleading conclusions. For example, the “whitest” line in the entire MTA system during the survey period was the 457 freeway express, which circulated through the predominately white neighborhoods in Seal Beach and southeastern Long Beach before converting to express freeway service up the Long Beach Freeway (I-710) and into downtown Los Angeles. MTA survey data showed that four out of five riders on the 457 Express were white, which was the highest level of white ridership in the MTA system. But, because the 457 passed through predominately minority census tracts in Compton, Lynwood, South Gate, Bell Gardens, Commerce, and East Los Angeles on its freeway run into downtown LA, the 457 was classified a minority line by the MTA for Title VI purposes.

Given the obvious problems in using the MTA definition of “minority” and “non-minority” lines, we have chosen in this analysis to use a more direct measure of the minority and non-minority transit service; our analyses is based on who is riding the bus or train, not on who

and dividing this amount by the sum of all unlinked passenger trips.

¹⁹Los Angeles Metropolitan Transportation Authority. 1994. *Title VI Assessment For Capital And Operating Assistance: Triennial Update 1993*. Los Angeles: LA MTA. July (revised). Page 3.

²⁰A “minority census tract” is a census tract that includes a higher percentage of minorities than the average percentage of minorities in the whole service area of the transit service agency; from the Los Angeles Metropolitan Transportation Authority. 1994. *Title VI Assessment For Capital And Operating Assistance: Triennial Update 1993*. July (revised). Page 3.

²¹A “traffic analysis zone” is a census tract or a collection of several census tracts used for traffic analysis; from the Los Angeles Metropolitan Transportation Authority. 1994. *Title VI Assessment For Capital And Operating Assistance: Triennial Update 1993*. Los Angeles: LA MTA. July (revised). Page

lives near the bus or train line. The logic here is simple: the census tract is an inappropriate unit of analysis because people, not census tracts, ride public transit.

In 1993, the MTA reported on the operation of 127 lines of bus service, one line of light rail service (commonly known as the Blue Line), and one line of heavy rail service (commonly known as the Red Line).²² All data used in the following analyses were obtained from MTA documents, reports, databases, or surveys.²³ Line-by-line data were available for most bus lines and for the Blue Line, though very little data were available for the Red Line.²⁴ Using these line-by-line data, the 25 transit lines with the highest percentage of minority passengers ("Most Minority Lines")²⁵ are grouped and compared with group data for the 25 transit lines with the

3.

²²Los Angeles Metropolitan Transportation Authority. 1994. *Title VI Assessment For Capital And Operating Assistance: Triennial Update 1993*. Los Angeles: LA MTA. July (revised). Page 1.

²³See **Appendix A** for a list of documents, studies, reports, databases, and surveys used in these analyses.

²⁴Many of the reporting procedures used by the MTA do not facilitate easy comparisons between the bus and rail services. For example, the peak load factor, which is a measure of how crowded a transit vehicle is during the busiest time of the day, is reported for all 127 bus lines in the *Line Performance Trends Reports*. But we were unable to locate an equivalent measure reported for the Blue Line. Furthermore, ridership and operating data for the Red Line are very limited.

²⁵A "minority" rider is defined here as a person who responded to the ethnicity question on MTA's 1991, 1992, or 1993 Origin-Destination (OD) Passenger Survey as either a "Hispanic," "Black," "Asian/Pacific Islander," or "American Indian/Aleutian." Similarly, a "white" rider is defined as a person who responded to this same question as "white." For the purposes of these analyses, if a respondent checked "other" for his/her ethnicity, this person is not included as either a "minority" or a "white." Instead, these respondents (who made up about 2.4% of all respondents who answered the ethnicity question) are largely excluded from this analysis. Thus, many of the percentages reported below do not sum to 100 percent.

lowest percentage of minority passengers ("Least Minority Lines").²⁶

In addition, the ethnicity data from these surveys were grouped by MTA-designed line. In other words, all branch lines were grouped in with the respective main line defined in the *Line Names and One-Way Mileage Report No. 4-10*, dated 26 June 1994, Chapter 11. A complete listing of all lines and the branches is shown in **Appendix B**.

²⁶**Appendix C** contains a listing of all bus lines assigned to the “Most Minority Lines” and “Least Minority Lines.” As we would expect, the 25 lines with the highest percentage of minority passengers generally have the lowest percentage of white passengers, while the 25 lines with the lowest percentage of minority passengers generally have the highest percentage of white passengers.

Table 1. Comparison of the 25 Least Minority MTA Lines and the 25 Most Minority MTA Lines.			
	Least Minority	Most Minority	% Diff
Unweighted ²⁷ Average Percentage Minority Ridership	54.8	92.4	+ 69%
Unweighted Average Percentage White Ridership	42.2	6.0	- 86%
Weighted ²⁸ Average Percentage Minority Ridership	58.2	91.8	+ 58%
Weighted Average Percentage White Ridership	39.2	6.1	- 84%
Percent Express Lines	44.0	4.0	- 91%

Table 1 shows the significant differences in the racial/ethnic composition of the Most Minority Lines and the Least Minority Lines. The table also shows that, in addition to these demographic differences, the two groups of lines vary substantially and service type as well. The Most Minority Lines consist almost exclusively of local bus lines, while nearly half of the Least Minority Lines are relatively expensive peak-hour, peak-direction express service.

²⁷Unweighted refers to the actual percentage of respondents to the ethnicity question on the on-board Origin-Destination (OD) Passenger Surveys collected by the MTA staff for the years 1991, 1992, and 1993.

²⁸Weighted percentages were obtained by multiplying the unweighted percentage of respondents to the ethnicity question from the 1991, 1992, and 1993 OD Surveys for each transit line by that line's total weekday boardings (as reported by the MTA for the most recent Ride Check day in the 15Mar1995 Line Performance Trends Report), and then taking the sum of these numbers and dividing it by the sum of the total weekday boardings. This weighting is important because the unweighted percentages can be affected by a number of potential biases which the MTA's surveying methodology was unable to completely control for, such as language barriers, the time of day, direction of trip, and length of trip among others. Thus, weighting allows for a better estimate of all passengers who ride transit and not just the ones who were actually surveyed. It is also important to note that the MTA routinely utilizes some variation of a weighting procedure itself, as evidenced by the existence of two variables ("WGTRESP" and "WGTGEO") in its own database used to store the

IV. DIFFERENCES IN FARES AND COSTS BY RACE/ETHNICITY²⁹

As noted in the previous section, data limitations prevent a full analysis of the differences in the average subsidy of white and minority MTA riders. The MTA cost model does not fully allocate costs to peak and off-peak service, nor does it differentially allocate costs between peak-direction service and backhauls. Further, the ridership demographic data gathered from the on-board surveys do not gather data on time of travel. On the other hand, differential cost ridership data are available for trip length and for transit mode and these two cost dimensions are analyzed in some detail below.

Peak versus Off-Peak Service and Peak-Direction versus Backhaul Service

While complete data are not available to analyze these two cost dimensions, there is some evidence that white MTA riders do, in fact, consume relatively more peak service than minority transit users. Table 2 shows the relative differences in ridership demographics and per boardings subsidies by service type -- local bus, peak hour express service, and rail. These data do not include cost variance by peak hour and peak direction, but they do show that white riders consume the more expensive express and rail services than minority riders.

information collected for its 1991, 1992, and 1993 OD Surveys.

²⁹Data are either drawn directly or calculated from the 15 March 1995 Ride Check day for each line in the Line Performance Trends Report (LPTR). Capital costs are drawn from Rubin, Thomas. 1994. "A Look At The Los Angeles Metropolitan Transportation Authority," Metropolitan Transportation Authority. January.

Table 2. MTA Ridership Demographics by Mode			
	Local Bus	Express Bus	Difference
Percent White Passengers	20	29	+ 45%
Taxpayer Subsidy per Boarding	\$1.25	\$2.53	+ 102%
	Local Bus	Blue Line	Difference
Percent White Passengers	20	24	+ 20%
Taxpayer Subsidy per Boarding	\$1.25	\$11.46	+817%

Trip Length

Except for express bus services, MTA fares do not vary by trip length. Since taxpayer subsidies are used to make up the difference between the fare paid and the total (capital plus operating) cost of providing a transit trip, the average subsidy per passenger for local bus and rail transit patrons varies substantially by the distance traveled. In other words, very long trips are heavily subsidized, while very short trips (of a block or two) may require no subsidy at all, or may even operate at a profit.³⁰ And if minority transit riders, as a group, make shorter trips on MTA vehicles than white riders as a group, then the MTA’s flat fare policy will result in higher subsidies for white patrons.

To examine this issue, standard address matching procedures developed for geographic information systems (GIS) technology were used to compute the distance between MTA survey

³⁰Cervero, Robert. 1990. “Profiling Profitable Bus Routes,”

respondent's origins and destinations.³¹ The distances were calculated by race/ethnicity and then compared across various groups.³² This analysis, summarized in Table 3 below, shows that

Transportation Quarterly, 44(2): 183-201.

³¹We noted earlier that the survey methodology may have resulted in a response bias that, in turn, minimizes the apparent trip length differences between white and minority riders. These potential sources of bias are: (1) the experiences of the many non-English and non-Spanish speaking transit users are excluded from participation in the survey, and (2) fear of government-sponsored data collection efforts by undocumented residents may have suppressed responses by transit dependents. Evidence of an undercounting of the minority transit dependents is found in the data, which shows that the average trip distances of survey respondents to be at least 1 to 2 miles longer than overall trip distances averages estimated by the MTA.

³²The address matching was done using Atlas GIS software and trip origins and destinations from the OD Passenger Surveys administered by the MTA for the years 1991, 1992, and 1993. The address matching was done in a five-step process. The first step was to attempt an initial pass through all the origin street addresses (the field named Q3ADDRES) without relaxing any of the possible constraints. The second pass through the remaining unmatched addresses was done by relaxing the street type, street prefix, and street suffix direction constraints. The third pass relaxed all the constraints except street number, street name, and zip code. The fourth pass relaxed all constraints, including zip code, except for street number and street name. The final pass through the remaining unmatched addresses was done by changing the address source to the nearest cross street (a field created by combining the 2 fields named Q3CROSSA and Q3CROSSB) and relaxing none of the constraints. These five steps were then repeated for the destination fields (Q7ADDRES and a combination of Q7CROSSA and Q7CROSSB). For each matched address, Atlas GIS generated a latitude and a longitude for the location. The distance between the origins and destinations were then computed using the following formula: Distance = SQRT (((OLAT-DLAT)^2)*68.935 - ((OLONG-DLONG)^2)*56.725). The conversion factors from latitudes and longitudes to miles was derived from a table in Arthur N. Strahler's Physical Geography, 4th Edition, page 643, for locations at a latitude of 35 degrees (Los Angeles is located at approximately 34 degrees latitude). This process resulted in 7,113 address matches that contained both a valid origin and destination out of 16,021 possible cases which reported an ethnicity on the survey itself. It should be noted that this distance measure is an approximation of trip length. Ideally, one would want to measure how far a transit passenger actually travels aboard a transit vehicle. But this is not possible from the MTA's data. Instead, the measure used probably underestimates the actual transit distance traveled because transit vehicles don't take a straight line path between a passenger's origin and destination. Yet, the measure used also probably overestimates the actual distance traveled on a transit

minority passengers do, in fact, travel shorter distances on average than white MTA riders. And given the likelihood (discussed earlier) that the passenger survey data used here underreports the experience of minority, transit dependent riders, the differences reported here may actually be much larger.

Table 3. MTA Passenger Trip Length by Race/Ethnicity and Mode (in miles).

	White Passengers	Minority Passengers	Absolute Difference	Percent Difference
Local and Express Bus	8.7	7.8	- 0.9***	- 12%
Blue Line	17.1	12.5	- 4.6***	- 37%
System Wide	9.4	8.1	- 1.3***	- 16%

***: Difference is statistically significant at the 0.01 level.

With respect to fares, these differences in average travel distance between white and minority passengers mean that the “flat” MTA fares vary significantly on a per mile basis. Table 4 shows that the difference in average travel distance between whites and minorities means that the average fare paid by minority transit patrons is 16 percent higher per mile than the average fare paid by white patrons.

Table 4. Average per Mile Fares Paid by White and Minority MTA Riders.

	White Passengers	Minority Passengers	Absolute Difference	Percent Difference
With \$1.10 Base Fare	\$0.117/mile	\$0.136/mile	\$0.019/mile	+ 16%
With \$1.35 Base Fare	\$0.143/mile	\$0.166/mile	\$0.023/mile	+ 16%

Transit Mode

vehicle because passengers almost always have to walk some distance at both ends of their transit trip (from their origin to the transit stop, and from the other transit stop to their destination). Despite these shortcomings, this measure of trip

Outside of very densely developed, high transit use corridors, rail transit is generally more expensive to operate (per service hour, vehicle mile, boarding, or passenger mile) than buses. This is especially so when annualized capital costs are included in the calculation, because the cost of rails, catenary, tunnels, yards, etc. are far higher for trains operating in partially or fully exclusive rights of way than for buses that share established street systems with automobiles. Red Line construction costs, for example, are in excess of \$250 million per mile and new rail cars are typically \$1 million each. Buses, on the other hand, cost between \$250,000 and \$300,000 each. The annualized capital cost per boarding for 1992 was estimated to be \$0.25 for MTA buses, \$2.63 for the first segment of the Red Line, and \$8.27 for the Blue Line. Among buses, the total cost of express service is over twice as high per passenger (\$3.33) as local bus service (\$1.84). These modal differences in overall costs are compared with ridership patterns by race/ethnicity in Table 5 which shows that white MTA riders consume a relatively higher proportion (30%) of expensive rail and express bus service than minority patrons (22%).

Table 5. Ridership Demographics and Costs on Local versus Express and Rail Lines.			
	Rail and Express Service	Local Bus Service	Totals
White Passenger Miles	30%	70%	100%
Minority Passenger Miles	22%	78%	100%
Total Cost per Passenger	\$5.50	\$1.84	n/a

V. RACIAL/ETHNIC DIFFERENCES IN TAXPAYER SUBSIDY PER PASSENGER.³³

distance still remains the best available estimate from MTA data.

³³Data for this analysis were obtained from the most recent Ride Check

Put very simply, taxpayer subsidies are required by transit operators to cover all costs in excess of revenues. Because almost all transit service operates at a loss, large, ongoing subsidies are required. The cost of providing MTA transit service exceeds the revenues generated in virtually every identifiable manner, though the size of this subsidy varies substantially depending upon the transit service operated and the measure used. In the following analyses, two common industry performance measures are examined -- subsidy per passenger boarding and subsidy per passenger hour -- to test for systematic differences between the taxpayer subsidy for minority and white MTA riders.

While fare revenues are straightforward to measure, system costs are allocated to different transit services using a cost estimation model. The MTA cost model allocates costs by line, but not, as noted earlier, by peak versus off-peak or peak direction versus backhaul. Two kinds of costs are allocated to each line: operating and capital. Operating costs include wages for drivers, mechanics, administrators, fuel, and most maintenance costs. Capital costs include the purchase price of buses, rail cars, and rights-of-way for busways and rails, all of which can be annualized or depreciated over different lengths of time. Capital costs are especially important in modal analyses because they can vary by orders of magnitude between rail and bus service.

Subsidy per Passenger Boarding

Table 6 shows that minority MTA transit patrons receive smaller average subsidies per boarding than white transit patrons. The observed difference in subsidy between white and

day for each line in the 15Mar1995 Line Performance Trends Report (LPTR). The specific fields used from the LPTR for the weekday transit service are the costs, revenues, and subsidies per boarding, per passenger mile, and per passenger hour.

minority patrons is due largely to the greater proportion of white patrons on more expensive rail service and express bus lines.³⁴

Table 6. Differences in Average Subsidy per Boarding between White And Minority MTA Passengers.				
	White Passengers	Minority Passengers	Absolute Difference	Percent Difference
Operating Subsidy per Boarding	\$1.34	\$1.15	\$0.19	- 17%
Total Subsidy per Boarding	\$1.91	\$1.63	\$0.28	- 17%

When the 25 MTA lines with the highest proportion of minority riders is compared to the 25 lines with the lowest proportion of minority riders, the differences in average subsidy per boarding are even more sharply drawn (Table 7).

Table 7. Average Subsidy per Boarding on the 25 Lines with the Lowest and Highest Proportions of Minority Ridership.				
	25 Least Minority Lines	25 Most Minority Lines	Absolute Difference	Percent Difference
Operating Subsidy/Boarding	\$1.36	\$0.88	\$0.48	- 55%
Total Subsidy per Boarding	\$1.61	\$1.13	\$0.48	- 43%

Another way to interpret the data in Table 7 is on the basis of annual subsidy. Typical commuters on one of the MTA lines with the highest proportion of white riders receives an annual taxpayer subsidy \$250 greater than the passengers on the MTA lines with the highest proportion of minority riders.

Finally, the most common measure of operating performance is the farebox recovery

³⁴The observed \$0.28 difference in total subsidy per boarding between whites and minority transit patrons does not include peaking cost factors (time and direction), both of which would be expected to magnify the racial/ethnic

ratio. Also known as the operating ratio, the farebox recovery ratio indicates the proportion of operating costs that are recovered through revenues collected from passenger fares. Higher farebox recovery ratios indicate higher levels of cost recovery and cost efficient service, in turn, requires lower levels of taxpayer subsidy.

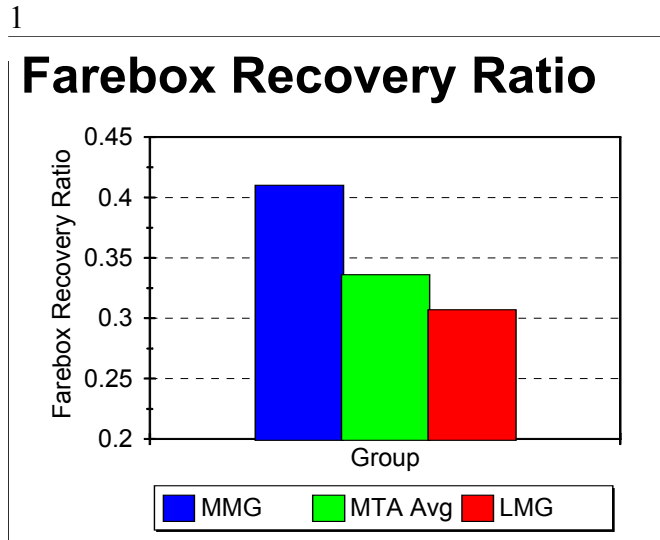
Minority MTA passengers, on average, pay a greater share of the costs of transit service they consume than white passengers. The average farebox recovery ratio for minority passengers for the entire MTA system (including the Blue Line) is 34.4 percent, compared to a systemwide average farebox recovery ratio of 31.1 percent for white passengers.

These system-wide differences in the average farebox recovery ratio are even

more dramatic when comparing the 25 Least Minority Lines with the 25 Most Minority Lines (Figure 1). The 25 Least Minority Lines (labeled as LMG) have a farebox recovery ratio of about 31 percent, compared to a farebox recovery ratio of about 41 percent on the 25 Most Minority Lines (labeled as MMG).

Subsidy per Passenger Hour

Boarding data can be normalized to control for trip length (in terms of either hours or miles) to test for racial/ethnic differences in total service consumed. Passenger hours, for



differences in average subsidy per boarding.

example, is a measure which equates carrying one passenger for one hour, two passengers for 30 minutes each, or six passengers for 10 minutes each. Table 8 below shows that, even controlling for on vehicle time by using a measure of passenger hours, there remains a difference in average subsidy per passenger between white and minority MTA riders.³⁵ Further, these differences in average subsidy per passenger hour remain quite robust when comparing the 25 lines with the highest proportion of minority riders with the 25 lines with the lowest proportion of minority riders (Table 9).³⁶

Table 8. Average Subsidy per Passenger Hour between White And Minority MTA Passengers.				
	White Passenger Hours	Minority Passenger Hours	Absolute Difference	Percent Difference
Op Subsidy/Pass Hour	\$4.45	\$4.05	\$0.40	- 10%
Total Subsidy/Pass Hour	\$5.33	\$4.99	\$0.34	- 7%

Table 9. Average Subsidy per Passenger Hour on the 25 Lines with the Lowest and Highest Proportions of Minority Ridership.				
	25 Least Minority Lines	25 Most Minority Lines	Absolute Difference	Percent Difference
Operating Subsidy/Pass Hour	\$4.71	\$3.60	\$1.11	- 31%
Total Subsidy per Pass Hour	\$5.58	\$4.62	\$0.96	- 21%

³⁵The data in Tables 8 and 9 are not directly comparable with Tables 6 and 7 because the passenger hour data reported here excludes Blue Line data, which are not reported in a format compatible with this analysis. And, by excluding Blue Line data, much of the modal variation in costs and subsidy are excluded.

³⁶A separate analysis by passenger mile largely excludes the differences in average travel distance between minority and white MTA riders, but still shows that minority riders receive lower average subsidy than white MTA riders.

VI. CONCLUSION

This paper examines whether minority riders on Los Angeles MTA buses and trains pay higher average fares or receive lower average subsidies than white riders. Ridership demographic data are combined with cost data allocated across two of the four principal transit cost dimensions (trip length and transit mode) to show that, by an array of measures, minority riders (1) pay higher average fares than white riders and (2) receive lower average subsidies than white riders. These differences are largely due to the fact that (1) white riders travel longer distances, on average, than minority riders and (2) white riders use expensive express and rail services in higher proportions than minorities. These systematic racial/ethnic differences in ridership combined with a fare structure that (except for express buses) does not vary by distance or mode to differentially favor white MTA riders, as a group, over minority MTA riders, as a group. Further, while available data do not allow for an analysis of racial/ethnic variations in fares and subsidies by peak and off-peak service and by peak direction and backhauls, preliminary evidence suggests that such an analysis would only compound the racial/ethnic differences reported here.

Thus, while non-whites use public transit in far greater proportions than whites, this analysis has shown that whites pay lower average fares and receive higher average subsidies than minority transit users.³⁷ These variations in fare payment and public subsidy by race and

³⁷That minorities ride transit in greater proportions than whites tells us little about the relative treatment of various racial/ethnic groups on public transit. Two factors principally explain the higher levels of transit patronage among non-whites. First, levels of transit use are highest for those without access to automobiles. Since non-whites earn lower average wages than whites and car

ethnicity derive, in part, from a series of MTA policy decisions to (1) expand relatively expensive rail and commuter express services serving a disproportionately white clientele and (2) adopt a generally flat fare structure that causes riders making relatively short trips on local buses (who are disproportionately minority) to cross-subsidize riders making longer trips on express and rail lines (who are disproportionately white). As a result of these policy choices, minority riders, on average, pay substantially more for MTA service and receive lower average taxpayer subsidies than white riders.

ownership requires financial resources, “transit dependents” -- the population that is unable to drive due to age, income, or infirmity -- are comprised of a higher proportion of racial/ethnic minorities than the general population. And second, the majority of transit use takes place to, from, and around the central business districts of the nation’s largest cities; the ten largest U.S. transit systems (New York, Chicago, Los Angeles, Washington, DC, Boston, Philadelphia, San Francisco, New Jersey, Atlanta, and Baltimore) carry more passengers than does all of the other 5,000+ transit systems combined, and transit use in the New York metropolitan area accounts nearly one-third of all transit trips nationwide (American Public Transit Association. 1995. *1995 Transit Fact Book*. Washington, D.C.: American Public Transit Association). Thus transit ridership is highest (in large cities) where minority populations are similarly concentrated; sixty-three percent of all minorities live in metropolitan areas over one million population, compared to just 46 percent of all whites (Frey, William H. 1993. “The New Urban Revival in the United States,” *Urban Studies*, 30(4/5): 741-774).

Appendix A:
A Listing of All Documents, Reports, Databases, and Surveys Used in this Report

- American Public Transit Association data published in: American Public Transit Association. 1990, 1991, 1992, 1993, 1995. *199_ Transit Fact Book*. Washington, D.C.: American Public Transit Association.
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**Appendix B:
A Listing of All MTA Bus Lines and Their Branch Lines**

<u>Line</u>	<u>Branch(es)</u>	<u>Line</u>	<u>Branch(es)</u>	<u>Line</u>	<u>Branch(es)</u>
1	217	125		254	
2	3	127		255	
4	304	130		256	
10	48	152		259	258
14	37	154		260	
16		158		262	
18		161		264	
20	22, 320, 322	163		265	275
26	51	165	164	266	
28	27, 83, 84	166		267	
30	31	167		268	
33	333	168		270	
38	71	169		401	402
40	42, 442	170		418	
45	345	175		420	
53		176		424	425
55		177		426	
56		180	181	427	
60		188		429	
65		200		434	
66	67	201		436	
68		202		439	
70		204	354	443	
76		205		444	
78	79, 378	206		445	
81		207	357	446	447
90	91, 406	208		457	
92	93	209		460	
94		210		462	
96	97	211	215	466	
102		212		470	471
104		220		483	485
105		225	226	484	
107		228		486	
108		230	239	487	491
110		232		488	
111	112	234	183	489	
114		236		490	
115		240		497	
117		243		560	
119	126	245		573	
120		250		576	
124		251		620	

Appendix C:
A Listing of the Bus Lines Assigned to Either the “Most Minority Lines’ or “Least Minority Lines”

Most Minority Lines:

576, 66, 127, 55, 250, 102, 56, 68, 53, 26, 65, 254, 107, 30, 209, 45, 202, 207, 110, 251, 114, 40, 111, 255, and 60.

Least Minority Lines:

457, 220, 443, 208, 445, 427, 466, 434, 243, 497, 436, 177, 426, 1, 236, 240, 180, 560, 418, 158, 2, 245, 167, 234, and 163.