

Metropolitan Transit Authority

Fare Evasion Study

February 2002



Background

- ◆ The **Metropolitan Transportation Authority (MTA)** is the primary provider of transit-related services for the Southern California region and is dedicated to providing Southern California residents and visitors transportation alternatives and solutions.
- ◆ The MTA's Metro Rail system operates approximately 60 miles of rail service accommodating an estimated 5 million passenger boardings each month. Metro Rail consists of three lines: Red, Blue, and Green.
- ◆ Currently, the Metro Rail operates on a barrier-free system, which requires passengers to purchase a valid ticket or pass prior to boarding a train. The primary means of ensuring that riders have valid tickets is via random inspections (by LAPD/LASD) that carry the threat of a \$250 fine. In contrast to traditional barrier systems, there are no turnstiles or station attendants.
- ◆ The viability of a barrier-free system depends on the extent of fare evasion by the ridership.



Objectives

◆ Objectives

- ◆ The primary objective of this study was to provide MTA with an accurate estimate of the fare evasion rate on the Metro Rail System.
- ◆ The secondary objective was to assess the key factors that impact the fare evasion rate and make recommendations on how to decrease it.

Methodology

◆ Sampling

- ◆ To meet the primary objective of estimating the evasion rate, we inspected the fares of 4928 Metro Rail system riders.
 - ◆ Fare Checks started on January 7th, 2002 and continued through to January 18th, 2002.
 - ◆ We resumed the Fare Check February 19th through 28th, 2002, to survey ridership in the period from 9pm to 11pm, after a pilot test suggested that the evasion rate was extraordinarily higher after 9pm.
- ◆ To meet the secondary objective of assessing the factors impacting evasion rate, we interviewed 485 riders; 173 fare evaders and 312 valid-fare commuters.
 - ◆ In addition to the fare check, the interview for this phase included a Diagnostic section for assessing the factors impacting the evasion.
 - ◆ 120 of these 485 interviews were conducted as part of the Fare Check phase described above.
 - ◆ The 312 valid-fare commuter interviews and 53 of the fare evader interviews were conducted by a separate team from that conducting the fare checks described above. These interviews started on January 7th, 2002 and continued through to January 14th, 2002.

Methodology

◆ Sampling (Cont.)

- ◆ The following table contains a breakdown of our samples in terms of the a) time of day, b) day-type, and c) Metro Line at which the interviews were conducted.
 - ◆ This data is presented alongside the data collected as part of the MTA Ridership Survey (through December, 2001), which measures the actual ridership patterns throughout the Metro Rail system.
- ◆ Our estimates of the Fare Evasion rates were weighted to control for minor discrepancies that emerged between our Fare Check sample and the MTA Ridership data.
 - ◆ See Appendix E for details of this weighting procedure.

Methodology

◆ Sampling (Cont.)

	SAMPLE BREAKDOWN TABLE		
	Fare-Check Sample	Diagnostic Sample	Ridership Data
Base:	4928	485	-
Time of Day			
6am-9am	21%	19%	16%
9am-3pm	31%	43%	43%
3pm-7pm	31%	17%	32%
7pm-11pm	17%	21%	8%
Day-Type			
Weekdays	82%	81%	83%
Weekends	18%	19%	17%
Metro Line			
Blue	28%	38%	36%
Green	21%	29%	13%
Red	51%	31%	51%

Methodology

◆ Sampling (Cont.)

- ◆ Two independent samples were drawn, one for fare checks and one for Diagnostic Interviews (see Interviewing Procedure on slide 10). Each sample consisted of riders waiting for trains at a specified sequence of stations.
- ◆ A probability sampling method was used to select the sequence of stations for each sample.
- ◆ Interviewers were instructed to spend 15 minutes at each station, do as many interviews as possible, then move on to the next station in the sequence. Interviewers worked on each sequence for 2-2.5 hours.
- ◆ The assessment period modeled one complete week of operation, from Monday to Sunday, on all three Metro Lines.
 - ◆ See Appendix A for a complete description of how the sample was selected.

Methodology

◆ Questionnaire

- ◆ In conjunction with the MTA, we developed a questionnaire consisting of a Fare Check and a Diagnostic Interview.
 - ◆ The Fare Check Interview identified whether a rider was an evader or not based on fare medium used.
 - ◆ Interviewers asked riders for their fare media and evaluated whether or not it was valid.
 - ◆ The Diagnostic Interview contained these sections:
 - ◆ Fare Check
 - ◆ The second section consisted of a battery of questions aimed at measuring riders knowledge of and attitudes towards the Metro system.
 - ◆ The third section consisted of questions related to commuter characteristics, such as demographics and travel patterns.
- ◆ To accommodate riders who are primary Spanish speakers, our questionnaire was translated into Spanish.
 - ◆ See Appendix D for English and Spanish versions of the questionnaire.

Methodology

✦ Interviewer Training

- ✦ All interviewing candidates were trained to recognize valid fare media. All candidates were tested for their knowledge of valid fare media, and only those scoring at least 80% on the test were permitted to conduct the interviews.
 - ✦ See Appendix C for this test, as well as the scores obtained by the interviewers.
- ✦ Interviewers were trained in the use of both English and Spanish versions of the questionnaire, and in the operation of the hand-held units used in data collection.
 - ✦ Only one of our interviewers did not speak Spanish.

Methodology

✦ Interviewing Procedure

- ✦ We used two interviewing teams, one for the Fare Check phase and one for Diagnostic Interviewing phase.
 - ✦ Fare-checkers checked fares and conducted Diagnostic interviews with Fare Evaders.
 - ✦ Diagnostic interviewers conducted Diagnostic Interviews with everyone.
 - ✦ Valid Fare riders were asked to participate in the Diagnostic Interview while Fare Evaders were interviewed without an explicit agreement.
- ✦ Both teams used the following procedures:
 - ✦ Each team would start its task at an assigned station at a given day and time.
 - ✦ Two interviewers would either start at opposite ends of the platform and work their way towards each other or they would start in the middle and work towards the opposite ends of the platform, away from each other. This platform sweep strategy was systematically altered from station to station.
 - ✦ This alternating sweep strategy was implemented because in the pilot test we noticed a potential trend: Fare evaders appeared to hide at specific out of sight location on the platform (usually at the ends, behind stairwells) to minimize their visibility and likelihood of getting caught.
 - ✦ The interviewers would continue fare checking or interviewing for as long as there were any riders at the platform or for maximum duration of 15 minutes.

Methodology

✦ Interviewing Procedure (Cont.)

✦ Both teams used the following procedures (Cont.):

- ✦ After the allocated time at a specific station expired, the interviewers would ride to the next (consecutive) station in the assigned direction and repeat the process above.
- ✦ The interviewers would continue this process of checking for up to 15 minutes at a station and then move to the next consecutive station for a fixed duration of time, generally 2-2.5 hours during weekdays and 1-1.5 hours during the weekend.
- ✦ Then they would go to next assigned station (assignment).
- ✦ For more details, see Appendix A

Methodology

◆ Interviewing Procedure (Cont.)

- ◆ To minimize the refusal rate, the following procedures were adopted:
 - ◆ Every interviewing team consisted of two interviewers and two undercover police officers.
 - ◆ In the event that a commuter selected by an interviewer refused to cooperate, police assistance was used to persuade the commuter to comply.
 - ◆ A \$5 voucher was offered to Valid Fare riders as an incentive to complete the Diagnostic Interview.
 - ◆ These procedures resulted in a refusal rate of only .3% of all contacts (refusals/(completes+refusals)) for both Fare Checks and Diagnostic Interviews.

◆ Fare Evasion

- ◆ Evaders were classified as riders who did not have a ticket/pass, claimed to have lost it, had an invalid ticket/pass or refused to show a ticket/pass.

Overall Fare Evasion Rate

Overall Fare Evasion Rate

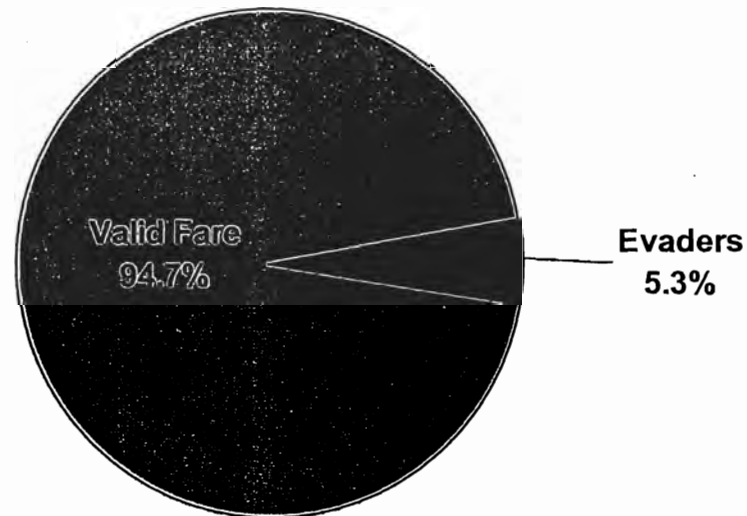
- ◆ All the estimates in this section are based on sampling Metro operations from 6am to 11pm. We estimate that this represents over 95% of the total rider population.

Overall Fare Evasion Rate

◆ Evasion - System Wide

- ◆ The system wide evasion rate is estimated to be 5.3% with error +/- .65%, using 95% confidence.
 - ◆ This confidence level is used throughout this report.

Estimated Total Evasion Rate

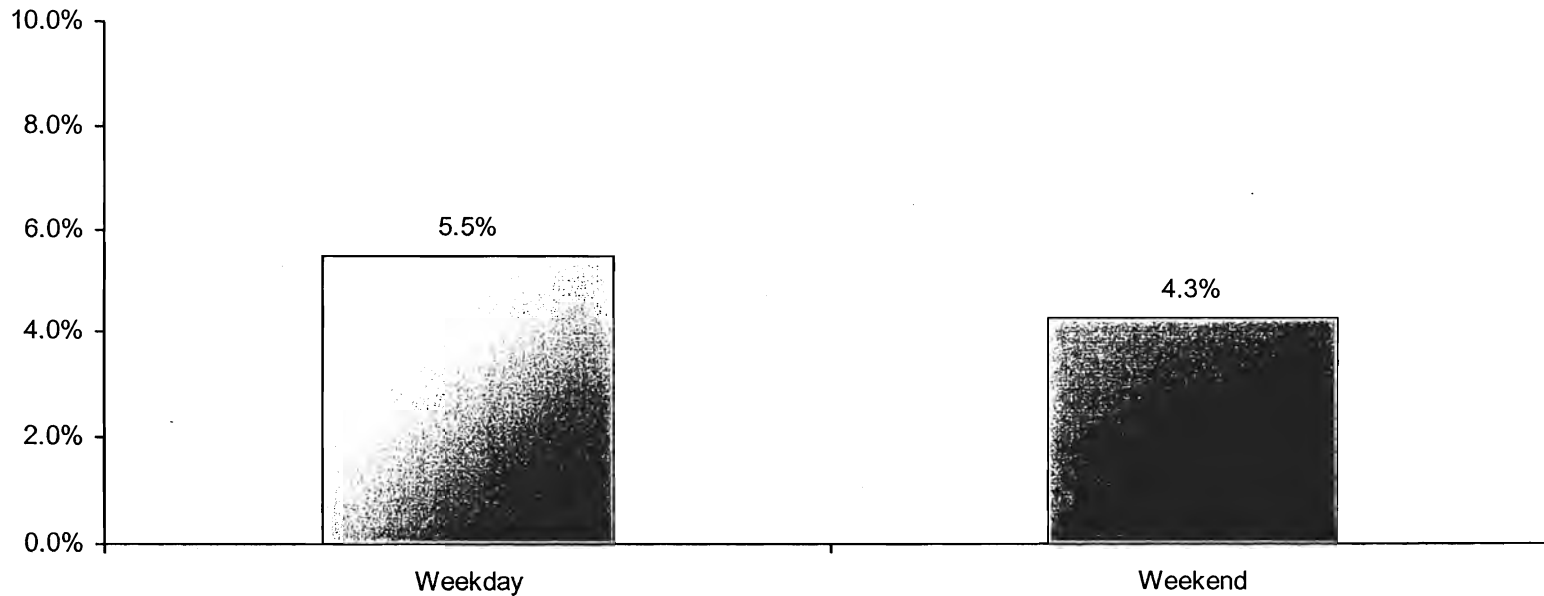


Overall Fare Evasion Rate

◆ Evasion by Day-Type

- ◆ The evasion rate is significantly higher on weekdays (5.5%, +/- .71%), compared to weekends (4.3%, +/- 1.36%).

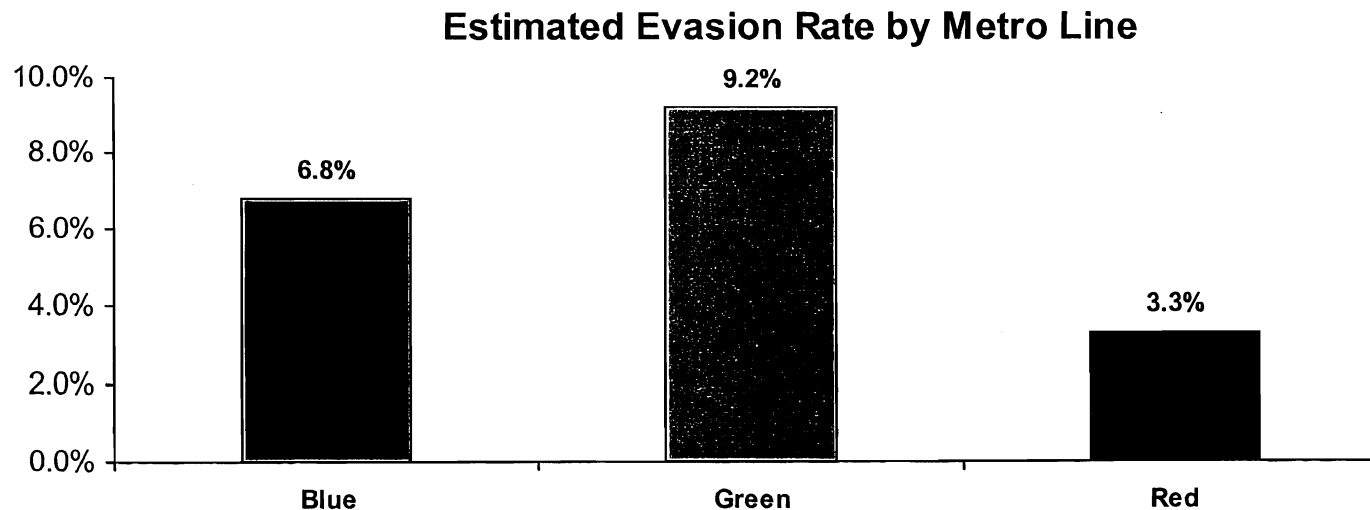
Estimated Evasion Rate by Day-Type



Overall Fare Evasion Rate

◆ Evasion by Metro Line

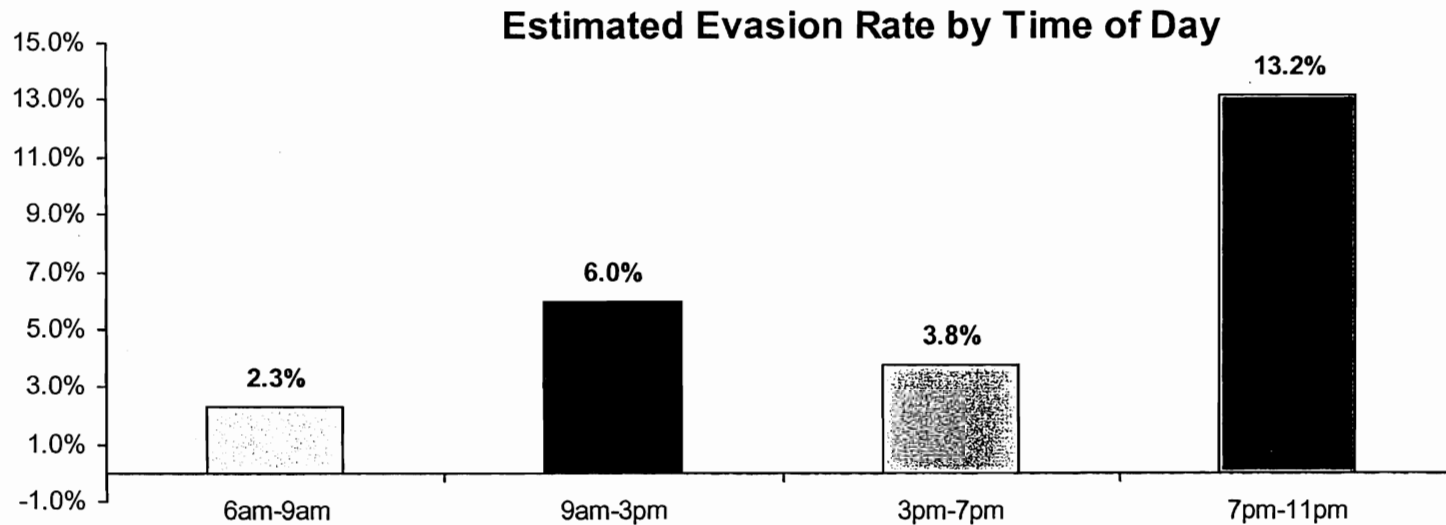
- ◆ The evasion rate is the highest at Green line (9.2%, +/-2.40).
- ◆ Lower than at Green line, the Blue line (6.8%, +/-1.24) has an evasion rate twice as high as the Red line (3.3%, +/-0.65).



Overall Fare Evasion Rate

◆ Evasion by Time of Day

- ◆ The evasion rate during peak hours is significantly lower than during off-peak hours.
 - ◆ For the peak hours, the 6am-9am segment has an evasion rate at 2.3% with error +/-1.10%, while the 3pm-7pm segment has it at 3.8% with error +/-0.96%.
 - ◆ For the off-peak hours, the 9am-3pm segment has an evasion rate at 6.0% with error +/-1.03%, while the 7pm-11pm segment has it at 13.2% with error +/-3.21%.

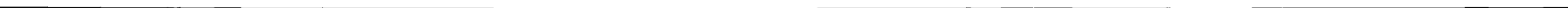


Overall Fare Evasion Rate

◆ Evasion by Day-Type and Time Within Line

- ◆ Most evasion prone are the Blue and Green lines during 7pm to 11pm segment.
- ◆ The Red line has generally the lowest evasion rate.

Fare evasion estimates	Total	Day-Type		Time			
		Weekday	Weekend	6am-9am	9am-3pm	3pm-7pm	7pm-11pm
Total	5.3%	5.5%	4.3%	2.3%	6.0%	3.8%	13.2%
Blue	6.8%	7.2%	4.2%	3.0%	6.2%	7.6%	16.5%
Green	9.2%	9.1%	9.3%	3.6%	8.5%	6.2%	17.8%
Red	3.3%	3.6%	1.3%	1.7%	5.2%	1.5%	4.7%



Typical Rider Patterns

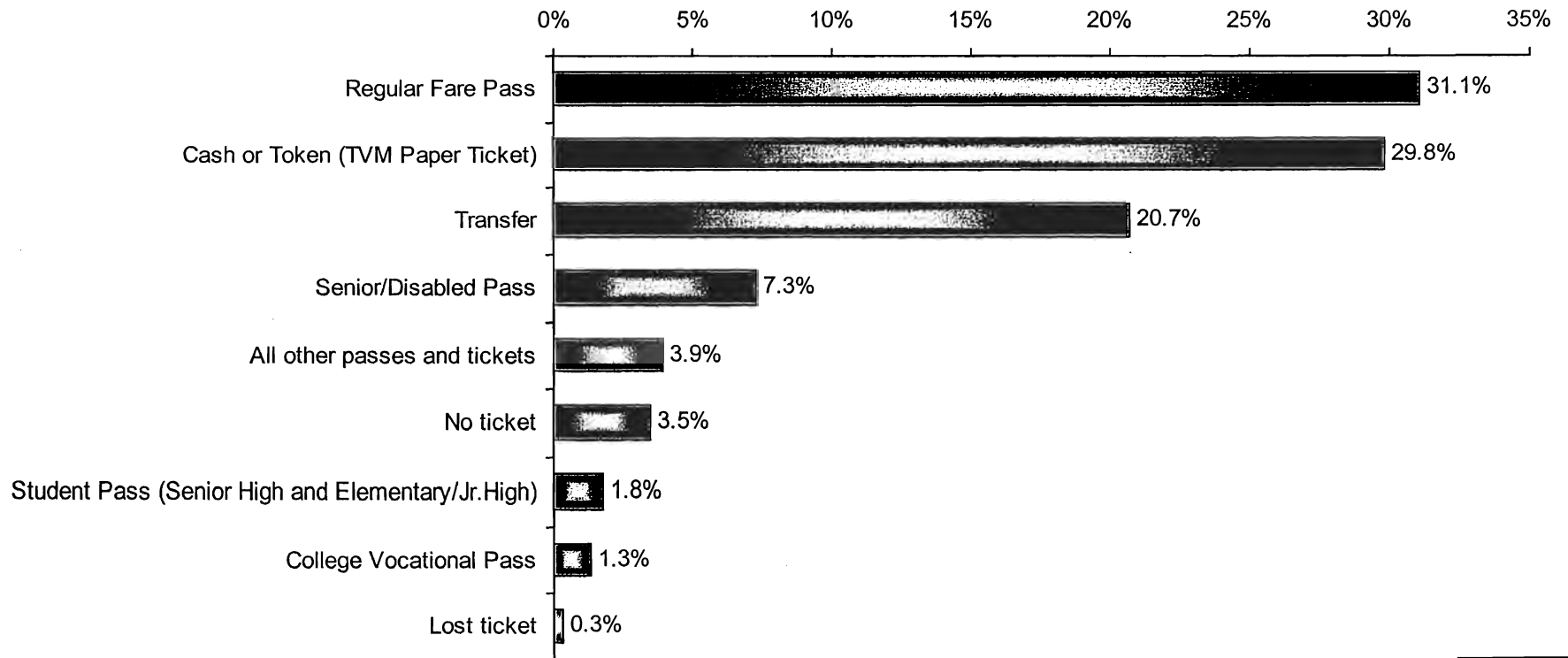


Typical Rider Patterns

◆ Type of Fare Media Used by Riders

- ◆ The three most often used fare media are the regular fare pass (31%), TVM's (30%) and transfers (21%).

Type of Fare Media Riders Were Using

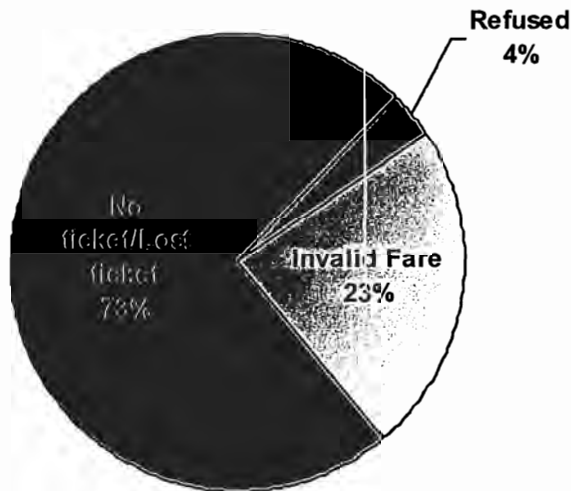


Typical Rider Patterns

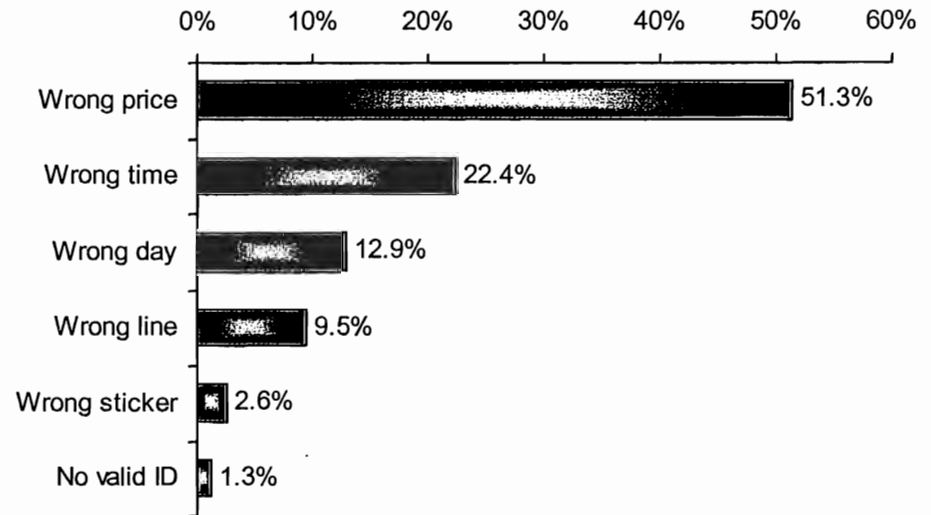
◆ Fare Evaders - Fare Media Used

- ◆ 73% of Fare Evaders did not have any ticket or claimed to have lost it, while
- ◆ 23% had an invalid ticket.
 - ◆ The most frequent reason for an invalid fare was that the rider failed to pay the correct price for their journey (51.3%), such as didn't get transfer, returning on a one-way ticket, etc.

Type of Fare Evaders



Fare Evaders Using Invalid Fare

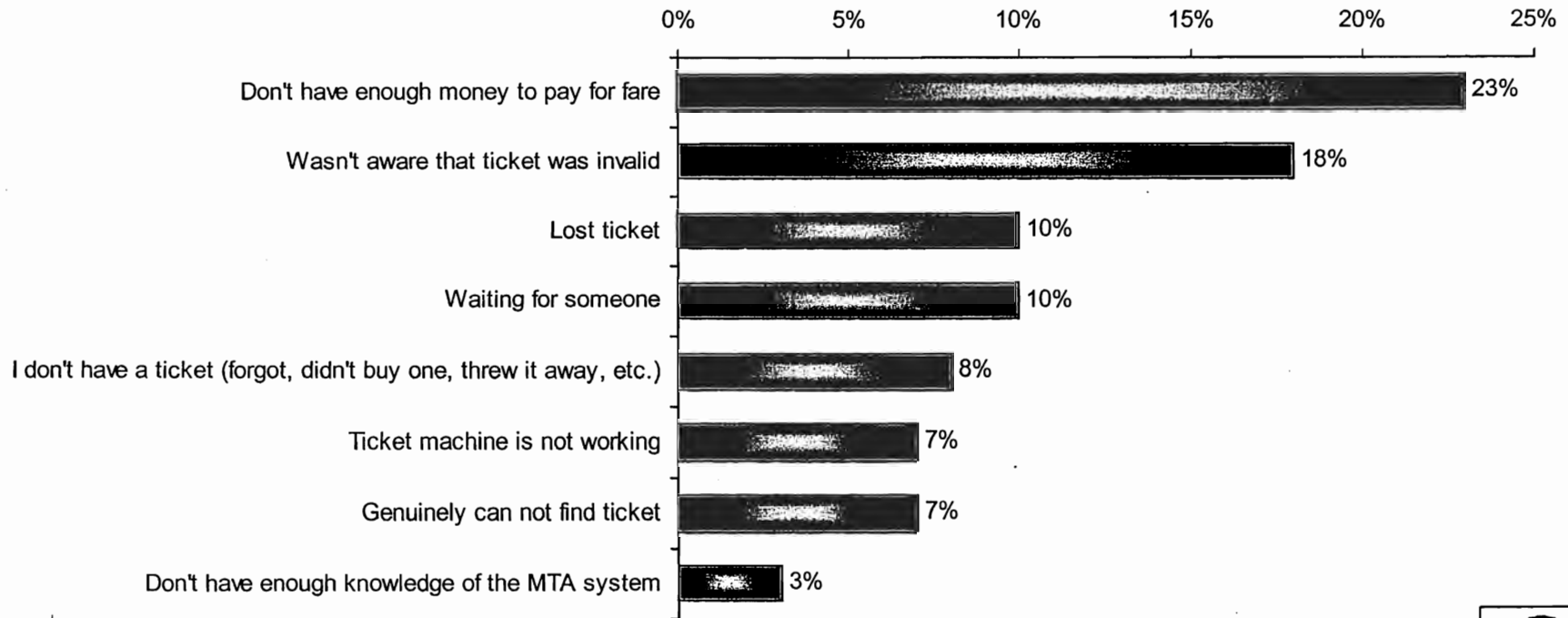


Typical Rider Patterns

◆ Reasons Fare Evaders Gave for Not Having Valid Fare

- ◆ The most frequently given reason was that fare evaders did not have enough money (23%).
- ◆ Also significant from the point of view of taking remedial action is that 18% of riders were not aware that their ticket was invalid.

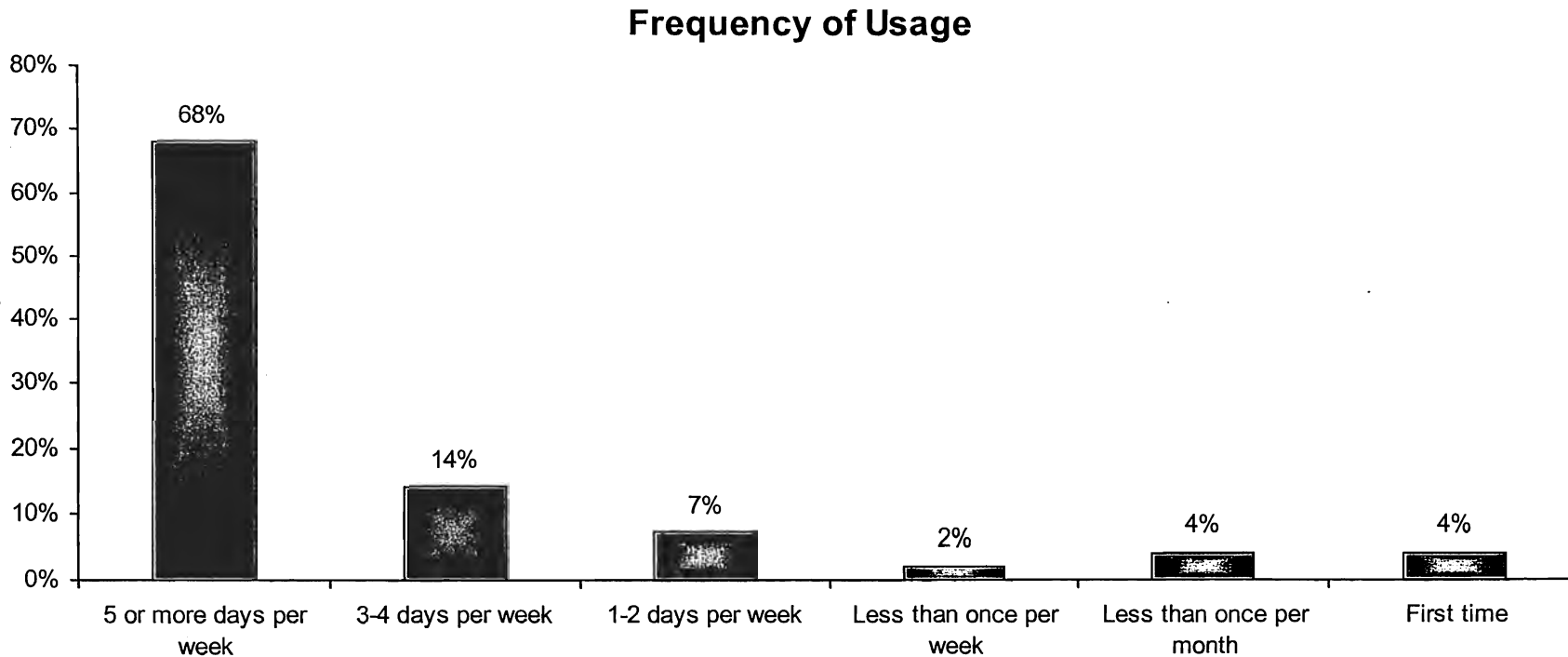
Eight Most Frequent Reasons Why Fare Evaders Did Not Have Valid Fare



Typical Rider Patterns

◆ Frequency of Metro System Usage

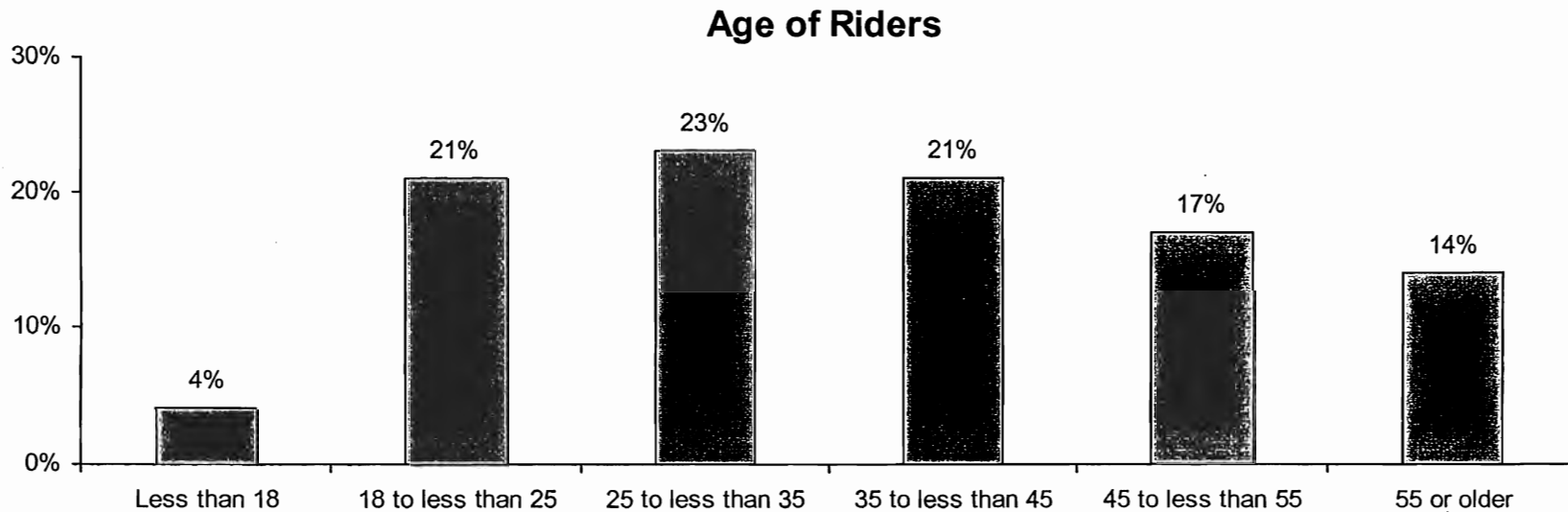
- ◆ More than two thirds of riders use the system 5 days or more per week.
- ◆ Only 8% use the system 1 day a week or less often.



Typical Rider Patterns

◆ Age of Riders

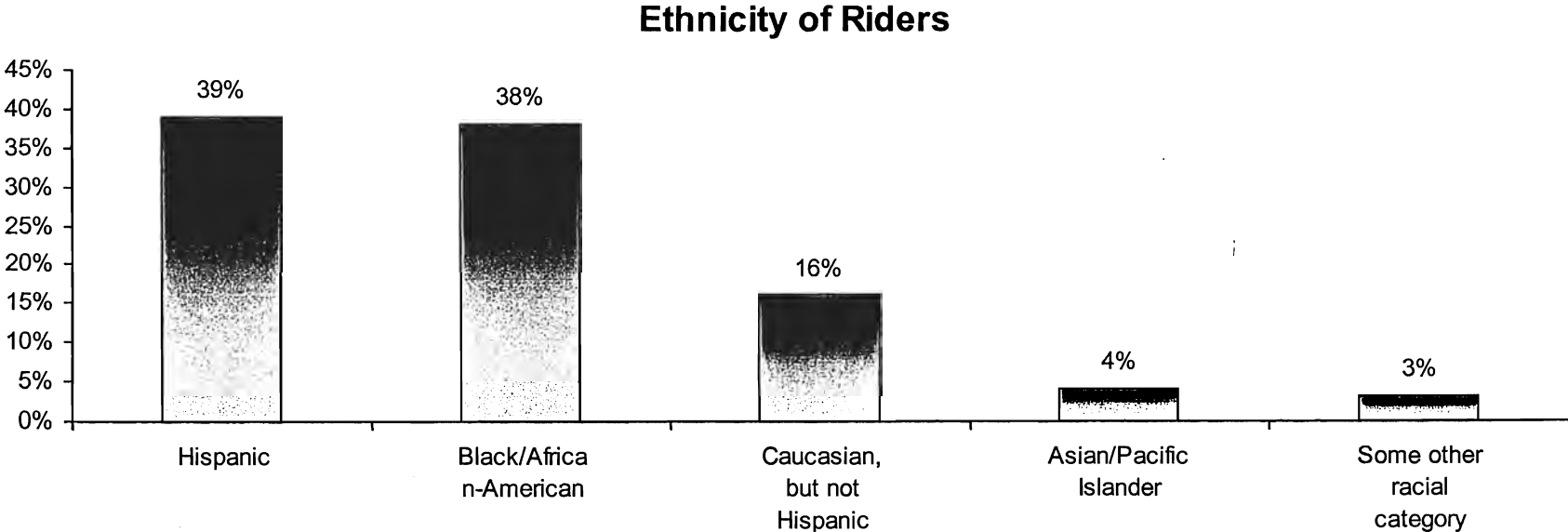
- ◆ Median age of riders is 35.9 years.
- ◆ 1/4 of riders are younger than 25 years.



Typical Rider Patterns

◆ Ethnicity of Riders

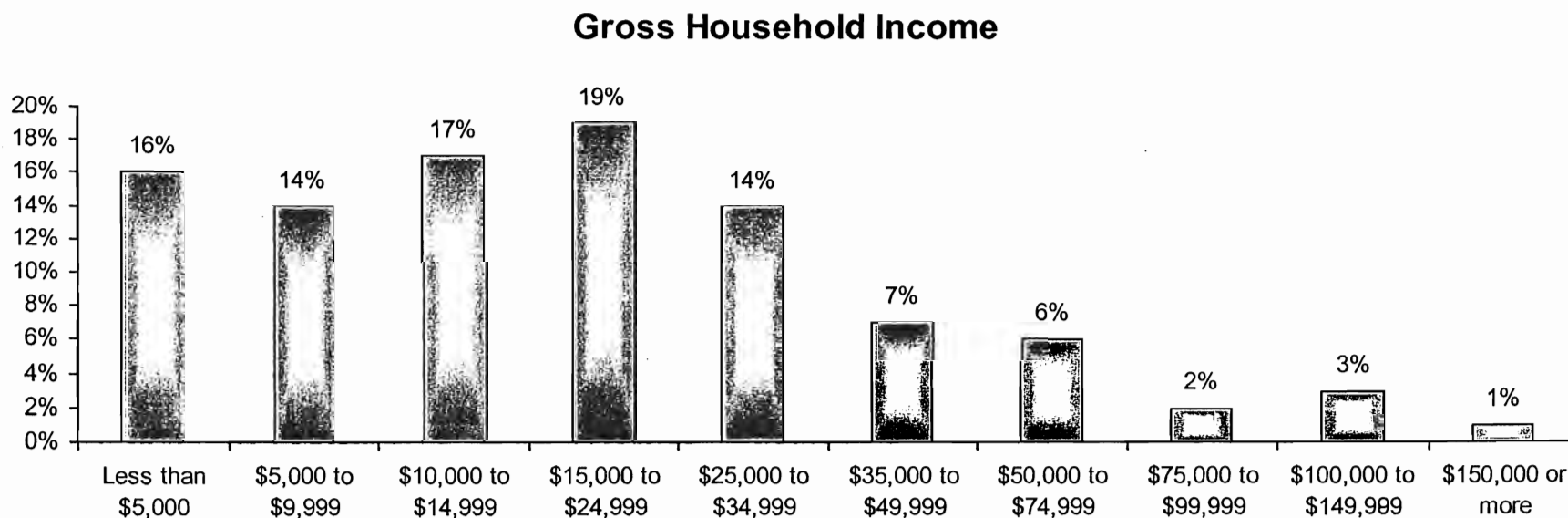
- ◆ Hispanics (39%) and African Americans (38%) are the most sizable ethnic groups using the Metro system.



Typical Rider Patterns

◆ Income of Riders

- ◆ Riders' median household income is \$16,100.
- ◆ Almost a half (47%) has their household income under \$15,000 a year.



Factors Impacting Fare Evasion

Factors Impacting Fare Evasion

- ◆ To identify the factors impacting fare evasion and to assess their relative importance, we built a binomial regression model predicting the observed fare evasion rate from the following broad classes:
 - ◆ Knowledge of the system,
 - ◆ TVM Access,
 - ◆ Commuter characteristics such as
 - ◆ Demographics,
 - ◆ Travel patterns, and
 - ◆ Fare media type
- ◆ The fitted model explained nearly 27.3% of the variance of the observed evasion rate. The model residual variance (62.7%) is potentially attributable to:
 - ◆ Characteristics of lines (such as Red line being an underground system),
 - ◆ Differences in enforcement or its perception.

Factors Impacting Fare Evasion

◆ Knowledge of the System

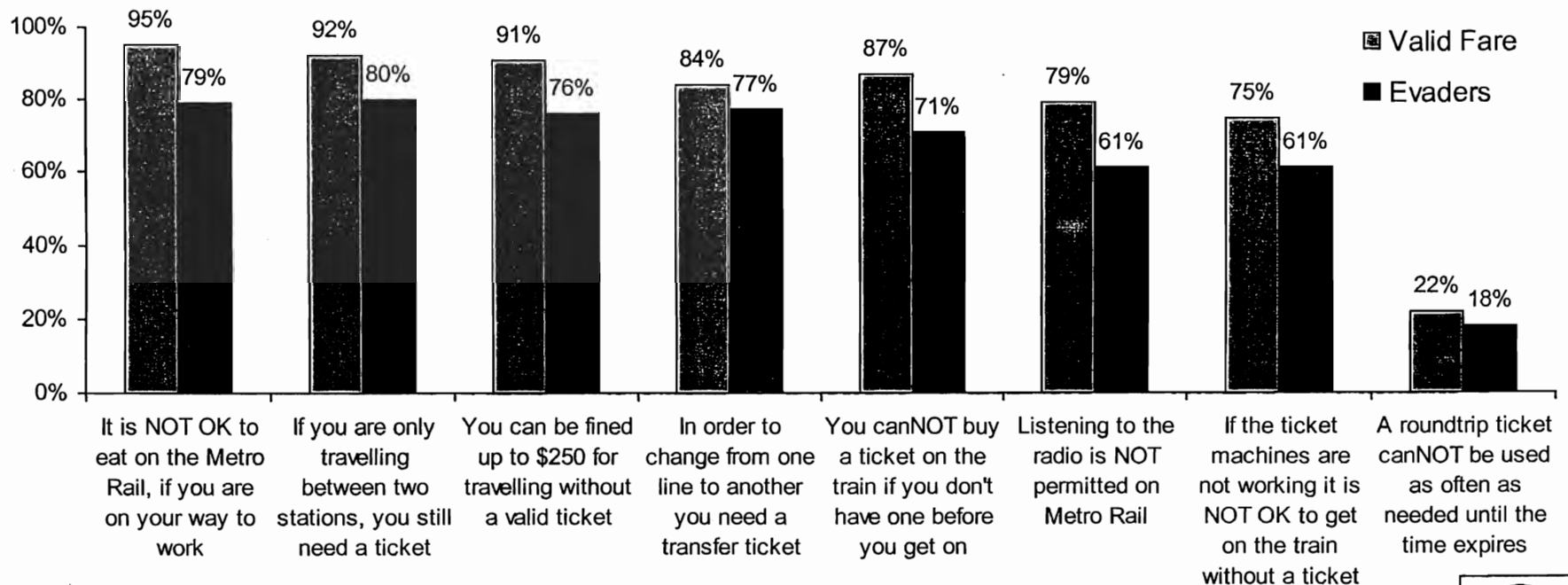
- ◆ We measured knowledge of the system by asking riders to judge eight statements about the Metro system as either true or false.
 - ◆ (1) In order to change from one line to another you need a transfer ticket.
 - ◆ (2) If the ticket machines are not working it is OK to get on the train without a ticket.
 - ◆ (3) A round trip ticket can be used as often as needed until the time expires.
 - ◆ (4) You can buy a ticket on the train if you don't have one before you get on.
 - ◆ (5) You can be fined up to \$250 for traveling without a valid ticket.
 - ◆ (6) Listening to the radio is permitted on Metro Rail.
 - ◆ (7) If you are traveling between two stations, you still need a ticket.
 - ◆ (8) It is OK to eat on the Metro Rail, if you are on your way to work.
- ◆ A Knowledge Composite Score was calculated by scoring 1 point for each of statements 1, 5, and 7 answered 'true' and 1 point for each of statements 2, 3, 4, 6, and 8 answered 'false'.

Factors Impacting Fare Evasion

◆ Knowledge of the System (Cont.)

- ◆ Significant differences between Fare-Evaders and Valid-Fare riders exist on virtually all statements. Both groups of riders lack correct knowledge about using a round-trip ticket.

Percent Answering These Statements about Metro Line in the Correct Direction

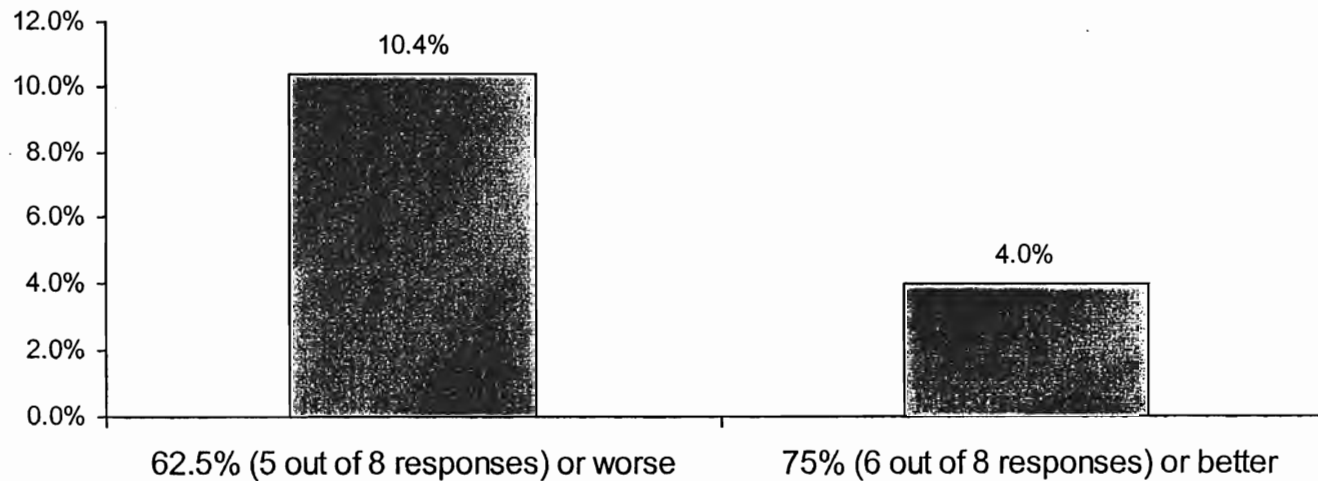


Factors Impacting Fare Evasion

◆ Knowledge of the System (Cont.)

- ◆ Riders with less accurate knowledge of the system are more likely to evade paying the fare.
 - ◆ In this particular instance, only 4.0% of riders with Knowledge Composite Score 75% or higher (6 out of 8 responses correct or more) were Fare Evaders, compared to 10.4% of riders with Knowledge Composite Score 62.5% or lower (5 out of 8 responses correct or worse).

Evasion Rate Given Riders' Knowledge Composite Score



Factors Impacting Fare Evasion

◆ Knowledge of the System (Cont.)

- ◆ Improving the knowledge that riders have of the system could substantially improve the fare evasion rate.
- ◆ We estimate that 10% improvement in the accuracy of knowledge riders have would result in a 24% reduction of the fare evasion rate from 5.3% to 4.0%.
- ◆ The specific aspects of knowledge that would lead to improvement in fare evasion rate are:
 - ◆ Ensuring that riders know that a round trip ticket can only be used for one round trip and that a transfer ticket is needed when changing from one line to another.
 - ◆ Riders should also be aware that they cannot be on the train/platform without a ticket, notwithstanding reasons such as broken TVM's, waiting for someone, or traveling between two consecutive stations.

Factors Impacting Fare Evasion

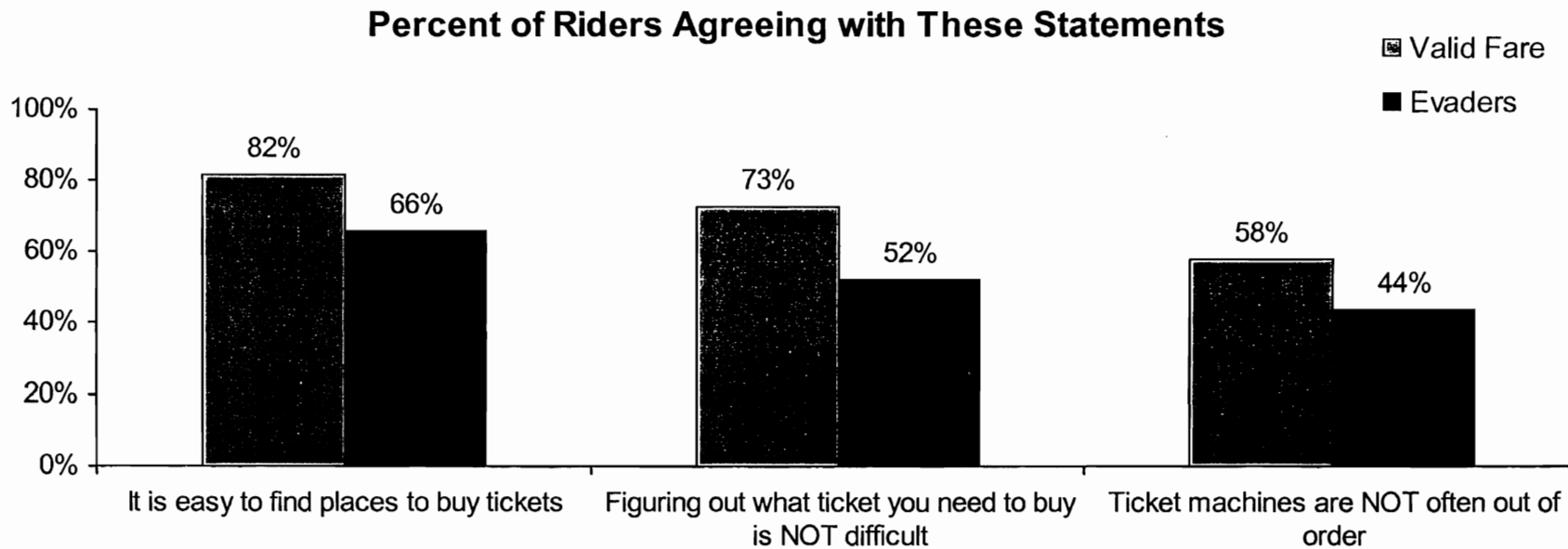
✦ TVM Access

- ✦ Another predictor of evasion identified by our model is how easy it is to obtain tickets.
 - ✦ This score is composed of following three statements:
 - ✦ (1) Ticket machines are often out of order.
 - ✦ (2) It is easy to find places to buy a ticket.
 - ✦ (3) Figuring out what ticket you need to buy is difficult.
 - ✦ Interviewed riders scored each statement as either agree, disagree or don't know. We coded agree=0, disagree=1 and don't know=.5 for statements (1) and (3). For statement (2), we coded agree=1, disagree=0 and don't know=.5.
 - ✦ This composite score was computed by averaging these three statements and multiplied by 100.
 - ✦ The composite score could be interpreted as indicating how easy riders perceive it to be to obtain fare media - the higher the score, the easier they perceive it to be.

Factors Impacting Fare Evasion

✦ TVM Access (Cont.)

- ✦ Evaders are significantly less likely to find it easy to obtain tickets.
 - ✦ Compared to Valid Fare riders, the evaders find it less easy to locate the places to buy tickets (66% vs. 82%) and less easy to figure out what ticket they need (52% vs. 73%). Also, they encounter properly working ticket machines less frequently (44% vs. 58%).

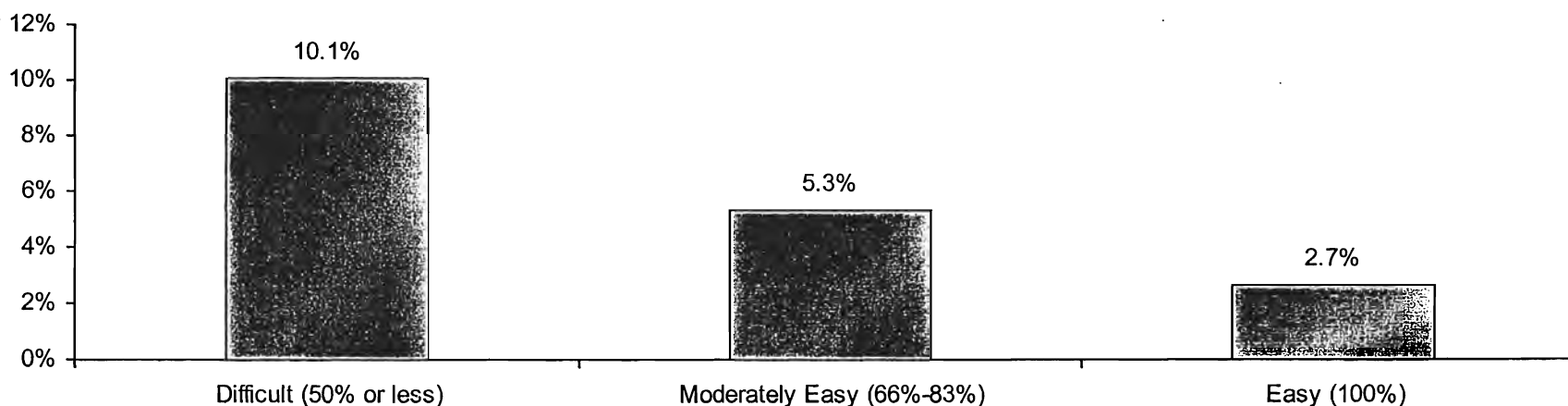


Factors Impacting Fare Evasion

◆ TVM Access (Cont.)

- ◆ Riders finding it more difficult to obtain tickets are more likely to evade paying a fare.
 - ◆ In this particular instance, only 2.7% of riders who found obtaining tickets easy (100% score) were fare evaders, compared to 10.1% of riders who found it difficult (50% score).

Evasion Rate Relative to Ease of Obtaining Ticket



Factors Impacting Fare Evasion

◆ TVM Access (Cont.)

- ◆ Improving the ease with which tickets can be obtained also has the potential to reduce the fare evasion rate.
- ◆ Our model predicts that a 10% improvement in the ease of obtaining tickets would result in a 7.2% reduction of evasion rate, or a change from 5.3% to 4.9%.
- ◆ Specifically, MTA could post signage explaining...
 - ◆ what to do when TVM's are not functional (such as alternative location for purchase of TVM's or other fare media), and
 - ◆ improve their existing instructions as to what ticket to buy.
- ◆ If MTA were able to BOTH improve the ease of obtaining tickets by 10% and improve riders' knowledge (as discussed in the previous section), our model predicts a 30% reduction in evasion rate, or a change from 5.3% to 3.7%.

Factors Impacting Fare Evasion

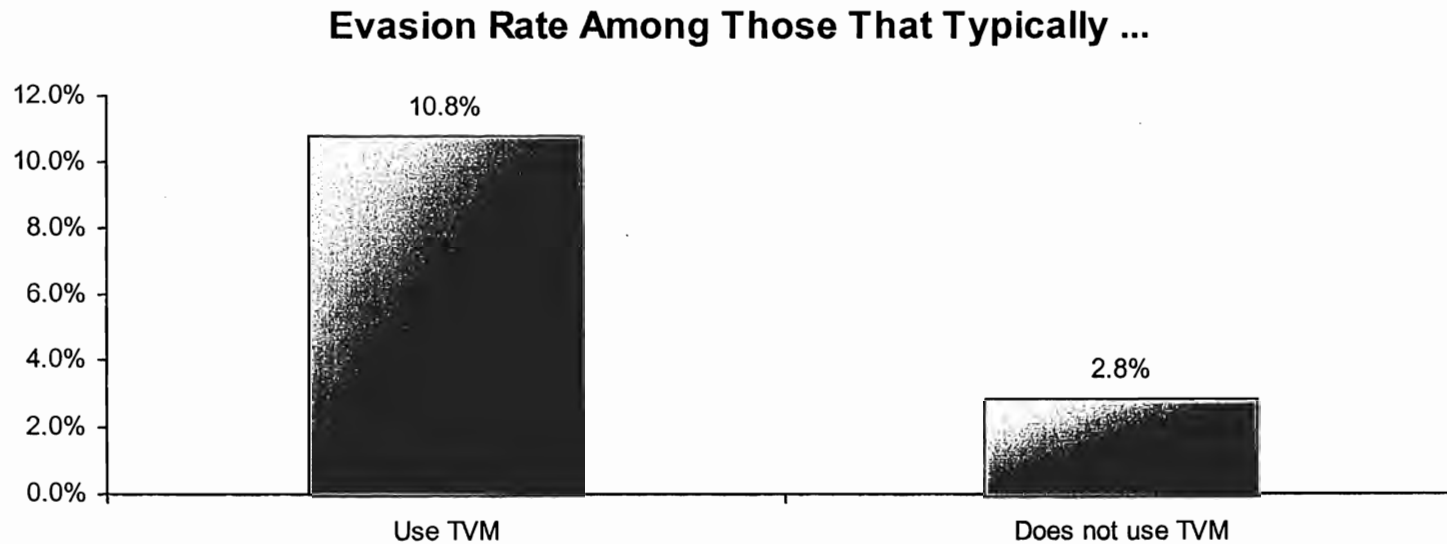
◆ Commuter Characteristics

- ◆ There are five rider-characteristics that we found to significantly improve our prediction of the fare evasion rate. These are ...
 - ◆ Type of fare media typically used, specifically the percent of riders typically using TVMs.
 - ◆ Use of TVMs increases the likelihood of evasion. Virtually no one who typically uses a pass was an evader.
 - ◆ Frequency with which riders use the Metro Rail system (number of days per week)
 - ◆ Daily riders (5 days a week) are less likely to evade.
 - ◆ Age and
 - ◆ Older riders are less likely to evade.
 - ◆ Income
 - ◆ People with higher incomes are less likely to evade paying fare.
 - ◆ Ethnicity
 - ◆ African Americans contain a disproportionately higher number of fare evaders compared to other ethnic groups, even controlling for age and income effects.

Factors Impacting Fare Evasion

◆ Commuter Characteristics (Cont.)

- ◆ Riders who typically use TVMs are significantly more likely to evade paying fare than riders typically using other fare media.
 - ◆ Only 2.84% of riders with fare media other than TVM are fare evaders.
 - ◆ However, 10.8% of riders who typically use TVMs are fare evaders.

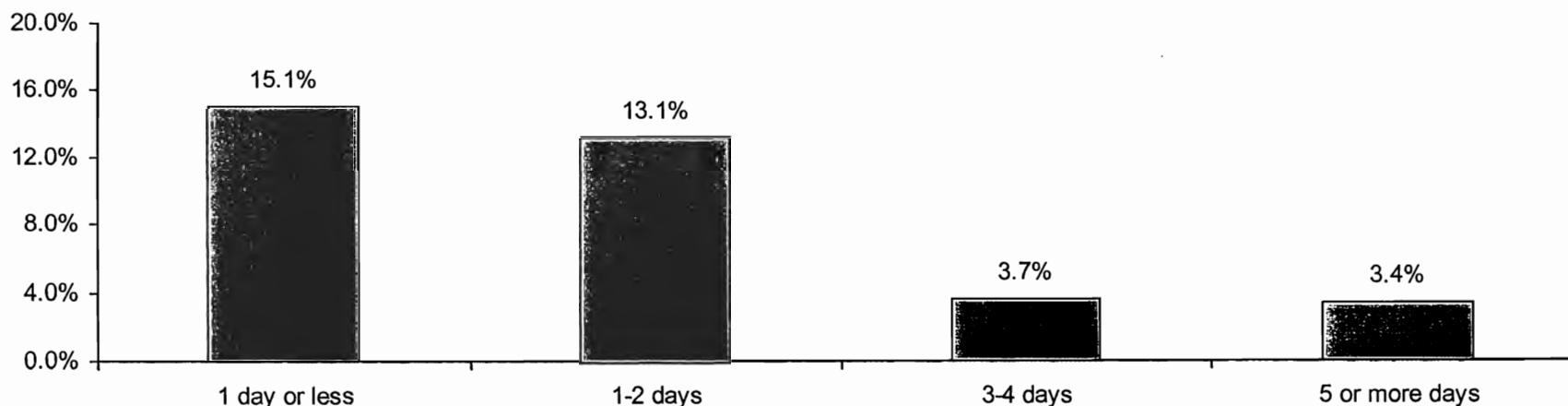


Factors Impacting Fare Evasion

◆ Commuter Characteristics (Cont.)

- ◆ There is a negative relationship between the fare evasion rate and the weekly frequency of Metro use.
 - ◆ Riders that commute every day (5 days +) are less likely (3.4%) to avoid paying the fare than riders commuting 2 days per week or less frequently (13.1% to 15.1%).

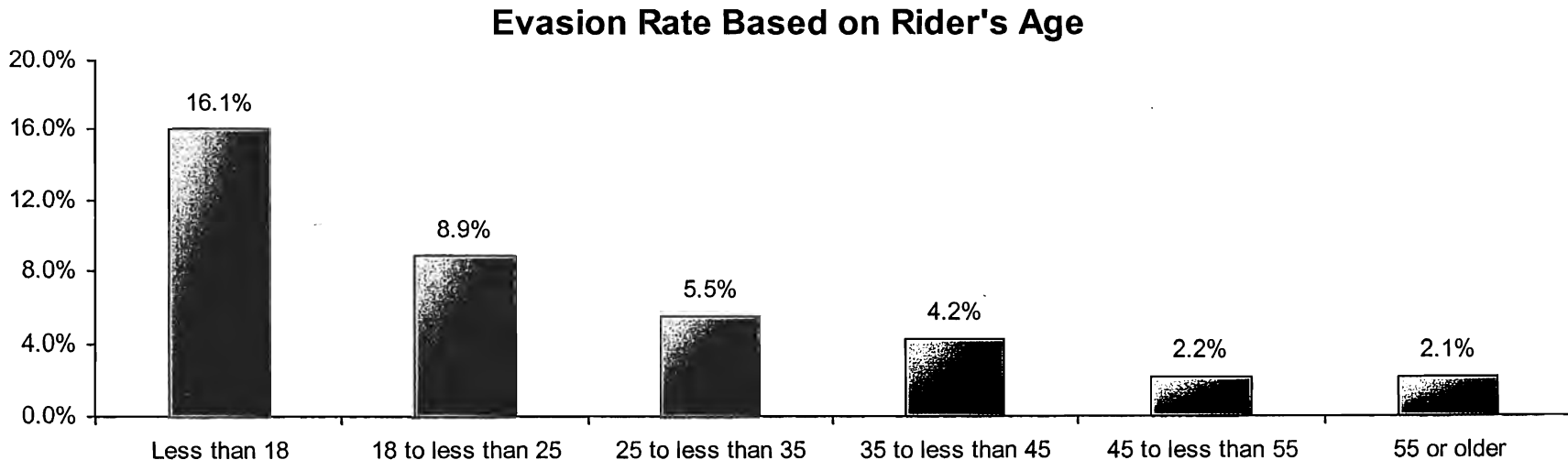
Evasion Rate Based on Weekly Frequency of Metro Usage



Factors Impacting Fare Evasion

◆ Commuter Characteristics (Cont.)

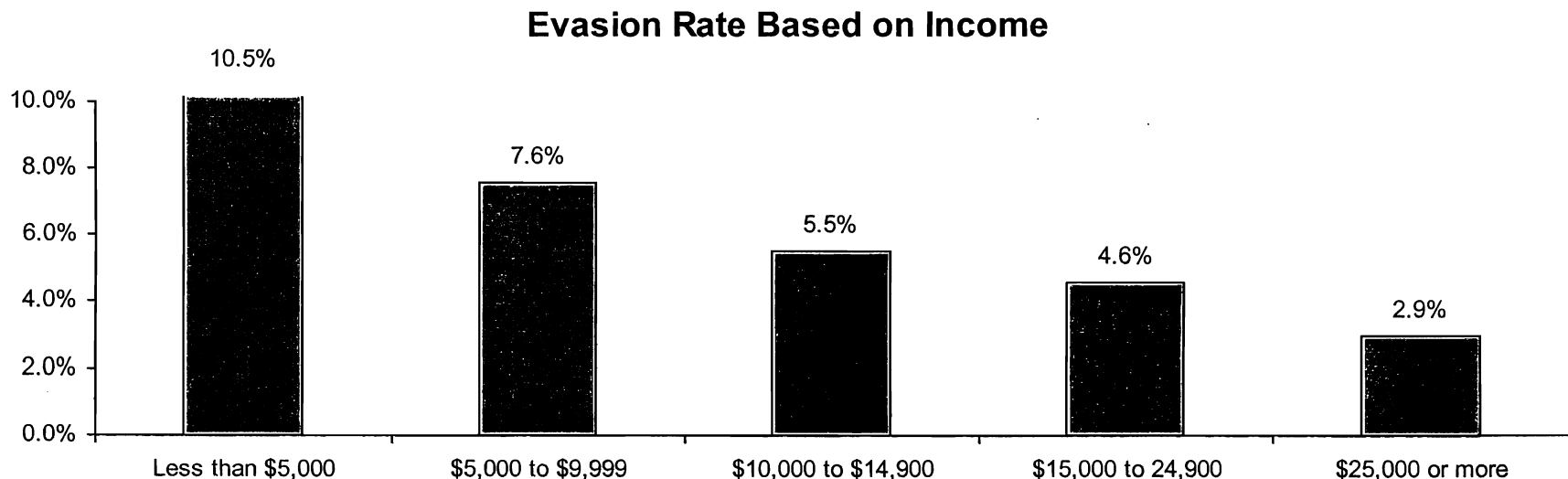
- ◆ Age has a negative relationship with the evasion rate.
 - ◆ Young riders (Less than 18) are 4 times as likely to evade paying fare (16.1%) than middle age riders (35 to less than 45: 4.2%).



Factors Impacting Fare Evasion

◆ Commuter Characteristics (Cont.)

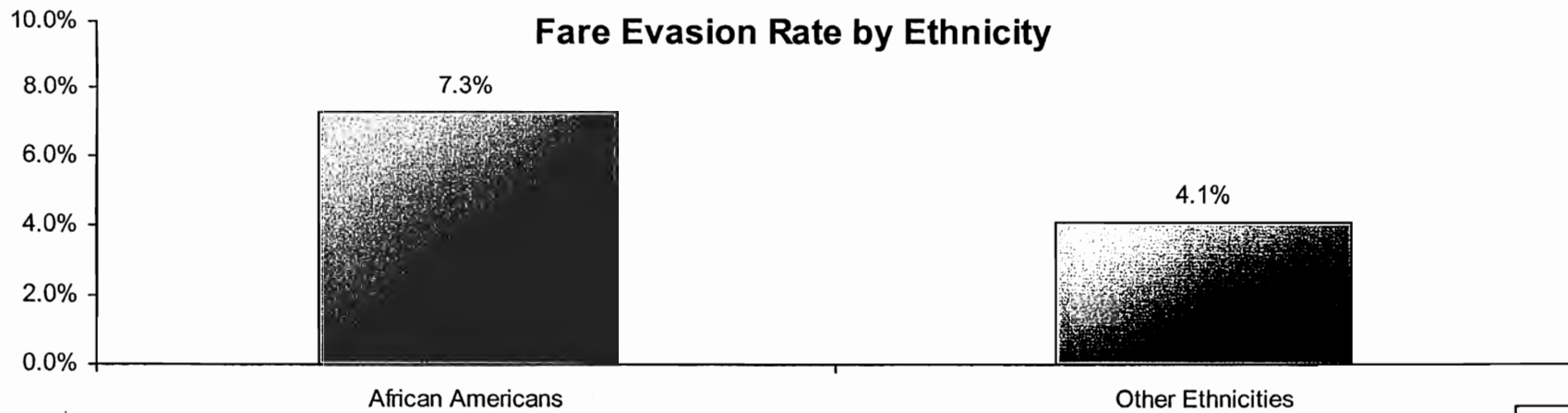
- ◆ There is also a negative relationship between evasion rate and income of riders.
 - ◆ Riders with annual household income of \$5,000 or less are almost 4 times as likely to evade paying fare (10.5%) than riders with income \$25,000 or higher (2.9%).



Factors Impacting Fare Evasion

◆ Commuter Characteristics (Cont.)

- ◆ There is a disproportionately higher number of evaders among African Americans (7.3%) compared to other ethnic groups (4.1%).
 - ◆ This variable has a significant impact on the evasion rate even after income and age are accounted for, although it is the least important variable.
 - ◆ Specifically, the model with this ethnic variable accounts for 27.3% of variance in evasion, while the model without it accounts for 25.8% of variance. This means that ethnicity accounts for 5.8% of explained variance.
 - ◆ It is likely that factors other than age and income may be a cause of this apparent relationship.



Enforcement

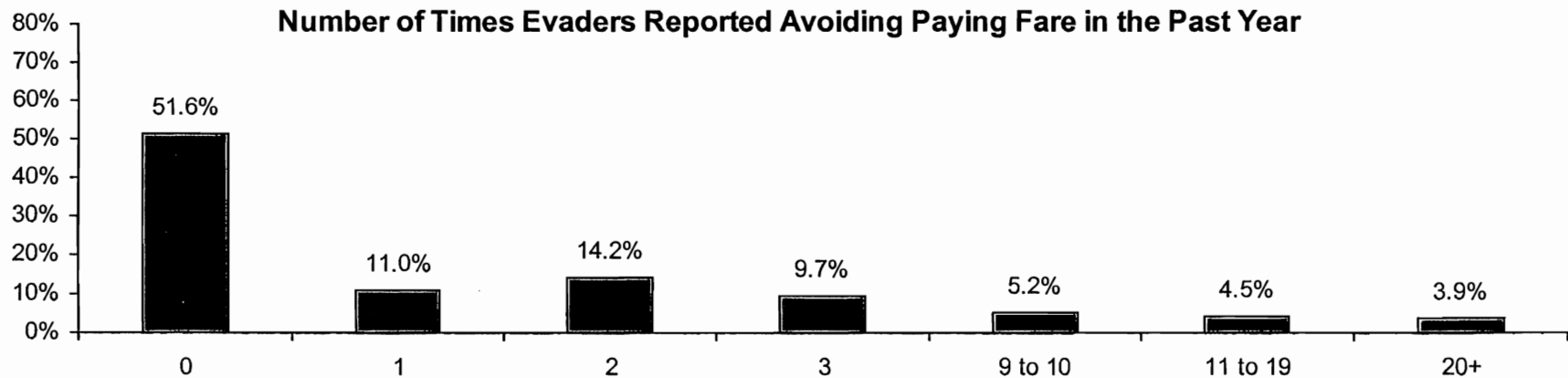
Enforcement

- ◆ A number of variables related to law enforcement were included in the survey:
 - ◆ Perceived likelihood of getting caught if riding regularly without a ticket,
 - ◆ Number of times having a ticket inspected in the past year,
 - ◆ Number of times evading paying fare in the past year,
 - ◆ Number of times getting caught in the past year, and
 - ◆ Punishment received for evading in the past year.
- ◆ None of these self reported variables were related to evasion. One might conclude, therefore, that enforcement is not important to the evasion rate. However, it seems inconceivable that the evasion rate is so low without the threat of being caught and punished factoring into a rider's consideration of whether or not to evade.
- ◆ In this section, we demonstrate that current law enforcement system works for the majority of riders, but not for a small minority.
 - ◆ The reason that self reports about law enforcement do not relate to evasion is that riders do not provide accurate recollections.

Enforcement

◆ Riders Under-report the Frequency of Past Year Evasions

- ◆ A half of Evaders (51.6%) report that their only evasion in the past year was the journey on which they had their fare checked for this study.
 - ◆ The mean number of evasions per year for this group of riders is 2.02.
 - ◆ Taking them at their word, and taking into account their frequency of ridership at 156 times per year, we would expect their evasion rate to be only 1.3%.
 - ◆ However, we know that the evasion likelihood for this group is at least 5.3% and most likely higher.
 - ◆ Therefore, it appears that evaders are under representing their evasion frequency.



Enforcement

◆ Estimated Evasion Likelihood

- ◆ Knowing that we cannot rely on the reported evasion frequency, we used our binomial model to predict this frequency indirectly, by calculating the evasion likelihood based on our predictive model.
- ◆ Each commuter characteristic is associated with a certain observed evasion rate. For example, we can group riders into those who typically use TVM's and those who do not. We observed that 10.8% of TVM users are evaders while only 2.8% of other fare media users are evaders. We can produce these types of estimates for all commuter characteristics. Finally, the model combines all these group estimates via regression weights and produces an evasion likelihood estimate for every individual whom we observed. Thus, in essence, the individual evasion likelihood is a function of likelihood of specific commuter characteristics that this individual possesses.

Enforcement

◆ Estimated Evasion Likelihood (Cont.)

◆ Example

- ◆ For example, an African American who does not use TVM's, has the Knowledge Composite score of 62.5%, has the TVM Access score of 83.3%, is 25 to 35 years old, with income \$35,000 to \$50,000, riding metro 3 to 4 times a week is estimated to have an evasion likelihood of 3.2%.
- ◆ On the other hand, an African American who uses TVM's, has higher Knowledge Composite score (93.75%), has low TVM Access score (0%), is younger (18 to 25), makes less money (under \$5,000), and also rides metro 3 to 4 times a week is estimated to have an evasion likelihood of 29.3%.
- ◆ Both of these individuals had a valid ticket when inspected.

Enforcement

◆ Estimated Evasion Likelihood (Cont.)

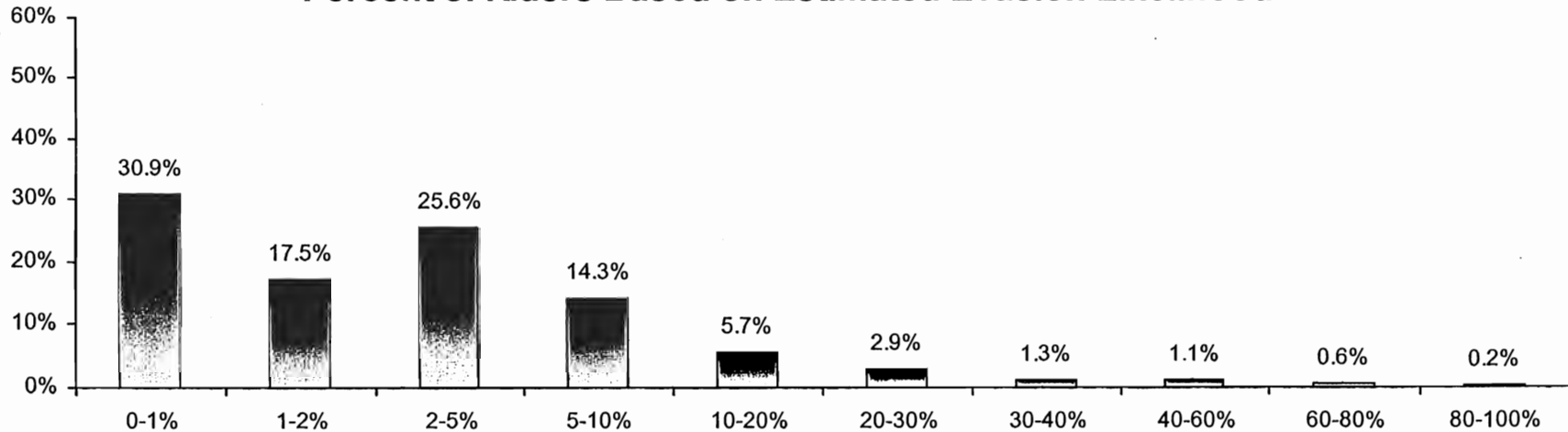
- ◆ For convenience, we categorized riders based on their estimated evasion likelihood into 4 groups:
 - ◆ Low risk - 30.9% of riders who evade less than 1 time per 100 rides.
 - ◆ Moderate risk - 43.1% of riders who evade 1 to 5 times per 100 rides.
 - ◆ High risk - 20% of riders who evade 5 to 20 times per 100 rides.
 - ◆ Extreme risk - 6% of riders who evade 20 or more times per 100 rides.

Enforcement

◆ Estimated Evasion Likelihood (Cont.)

- ◆ We can conclude that the enforcement system works to the extent that only 5.3% of the ridership evades on any given week. Furthermore, 74% of riders (low to moderate evasion risk) are clearly deterred by enforcement.
- ◆ On the other hand, 6% of riders (extreme risk group) either do not worry too much about being caught or found a way to avoid being caught.

Percent of Riders Based on Estimated Evasion Likelihood

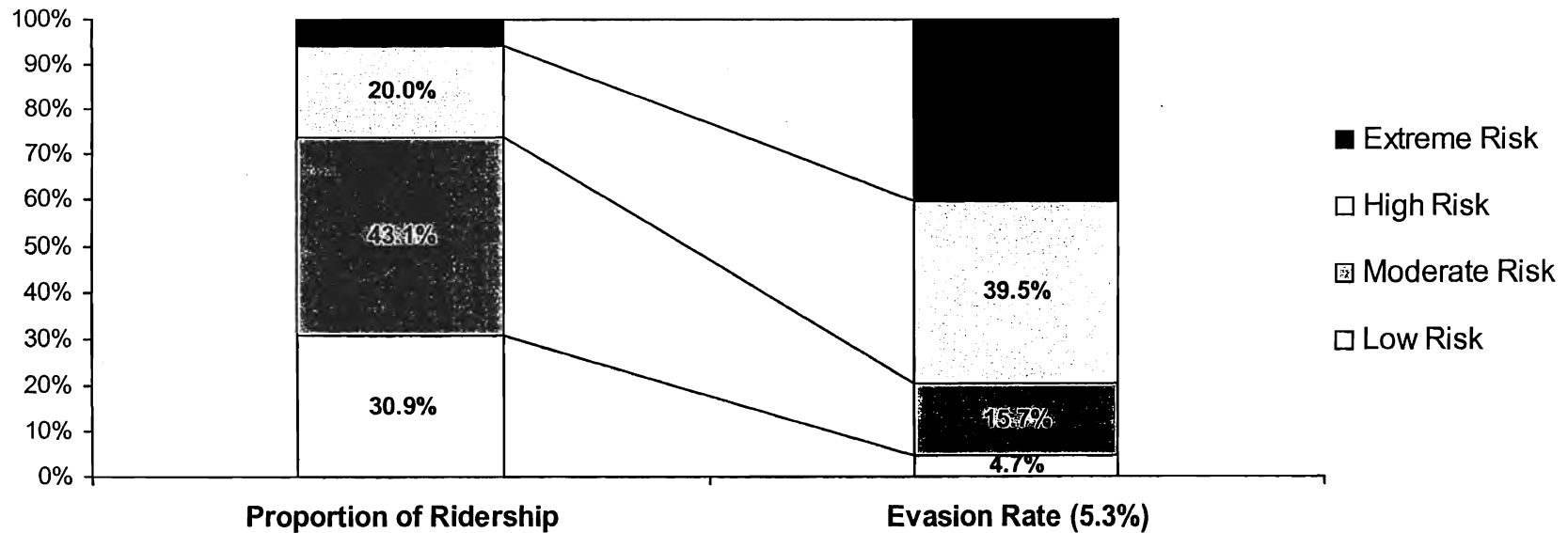


Enforcement

◆ Evasion Rate: Contribution by Risk Groups

- ◆ 6% of riders (the Extreme risk group) accounts for 40% of all evasions.
- ◆ While 74% of riders (the Low to Moderate risk group) account for 19.4% of evasion.

Proportion of Ridership By Risk Group in Relation to Evasion



Enforcement

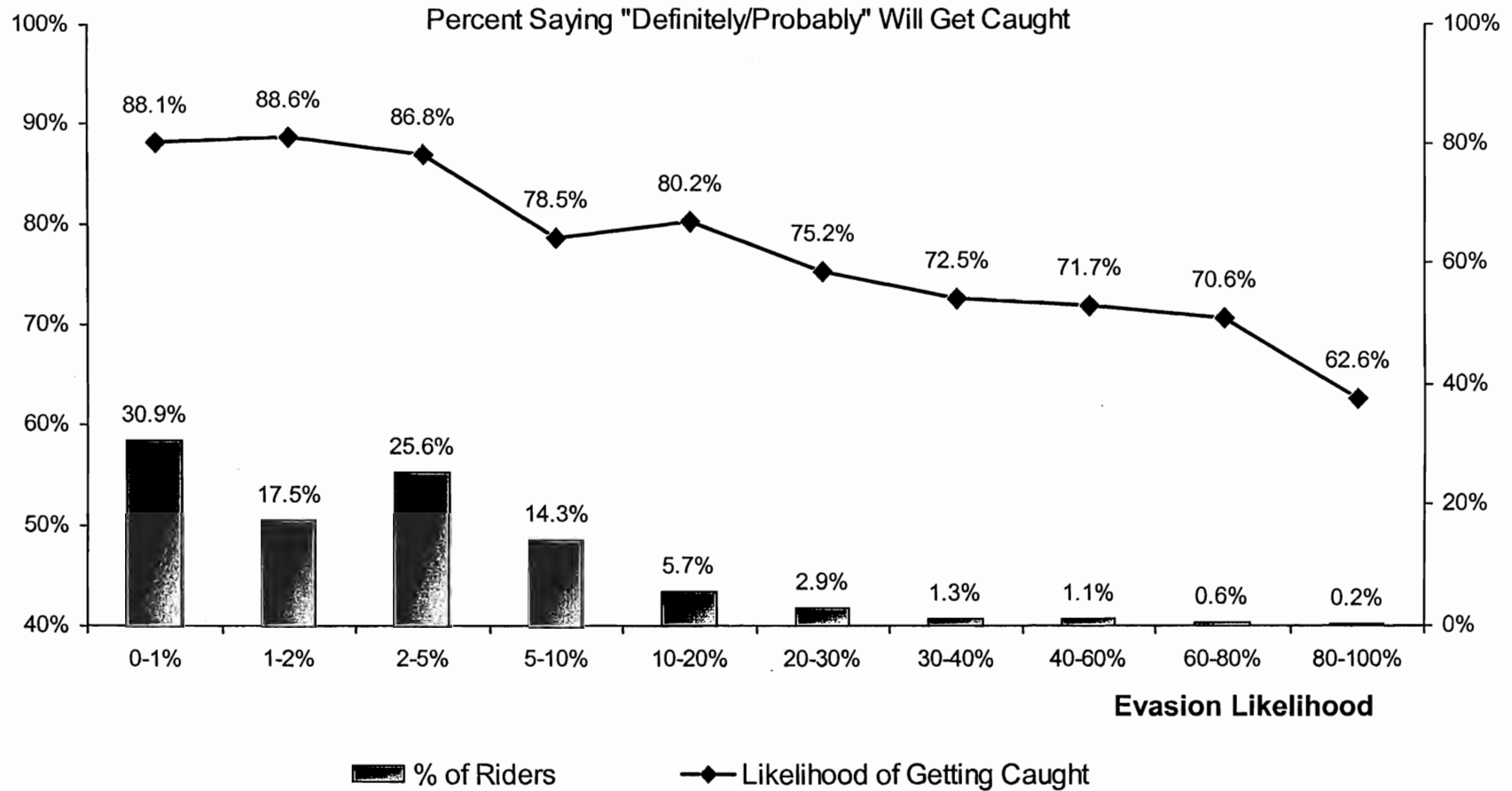
◆ Likelihood of Getting Caught

- ◆ The chart on the next slide shows a “smoothed*” relationship between perceived likelihood of getting caught and the estimated likelihood to evade.
 - ◆ The perceived likelihood of getting caught is expressed as the percent of riders who believe that they are definitely/probably going to get caught if riding regularly without a ticket.
- ◆ Clearly, the less likely riders believe that they will get caught, the more likely they will evade.
 - ◆ This result supports the conclusion that riders with high evasion likelihood must have found ways to evade being captured by law enforcement officials.
 - ◆ Based on discussions with our interviewees, we suspect that the indicated evasion strategies might include:
 - ◆ Waiting outside a station and catch a train at the last moment, or
 - ◆ Using stations with multiple exits and high visibility.

* This refers to the Loess Smoother, a part of Splus 6 statistics library

Enforcement

Percieved Likelihood of Getting Caught as a Function of Estimated Evasion Likelihood

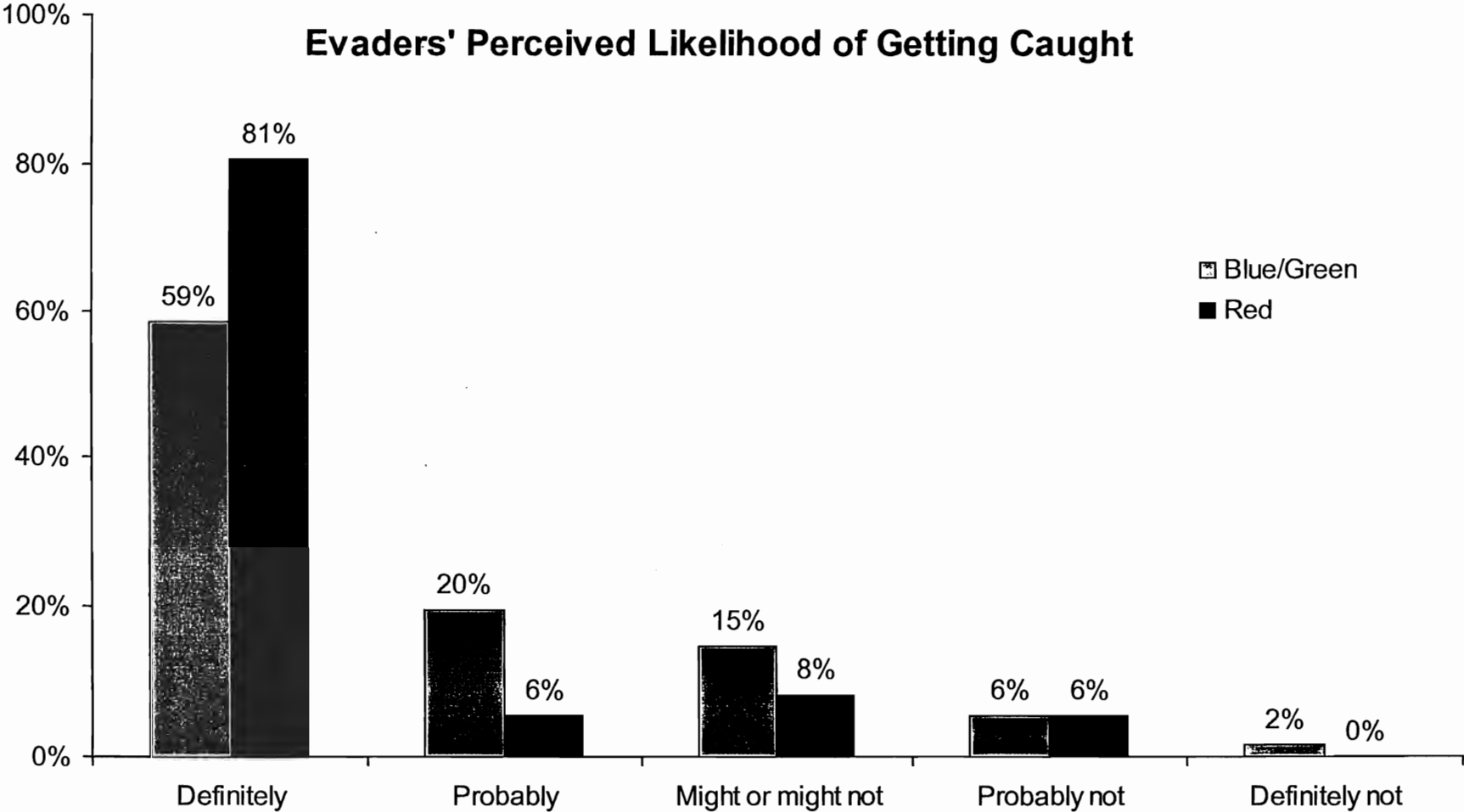


Enforcement

◆ Likelihood of Getting Caught (Cont.)

- ◆ Blue and Green lines have two to three times higher evasion rates than the Red line. Our model attributes some of this to differences in commuter characteristics, such as higher TVM use, slightly younger age, lower income and ethnicity of Blue and Green line riders.
- ◆ We believe that a part of this unexplained difference is due to Red line being an underground system where it is more difficult for evaders to avoid the police simply by not being able to see them in time.
- ◆ If this is so, we would expect that Red line evaders are more likely to believe that they would get caught if riding regularly without a ticket. That is what we observe.
 - ◆ 81% of Red line evaders believe that they will definitely be caught, while only
 - ◆ 59% of Blue/Green line evaders believe that will definitely be caught.

Enforcement



Enforcement

✦ Penalties for Getting Caught (Based on Self Report)

- ✦ The self reports of evaders who admitted to being caught in the past year indicate that a large portion of them (37.3%) get off with a warning or no consequence (4.1%).
 - ✦ Young offenders are more likely to get away without consequences.
 - ✦ 58.6% of riders 24 years old or younger receive only warning.
- ✦ Since younger offenders are more likely to evade paying fare, it is imperative that they are punished. It is here where the law enforcement is failing.

Recommendations for Decreasing Fare Evasion Rate

Recommendations for Decreasing Fare Evasion Rate

✦ Enforcement Issues

- ✦ We recommend that MTA examines enforcement issues, specifically as they relate to young offenders, such as insuring that there is a punishment for evading.
 - ✦ As suggested in the enforcement section, one likely reason that Red line has lower evasion rates is that police are less visible (that is, Red line riders are substantially less successful than Blue or Green line riders in spotting police officers with enough time to evade them).
 - ✦ To solve this “visibility” problem on Blue and Green lines, we suggest MTA examine the efficacy of the following:
 - ✦ Restructuring stations to limit access points;
 - ✦ Have more random checks at problem areas, including on train inspections;
 - ✦ Use a contingent of undercover officers to compliment the uniformed police, at least for the problem areas;
 - ✦ Consider increasing the number of officers inspecting fares at a given time so that a better coverage of the entrances and exits is achieved.

Recommendations for Decreasing Fare Evasion Rate

✦ Education, Accessibility and System Simplification

- ✦ The data clearly suggest that riders do not understand the system as well as they could. It is also clear that this lack of knowledge substantially contributes to fare evasion.
- ✦ Furthermore, TVM access has also been shown to contribute to the evasion rate. This includes an apparent complexity of figuring out what ticket to buy, TVM machines being out of order, or simply riders not being able to find a place to buy a ticket.
- ✦ We recommend that the least expensive way of reducing the fare evasion rate is to have well informed riders and to improve the accessibility of fare media. Specifically, MTA should consider issues such as:
 - ✦ Have better, simpler and more abundant signs regarding the Metro rules and fares.
 - ✦ Improve accessibility to fare media - this could be done in a form of signs explaining what to do when TVM's are not working and/or where alternative media could be obtained.
- ✦ Alternatively or concurrently with educational campaign, MTA could consider simplifying its fare system.
 - ✦ One consideration would be reducing the gamut of available media to only a few types. This would also simplify rules for fare usage and fare checking.

Recommendations for Decreasing Fare Evasion Rate

✦ Education, Accessibility and System Simplification (Cont.)

- ✦ If MTA were able to BOTH improve the ease of obtaining tickets by 10% and improve riders' knowledge (as discussed in the previous section), our model predicts a 30% reduction in evasion rate, or a change from 5.3% to 3.7%.

✦ Commuter Characteristics

- ✦ Since TVM users are more likely to evade, encouraging them to buy passes through education and advertisement or creating special "By a Pass" programs targeting specific subgroups of riders could decrease the evasion rate.
- ✦ The evasion rate is disproportionately higher among young and low-income riders. Therefore, targeting schools for an educational and or advertising campaign explaining MTA passes could have a positive effect on evasion.

Metropolitan **T**ransit **A**uthority

Fare Evasion Study

Appendix E



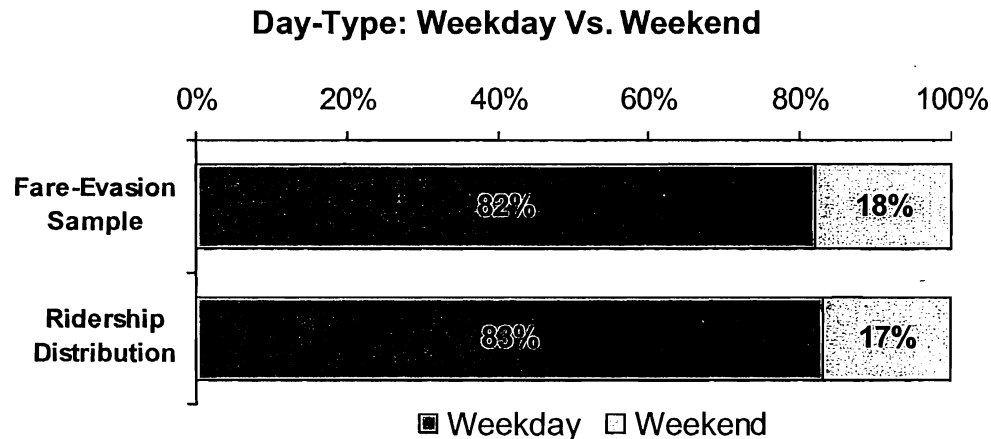
Estimating Evasion Rate

Using All Three Weighting Methods

Estimating Evasion Rate

◆ Sample Characteristics

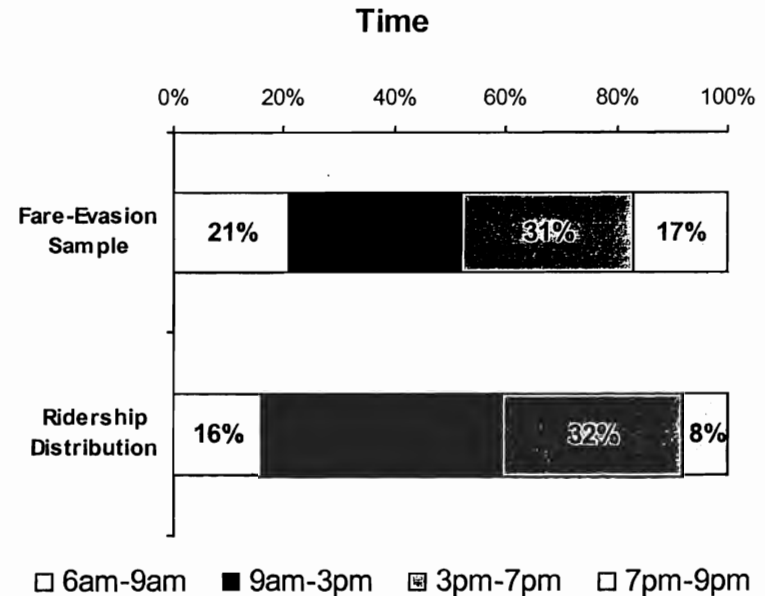
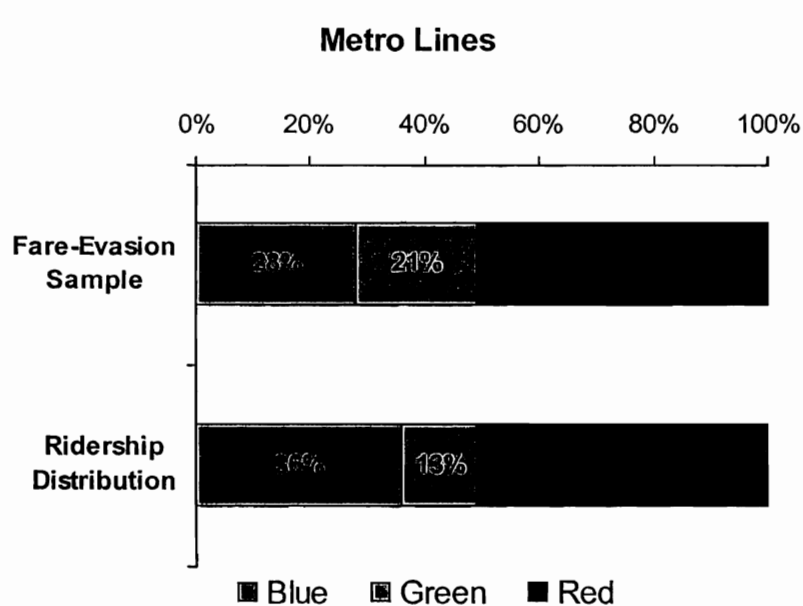
- ◆ The objective of the sampling method was to produce a sample that approximates the Rider-ship distribution on day-type, time of day and metro line.
 - ◆ The sample matches the Rider-ship distribution very well on proportion of day-type riders (weekday vs. weekend)



Estimating Evasion Rate

◆ Sample Characteristics (Cont.)

- ◆ The sample matches the Rider-ship Distribution less well on proportion of Metro Line riders, being heavier on Green Line while lighter on Blue Line riders.
- ◆ Also, the Fare-Evasion sample contains proportionately more off peak riders, specifically 6am-9am and 7pm-12am segments.



Estimating Evasion Rate

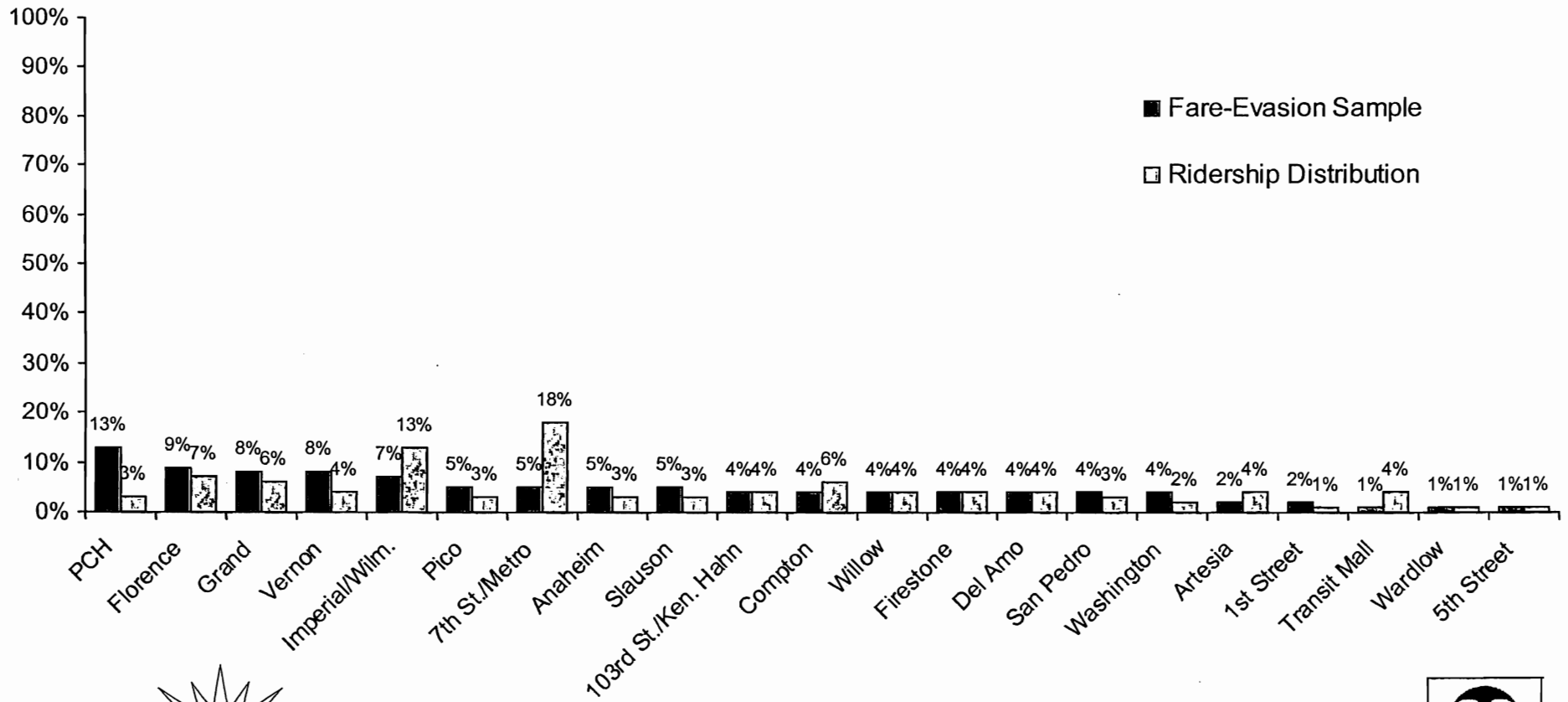
◆ Sample Characteristics (Cont.)

- ◆ The sampling method was not designed to match the proportion of riders boarding trains at various stations. However for completeness and potential influence of such disparities on the estimate of fare-evasion rate, we present these proportions for each of the three lines.
 - ◆ Clearly, some stations have much higher representation in our sample, while other much lower.

Estimating Evasion Rate

◆ Sample Characteristics (Cont.)

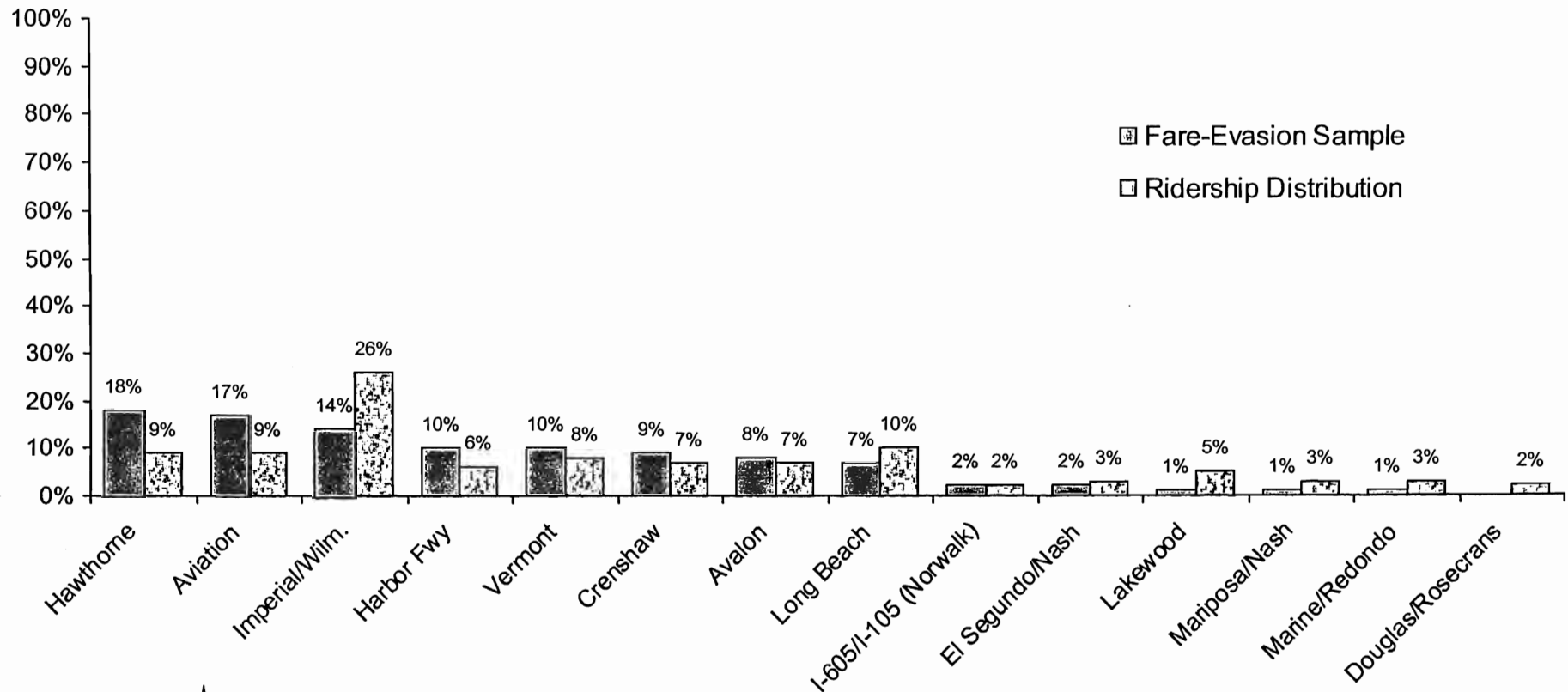
Proportion of Riders Boarding Blue Line



Estimating Evasion Rate

◆ Sample Characteristics (Cont.)

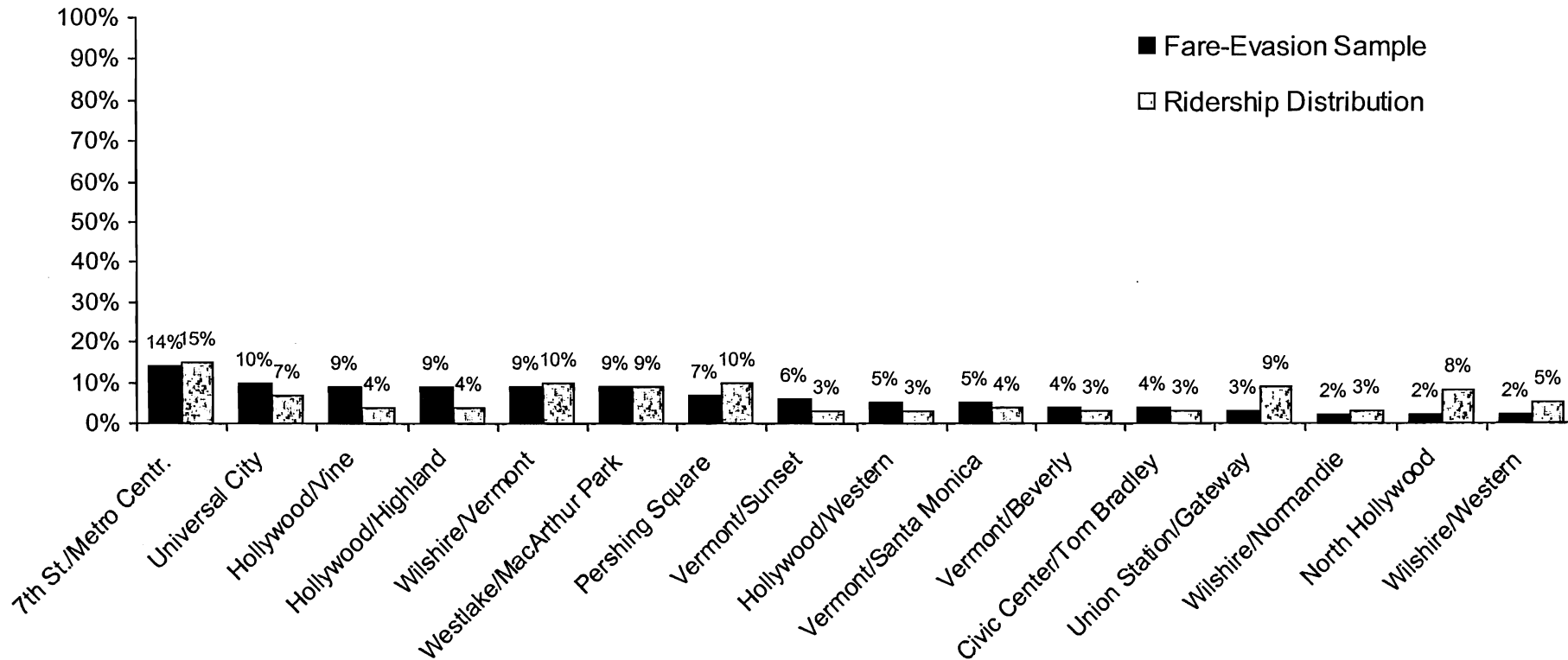
Proportion of Riders Boarding Green Line



Estimating Evasion Rate

◆ Sample Characteristics (Cont.)

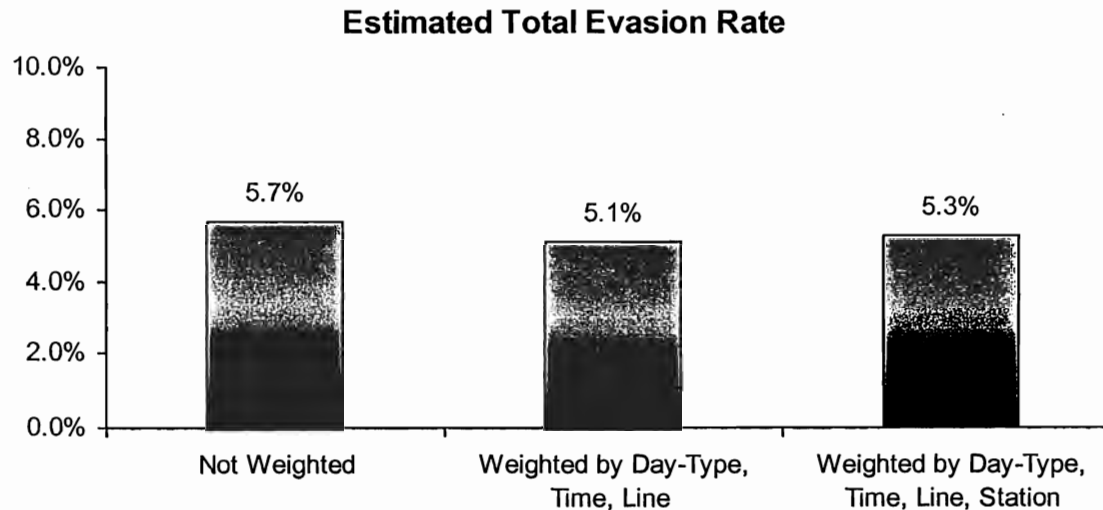
Proportion of Riders Boarding Red Line



Estimating Evasion Rate

◆ Evasion Rate Estimate

- ◆ The evaders were classified as riders who did not have a ticket, claimed to have lost it, had an invalid ticket or refused to show the ticket (the refusals accounted for .3% of evaders).
- ◆ Given this definition, the evasion rate is 5.1% to 5.7%, depending on the weighting method used.



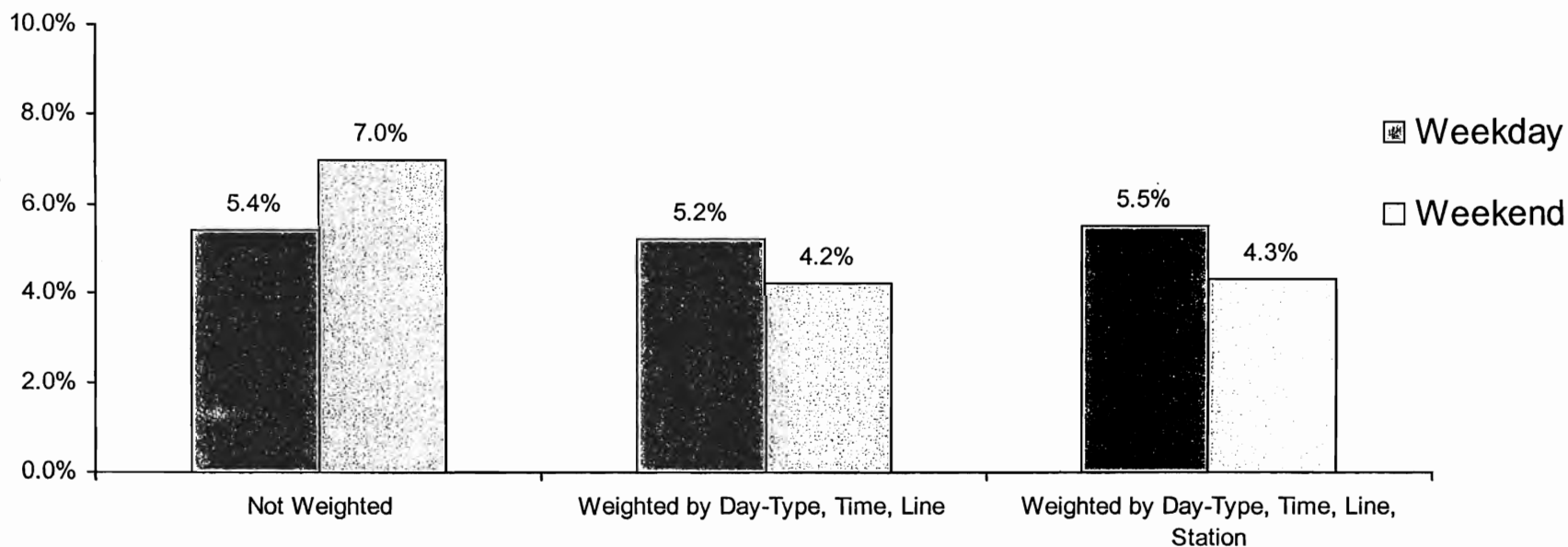
Estimating Evasion Rate

◆ Evasion Rate Estimate (Cont.)

◆ Evasion by Day-Type

- ◆ Proportion of evaders on weekdays is 5.2%-5.5%.
- ◆ Weekend rates are slightly lower when weighting is used (4.2%-4.3%), but higher when no weighting is used (7.0%).

Estimated Evasion Rate by Day-Type

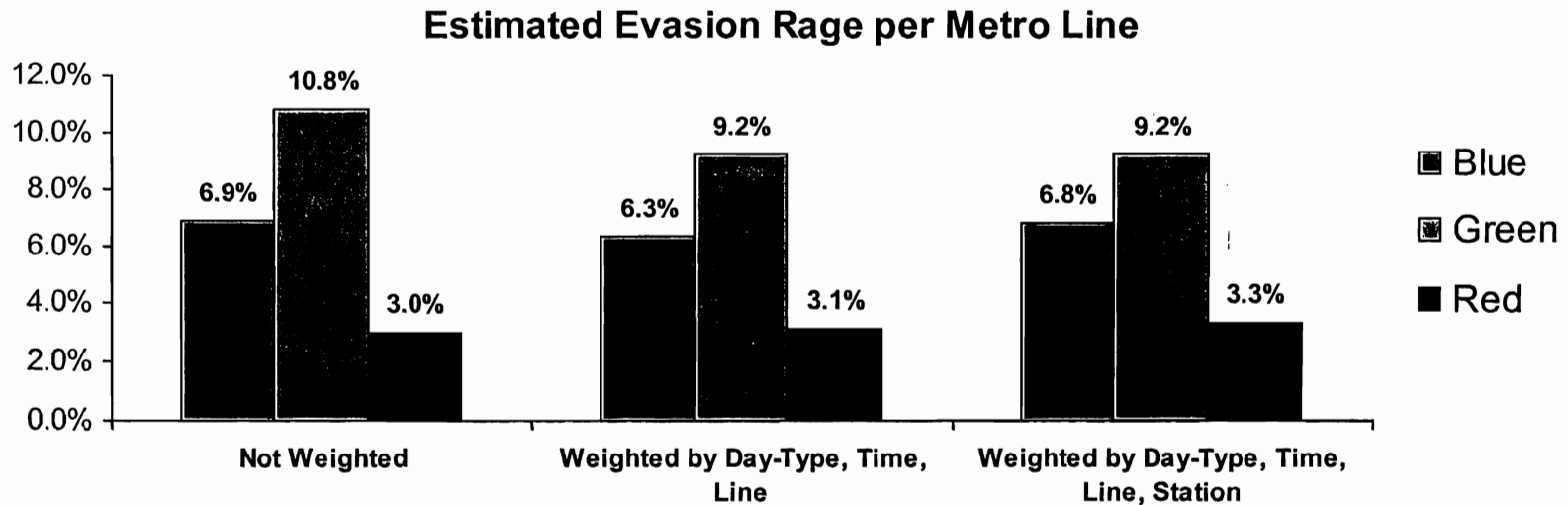


Estimating Evasion Rate

◆ Evasion Rate Estimate (Cont.)

◆ Evasion by Metro Line

- ◆ The highest proportion of evaders is amongst the Green (9.2%-10.8%) and Blue (6.3%-6.9%) line riders.
- ◆ While the lowest proportion of evaders is amongst the Red Line riders (3.0%-3.3%).



Estimating Evasion Rate

◆ Evasion Rate Estimate (Cont.)

◆ Evasion by Time

- ◆ The evasion rate during peak hours (6am-9am and 3pm-7pm) is around 3.5%.
- ◆ This rate doubles during off-peak 9am-3pm segment (about 6%) and quadruples during off-peak 7pm-12am (about 12%).

