Transportation Spending by Low-Income California Households: Lessons for the San Francisco Bay Area

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2004

Public Policy Institute of California
1994–2004

Library of Congress Cataloging-in-Publication Data
Rice, Lorien, 1968-
Transportation spending by low-income households : lessons for the San Francisco Bay Area / Lorien Rice.
p. cm.
Includes bibliographical references.
ISBN: 1-58213-090-6
1. Poor—Transportation—California—San Francisco Bay Area. 2. Transportation—California—San Francisco Bay Area—Costs. 3. Cost and standard of living—California—San Francisco Bay Area. I. Public Policy Institute of California. II. Title.

HE310.S36R53 2004
388.4'042—dc22 2004014777

Foreword

Mismatches between jobs and housing—a long-standing concern of urban economists and transportation planners—can create situations in which transportation costs make excessive demands on workers' time and earnings. Planners often describe these mismatches in terms of affordability, especially when workers conclude that they cannot afford to accept (or even seek) jobs that involve burdensome commutes.

To help the Metropolitan Transportation Commission (MTC) understand the issue of transportation affordability in the San Francisco Bay Area, Lorien Rice analyzed transportation expenditures and costs for a sample of households in metropolitan California. Her main finding is surprising: Low-income households spend about the same percentage of their budgets on transportation as do more affluent households. Low-income workers walk, carpool, and use public transit at higher rates than their more affluent counterparts; yet low-income households that own vehicles spend a larger portion of their smaller budgets on them. Taken together, these two facts help explain why households with different incomes devote the same proportion of their budgets to transportation.

Rice is careful to note that her analysis examines only one aspect of the affordability question. Low-income households may spend less on transportation precisely because they cannot afford to purchase a car; if so, we should not equate low expenditures on private vehicles with affordable transportation. At the same time, she notes that more than half of the Bay Area's low-income workers regularly drive alone to work. Although expenditure data alone cannot settle the debate over affordability, Rice's work greatly improves our understanding of what low-income households spend on different types of transportation. Responding to MTC requests, Rice also reviews over 20 strategies that have been or could be adopted to lower transportation costs for low-income families and offers suggestions for further research on affordability.

Rice's conclusions are based on the best data available, and she is cautious about what can and cannot be said on the basis of her findings. She concludes that more work can and should be done to assess the transportation needs of low-income households, and that programs to make transportation more affordable should be evaluated to assess their effectiveness and efficiency. Government subsidies should be based on an understanding of the costs and benefits of the services provided, and this report provides some of the information necessary for that understanding in the Bay Area.

David W. Lyon
President and CEO
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Summary

Transportation is an important issue for low-income households. Prohibitive transportation costs can interfere with employment prospects and economic self-sufficiency, and researchers have confirmed links between transportation and employment outcomes. To reduce transportation barriers to employment, many policymakers have implemented or proposed programs to make transportation more affordable. These programs include vouchers to cover transit or gasoline expenditures and loans or grants to purchase or repair private vehicles. Yet very little empirical research has explored actual transportation costs and affordability more generally. The affordability question is an important one, for if transportation costs are exceptionally high, low-income households may face difficult choices between mobility and access on the one hand and household necessities on the other.

This report addresses the lack of empirical research by studying the role transportation expenditures play in the finances of the Bay Area's low-income households. The report has two goals. The first is to analyze several existing datasets to arrive at a fuller understanding of transportation costs and expenditures and the factors that affect them. The second is to provide a menu of program options and research priorities for addressing transportation affordability. By focusing on expenditures, this study defers the examination of two other critical factors: the non-monetary costs of transportation (for example, time spent commuting) and the quality of transportation available to the Bay Area's low-income households. In this sense, the report is best seen as a first step in addressing the larger question of transportation affordability among low-income households.

Part I of the report includes an analysis of expenditure data for California households, estimates of transportation costs for several example commutes in the Bay Area, and an exploration of mode choice and other travel factors that influence monetary costs. Part II responds

to the Metropolitan Transportation Commission's (MTC's) request for both a menu of policy options to address transportation affordability and ideas for further research on the topic.

Key Findings

Transportation is the third-largest budget item for low-income households in California's metropolitan areas.

For low-income households—roughly the poorest 25 percent of households—only housing and food expenditures constitute larger budget shares than transportation expenditures. For all other households, transportation displaces food as the second-largest budget item.

Low-income households allocate a slightly smaller proportion of household expenditures to transportation than do other households.

Median annual transportation expenditures are $2,164 for low-income households, accounting for 13 percent of their household budget (Table S.1). At the median, all other households spend $6,569 annually on transportation, which comes to 15 percent of their budgets.

Cost appears to be a barrier to vehicle ownership among low-income households in the Bay Area.

A key difference between low-income and higher-income households is vehicle ownership rates. Two-thirds of low-income California households own vehicles, compared to 90 percent of other California households (Figure S.1). Vehicle access rates in the Bay Area indicate that 73 percent of low-income households report having access to a vehicle, compared to 94 percent of higher-income households. Similarly, in the Bay Area, 53 percent of low-income workers and 70 percent of higher-income workers drive alone to work. These differences suggest that the costs of vehicle ownership and operation are prohibitive for many low-income households. Among low-income households in California that do own vehicles, vehicle-related expenditures averaged $3,586—about 19 percent of their household budgets (Table S.1). Some low-income households have very high vehicle expenditures; 10

Table S.1

Median Annual Transportation Expenditures for California Households, by Income Group

	Low-Income Households		All Other Households	
	Dollar Amount	% of Household Budget	Dollar Amount	% of Household Budget
Total transportation expenditures for all households[a]	$2,164	13	$6,569	15
Private vehicle expenditures for vehicle users[b]	$3,586	19	$7,144	16
Public transit expenditures for transit users[c]	$360	2	$434	1

SOURCE: Consumer Expenditure Survey, Bureau of Labor Statistics, 1999–2001.

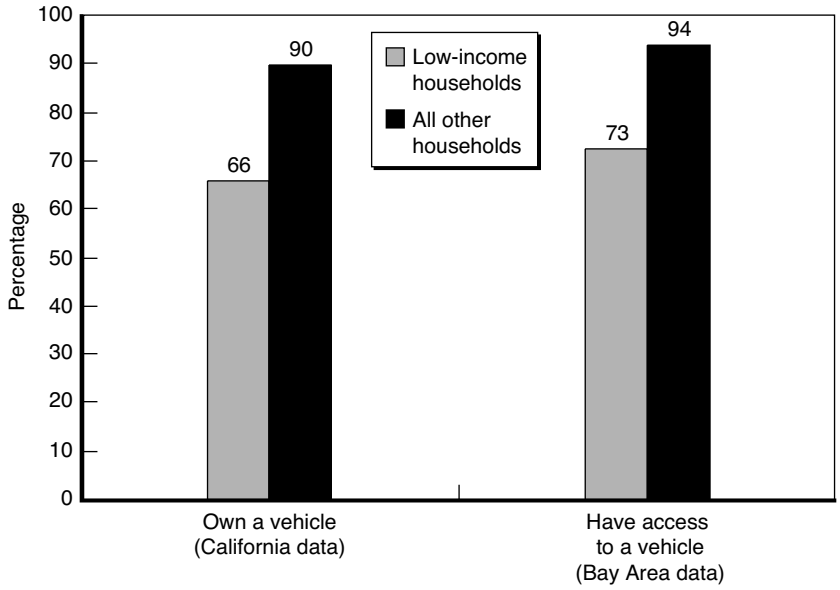
[a]This sample includes all households, regardless of vehicle ownership status or public transit use. Therefore, the averages presented include households with values of zero for each given item.

[b]This sample includes all households that own a vehicle and have private vehicle expenditures over $500. Some of these households also have public transit expenditures.

[c]This sample includes all households with public transit expenditures above $100. This includes some households that also have private vehicle expenditures.

percent of low-income households with vehicles pay 35 percent or more of their household budgets on vehicle-related expenses.

By their very nature, expenditure data do not reflect transportation outlays that were not made because the goods or services were too expensive. Because the cost of these outlays, even when they are not made, is also pertinent to the question of affordability, we conducted a separate analysis in which we estimated private vehicle costs of specific commutes in the Bay Area. We found that the cost of these example commutes ranged between 5 percent and 30 percent of the median annual income for low-income households. The variation depended on the mileage rate used to estimate the cost and on whether the commutes crossed county borders.



SOURCES: Consumer Expenditure Survey, 1999–2001; Census 2000 Public Use Microdata Sample.

Figure S.1—Vehicle Ownership and Access Rates, by Income Group

Cost is unlikely to be a barrier to transit use for most low-income households but may be a barrier for some.

Expenditure data suggest that transit costs are considerably lower than private vehicle costs. At the median, low-income households that regularly use transit spend an average of $360, or 2 percent of their total household expenditures, on transit (Table S.1). Even those in the top 10 percent of transit expenditures spend only 7 percent of their household budget on transit. Although monetary outlays appear to be lower for households that use transit than for those with private vehicles, the non-monetary costs (in terms of time as well as forgone access and opportunities) may be high.

Transit costs may be a barrier for some low-income subgroups. Again, the expenditure data do not reflect the likelihood that some households are forgoing better jobs or reducing the number of trips they make because they cannot afford extra transit costs. The analysis of sample commutes in the Bay Area indicates that transit costs account for

about 5 to 10 percent of the median annual income in low-income households. Because these figures would be even higher if they included other travel besides commutes, these results suggest (but do not show conclusively) that transit fares are unaffordable for some low-income households. When public transit transfers are not free, workers with complex commutes may be especially affected.

Low-income commuters are less likely than other workers to drive alone and more likely to carpool, walk, or travel by bus.

Although there are large differences in vehicle use rates across income levels, driving alone is still the most common way to commute for low-income workers, with over half of low-income commuters driving alone to work. Seventeen percent of low-income workers carpool, compared to 12 percent of all other workers. Twelve percent of low-income workers and 5 percent of other commuters take the bus to work. Low-income workers are over twice as likely as other workers to walk to work (7%, compared to 3%). Use rates for other modes (including Bay Area Rapid Transit (BART), trolley, ferry, and bicycle) are similar between income groups. Differences in mode choice between income groups are closely linked to differences in residential location. The distribution of mode choice is fairly similar for low- and higher-income commuters living in the same neighborhood.

Low-income workers have somewhat shorter commute times than other workers.

On average, low-income workers spend 28 minutes for each commute, in contrast to other workers who spend 30 minutes commuting. Part of the reason we see shorter commute times for low-income workers is that they walk more often, and the median duration for walking commutes is only 10 minutes. Low-income transit takers also have significantly shorter commutes than higher-income transit takers. Low-income drivers have about the same commute durations as higher-income drivers. Other research suggests that low-income workers travel shorter distances than other workers, which may be another reason why commute times are shorter.

Policy Responses and Research Needs

The data analysis, although illuminating, cannot provide definitive answers about transportation affordability—the notion that the cost of transportation should not be a barrier to access to essential destinations, such as jobs and health care. First, much of the analysis rests on expenditure data, which may not reflect the true cost of transportation if costs are prohibitively high. Second, even cost data cannot fully capture affordability, which is also a function of the costs of competing household budget items, the ability to borrow or draw on savings to cover costs, the level of transportation needs, and the quality of transportation services available. However, the analysis does suggest that private vehicle costs may hinder vehicle ownership for low-income households and that certain families may find transit costs problematic as well. Concerned about the costs of transportation, MTC requested a menu of strategies for addressing transportation affordability. In response to this request, the report lays out policy options for consideration. The policy options discussed in the report do not follow directly from the data analysis and the report does not make specific policy recommendations.

The report considers five ways to make transportation more affordable for low-income households:

1. Reduce commute expenses by enabling low-income households to locate near major job centers or transit hubs;
2. Decrease the need for spending on travel by encouraging job and service growth in or near low-income communities;
3. Reduce transportation costs for a given transportation mode or enable low-income workers to use low-cost transportation;
4. Make it easier for low-income parents to transport their children from school and child care; and
5. Increase household income directly through income subsidies or tax credits to offset the burden imposed by transportation costs.

Most policies discussed in the report fall into the third category: transportation-oriented strategies. Some of these policy options focus on reducing the costs of a particular transportation mode—for example,

providing discounted transit fares or subsidizing private vehicle costs through loans or grants. Other policy options focus on finding ways to enable low-income households to meet their transportation needs through low-cost transportation options. Examples include improvements in transit service or expansion of alternative transportation programs such as paratransit and car-sharing. The report also discusses the importance of employer involvement in transportation planning and financing.

It is beyond the scope of this report to weigh the benefits and costs of each policy option explored. However, policymakers should be mindful of potential benefits as well as costs when crafting transportation policy. Lower costs do not necessarily make families better off if they come attached to longer commute times or reduced mobility. Because no single solution will make transportation affordable for all families, a blend of targeted policies should be used. Policies should be tailored to account for differences in the geographic density of jobs and workers and differences in the needs of specific subgroups (for example, households with children, non-English speakers, and those with extremely low incomes). Whatever the mix of policy options chosen to address transportation affordability, each option must be well advertised and easy to use.

The report identifies two priority areas for future research. First, surveys of low-income Bay Area residents could help gauge the importance of transportation costs, compared to other issues such as commute time and safety. The results from such surveys could also be used to identify specific subgroups that need targeted financial assistance. A second promising area for future research is the formal evaluation of different transportation affordability programs in the Bay Area, possibly using methods of random assignment to isolate the effects of each program. A wide variety of projects addressing transportation affordability are already in place around the Bay Area, and new ones will certainly appear over time. Evaluating the success of these projects will help policymakers understand how to allocate resources most effectively to meet the transportation needs of low-income households.

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Acknowledgments

I would like to thank Deborah Reed for her insightful comments and suggestions. This report also would not have been possible without the support of the Metropolitan Transportation Commission (MTC). Evelyn Baker and Connie Soper played a vital part in organizing the project; Charles Purvis and Mike Skowronek provided helpful technical advice concerning data; and Jacob Avidon provided information about the TransLink® program. Meetings with MTC's Minority Citizens Advisory Council and the Regional Welfare-to-Work Transportation Group provided insights that helped inform the report. Amanda Bailey provided research assistance and played a crucial role in processing the data. Evelyn Blumenberg, Laura Hill, Carolyn Jeskey, Jonathan Mason, Joyce Peterson, Peter Richardson, Fred Silva, and Junfu Zhang all provided valuable comments. In addition, we thank those who attended a preliminary meeting pulled together by MTC to discuss transportation affordability issues: Elizabeth Deakin, Hans Johnson, Noreen McDonald, Paul Ong, Steven Raphael, Onésimo Sandoval, Sonya Tafoya, Brian Taylor, Michael Teitz, and Martin Wachs. Laura Paszkiewicz at the Bureau of Labor Statistics provided helpful responses to questions about the Consumer Expenditure Survey. Any errors are my own and any opinions or interpretations expressed in this report are mine alone and do not necessarily reflect the views of the Public Policy Institute of California.

1. Introduction

Costs associated with transportation can strain the already tight budgets of low-income families. To the extent that transportation costs limit the mobility of low-income households, they may also reduce access to jobs and to other destinations such as health care facilities, grocery stores, and social service agencies. Diminished access to job opportunities can lead to negative consequences in the labor market—lower employment rates and lower earnings—thereby placing even more pressure on household budgets. If transportation is unaffordable, the potential consequences for low-income households are serious. So the question arises: Is transportation affordable for low-income households, and if not, what can we do about it?

Unfortunately, measuring transportation affordability is not as easy as it may seem. Affordability depends not only on the cost of transportation but also on household income, savings, ability to borrow, the costs of other necessities, the quality of transportation services provided at a given price, and the ability of households to choose a residential location that is convenient to work and other frequent destinations.[1] Given these complexities, this report focuses on the more modest goal of understanding the monetary costs of transportation and how they interrelate with time costs and mobility.

[1]The following passage from Quigley and Raphael's recent article on housing affordability also applies well to transportation affordability: "the rhetoric of 'affordability' . . . jumbles together in a single term a number of disparate issues: the distribution of housing prices, the distribution of housing quality, the distribution of income, the ability of households to borrow, public policies affecting housing markets, conditions affecting the supply of new or refurbished housing, and the choices that people make about how much housing to consume relative to other goods. This mixture of issues raises difficulties in interpreting even basic facts about housing affordability" (Quigley and Raphael, 2004, p. 191).

Specifically, this report

- Measures how much low-income Californians spend on transportation;
- Estimates the monetary costs of specific commutes that low-income households face in the San Francisco Bay Area;
- Discusses tradeoffs among monetary costs, time costs, and mobility;
- Considers policy options for dealing with transportation affordability issues; and
- Proposes areas for further research.

Context

Researchers and social service agencies alike have long noted that transportation problems can negatively affect employment outcomes for low-income populations.[2] Recent research has focused specifically on the role of transportation in determining employment status, wages, and earnings. Several articles have documented the advantages of private automobile ownership in terms of increasing the likelihood of employment.[3] Some research has also found that transit service has a small, positive effect on employment prospects.[4]

Since the passage of federal welfare reform legislation in 1996, time limits for welfare usage have led to a greater sense of urgency for connecting low-income households to employment opportunities. This urgency generated a great deal of research and policy interest in the issue

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[2]The academic research literature on the topic extends back to an influential 1968 paper by John Kain, in which he presented evidence that physical distance from jobs helped to explain the differences in labor market outcomes between races. This concept, referred to as the "spatial mismatch hypothesis," has been the subject of a vast and rich body of articles, some of which found evidence in support of the hypothesis and others against. However, several recent survey articles come to the conclusion that the bulk of the evidence has supported the spatial mismatch hypothesis. See, for example, Holzer (1991), Kain (1992), and Ihlanfeldt and Sjoquist (1998).

[3]Ong (1996, 2002), Raphael and Rice (2002), and Cervero, Sandoval, and Landis (2002).

[4]Holzer, Quigley, and Raphael (2003), Ong and Houston (2002), Rice (2001), and Sanchez (1999).

of "welfare-to-work" transportation. When the federal government passed the Transportation Equity Act for the 21st Century (TEA-21) in 1998, $750 million was authorized for assisting low-income persons with transportation to work through the JARC (Job Access and Reverse Commute) program.

Several studies have focused specifically on the effect of transportation on the probability of leaving welfare. Others have mapped out where welfare recipients live, where jobs are located, and where the transit lines go, thereby pointing to gaps in service that need to be addressed.[5] The Bay Area's Metropolitan Transportation Commission (MTC) recently undertook its own major study to identify the spatial gaps within its nine-county region.[6] This last study, the Lifeline Transportation Network Report, also documented gaps in temporal service, identifying situations where transit does not always meet the needs of workers who work nonstandard hours.

The Public Health Institute recently conducted a study in Alameda County looking at barriers to work for participants in CalWORKs, California's version of the TANF program.[7] The study found that one-third of CalWORKs recipients cited a need for assistance with transportation and concluded that "transportation barriers were consistently found to be associated with lack of full-time work."[8] A separate report on welfare leavers in six Bay Area counties found that transportation was a barrier to full-time employment "for about 16 percent of one-parent families and 12 percent of two-parent families."[9] Although these studies underline the importance of transportation for

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[5]Coulton, Leete, and Bania (1999) and Rich and Coughlin (1998). A related article is Blumenberg and Hess (2002).

[6]Metropolitan Transportation Commission (2001b).

[7]TANF is the federal Temporary Assistance for Needy Families welfare-to-work program, which replaced the Aid to Families with Dependent Children (AFDC) entitlement program.

[8]Dasinger et al. (2002).

[9]MaCurdy, Marrufo, and O'Brien-Strain (2003), p. 26. However, this report did not find that having a travel barrier to full-time employment was a significant determinant of whether the welfare leaver was likely to return to CalWORKs (see pp. 65 and 66).

low-income households, they do not focus on the extent to which monetary costs play a role.

In contrast, many current or proposed policies focus on the perceived need to make transportation more affordable. Welfare agencies in California and throughout the country regularly provide transportation vouchers for public transit or for vehicle operating expenses. Other policies include a loan program in San Mateo County that helps low-income residents pay for large, infrequent transportation costs (such as automobile purchase or repair) and a now-discontinued pilot bus-pass program in Alameda County for low-income students. As transportation and social service agencies have tackled the transportation problems of low-income groups, the need for more information on transportation costs and how they affect low-income households has become increasingly apparent. In fact, very little research has focused on this issue directly.[10] This report looks at transportation costs and expenditures in great detail, focusing particularly on California and the nine Bay Area counties under MTC's purview.

Structure of the Report

The report proceeds as follows. Part I contains all of the data analysis. Chapter 2 provides information on the data and methods used in the analysis. Chapter 3 uses data from the Consumer Expenditure Survey to examine transportation expenditures made by California households. Chapter 4 provides cost estimates for example commutes within the Bay Area, by public and private transportation. Chapter 5 looks at underlying differences in commute behavior (such as mode choice and time of day) that help determine how monetary costs, time costs, and mobility vary between income groups. Chapter 6 draws conclusions from the data analyses performed in Chapters 3 through 5. Part II of the report responds to a request by MTC to develop a menu of policy strategies and to identify priorities for future research. Chapter 7

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[10]These include the Bureau of Transportation Statistics (2003), Surface Transportation Policy Project (STPP) (2003), and Blumenberg (2003). Polzin (2003) also addresses the issue of transportation costs, but does not focus on low-income households in particular. A sensitivity analysis in Appendix C of this report compares our results to methods used in some of these other documents.

lays out policy options for addressing affordability issues and discusses some of the advantages and disadvantages of different approaches. Because the strategy menu does not rest on the data analysis, the report does not make specific policy recommendations. Chapter 8 describes promising areas for further research on transportation affordability in the Bay Area.

Appendix A provides information on methods that cuts across the four datasets used in this report. Appendix B presents information specific to each dataset. Appendix C performs a sensitivity analysis for our key transportation expenditure results from Chapter 3. Finally, Appendix D explains the methods used for the example commute analysis.

Part I
Data Analysis of Transportation Expenditures and Costs

2. Data and Methods

In this report, we use several data sources to look separately at expenditures, costs, and commute durations across income groups. We draw inferences about the relationships among these measures based on what we discover about differences in commute behavior (e.g., mode choice) across the income groups. The report draws on four datasets—the Consumer Expenditure Survey (CES), the Census Public Use Microdata Sample 2000 (PUMS), the Census Transportation Planning Package 2000 (CTPP), and the MTC Bay Area Travel Survey (BATS).

Description of the Datasets Used

The CES dataset is a nationwide survey maintained by the Bureau of Labor Statistics to collect information on household spending behavior. We use CES data from 1999 to 2001 to examine transportation expenditures for households in metropolitan California. (Unfortunately, we are not able to look specifically at the Bay Area with the CES household-level microdata.) These microdata provide expenditure information on the different types of transportation expenditures and on other household budget categories such as food and housing.

PUMS provides individual and household level data on travel behavior from the long form of the 2000 Census. We use this dataset to analyze commute mode, minutes to work, number of vehicles, and commute hours, controlling for income level and household structure. All of the PUMS analysis uses data on the nine Bay Area counties in the MTC region. To a lesser extent, we also use the residence files from the CTPP, which allow us to look at travel behavior data at the neighborhood level, and BATS, an MTC dataset that includes roughly 15,000 households in the nine-county Bay Area.

Defining the Income Groups

The entire report is set up around three income categories across which various measures are compared: poor, low-income, and higher-income. The general idea is that the poor group includes those who are below the federal poverty level, the low-income group includes those who are below 200 percent of the federal poverty level, and the higher-income group includes those who are at or above 200 percent of the poverty level. Please note that the poor and low-income groups are not mutually exclusive: The poor group is a subset of the low-income group. The poor group contains the poorest 11 percent of households; the low-income group contains the poorest 27 percent of households, and the higher-income group is the top 73 percent. In the Bay Area, 11 percent of the poor group, 7 percent of the low-income group, and 1 percent of the higher-income group receive some sort of public assistance.

Using federal poverty thresholds has a distinct advantage over other income categorization methods because it adjusts for the structure of the household. For example, in 1999 the federal poverty threshold for a family of four (two adults and two children) was $16,895, whereas the threshold for a single parent with two children was $13,423.[1] Allowing for differences in the size and composition of the household provides a better measure of the amount of resources per person in the household than simple income cut-offs.[2]

A second benefit to using income categories based on the federal poverty rate is that it is a measure commonly used by MTC and by other researchers, which allows for ease of comparison across studies.[3] A third

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[1]Another commonly used measure is a given percentage of median family income. Median Bay Area household income in 1999, according to PUMS data, was $62,000. Thirty percent of that is $18,600, 50 percent is $31,000, and 80 percent is $49,600. By comparison, our poverty threshold for a two adult, two child family is $16,895 and our low-income threshold is $33,790.

[2]The official poverty threshold schedules are available at http://www.census.gov/hhes/poverty/threshld.html.

[3]For example, the MTC *2001 Regional Transportation Plan Equity Analysis and Environmental Justice Report* defines low-income households using the 200 percent of poverty threshold (pp. 3–5).

advantage to this approach is that it allows us to create similar income categories across the four datasets, although the income categories are not exactly the same across the datasets. Some datasets reported only a range for income, rather than an exact income amount, for example.

The most important difference between datasets in terms of income-group categorization is that we created categories for the Consumer Expenditure Survey based on expenditure data, whereas for the other datasets, we used income data because consumption measures are not available in those datasets. The CES analysis uses expenditures instead of income for three main reasons:

1. Consumption is a better measure than annual income of households' long-term economic resources.[4]
2. Income data are missing for almost a fifth of the California CES sample; classifying based on expenditures allows us to keep these households in the analysis.[5]
3. For other households, income is not missing but it appears to be underreported, biasing the expenditure results upward for low-income households and downward for other households.

These reasons are discussed further in the CES section of Appendix A. (In addition, a sensitivity analysis showing how results change when based on income data is presented in Appendix Table C.1 and discussed in Appendix C.) The methods used for classifying households into income categories for each of the four datasets are discussed in more detail in Appendix A.

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[4]From U.S. Census Bureau (2003): "A basic premise of this view is that families and individuals derive material well-being from the actual consumption of goods and services rather than from the receipt of income per se; hence, it is appropriate to estimate their consumption directly. One argument that is often made for preferring consumption as the resource definition rather than income is that consumption is a better estimate of families' long-term or 'permanent' income" (p. 3).

[5]Because the households that have missing income data have lower total expenditure levels than the average, dropping households with missing income data from the analysis would probably eliminate proportionally more low-income households than higher-income households.

Identifying Example Commutes

In Chapter 4, where we calculate the costs of some example commutes within the Bay Area, we began by identifying likely origin points for commutes made by low-income residents in each county. We pinpointed the two neighborhoods or Traffic Analysis Zones (TAZs) in each county with the highest number of low-income residents.[6] Next, we identified likely commute destinations by finding the city within each county with the highest number of jobs. We then calculated the cost of traveling from the commute origin points to the commute destination points, using public transit and private vehicle transportation. For each county of residence, we calculated both "within-county" commute costs and "intercounty" commute costs. For the within-county commutes, we calculated the costs of traveling from the two low-income neighborhoods chosen for that county to the city within that same county that has the most jobs. For between-county commutes, we calculated the costs of traveling from those same two low-income neighborhoods to the most job-rich city in the next most popular destination county for that origin county. (See Figures 4.3 and 4.4 for maps of the within-county commutes and Figure 4.5 for the intercounty commutes.) Further details on the methods of calculating these costs are presented in Chapter 4 and in Appendix D.

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[6]There is one exception to this rule: In Santa Clara County, Stanford CDP (Census Designated Place) has the highest number of low-income residents because of the large number of students attending Stanford University. Therefore, for Santa Clara County, this analysis uses the two TAZs with the highest numbers of low-income residents that were not in Stanford CDP.

3. Transportation Expenditures in Metropolitan California

This chapter uses expenditure data from the CES to analyze household expenditures on transportation and to calculate the share of the household budget that goes toward transportation. The Consumer Expenditure Survey provides data on all transportation costs (not just work-related costs) for Californians living in metropolitan areas. To protect the confidentiality of the survey respondents and to ensure the statistical viability of the estimates, the dataset does not allow us to isolate Bay Area households. However, after we present the estimates for all metropolitan California households, we discuss how representative these numbers are likely to be for the Bay Area. We report findings for three different groups—poor, low-income, and higher-income households—based on the level of total household expenditures.[1] Please note that the low-income group includes those in the poor group.

Differences in Mean Annual Transportation Expenditures Across Income Groups

The CES data on metropolitan California households indicate that the dollar amount spent on transportation increases dramatically as income rises. On average, low-income households pay $2,906 annually for transportation, which is only about 40 percent of the $7,606 amount paid by higher-income households (Table 3.1). Average transportation expenditures for the poor group are $1,719, even lower than for the low-income group as a whole.

As shown in the top portion of Table 3.1, the bulk of household transportation expenditures goes toward costs associated with private

[1] In this chapter, the term "household" is used to refer to the actual unit of observation, which is the "consumer unit." In a small fraction of the sample, there is more than one consumer unit (financial decisionmaking unit) within the household.

Table 3.1

Mean Annual Transportation Expenditures for California Households, by Income Group

	Poor	Low-Income	Higher-Income
Average expenditures for the entire income group[a] ($)			
Public transit	88	74	56
Private vehicle	1,626	2,825	7,535
Other (taxi and private school bus)	5	6	14
Total transportation expenditures[a]	$1,719	$2,906	$7,606
% public transit users[b]	19	16	8
Public transit expenditures for transit users	$444	$451	$651
% private vehicle users[c]	45	61	89
Private vehicle expenditures for vehicle users	$3,340	$4,326	$8,232
% with zero transportation expenditures	19	11	1

SOURCES: Consumer Expenditure Survey, 1999–2001.

[a]This sample includes all households, regardless of vehicle ownership status or public transit use. Therefore, the averages presented include households with values of zero for each given item.

[b]This sample includes all households with public transit expenditures above $100. This includes some households that also have private vehicle expenditures. Six percent of the poor group, 4 percent of the low-income group, and 2 percent of the higher-income group had positive public transit expenditures amounting to less than $100 and these households were excluded from this calculation.

[c]This sample includes all households that own a vehicle and have private vehicle expenditures over $500. Some of these households also have public transit expenditures. Five percent of the poor households with vehicles, 4 percent of the low-income households with vehicles, and 1 percent of the higher-income households with vehicles had positive vehicle expenditures amounting to less than $500 and these households were excluded from this calculation. In addition, some households without vehicles have vehicle expenditures greater than $500 and these households were also excluded from this calculation (7% of the poor households, 8% of the low-income households, and 7% of the higher-income households).

vehicles, with a much smaller amount going toward public transit, and a very minor amount going toward taxis and private school buses. On average, private vehicle costs constitute 76 percent of transportation costs for poor households, 85 percent for low-income households, and 97

percent for higher-income households. However, the dollar figures presented in the top section of Table 3.1 are averages across *all* households within each income group regardless of whether the household owns a vehicle. Although the percentage of transportation dollars spent on private vehicles on average is very high across all income levels, this pattern obscures the fact that a fair number of households in the poor and low-income categories have little or no vehicle-related expenditures.

In fact, one main reason for the large difference in total transportation costs across the income groups can be explained by the enormous differences between income groups in terms of the percentage who own and regularly use their own vehicles (along with the fact that private vehicle expenditures are substantially greater than public transit expenditures). Table 3.1 shows differences in the percentage of "vehicle users" across income groups, where we define vehicle users to be households with a vehicle and with private vehicle expenditures above $500. (We exclude vehicle owners with expenditures less than $500 to provide a better estimate of costs related to regular use of a vehicle.)

Table 3.2 illustrates how vehicle use rates compare to vehicle ownership and access rates. Eighty-nine percent of higher-income households are classified as vehicle users, whereas only 61 percent of low-income households and 45 percent of poor households are so classified (Table 3.2). Transportation expenditures are also higher for the higher-

Table 3.2

Vehicle Use, Vehicle Ownership, and Vehicle Access Rates
(in percent)

	Poor	Low-Income	Higher-Income
% of CES households with vehicles and > $500 in vehicle expenses (metropolitan California)	45	61	89
% of CES households with vehicles, all levels of vehicle expenses (metropolitan California)	50	66	90
% of PUMS households with access to a vehicle (metropolitan California)	73	78	95
% of PUMS households with access to a vehicle (Bay Area)	70	73	94

SOURCES: Consumer Expenditure Survey, 1999–2001, and Census 2000 Public Use Microdata Sample.

income group because among households that regularly own and use a vehicle, private vehicle expenditures are much higher as income goes up: $3,340 for vehicle users in the poor group, $4,326 for those in the low-income group, and $8,232 for those in the higher-income group (Table 3.1).

Although average public transit expenditures are lower for higher-income households than for the other groups, transit expenditures for the minority of households that regularly use transit show the opposite pattern. For these households, transit expenditures actually increase with income. The average annual expenditure on public transit for a poor household is $88 and the corresponding figures for low-income households and higher-income households are $74 and $56, respectively (Table 3.1). This pattern, where average transit expenditures decline as income rises, is entirely due to differences in the share of each income group that uses public transportation. Table 3.1 reveals that roughly twice as many poor and low-income households as higher-income households regularly use public transportation, with transit use at 8 percent for higher-income households, 16 percent for low-income households, and 19 percent for poor households (where regular transit use is defined as spending more than $100 annually for transit). Of those households that regularly use public transportation, the higher-income households in fact spend more on public transit than the low-income households (about $650 for higher- income households and about $450 for both low-income and poor households).[2]

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[2]The percentage of those using public transportation and the percentage who own vehicles does not sum to 100. A number of households did not report either transit or private vehicle expenditures (19% of the poor group, 11% of the low-income group, and 1% of the higher-income group—see Table 3.1). In addition, some households reported not owning vehicles but did report private vehicle expenditures, and we did not include these households when calculating "private vehicle expenditures for vehicle users." This group appears to be a mixture of households that were mislabeled as not owning a vehicle when they actually did (e.g., they report vehicle registration and insurance costs) and households that simply contributed toward expenditures for vehicles that they did not actually own (e.g., they report only gasoline expenditures). We also excluded some households from the calculation of the means because they had extremely low expenditure amounts, which suggested that they did not regularly use this mode of transportation. These cutoffs are noted in the notes to the table.

Components of Vehicle-Related Expenditures

Although the CES dataset does not break down public transportation expenditures by transit mode (bus, rail, etc.), it does allow us to investigate detailed components of vehicle-related expenditures, which we discuss in this section. Table 3.3 illustrates the breakdown of vehicle-related expenditures into various components, restricting the sample to those who own and regularly use vehicles. Once we limit the sample to households that are regular vehicle users, the sample size becomes relatively small for the poor group, so we do not report those results in this section. Some component costs are very different for the low-income and higher-income groups, but others are not. However, for

Table 3.3

Vehicle-Related Expenditures for California Households with Vehicles

	Low-Income		Higher-Income	
	Dollar Amount	% of Vehicle-Related Expenditures	Dollar Amount	% of Vehicle-Related Expenditures
Capital cost[a]	2,041	40	3,859	42
Vehicle finance charges	176	3	437	4
Insurance	546	15	1,086	14
Gasoline and motor oil	1,084	31	1,557	23
Maintenance and repairs	381	9	1,021	12
State and local registration	60	1	182	2
Other[b]	38	1	90	1
Total vehicle-related expenditures	4,326	100	8,232	100

SOURCES: Consumer Expenditure Survey, 1999–2001.

NOTES: This sample includes all households that own a vehicle and have private vehicle expenditures above $500. This includes some households that also have public transit expenditures. Columns may not sum to 100 percent because of rounding.

[a]Capital cost is the amortized cost of the purchase of the vehicle, using a five-year straight-line depreciation.

[b]The category "Other" includes parking, driver's license, vehicle inspection, and auto club membership.

all of the categories, higher-income households spend higher dollar amounts than low-income households.

Vehicle capital cost is the largest component of vehicle expenditures for both low-income and higher-income vehicle users, accounting for about 40 percent of the total. (The capital cost of the vehicle is the amortized cost of the purchase of the vehicle, calculated using a five-year straight-line method of depreciation.) Although capital cost as a percentage of all vehicle expenditures is fairly similar between the income groups, the dollar amount is almost twice as high for the higher-income group ($3,859 compared to $2,041 for the low-income group). The numbers in Table 3.3 are averages across all households with vehicles, including households that bought or did not buy vehicles during the data collection period. Therefore, actual annual vehicle-related expenses will differ greatly for individual households depending on whether the household bought a vehicle within the past year. For vehicle purchasers, total annual vehicle expenditures will be much higher than the numbers shown at the bottom of Table 3.3, whereas for those who have not purchased a vehicle in the past year, total annual vehicle expenditures will be lower.

After the capital cost of the vehicle, the next largest components of vehicle expenditures for both income groups are gasoline and motor oil, insurance, and maintenance and repairs (Table 3.3). Low-income households with vehicles pay about $1,000 annually on gasoline and motor oil, which accounts for about a third of all vehicle expenditures. Higher-income households pay more (about $1,500), although a smaller share of their vehicle-related costs goes toward gas and motor oil (23%). Insurance expenditures for low-income households with vehicles are about $500 annually—about half the amount higher-income households pay. Low-income vehicle users pay around $400 annually for maintenance and repairs, whereas higher-income households pay slightly over $1,000. For both low-income and higher-income vehicle owners, state and local registration fees account for 2 percent or less of total annual vehicle-related costs. Parking expenses, driver's licenses, vehicle

inspection, and auto club membership fees taken together account for only 1 percent of vehicle-related costs.[3]

One main difference in transportation costs between income groups lies in the purchase price of the vehicles. Table 3.4 depicts vehicle purchases for households that have purchased vehicles within the interview period. We report the mean and median vehicle purchase prices for the two income groups, where the median is the midpoint at

Table 3.4

Vehicle Purchase Information for California Households That Purchased a Vehicle During the Interview Period

	Low-Income	Higher-Income
Mean purchase price of vehicles[a] ($)	6,597	14,818
Median purchase price of vehicles[a] ($)	3,326	13,621
% buying used vehicles	89	63
% financing vehicle purchases	51	61
Median age of car purchased (years)	11	3
Purchasers as a % of the total income group	4	7

SOURCES: Consumer Expenditure Survey, 1999–2001.

NOTE: Numbers are not presented for the poor group because the low sample size for poor vehicle purchasers renders the results unreliable.

[a]Mean and median purchase prices are in 2000 dollars.

[3]For comparison purposes, we cite national cost estimates from the American Automobile Association (AAA): depreciation, 48 percent ($3,738); finance charges, 10 percent ($744); insurance, 14 percent ($1,102); gas and motor oil, 14 percent ($1,080); maintenance and repairs, 8 percent ($615); license, registration, and taxes, 3 percent ($205); and tires, 4 percent ($270) (American Automobile Association, 2003). These numbers are based on vehicles purchased new in 2003, whereas our CES numbers also include used vehicles. This distinction may help account for the differences in estimates for depreciation (capital cost) and finance charges. This may also account for the difference in gasoline and motor oil expenses because older vehicles may be substantially less fuel efficient. The Federal Highway Administration (FHWA) arrives at a somewhat different distribution of expenditures: depreciation, 35 percent; financing, 15 percent; insurance, 27 percent; fuel tax, 4 percent; fuel cost without taxes, 9 percent; maintenance, 5 percent; repairs, 2 percent; and state fees, 3 percent (Federal Highway Administration, 2004). Regarding methodology, the FHWA document that we consulted stated only that the FHWA estimates were "based on the 2001 editions of 'The Complete Car Cost Guide' and 'Complete Small Truck Guide' from Intellichoice, Inc. and sales figures from 'Automotive News'" (Federal Highway Administration, 2003, p. 4).

which half of the households in the group pay more and half of the households pay less, and the mean is the simple average across the households within the income group. Whether we look at the median or the mean, it is clear that purchase prices are substantially higher for the higher-income group than for the low-income group. The median purchase price of vehicles bought by low-income households ($3,326) is less than a quarter of the median price of vehicles purchased by higher-income households ($13,621). The difference between the means is slightly less dramatic than the difference between the medians; the mean for low-income vehicle purchasers is $6,597 compared to $14,818 for higher-income vehicle purchasers. That the mean is about twice the value of the median for the low-income group is an indication that the distribution of purchase prices is skewed: Half of the low-income households are paying less than $3,326 for their vehicles, but some low-income households at the top end of the vehicle price distribution are paying many times that price for their vehicles, which is bringing up the mean.[4]

Purchase prices are lower for the lower-income group in part because those households are much more likely to buy used vehicles.[5] Table 3.4 shows that there is a 26 percentage-point difference between the low-

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[4]Although purchase price varies dramatically across income groups, the percentage of households that finance their vehicle purchase varies as well. Only 51 percent of low-income vehicle purchasers finance their purchase, compared to 61 percent of the higher-income group. This difference may be partly a function of the way we have constructed the income groups for this chapter. Division into low-income and higher-income categories depends on total household expenditures, which in turn depends in part on the capital cost of the vehicles in the household, which will be higher as the purchase price of the household vehicle increases. Households at the margin between the low-income and higher-income groups may face a choice between buying a fairly expensive car with the use of credit (thereby putting themselves into the higher-income group) or buying a fairly inexpensive car with cash (thereby putting themselves into the low-income group). Therefore, the apparent difference between the income groups in credit use cannot be used as evidence to support the hypothesis that low-income households borrow less because they have less access to credit markets, because this pattern is built into our data to a certain extent. That is, our finding does not provide conclusive evidence either way regarding the relative availability of credit to different income groups.

[5]For comparison purposes, see Dixon and Garber (2001, pp. 42–43), who estimate the average price of a used vehicle in California to be $5,500, using Kelley Blue Book data. For the average price of a new vehicle bought in California, they use a value of $22,500, using data from the American Automobile Manufacturers Association.

income households and the higher-income households in terms of the percentage that buy used vehicles (89% versus 63%). Table 3.4 also demonstrates that the median age of the vehicle bought by a low-income household is considerably higher than that of a vehicle bought by a higher-income household: 11 years as opposed to three.[6]

Transportation As a Share of Total Household Expenditures

Just as the dollar amount of transportation expenditures increases as income increases, transportation expenditures as a share of the household budget also increases, but not to such a striking degree (Table 3.5). Mean annual household expenditures for higher-income households ($50,900) are almost three times higher than they are for the low-income group ($17,655). For the poor group, mean annual household

Table 3.5

Transportation Expenditures As a Share of Total Household Expenditures for California Households

	Poor		Low-Income		Higher-Income	
	Dollar Amount	% of Household Budget	Dollar Amount	% of Household Budget	Dollar Amount	% of Household Budget
Housing	5,507	43	6,871	40	18,800	37
Food	3,269	26	3,895	23	6,744	14
Transportation	1,719	11	2,906	14	7,606	16
Personal insurance and pensions	564	4	1,019	5	5,654	10
Apparel and services	564	4	720	4	1,998	4
Health care	404	4	685	4	2,201	5
Entertainment	400	3	604	3	2,661	5
Education	49	1	96	1	911	1
Other expenses	519	4	857	5	4,326	8
Total expenditures	12,994	100	17,655	100	50,900	100

SOURCES: Consumer Expenditure Survey, 1999–2001.

NOTE: Columns may not sum to 100 percent because of rounding.

[6]Using data from the Nationwide Personal Transportation Survey (NPTS), Murakami and Young (1997) found that the average car in low-income families is 10 years old, compared to 7.3 years for other households.

expenditures are $12,994. Because the total budget rises almost as fast as transportation spending does across income groups, this results in relatively modest differences in mean transportation budget shares across income groups (11%, 14%, and 16% for the poor, low-income, and higher-income groups, respectively). Although these differences are not large, they are all statistically significant.

We have seen that the lower the income level of the household, the less is spent on transportation, both in absolute dollar amounts and in the share of the budget that goes toward transportation. A sensitivity analysis reported in Appendix C demonstrates that this pattern holds true even if we examine transportation expenditures as a share of income rather than as a share of expenditures (Table C.1, Case 3). This finding suggests that transportation costs may not be as big a problem as we would have thought had we found very high budget shares. However, this result cannot be interpreted as conclusive evidence that transportation is affordable for low-income households. Here we outline several reasons why budget shares do not necessarily reflect affordability.

First, low expenditures on a particular budget item can sometimes be a signal that the item is priced prohibitively high. For example, low levels of spending on vehicle purchases or insurance may indicate that these items are out of reach of the household budget. If transportation costs are high, low-income households may respond by limiting the number of trips that they take, choosing jobs closer to home, driving without insurance, or switching to cheaper modes of transportation—all of which would result in relatively low transportation expenditures.

Second, affordability depends on the quality of an item as well as its cost. Low- and higher-income households may spend a similar share of their budget on transportation, but the value of the transportation services that they receive in return may differ dramatically.[7] Because this

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[7]In addition, when comparing transportation expenditures across income groups, it is important to be aware that transportation expenditures for higher-income households may provide many goods or services that have little to do with transportation in the sense of providing access or mobility. Private vehicles may also offer prestige, an expression of self, aesthetic pleasure in driving, off-roading capabilities, a state-of-the-art sound system, etc. Polzin (2003) states that "Spending on transportation is a function of what people

report looks primarily at cost and not at quality of transportation service, we cannot draw conclusions about the relative return on transportation expenditures for low- and higher-income households.

Third, low-income households spend 63 percent of their budget on food and housing, leaving only 37 percent available for transportation and everything else, whereas higher-income households spend only 51 percent of their budget on food and housing, leaving 49 percent available for transportation and other items. This pattern could be interpreted as evidence that low-income households do not spend as much on transportation because they do not have much discretionary income left after paying for their basic necessities. However, the connection between transportation decisions and housing location decisions makes it difficult to disentangle the interplay between the transportation budget share and the housing budget share.

Three items in the household budget increase their share as long-term income rises—transportation, personal insurance and pensions, and "other expenses." The budget shares of housing and food both decline (Table 3.5). The other budget categories—apparel and services, health care, entertainment, and education—consume approximately the same proportion of the household budget regardless of the income level of the household.

To identify the budgetary tradeoffs that low-income households face, we divided the low-income sample into equal thirds—those with low, medium, and high transportation expenditures. On average, low-income households in the top tercile spend 27 percent of their budget on transportation and those in the bottom tercile spend only 4 percent on transportation, for a difference of 23 percentage points (Table 3.6). In dollar amounts, those in the top tercile of transportation expenditures spend $4,189 more on transportation than those in the bottom tercile of transportation expenditures ($5,268 for the top tercile less $1,079 for the bottom tercile).

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have to spend on transportation and what people choose to spend on transportation." We hypothesize that for higher-income households, a greater proportion of transportation spending is going to "what people choose to spend on transportation" than is true for low-income households.

Only two categories in the budget seem to adjust to higher transportation costs: housing and food.[8] The results in Table 3.6 indicate that for households with similar levels of total household expenditures, those with higher transportation expenditures offset those higher transportation expenditures primarily by cutting back on housing expenditures. Those in the top tercile of transportation expenditures spend $2,265 less on housing than those in the bottom tercile. There is also a smaller decrease in expenditures on food for those in the high transportation tercile ($578).[9] Notably, none of the other budget categories seems to change much at all between transportation expenditure terciles.

Table 3.6

Budgetary Tradeoffs for Low-Income California Households

	Difference Between Top and Bottom Transportation Expenditure Tercile	
	Dollar Amount	% Points of the Budget Share
Housing	–2,265	–15
Food	–578	–4
Transportation	4,189	23
Personal insurance and pensions	77	1
Apparel and services	–188	–1
Health care	–210	–1
Entertainment	–75	0
Education	–36	0
Other expenses	–268	–1

SOURCES: Consumer Expenditure Survey, 1999–2001.

[8]To control for the level of total household expenditure, we divided the sample into 10 groups based on the level of total household expenditures. For each of these decile groups, we calculated the differences between the low and high transportation expenditure terciles. We then averaged these differences across the groups to arrive at the numbers in Table 3.6.

[9]Note that even though we made these estimates separately by deciles of total household expenditures, we still find that within each decile, the households in the top tercile of transportation costs have total expenditures on average about $1,000 more than the households in the bottom tercile of transportation costs. For this reason, the dollar amounts in Table 3.6 sum to roughly $1,000, and the increase in transportation costs is not entirely offset by reductions in the other categories.

The results from Table 3.5 indicate that low-income households are making different tradeoffs between housing and transportation expenditures than are higher-income households (i.e., low-income households spend a smaller budget share on transportation and a larger budget share on housing). However, it is not clear how these tradeoffs work. Perhaps low-income households do not spend as much on transportation because the areas where they can afford to live are generally well-served by transit. Perhaps low-income households live in high-density areas with rents that constitute relatively high budget shares because they know that they cannot afford a private vehicle. It is hard to tell from the data the extent to which the budget allocation numbers simply represent differing preferences between low-income and higher-income households for housing and transportation or choices that are imposed upon the low-income households by a lack of affordable housing or the cost of transportation. In any case, it is worth noting that housing and transportation combined make up roughly 54 percent of the budget for all three income groups.

Variation in Transportation Expenditures

Although the means of transportation costs and transportation budget shares presented in Table 3.5 conveyed some important information about differences between income groups, Table 3.7 uses alternative measures to provide a better sense of what happens for households in the middle of each income category and to explore the degree of variation within each. The table shows that the median transportation cost is $765 for the poor group, $2,164 for the low-income group, and $6,569 for the higher-income group. These median values are all below the mean values shown in Table 3.5, indicating that a minority of households within each income group have relatively high transportation spending. The mean and median are particularly different for the poor group ($1,719, compared to $765—the mean being more than twice the median), indicating that the poor group has some very high spenders who are inflating the mean.

In addition to looking at means and medians as measures of the "average" transportation cost, it is also informative to consider how much variation in transportation costs exists within each income group.

Table 3.7

Variation in Transportation Expenditures Within Income Groups for California Households

	Poor		Low-Income		Higher-Income	
	Dollar Amount	% of Household Budget	Dollar Amount	% of Household Budget	Dollar Amount	% of Household Budget
All Transportation Expenditures for All Households						
10th percentile	0	0	0	0	1,464	4
50th percentile	765	8	2,164	13	6,569	15
90th percentile	4,647	27	7,019	31	14,699	29
Mean	1,719	11	2,906	14	7,606	16
Transit Expenditures for Transit Users[a]						
10th percentile	124	1	132	1	124	0
50th percentile	350	3	360	2	434	1
90th percentile	887	8	887	7	1,488	3
Mean	444	4	451	3	651	2
Vehicle Expenditures for Vehicle Users[b]						
10th percentile	960	8	1,199	8	2,384	6
50th percentile	2,800	19	3,586	19	7,144	16
90th percentile	6,537	34	8,124	35	15,207	30
Mean	3,340	20	4,326	21	8,232	17

SOURCES: Consumer Expenditure Survey, 1999–2001.

[a]This sample includes all households with public transit expenditures above $100.

[b]This sample includes all households that own a vehicle and have private vehicle expenditures over $500.

Table 3.7 also shows the 10th and 90th percentiles of costs for each income category. Low-income households in the bottom 10 percent of the transportation expenditures distribution have $0 in annual expenditures on transportation, whereas at the top end of the distribution, 10 percent of households have costs that exceed $7,019. The results are somewhat similar for the poor group. These large differences between the 10th and 90th percentiles indicate a high level of

variation in transportation costs within the poor and low-income groups, with those on the high end paying over three times as much as the median family within that income group. For the higher-income group, there is an even bigger difference in the dollar amount spent by those at the 10th percentile and those at the 90th percentile, with the middle 80 percent having transportation costs that lie between $1,464 and $14,699.

The distribution of the transportation budget share is somewhat similar across the three income categories. The 10th percentile value of the transportation budget share is less than 5 percent, and the 90th percentile of the budget share is around 30 percent, for all three groups. There is more variation in the 50th percentile across the income groups than in the 10th and 90th percentiles, with poor households spending only 8 percent of their budget on transportation, low-income households spending 13 percent, and higher-income households spending 15 percent. Note that the medians of the transportation budget share are all lower than the means, particularly in the poor group.

The second and third panels of Table 3.7 break out expenditures for transit users and for vehicle users. The numbers for transit indicate that transit expenditures make up a small share of total household expenditures. Even low-income households in the top 10 percent of transit expenditures spend only 7 percent of their budget on transit. For low-income private vehicle users, on the other hand, we find that the median budget share for vehicle expenditures is 19 percent and that those in the top decile of vehicle expenditures pay 35 percent of total household expenditures toward vehicle costs. In contrast to the findings for overall transportation expenditures, low-income vehicle users pay a higher budget share than higher-income vehicle users toward vehicle-related expenditures. Median budget shares for vehicle expenditures are 19 percent for the low-income group, compared to 16 percent for the higher-income group.

One conclusion to be drawn from Table 3.7 is that for a subset of each income group, the budgetary burden of transportation costs is much higher than for the typical household in their income group. The next several sections of this chapter present more detailed information on

some of the household characteristics that we found to be most strongly associated with having higher transportation expenditures.[10]

Our first finding regarding transportation spending and characteristics of households is that within each income group the mean of transportation expenditures is always substantially higher for households with children. As shown in Table 3.8, these expenditures are more than twice as high for low-income households with children than for those without children ($4,166 to $1,656). The difference between poor households with and without children is even more conspicuous ($2,566 to $787). The difference between higher-income households with children and without is not nearly as striking ($9,197 to $6,761).

To some extent, the differences in transportation expenditures between households with and without children are connected to greater

Table 3.8

Transportation Expenditures and Vehicle Ownership Rates in California, by Presence of Children in the Household

	Poor		Low-Income		Higher-Income	
	No Children	With Children	No Children	With Children	No Children	With Children
Total household expenditures ($)	8,384	17,188	12,427	22,924	45,575	60,933
Transportation expenditures ($)	787	2,566	1,656	4,166	6,761	9,197
% of household budget spent on transportation	8	14	12	17	16	17
% vehicle users[a]	26	62	46	77	87	92

SOURCES: Consumer Expenditure Survey, 1999–2001.

[a]This sample includes all households that own a vehicle and have private vehicle expenditures over $500.

[10]We performed some exploratory regression analysis to identify characteristics of households with particularly high or low transportation budget shares. In brief, we found after controlling for total household expenditures, the following types of households had higher transportation expenditures: households with children, married households, larger households, home-owning households, households with younger householders, and households that were not on any sort of public assistance. We found no significant effect of the race of the head of the household or of the number of children in the household. In regressions limited to households with children, we found that transportation expenditures were higher for households with children over age 18.

overall household expenditures for households with children. Total household expenditures for low-income households with children are about twice the expenditures of households without children ($22,924, compared to $12,427). Households with children will have higher expenditures simply because they contain more individuals and household costs increase as the number of household members needing transportation increases.

The presence of children in the household does not have much effect on the transportation budget shares of higher-income households, but it does have a notable effect on those in the lower-income levels. Table 3.8 indicates that higher-income households without children have transportation budget shares only 1 percentage point lower than higher-income households with children (16% versus 17%). However, the difference in budget shares between households with and without children is larger for the lower-income groups—12 percent for low-income households without children versus 17 percent for low-income households with children; corresponding percentages for poor households are 8 percent and 14 percent.

The final line of Table 3.8 suggests that the differences in the dollar amounts of transportation expenditures between households with and without children are connected to differences in vehicle use rates across the groups. Poor and low-income households without children are much less likely than their counterparts with children to regularly use a vehicle. The differences are enormous. Low-income households without children have a 46 percent vehicle use rate, whereas low-income households with children have a 77 percent vehicle use rate—a difference of 31 percentage points. The results are similar for the poor group, although vehicle use is lower overall for that group. This pattern makes sense: Poor and low-income households with children would understandably be more inclined than households without children to own vehicles because of the increased need for speed, geographic mobility, and schedule flexibility when children are present. Having children in the home means trips to school and child care centers, which may turn the commute to work into a complicated and time-consuming process, especially if the household must rely on public transit. However, there is not a large difference in vehicle use rates between higher-income

households with and without children (5 percentage points). Above, we mentioned that the transportation expenditures of higher-income households appear to be less sensitive than the transportation expenditures of low-income households to the presence of children; here we see that the same is true of vehicle use rates as well.

Using PUMS data, we found that differences in vehicle ownership rates between low-income households with and without children persisted even after we controlled for the age of the householder. We also found that car ownership rates differed very little by the age of the head of householder within each income subgroup. Car ownership rates for low-income households with children differed by a maximum of 3 percentage points between the age categories, and similar results were obtained for the low-income households *without* children.[11] We also looked for differences in expenditures based on the number and age of the children in the household but did not find any strong patterns related to these factors. Somewhat surprisingly, we found that the number of children did not have any statistically measurable effect on transportation expenditures. The age of the children had no effect either, except for households with children over age 18, which had somewhat higher expenditures.

Transportation expenditure data from the Consumer Expenditure Survey do not permit us to isolate work-related expenditures from nonwork-related expenditures, but we find some evidence that expenditures are higher for employed households. One might expect to see higher transportation expenditures when there are more employed adults in a household because most employed adults commute and unemployed adults do not, although this difference may be offset by job search trips by the unemployed. Households with fewer employed adults may also make fewer trips simply because their income is lower and they have less to spend on transportation.

The dollar amount of transportation expenditures is much lower for households with no earners than for households with any earners (Table 3.9). However, the number of employed adults in households with earners does not seem to have much further effect on the dollar amount

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[11] See the bottom of Table 5.13 for details.

Table 3.9

Transportation Expenditures for California Households with Two Adults, by the Number of Earners in the Household

	Poor			Low-Income			Higher-Income		
	No Adult Earners in Household	One Adult Earner in Household	Two Adult Earners in Household	No Adult Earners in Household	One Adult Earner in Household	Two Adult Earners in Household	No Adult Earners in Household	One Adult Earner in Household	Two Adult Earners in Household
Total household expenditures	$10,838	$15,299	$14,705	$13,790	$19,805	$21,119	$39,058	$56,536	$59,952
Transportation expenditures	$1,419	$2,094	$2,403	$1,823	$3,363	$4,011	$6,089	$8,083	$8,630
% of household budget spent on transportation	12	13	15	13	16	18	16	17	16
% vehicle users[a]	41	65	59	54	80	77	91	92	92

SOURCES: Consumer Expenditure Survey, 1999–2001.

[a]This sample includes all households that own a vehicle and have private vehicle expenditures over $500.

paid for transportation. We limit the sample in Table 3.9 to households with two adults to assure that we are measuring differences associated with having a greater number of earners, as distinct from differences associated with simply having a greater number of adults in the household. Controlling for the number of adults in this manner, we find that the higher the number of earners in a low-income household, the greater the transportation budget share. However, this increase seems fairly modest, rising only by 5 percentage points between the "No Adult Earners in the Household" category and the "Two Adult Earners in the Household" category.

Last, we find that the rate of vehicle use for the lower-income groups is also tied to whether there are employed adults in the household. Only about 40 percent of poor households with no earners seem to use a vehicle regularly, whereas the vehicle use rate for poor households with any earners is around 60 percent. The pattern is similar, but higher, for the low-income group, with vehicle use rates of about 50 percent for households with no earners, and roughly 80 percent for households with any earners.

Geographic Comparisons

The results reported up to this point in the chapter have been based on data for households living in California metropolitan areas. This section compares several main findings for metropolitan California with the metropolitan areas in the rest of the country. The final section of this chapter uses aggregate data to compare the San Francisco metropolitan area with other metropolitan areas throughout the United States.

Table 3.10 shows that metropolitan Californians in all three income groups spend a slightly higher dollar amount on transportation than do people living in metropolitan areas in the rest of the United States. Annually, all three income groups pay roughly $300 more on transportation than those households in the corresponding groups in the rest of the country. Although Californians pay more for transportation, they also earn more, so that the median transportation share of the

Table 3.10

Comparison of California with the Rest of the United States

	California			Rest of the U.S.[a]		
	Poor	Low-Income	Higher-Income	Poor	Low-Income	Higher-Income
Averages for the entire income group[b]						
Annual household expenditures	$12,994	$17,655	$50,900	$11,052	$15,551	$44,649
Total transportation expenditures	$1,719	$2,906	$7,606	$1,436	$2,573	$7,306
Public transit	$88	$74	$56	$61	$55	$62
Private vehicle	$1,626	$2,825	$7,535	$1,368	$2,509	$7,228
Other	$5	$6	$14	$8	$8	$16
% of household budget spent on transportation						
Median	8	13	15	6	12	17
Mean	11	14	16	11	15	17
% transit users[c]	19	16	8	14	11	8
Public transit expenditures for transit users	$444	$451	$651	$429	$487	$734
% vehicle users[d]	45	61	89	41	59	89
Private vehicle expenditures for vehicle owners	$3,340	$4,326	$8,232	$3,037	$4,043	$7,960
% who purchased vehicles during the interview quarter	(e)	4	7	(e)	4	8
Mean vehicle purchase price	(e)	$6,597	$14,818	(e)	$7,334	$13,723
Median vehicle purchase price	(e)	$3,326	$13,621	(e)	$4,862	$13,000

SOURCES: Consumer Expenditure Survey, 1999–2001

[a]The CES Rest of the U.S. sample is limited to consumer units residing inside a Metropolitan Statistical Area. All California consumer units in the CES sample reside inside an MSA.

[b]This sample includes all households, regardless of vehicle ownership status or transit use. Therefore, the averages presented include households with values of zero for each given item.

[c]This sample includes all households with public transit expenditures above $100.

[d]This sample includes all households that own a vehicle and have private vehicle expenditures above $500.

[e]Information on car purchases made by the poor group is not reported because of the small sample size of poor households that purchased a vehicle during the interview period.

household budget turns out to be virtually identical between California households and households in the rest of the United States for each income category—that is, about 7 percent for poor households, about 12 percent for low-income households, and about 16 percent for higher-income households.

The average annual public transit expenditures for those low-income households in California that regularly use public transit is lower than elsewhere in the United States ($451 compared to $487). However, the result reverses when the average is taken over the entire population of low-income households ($74 compared to $55). This comes about because a greater percentage of the low-income households in California use public transit than elsewhere in the United States (16% compared to 11%). Higher-income households in California use public transit about as much as higher-income households elsewhere (roughly 8%).

One main reason that Californians have higher transportation expenditures than those in the rest of the United States is because they pay more in private vehicle expenditures. For low-income households with vehicles, the difference in vehicle expenditures between California and the rest of the United States is roughly $300. Low-income California households have rates of regular private vehicle use that are about the same as low-income households elsewhere—roughly 60 percent. For low-income households that purchased a vehicle, purchase prices for vehicles are slightly lower in California than in the rest of the United States, but for the higher-income group, California vehicle purchase prices are slightly higher than elsewhere.

This next section makes use of a separate CES dataset to compare transportation expenditures in the San Francisco Bay Area to other metropolitan areas around the country. The Bureau of Labor Statistics provides a version of the CES data that is aggregated to the level of the Metropolitan Statistical Area (MSA), and this MSA-level dataset allows us to make comparisons across Metropolitan Statistical Areas but does not allow us to calculate results separately by income group.

Of the 28 Metropolitan Statistical Areas covered by the CES MSA-level data, the San Francisco MSA ranks fourth in terms of the dollar amount spent on transportation annually (Table 3.11). Only Anchorage, Dallas-Ft. Worth, and Houston have higher transportation

Table 3.11

Comparison of the San Francisco Metropolitan Area with Other Metropolitan Areas in the United States

Metropolitan Area[a]	Average Annual Transportation Expenditures ($)	Transportation Expenditures as a % of Total Household Expenditures[b]	Sum of Transportation and Housing Expenditures as a % of Total Household Expenditures[c]
Tampa	8,522	23	55
Phoenix	8,884	21	53
Cleveland	8,240	21	54
San Diego	9,572	21	58
Houston	9,644	21	51
Dallas-Ft. Worth	9,732	20	51
Cincinnati	8,039	20	52
St. Louis	7,997	20	49
Kansas City	7,667	20	51
Pittsburgh	7,037	19	48
Detroit	7,864	19	52
Miami	7,466	19	55
Seattle	8,387	18	52
Denver	8,399	18	54
Anchorage	9,793	18	51
Atlanta	6,817	18	55
Los Angeles	7,903	18	55
Milwaukee	6,850	17	51
San Francisco	9,609	17	54
Minneapolis-St. Paul	8,740	17	48
Chicago	7,804	17	53
Philadelphia	6,739	17	53
Boston	6,465	17	53
Baltimore	6,795	17	51
Portland	7,359	17	51
Washington, D.C.	7,730	16	52
New York	7,149	15	52
Honolulu	6,149	14	47
Average[d]	7,884	18	53

SOURCES: Consumer Expenditure Survey, 1999–2001.

NOTES: Total transportation expenditures at the MSA level differ from total transportation expenditures reported elsewhere in this report. MSA transportation totals include money spent on out-of-town travel, vehicle leases, and other vehicle expenses that

Table 3.11 (continued)

we include in the "other expenditure" category rather than the transportation category. See Appendix B for details.

[a]Generally, the information provided refers to a Consolidated Metropolitan Statistical Area (CMSA) wherever a CMSA exists and refers to an MSA wherever a CMSA does not exist. See Appendix B for details on what is included in each metropolitan area.

[b]Because household-level data are not available at the MSA level, the numbers reported here show the ratio of average transportation expenditures to average household expenditures, rather than the average of the household's ratio of transportation expenditures to total expenditures, which is what we report elsewhere in this chapter. See Appendix A for details regarding the differences between these two measures.

[c]The numbers reported here show the ratio of the sum of average transportation expenditures and average housing expenditures to average household expenditures. See the previous note.

[d]The average across the MSAs is weighted by the number of consumer units in each MSA.

expenditures than San Francisco. With an annual transportation expenditure of $9,609, San Francisco's transportation costs are 20 percent higher than the average of $7,884. However, because total household expenditures are also high in the San Francisco area, San Francisco ranks much lower in terms of the budget share going toward transportation. San Franciscans pay 17 percent of their total expenditures on transportation, which is virtually the same as the average across the 28 MSAs included in this sample.[12]

Comparing San Francisco to other California metropolitan areas, we find that San Francisco has a somewhat lower budget share for transportation expenditures than San Diego and about the same budget share as Los Angeles. Elsewhere, we calculate the transportation budget share across all households in all metropolitan California areas and find it to be similar to that in San Francisco (16%), even though dollar expenditures are much higher for San Francisco ($9,609) than for metropolitan California as a whole ($6,389). This pattern suggests that the results from the CES microdata presented in Table 3.1 through

[12]The average was weighted by the number of consumer units (households) in each MSA.

Table 3.10 have lower expenditure figures than what we would find if we were able to look specifically at Bay Area households, but that the budget shares are fairly similar to actual transportation budget shares for San Francisco area households. However, we do not know for certain if this is true within each income group or just in the aggregate.

Table 3.11 presents the sum of housing and transportation expenditures as a percentage of total expenditures. San Franciscans spend 54 percent of their total budget on housing and transportation. The figure is about the same for Los Angeles, but San Diego has the highest share of spending on housing and transportation of all 28 metropolitan areas (58%). The percentage of the household budget going toward housing and transportation together for all metropolitan households in California is identical to that for the San Francisco Bay Area (54%).

San Francisco has a similar number of vehicles per household to Los Angeles and San Diego. This is a somewhat unexpected finding, given that Census data show that public transit use is higher in the San Francisco Bay Area than in either of those metropolitan areas. With PUMS data, we calculate that 9.5 percent of employed adults in San Francisco commute by public transit compared to only 4.6 percent in Los Angeles and 3.3 percent in San Diego. Average public transit expenditures are higher in San Francisco than in these two other metropolitan areas, probably primarily because of greater transit use rates rather than higher fares, but we do not have individual-level data to verify that conjecture.

Gasoline expenditures are higher in San Francisco than in Los Angeles and San Diego, but not by much ($100 per year or less). Vehicle purchase prices are higher in San Diego than in San Francisco or in Los Angeles. Other vehicle-related expenditures looked fairly comparable across the three MSAs, although these were slightly lower in San Diego. The PUMS data indicate that the percentage of households with access to a vehicle is either 90 percent or just above 90 percent for all metropolitan households in California.

By investigating transportation expenditure data, this chapter finds that transportation expenditures constitute a fairly moderate portion of total expenditures for the average low-income household. However,

among the low-income group, there is considerable variation in the size of the transportation budget share, with some households spending nothing and others spending 30 percent or more toward transportation. Vehicle ownership in particular seems to be a strong factor in determining how much of the household budget goes toward transportation. The findings in this chapter indicate that vehicle-related expenditures are rather high and transit costs are relatively low, but because the expenditure data exclude information on the cost of items that are not purchased, we cannot necessarily assume that these same patterns accurately represent the relative costs of these modes. The next chapter addresses the issue of costs more directly.

4. Costs of Illustrative Bay Area Commutes

Whereas the previous chapter examined expenditures for all local travel, this one estimates costs for some example commutes in the Bay Area, using current transit fares and vehicle mileage rates. Because expenditure data exclude cost information for trips that are regarded as too expensive, transportation expenditure levels can be difficult to interpret. The cost estimates in this chapter provide a basis for comparison, to check whether the patterns identified in the previous chapter also hold true for costs, or whether they apply only to expenditures.

The first step in estimating costs for Bay Area commutes was to determine where low-income people live. Figure 4.1 depicts the geographic distribution of the low-income population within each census tract. Note that some census tracts have high concentrations of low-income persons but are sparsely populated, such that they have a fairly low *number* of low-income persons. Figure 4.2 shows the distribution of the number of low-income persons throughout the Bay Area. This map illustrates what the numbers in Table 4.1 tell about the distribution of workers across counties, by income level. Alameda County has the highest number of poor and low-income Bay Area workers (with 25.6% of the poor workers and 23.1% of the low-income workers). Santa Clara County follows as a close second, with 23.4 percent of the Bay Area's poor workers, and 22.2 percent of the low-income workers. San Francisco has about 15 percent of poor and low-income Bay Area workers, and Contra Costa County has about 11 percent of both groups. Together, these four counties hold almost three-quarters of the Bay Area's poor and low-income workers.

After identifying where low-income workers live, the next step was to identify where they work. Table 4.2 describes general commute

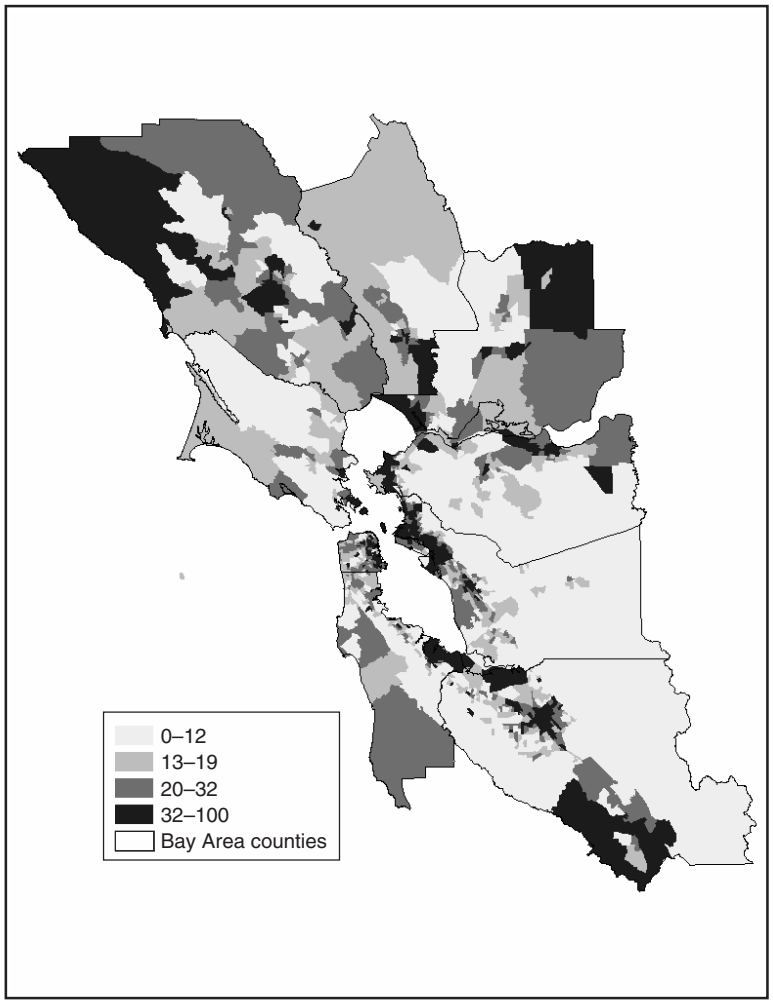

Figure 4.1—Percentage of Low-Income Persons in the Bay Area, Census 2000 Tract Level

patterns for low-income and higher-income Bay Area residents. For the Bay Area as a whole, about 80 percent of low-income workers and 70 percent of higher-income workers work in their county of residence. San Mateo, Contra Costa, and Solano Counties have the lowest percentages

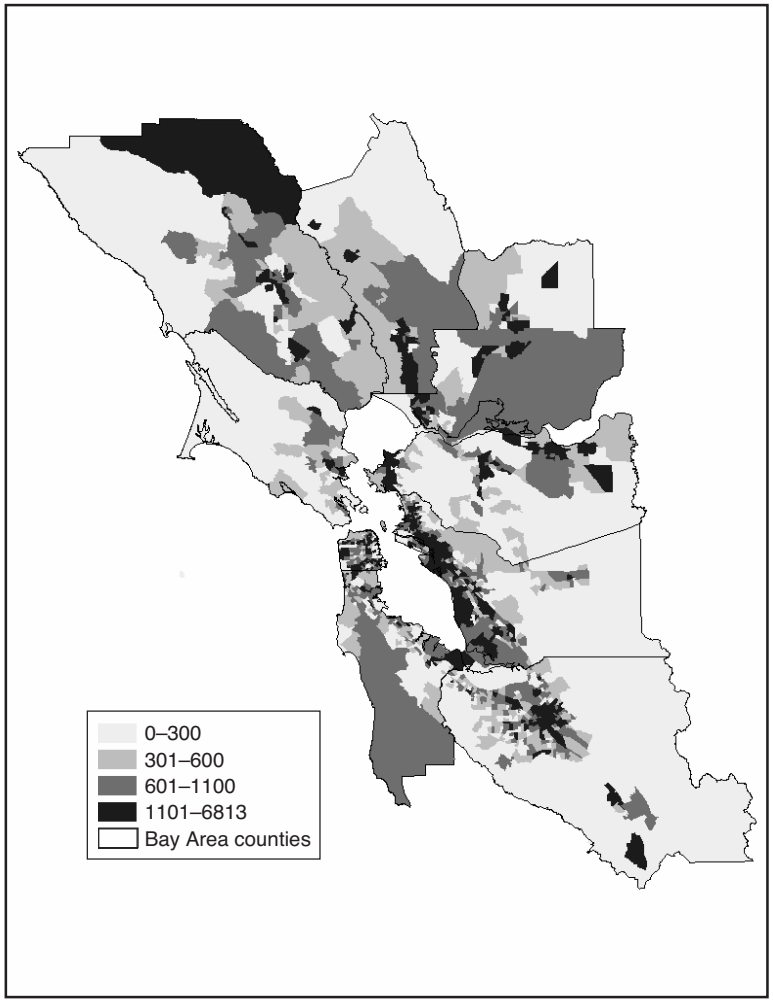

Figure 4.2—Number of Low-Income Persons in the Bay Area, Census 2000 Tract Level

of low-income workers commuting to work destinations within their own county, but even in these three counties the majority (roughly 70%) work inside the county. Santa Clara has the highest proportion of both

Table 4.1

County of Residence for Bay Area Workers, by Income Group

County	% of Poor Workers	% of Low-Income Workers	% of Higher-Income Workers	% of All Workers
Alameda	25.6	23.1	20.2	20.5
Contra Costa	10.8	11.6	13.6	13.4
Marin	3.5	3.3	3.9	3.8
Napa	2.2	2.3	1.7	1.8
San Francisco	14.8	15.2	12.3	12.6
San Mateo	7.5	8.2	11.0	10.7
Santa Clara	23.4	22.2	25.5	25.1
Solano	5.0	5.8	5.2	5.3
Sonoma	7.1	8.3	6.6	6.8

SOURCE: Census 2000 Public Use Microdata Sample.

low-income workers and higher-income workers who stay within the county to work (about 90% for both).[1]

For each of the nine Bay Area counties, we identified the two neighborhoods with the highest number of low-income residents.[2] For these two low-income neighborhoods, we then chose likely destination cities inside and outside the county. The PUMS data do not have information on the city within each county to which low-income workers most commonly commute: In the absence of that information, we use the city with the most jobs in the destination county.[3] (Chapter 2 and Appendix D both have further details on the

[1]Note that the percentage of workers who stay within the county to work is not exogenously determined but is linked to the location decision of the workers. Workers who know that vehicle ownership would impose a heavy monetary burden for them are more likely to choose a residential location where they will not have to travel to another county to work.

[2]The geographic unit that we used was the Traffic Analysis Zone (TAZ), which we refer to as a "neighborhood" throughout this report. A TAZ usually includes one or more Census blocks, block groups, or Census tracts. Note that we selected TAZs with the highest number of low-income residents, not those with the highest ratio of low-income to higher-income residents. The TAZs that we selected often have high numbers of higher-income residents as well.

[3]By the time of publication, more detailed information on job locations for low-income workers might be available through Part 2 of the Census Transportation Planning Package, "Detailed Workplace Tabulations."

Table 4.2

Place of Work Comparison for Low-Income and Higher-Income Workers

County of Residence	Workers Making Within-County Commutes (%)	Most Common Intercounty Destination	Workers Commuting to the Most Common Destination County (%)
Low-Income			
Alameda	75.6	San Francisco	9.6
Contra Costa	67.1	Alameda	16.6
Marin	76.4	San Francisco	12.2
Napa	87.8	Contra Costa	3.4
San Francisco	82.8	San Mateo	8.3
San Mateo	67.0	San Francisco	15.7
Santa Clara	90.4	Alameda	3.7
Solano	70.0	Contra Costa	7.0
Sonoma	88.8	Marin	4.8
Average for the Bay Area (weighted by the number of workers)	78.9		
Higher-Income			
Alameda	65.2	San Francisco	11.1
Contra Costa	55.9	Alameda	22.5
Marin	60.0	San Francisco	25.7
Napa	75.9	Solano	6.9
San Francisco	75.8	San Mateo	11.0
San Mateo	57.5	San Francisco	20.1
Santa Clara	87.6	San Mateo	5.1
Solano	54.5	Contra Costa	13.5
Sonoma	80.1	Marin	9.3
Average for the Bay Area (weighted by the number of workers)	70.5		

SOURCE: Census 2000 Public Use Microdata Sample.

methods used for this analysis.) Figure 4.3 depicts the within-county commutes that we identified for the northernmost counties in the Bay Area, Figure 4.4 depicts the within-county commutes for the central and southern counties, and Figure 4.5 depicts the between-county commutes for the entire Bay Area.

We estimated public transit costs by using Geographic Information Systems (GIS) data to identify the transit providers that

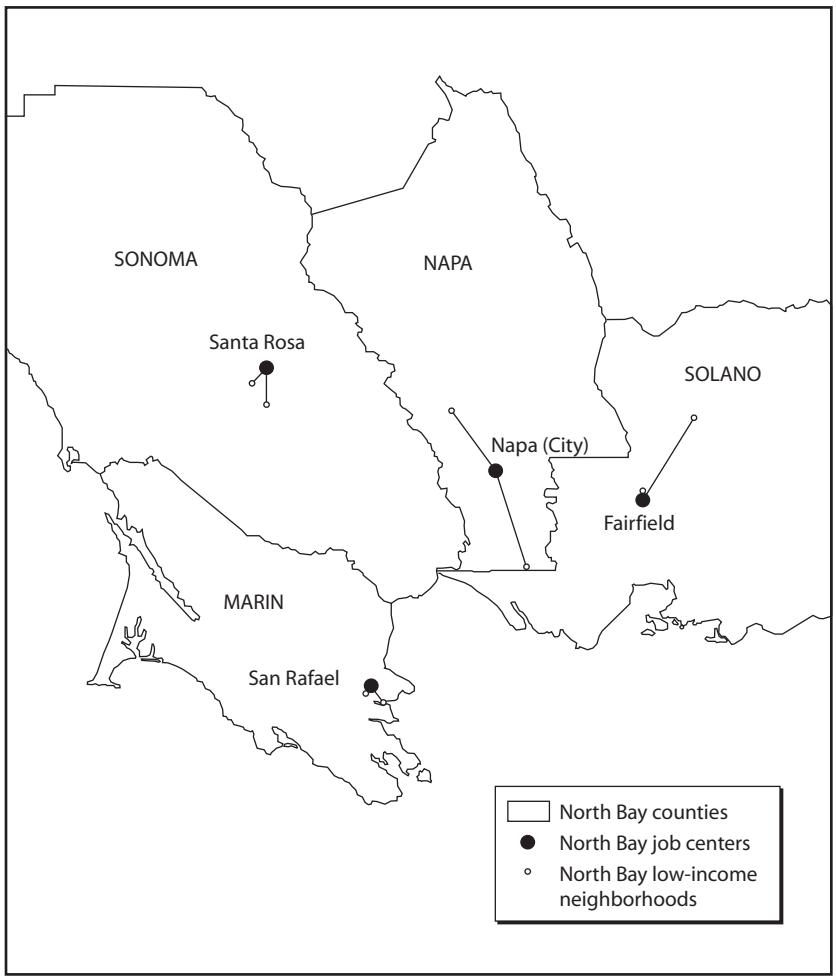

Figure 4.3—Illustrative Intracounty Commutes, North Bay

serve the two low-income neighborhoods identified for each county. We then obtained information from the transit agencies regarding the transit fares and transfer fees that would be required for each commute. Using these fares, we calculated commute costs for one adult rider. When a day pass was available and was less expensive than traveling without a day pass, we used its cost to calculate the annual

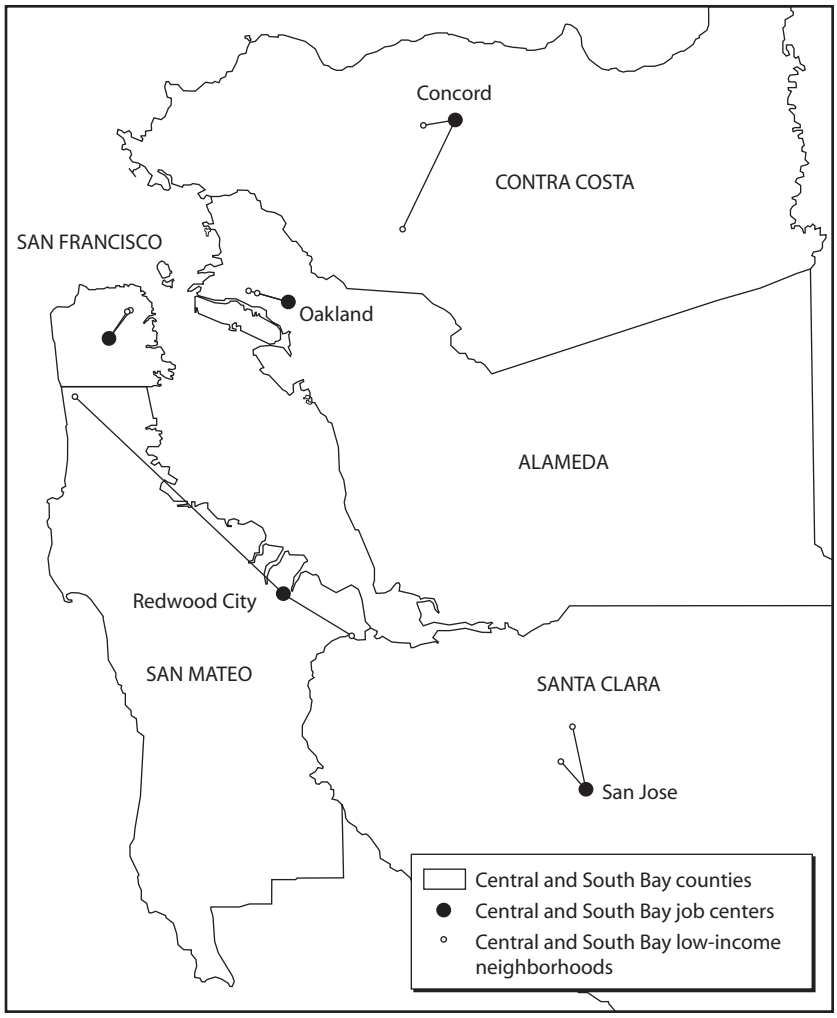

Figure 4.4—Illustrative Intracounty Commutes, Central and South Bay

cost of travel. We also calculated what the annual cost would be if the worker could use a discount, such as a monthly pass or a 40-ride pass.

We calculated private vehicle costs by ascertaining the distance between each neighborhood and the destination city and then

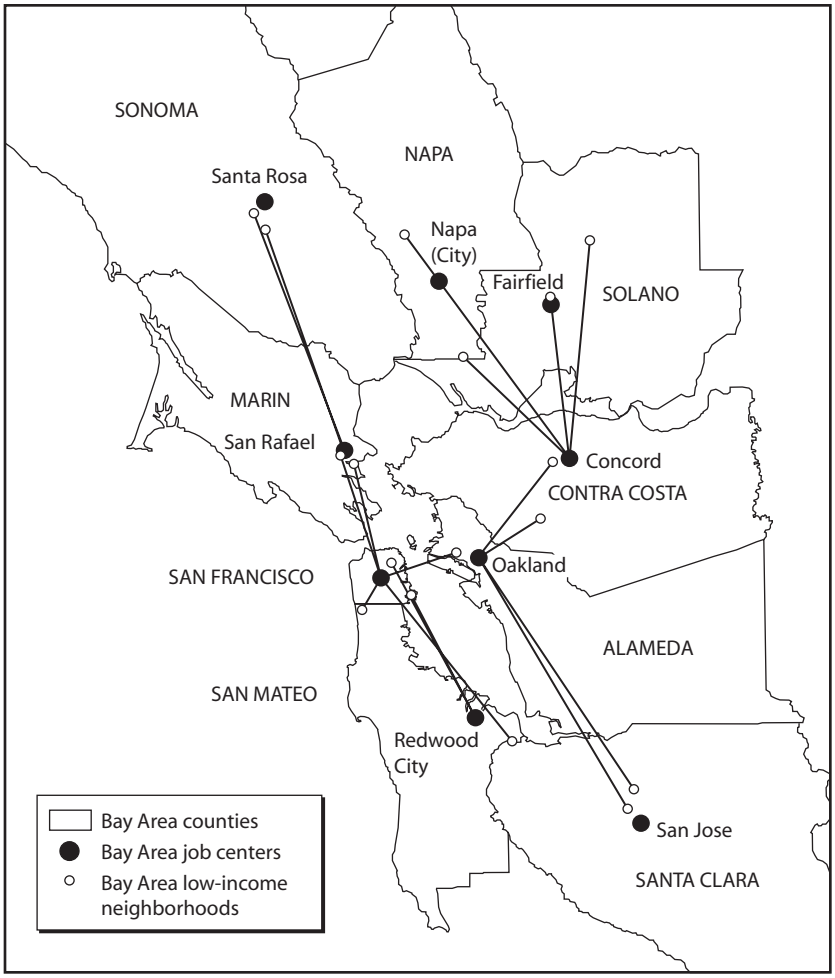

Figure 4.5—Illustrative Intercounty Commutes, Bay Area

multiplying those distances by a mileage rate and adding the cost of bridge tolls where appropriate. We did not include parking costs and we used straight-line distances between the origin point and the destination point, not the exact number of miles traveled. We use three mileage rates for the calculations: the Internal Revenue Service (IRS) mileage rate of 36¢ per mile, the Federal Highway

Administration (FHWA) mileage rate of 46.7¢ per mile, and the American Automobile Association (AAA) mileage rate of 51.7¢ per mile.[4] The costs were then annualized based on an assumption of 50 work weeks per year (i.e., 500 work trips annually).

The estimates of public transit costs are probably more reliable than the estimates of private vehicle costs because they rely on fewer assumptions. The main assumptions inherent in the estimates of public transit costs deal with the origin and the destination points of the example commutes. The mileage rates used to calculate private vehicle costs are based on further assumptions—such as the number of miles driven per year and the model and year of the vehicle—which may not be representative for low-income households.

For other reasons, too, the results presented in this chapter are not perfectly representative of the costs for all low-income commuters in each county. First, not all low-income households in a given county live in the two neighborhoods that we have selected. In fact, only 3.2 percent of low-income households in the Bay Area are in one of the neighborhoods that we have chosen for this analysis. In addition, not all of the workers who live in these two neighborhoods commute to the city with the most jobs. Another limitation of this analysis is that we approximate the destination point of the commute with the centroid of the destination city, which may not be the prime area within that city for jobs (or may not be the prime area for jobs for low-income workers). This approximation may affect our estimate of whether a transfer is required to get to the work destination and thus may overstate or

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[4]The 36¢ per mile 2002 IRS mileage rate includes gasoline, oil, maintenance and repairs, tires, insurance, license and registration fees, taxes, and depreciation (Internal Revenue Service, 2002). The 46.9¢ per mile 2001 FHWA mileage rate includes fuel, maintenance and repairs, insurance, registration, taxes, depreciation, and finance charges (Federal Highway Administration, 2004). The 51.7¢ per mile 2003 AAA mileage rate includes gasoline, oil, maintenance, tires, insurance, license, registration, taxes, depreciation, and finance charges (American Automobile Association, 2003). AAA offers different mileage rates, depending on the amount of miles driven per year. We use the rate for the lowest number of miles per year offered, which is 15,000. An individual worker's actual cost per mile may vary from these mileage rates, particularly if they drive infrequently and buy a relatively inexpensive vehicle. (The AAA mileage rate calculates depreciation based on the cost of a new (2003) vehicle. It is not clear whether the other two mileage rates are also based on new vehicle purchase prices.)

understate the actual public transit cost associated with a specific commute. Therefore, our results should be seen as illustrative examples of the range of potential commute costs that may be associated with the transportation options available in the Bay Area. The main purpose of this analysis is to identify factors that contribute to particularly high commute costs in the Bay Area overall, not to provide exact estimates of commute costs for each county.

Within-County Commutes

Within each county, the smaller circles on the maps in Figures 4.3 and 4.4 represent the two neighborhoods with the highest number of low-income individuals, and the larger circles represent the centroid of the city with the highest number of jobs. The transit operators serving the selected low-income neighborhoods for the within-county example commutes are shown in Table 4.3. All of the transit routes identified for the intracounty example commutes were bus routes, with the exception of one route in Contra Costa County, which requires a transfer from bus to BART to get to Concord. The "Annual Cost" column of Table 4.3 shows the public transit costs for the intracounty commutes that were calculated for the two selected low-income neighborhoods in each county.

The average annual cost across the 18 example commutes was $867, but there is a great deal of variation. Annual public transit costs for within-county commutes range from $500 for some commutes in Solano and Sonoma Counties to $1,325 in Contra Costa County. The relatively expensive public transit commutes in Santa Clara, San Mateo, and Contra Costa potentially affect a large number of low-income households in the Bay Area, because over 40 percent of the Bay Area's low-income households live in one of these three counties. Alameda County, the county with the highest number of low-income workers, has a relatively moderate public transit cost ranging from $750 to $875 per year. These estimated costs match fairly closely with results from a survey of CalWORKs recipients in Alameda County, which reports that the average amount spent on travel to work or job training by

Table 4.3

Costs of Illustrative Within-County Commutes Using Public Transportation

County of Residence	Destination City	Low-Income Neighbor-hood	Transit Agencies Used for the Commute	Transfer Required	Cost of Transfer ($)	Day Pass Available[a]	One-Way Fare ($)	Annual Cost ($)	Discounted Annual Cost ($)
Alameda	Oakland	1A	AC Transit	Yes	0.25	No	1.75	875	720
		1B	AC Transit	No		No	1.50	750	720
Contra Costa	Concord	2A	County Connection	No		No	1.50	750	563
		2B	County Connection + BART	Yes	(b)	No	2.65	1,325	1,128
Marin	San Rafael	3A	Golden Gate Transit	No		No	1.80	900	900
		3B	Golden Gate Transit	Yes	(c)	No	1.80	900	900
Napa	Napa (City)	4A	Napa Vine	No		No	1.50	750	480
		4B	Napa Vine	No		No	1.50	750	425
San Francisco	San Francisco	5A	Muni	No		Yes[a]	1.25	625	540
		5B	Muni	No		Yes[a]	1.25	625	540
San Mateo	Redwood City	6A	SamTrans Local	Yes	1.25	No	2.50	1,250	480
		6B	SamTrans Local	Yes	1.25	No	2.50	1,250	480
Santa Clara	San Jose	7A	Valley Transportation Authority	Yes	(d)	Yes	(a)	1,125	630
		7B	Valley Transportation Authority	Yes	(d)	Yes	(a)	1,125	630

Table 4.3 (continued)

County of Residence	Destination City	Low-Income Neighbor-hood	Transit Agencies Used for the Commute	Transfer Required	Cost of Transfer ($)	Day Pass Available[a]	One-Way Fare ($)	Annual Cost ($)	Discounted Annual Cost ($)
Solano	Fairfield	8A	Fairfield-Suisun Transit	No		No	1.00	500	408
		8B	Vacaville City Coach + Fairfield-Suisun Transit	No	(e)	No	2.00	1,000	600
Sonoma	Santa Rosa	9A	Santa Rosa CityBus	Yes	(c)	No	1.00	500	384
		9B	Sonoma County Transit	Yes	(c)	No	1.20	600	576
Average							1.67	867	617

[a]Valley Transportation Authority offers a day pass for $4.50 for unlimited rides, and we used that cost to calculate the annual cost. Muni offers a day pass for $9, but we did not include it in our fare calculations because it is more costly than individual tickets. AC Transit previously issued one-day passes but phased out that program in 2003.

[b]County Connection is part of the BART Plus program that allows riders to purchase BART Plus cards that give them unlimited local access on buses as well as stored BART value.

[c]Within-agency transfer adds no additional cost to rider fare.

[d]Valley Transportation Authority does not have a within-agency transfer program. Each single ride costs $1.50, thus it is more economical for riders to purchase a day pass for $4.50. We base our annual cost calculations on the cost of the day pass.

[e]Between-agency transfer requires that the rider pay full fare with both agencies.

participants who took transit or carpooled was $3.51 per day.[5] If we assume 250 work days in a year, then annual costs would be $878.

Transfers were required for half of the within-county commutes that we analyzed. Across all the agencies serving our within-county example commutes, all but four of the public transit providers allow free transfers. One exception, Sonoma County Transit, allows free transfers within any given zone but charges 35¢ for each additional zone.[6] AC Transit requires an additional 25¢ for each transfer, and the Valley Transportation Authority (VTA) and SamTrans both require a full fare to be paid for each transfer.

Because most agencies allow free transfers, most of the commutes that we priced out are unaffected by whether a transfer is involved. Our estimates of within-county public transportation costs for Sonoma County and Alameda County (where Sonoma County Transit and AC Transit operate, respectively) are not particularly high relative to costs in the other counties, so their transfer policies do not seem to impose a very large cost burden on the commutes that we have chosen to analyze. If we had not used the cost of the VTA's day pass to price out the Santa Clara County commutes, those would have been the most expensive example commutes out of the nine counties ($1,500 for both commutes). This high annual cost figure results because both of the Santa Clara commutes require transfers and VTA charges full price for those transfers (unless a day pass is used). If transfers were free in Santa Clara County, the public transit cost would be $750 annually, slightly below average. The most expensive commute out of our example commutes is the one that involves a transfer to BART ($1,325 for one of the commutes in Contra Costa County). The next most expensive commutes are those in San Mateo County ($1,250 for each), where transfers are required and SamTrans charges full price for those transfers.

Most of the transit operators who supply service for the example commutes sell monthly passes for an unlimited number of rides, but a few of the agencies sell discounted packages instead, which are good for

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[5]Green et al. (2000), p. 22.

[6]The transfer needed for the example commute that uses Sonoma County Transit was within-zone and therefore free.

40 rides. There are a few variations on the monthly discount theme. For example, VTA sells one monthly pass for local service and another monthly pass that includes express service. On average, the discounted price is about 70 percent of the undiscounted price, saving the commuter roughly $250 annually. However, there is a great deal of variation in discounts between transit providers. Golden Gate transit in Marin County provides no discounts for within-county travel (although it does provide a discount for travel to San Francisco). SamTrans in San Mateo County has the largest discount—about 60 percent off the regular fare. VTA in Santa Clara County also has a generous discount—about 45 percent off the regular fare.

Households with limited incomes may have trouble taking advantage of discount rates if they do not have the cash available at the right time. If monthly passes and rent are due at the same time of the month, and if paychecks arrive twice a month, then households will have to plan ahead and save to cover the cost of the transit pass for the following month.[7]

Annual private vehicle costs for within-county commutes are higher than public transit costs (Table 4.4). These costs also show a wide range, in part because we present estimates using three different mileage rates. Using the lowest mileage rate (36¢ per mile), the average annual cost across the 18 example commutes is $893, whereas the highest mileage rate (51.7¢ per mile) yields an average annual cost of $1,283.

Because the cost estimates are based on mileage rates, which are the same for all counties, the variation in private vehicle costs across commutes is driven exclusively by variation in the distances from the origin neighborhood to the destination city.[8] Marin County has the lowest private vehicle cost estimates, ranging from $144 to $548, and

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[7]Loveless (2000) notes, "Both transportation planners and social policy planners appear to have overlooked the cash-flow problems of low-income households. Often, low-income people do not have cash on hand to purchase the most cost-effective transit fare instruments—monthly passes. . . ." (p. 148).

[8]Note that the average length of the commutes that we selected is five miles. For comparison, data from the 1990 Census Special Tabulation Product #214 indicate that in the Bay Area, the median commute length for those with income under $25,000 was 5.87 miles. However, the median commute length for those who drove alone was longer—7.07 miles (Metropolitan Transportation Commission, 1996, p. 13).

Table 4.4

Costs of Illustrative Within-County Commutes Using Private Vehicle

County of Residence	Destination City	Low-Income Neighborhood	Distance (miles)	Annual Cost ($) IRS: 36¢/ mile	FHWA: 46.7¢/ mile	AAA: 51.7¢/ mile
Alameda	Oakland	1A	2.86	515	668	739
		1B	2.28	410	532	589
Contra Costa	Concord	2A	2.21	398	516	571
		2B	8.41	1,514	1,964	2,174
Marin	San Rafael	3A	0.80	144	187	207
		3B	2.12	382	495	548
Napa	Napa (City)	4A	9.99	1,798	2,333	2,582
		4B	7.33	1,319	1,712	1,895
San Francisco	San Francisco	5A	2.30	414	537	595
		5B	2.44	439	570	631
San Mateo	Redwood City	6A	11.58	2,084	2,704	2,993
		6B	13.81	2,486	3,225	3,570
Santa Clara	San Jose	7A	4.48	806	1,046	1,158
		7B	2.65	477	619	685
Solano	Fairfield	8A	0.92	166	215	238
		8B	9.45	1,701	2,207	2,443
Sonoma	Santa Rosa	9A	2.09	376	488	540
		9B	3.62	652	845	936
Average			4.96	893	1,159	1,283

San Mateo County has by far the highest, ranging from $2,084 to$3,570. Alameda County, where almost a quarter of low-income workers live, has relatively low private vehicle costs compared to other counties (ranging from $410 to $739). Santa Clara County, which also has a fairly large share of the Bay Area's low-income workers, has fairly low costs as well, ranging from $477 to $1,158. The estimated costs are quite high in Napa County ($1,319 to $2,582) and may impose a notable cost burden on low-income families there, but Napa County has only 2 percent of the Bay Area's low-income workers. Some counties show a large difference in private vehicle costs between the two neighborhoods that we have selected: Cost estimates in Contra Costa County range from $398 to $2,174, and cost estimates in Solano County range from $166 to $2,443.

Depending on the mileage rate used for the calculation, private vehicle costs are either about the same as discounted public transit costs or quite a bit higher. The ratio of average private vehicle costs to average annual (undiscounted) public transit costs ranges from 1 using the IRS mileage rate to 1.5 using the AAA mileage rate. However, there is a great deal of variation between the individual commutes, and for eight of the 18 example commutes, the annual cost of public transit is *greater* than any of the three private vehicle cost estimates. For one of the Santa Clara commutes, our estimated public transportation cost is substantially more than the private vehicle cost—$1,125 for transit, compared to a range of $477 to $685 for private vehicle use. However, for seven of the example commutes, all three estimates of private vehicle costs exceed the annual public transit cost. For one of the Napa commutes, public transportation costs are only $750, whereas private vehicle costs range from $1,798 to $2,582. For the remaining three example commutes, public transit costs fall between the high and low private vehicle cost estimates.

Intercounty Commutes

Roughly a quarter of Bay Area workers do not work in the same county where they reside. Figure 4.5 depicts the example commutes that we identified for those low-income workers who work outside their county of residence. Table 4.5 shows the relevant transit operators and the public transit costs for those commutes, and Table 4.6 shows the costs for those commutes using private vehicles.[9]

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[9]We found that the number of low-income workers commuting from Santa Clara to San Mateo was only very slightly less than the number commuting from Santa Clara to Alameda. For the tables in this chapter, we report the results only for the commutes from Santa Clara to Alameda; however, we have calculated the costs for San Mateo as well. The annual public transit costs that we calculated for the Santa Clara-San Mateo commute are $2,250 to $2,875, which compares to a Santa Clara-Alameda cost of $1,500. The discounted annual transit costs were also higher than for the Santa Clara-Alameda commute: a range of $1,110 to $1,494 for commutes to San Mateo versus a cost of $1,080 for commutes to Alameda. We calculated the private vehicle costs for the Santa Clara-San Mateo commute to range from $3,955 to $5,796, compared to $6,843 to $10,046 for private vehicle costs for the Santa Clara-Alameda commute.

Table 4.5

Costs of Illustrative Between-County Commutes Using Public Transportation

County of Residence	Destination County	Destination City	Low-Income Neighbor-hood	Transit Agencies Used for the Commute	Transfer Required	Transfer Policy	Day Pass Available[a]	One-Way Fare ($)	Annual Cost ($)	Discounted Annual Cost ($)
Alameda	San Francisco	San Francisco	10A	AC Transit Transbay	No		No	3.00	1,500	1,200
			10B	AC Transit Transbay	No		No	3.00	1,500	1,200
Contra Costa	Alameda	Oakland	11A	County Connection + BART	Yes	(b)	No	4.30	2,150	1,915
			11B	County Connection + BART	Yes	(b)	No	3.90	1,950	1,704
Marin	San Francisco	San Francisco	12A	Golden Gate Transit	No		No	3.40	1,700	1,360
			12B	Golden Gate Transit	No		No	3.40	1,700	1,360
Napa	Contra Costa	Concord	13A	Vallejo Transit to Benicia Transit to County Connection	Yes	(c)	No	4.35	2,175	1,871
			13B	Napa Vine to Benicia Transit to County Connection	Yes	(c)	No	4.50	2,250	1,715
San Francisco	San Mateo	Redwood City	14A	Muni + Caltrain	Yes	(c)	Yes[a]	4.25	2,125	1,494
			14B	Muni + Caltrain	Yes	(c)	Yes[a]	4.25	2,125	1,494
San Mateo	San Francisco	San Francisco	15A	SamTrans + BART	Yes	(b)	No	3.45	1,725	1,704
			15B	SamTrans Local + SamTrans Express + Muni	Yes	(c)	No	4.75	2,375	1,296

Table 4.5 (continued)

County of Residence	Destination County	Destination City	Low-Income Neighbor-hood	Transit Agencies Used for the Commute	Transfer Required	Transfer Policy	Day Pass Available[a]	One-Way Fare ($)	Annual Cost ($)	Discounted Annual Cost ($)
Santa Clara	Alameda	Oakland	16A	VTA + AC Transit	Yes	(c)	Yes[a]	(a)	1,125	1,080
			16B	VTA + AC Transit	Yes	(c)	Yes[a]	(a)	1,125	1,080
Solano	Contra Costa	Concord	17A	Fairfield-Suisun Transit + BART	Yes	(d)	No	5.65	2,825	1,595
			17B	Fairfield-Suisun Transit + BART	Yes	(d)	No	5.65	2,825	1,595
Sonoma	Marin	San Rafael	18A	Golden Gate Transit	No		No	4.15	2,075	1,660
			18B	Golden Gate Transit	No		No	4.15	2,075	1,660
Average								4.13	1,963	1,499

[a]Muni offers a day pass for $9 and Caltrain offers a day pass for $6, but we did not include these in our fare calculations because they are more costly than using individual tickets. Valley Transportation Authority offers a day pass for $4.50 for unlimited rides and we used that to calculate the annual cost. AC Transit previously issued one-day passes but phased out that program in 2003.

[b]This agency is part of the BART Plus program that allows riders to purchase BART Plus cards that give them unlimited local access on buses as well as stored BART value.

[c]This is an interagency transfer and riders must pay full fare for both agencies, with the exceptions noted as follows. For scenario 13A (Napa to Concord commute), Benicia Transit credits $1 to passengers from Vallejo Transit. For scenarios 14A and 14B, riders could purchase a Peninsula Pass for $45 that allows unlimited bus rides on Muni and local credit on SamTrans, Valley Transportation Authority, and Dumbarton Express. For scenarios 16A and 16B, there is an interagency agreement between Valley Transportation Authority and AC Transit that allows riders free transfers at shared bus stops.

[d]These agencies are not part of the BART Plus program and riders must pay full fare on both agencies.

Table 4.6

Costs of Illustrative Between-County Commutes Using Private Vehicle

County of Residence	Destination County	Destination City	Low-Income Neighbor-hood	Bridge Toll Cost ($)	Annual Bridge Toll Cost ($)	Distance (miles)	Annual Cost ($)		
							IRS: 36¢/mile	FHA: 46.7¢/mile	AAA: 51.7¢/mile
Alameda	San Francisco	San Francisco	10A	2	500	10.22	2,340	2,886	3,142
			10B	2	500	10.66	2,419	2,989	3,256
Contra Costa	Alameda	Oakland	11A	0	0	15.36	2,765	2,765	2,765
			11B	0	0	9.37	1,687	2,188	2,422
Marin	San Francisco	San Francisco	12A	5	1,250	16.35	4,193	5,068	5,476
			12B	5	1,250	14.82	3,918	4,710	5,081
Napa	Contra Costa	Concord	13A	2	500	18.71	3,868	4,869	5,337
			13B	2	500	35.19	6,834	8,717	9,597
San Francisco	San Mateo	Redwood City	14A	0	0	22.20	3,996	5,184	5,739
			14B	0	0	22.33	4,019	5,214	5,772
San Mateo	San Francisco	San Francisco	15A	0	0	26.66	4,799	6,225	6,892
			15B	0	0	4.60	828	1,074	1,189
Santa Clara	Alameda	Oakland	16A	2	500	35.24	6,843	8,729	9,610
			16B	2	500	36.93	7,147	9,123	10,046
Solano	Contra Costa	Concord	17A	2	500	20.00	4,100	5,170	5,670
			17B	2	500	27.75	5,495	6,980	7,673
Sonoma	Marin	San Rafael	18A	0	0	31.99	5,758	7,470	8,269
			18B	0	0	29.54	5,317	6,898	7,636
Average						21.55	4,240	5,348	5,865

Public transit costs run approximately twice as high for intercounty commutes as for within-county commutes, with an average annual cost of about $2,000 across the 18 example commutes. For the intercounty example commutes, travel originating from Alameda, Marin, Napa, Santa Clara, and Sonoma Counties was accomplished solely via bus, whereas travel originating in Contra Costa, Solano, and San Mateo Counties involved both bus and BART. Travel originating in San Francisco involved both bus and Caltrain. Compared to the within-county commutes, there is a bit less variation in public transit costs. Annual public transit costs for the between-county example commutes ranged from $1,125 for the Santa Clara to Alameda commutes to $2,825 for the commutes from Solano to Contra Costa. Public transit for between-county commutes is least expensive for the low-income commuters who live in Alameda and Santa Clara Counties. Together, these two counties account for almost half the low-income population in the Bay Area.

Transfer costs affect the cost of between-county commutes, as they did for within-county commutes. The most expensive commute, Solano to Contra Costa, requires a transfer and two full fares. In fact, two-thirds of the intercounty commutes require transfers. Alameda and Marin, both of which have intercounty commutes that do not require transfers, have relatively low public transit costs compared to the other counties. On the other hand, the commutes originating in Sonoma do not require transfers either, and those commute costs are slightly above the average.

Each of the between-county example commutes has the option of some kind of multi-ride discount: monthly discount passes, 20-day passes, 31-day passes, 40-day passes, or something of the kind. On average, the discounted price is about 75 percent of the undiscounted price, and the worker nets roughly $500 in savings over the undiscounted price. San Mateo has both the commute with the greatest savings available through the discounted price ($1,079) and the commute with the least savings through the discounted price ($21).

Private vehicle costs for the intercounty example commutes are higher than public transit costs and show a great deal of variation driven by differences in the distance of the commute. Using the lowest mileage rate (36¢ per mile), the average annual cost across the 18 example

commutes is $4,240, whereas the highest mileage rate (51.7¢ per mile) yields an average annual cost of $5,865 (Table 4.6).

Private transportation costs for between-county commutes range from $828 for a commute from San Mateo to San Francisco (using the IRS mileage rate) up to $10,046 for a commute from Santa Clara to Alameda (using the AAA mileage rate). Napa and Sonoma Counties also have high private vehicle costs for intercounty commutes. Although one San Mateo commute has the lowest private vehicle cost of all the commutes ($828), the other San Mateo commute is substantially higher, at $4,799 (both using the IRS mileage rate). The Alameda and Contra Costa cost estimates for between-county commutes are more consistently at the low end, ranging from $1,687 to $3,256. As mentioned above, the variation in cost is driven entirely by the distance of the commute and the mileage rate that is used.[10]

For all but two of our between-county example commutes, the commutes cost substantially more via private vehicle than via public transportation. One exception is one commute originating in Contra Costa County, where the range of costs for public transportation nest within the range of costs for private vehicle usage. The other exception is one commute originating in San Mateo, where the cost of commuting by public transportation ($2,375) is greater than the cost of commuting by private vehicle ($828 to $1,189, depending on which mileage rate is used). The difference in costs between public transportation and private vehicle is largest for the commute from Santa Clara to Alameda. This commute covers a relatively long distance, so that private vehicle costs were estimated to be quite high. For between-county example commutes, average private vehicle costs are double or triple the average

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[10]The average commute length for the commutes that we selected for this analysis is 22 miles. By comparison, 1990 data indicate that the median commute length across all workers in the Bay Area (including both intra- and intercounty commutes) is 8.58 miles (Metropolitan Transportation Commission, 1996). Therefore, our private vehicle cost estimates may not be representative of the costs commuters using private vehicles are actually paying. Some may choose to work closer to home or to not work at all rather than pay the monetary and time costs associated with the commutes that we have selected as examples. That is, the private vehicle estimates we provide in this chapter may be accurate estimates of private vehicle costs, whereas they would be overestimates of private vehicle expenditures.

public transit costs, depending on which mileage rate is used to calculate the private vehicle costs.

To compute commute costs as a percentage of family income, we calculated median annual family income in each county for low-income families with at least one employed adult. On average, our within-county public transit commutes would take up roughly 5 percent of the median income for these families, and intercounty commutes would take up roughly 10 percent. For low-income families that can take advantage of the monthly discount rates, the commutes take 1 to 2 percentage points less of the median income than the undiscounted rates. Estimated private vehicle costs for within-county commutes make up 5 percent to 7 percent of the median income for low-income families. Costs for between-county commutes account for 22 percent to 30 percent of median income for low-income households, depending on which mileage rate is used.

Parents without vehicles are particularly vulnerable to increased costs from transfer expenses because they may need to take an additional bus to transport children to school or child care on the way to work. If the $4.50 VTA day pass were not available, for example, parents served by VTA would have their within-county transit costs doubled by the need to drop off children.[11] Parents served by Sonoma County Transit may have costs that are up to a third higher depending on their exact commute patterns, and parents served by AC Transit face transit costs that are one-quarter higher. The other transit agencies offer free transfers, which means that parents face no financial penalty for having to drop off their children. However, free transfers within each agency will not be enough to help those families who need to transfer across agencies. Depending on the locations of home, school or child care, and work, an added destination may mean using multiple transit agencies. Because few of the interagency transfers provide any discounts, this would approximately double the transit costs for parents who face such commutes.

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[11]Although the price of the day pass is still relatively high, VTA does give a fairly deep discount to those who are willing and able to buy the $52.50 monthly pass for unlimited local service.

The results from this chapter seem to imply that the difference between public transit costs and private vehicle costs is smaller than was indicated by the CES results from the previous chapter. The CES analysis found that private vehicle expenditures (for low-income households that use vehicles) were roughly 10 times the size of public transit expenditures (for low-income households that use transit). In contrast, the example commutes in this chapter suggest that private vehicle costs are only one to 1.5 times the size of public transit costs for within-county commutes, and two to three times the size of public transit costs for between-county commutes.

The difference in results between the two chapters may indicate that we have underestimated private vehicle costs in this chapter by not including parking costs, by using national mileage rates that do not reflect local costs, and by using straight-line distance instead of actual driving distance in our calculations. On the other hand, the private vehicle costs may actually be overstated because the mileage rate calculations include depreciation amounts based on the value of a new vehicle, whereas most low-income households purchase used vehicles. Another difference between the CES analysis and the current analysis that may account for the contrasting results is that this chapter's emphasis is on commutes rather than overall travel. If households with vehicles tend to make more nonwork trips than households without vehicles, then total expenditures for households with vehicles would be higher even if the cost of commuting were the same for both public transit and private vehicles.

Another possible explanation as to why these results differ from the CES findings is that the cost of transit commutes that we estimate in this chapter may be so high that most low-income workers will choose not to take them. Thus, the unaffordable commutes would not show up in CES data.[12] Households will also choose not to take commutes that are excessively long, and many of the more expensive public transit example

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[12]As a purely hypothetical example, say that low-income individuals will choose to not take public transit if the cost is above average for the Bay Area ($867), choosing instead another mode or to not commute at all. Then the average *expenditures* on public transit for Bay Area low-income workers will be only $650 (the average over commutes where the cost is below $867), whereas the average of the actual *cost* is $867.

commutes analyzed in this chapter are likely to take the most time because of multiple transfers. If this is the case, then data on these commutes may not show up in the expenditure data because workers are not willing to spend that much time commuting.

In this chapter, we estimate the costs of example commutes throughout the nine MTC counties. We find substantial variation in these costs, but generally the estimates confirm the finding from Chapter 3 that traveling by private vehicle is more expensive than traveling by public transit. Clearly, mode choice has important implications for transportation costs and expenditures. The next chapter investigates differences in mode choice across income groups, among households in the Bay Area.

5. Commute Behavior in the Bay Area

This chapter investigates how commute patterns—mode choice, commute schedules, commute duration, etc.—vary across income groups in the San Francisco Bay Area. As the analyses in the previous chapters have demonstrated, mode choice can have a large effect on transportation expenditures. However, more expensive modes may provide shorter commute times or greater mobility. This chapter explores these tradeoffs.

In contrast to the CES data used in Chapter 3, the Census data used here have information only about work-related trips, but on the other hand, they do allow us to look specifically at the Bay Area. In spite of the differences in the data sources used in the chapters, the investigation of commute behaviors in this chapter helps illuminate some of the reasons behind the differences in expenditures levels across groups.

Differences in Travel Patterns Across Income Groups

Mode choice for commutes differs tremendously by income level.[1] Seventy percent of higher-income Bay Area workers commute by driving alone, whereas only 53 percent of the low-income group and 51 percent of the poor group drive alone to work (Table 5.1).[2] Conversely, those in the low-income category are twice as likely as those in the higher-income group to take the bus or trolley bus (12% versus 5%), and more than twice as likely to walk to work (7% versus 3%). The low-income group also has slightly higher rates of carpooling and biking than the higher-income group.

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[1]Census respondents who commute using multiple modes were asked to report only the mode by which they travel the longest distance.

[2]The difference between the low-income and poor group is small but statistically significant.

Table 5.1

Mode Choice and Vehicle Access Measures for the Bay Area, by Income Group

	Poor	Low-Income	Higher-Income
From PUMS			
Commute mode choice (%)			
Drove alone	51	53	70
Carpool	16	17	12
Bus or trolley bus	12	12	5
Streetcar or trolley car	0	0	0
Subway or elevated	2	2	3
Railroad	0	0	1
Ferryboat	0	0	0
Bicycle	2	2	1
Walked	8	7	3
Taxicab	0	0	0
Motorcycle	1	0	0
Other method	1	1	1
Worked at home	5	4	4
Commute mode choice for those who take public transit (%)			
Bus or trolley bus	78	77	52
Streetcar or trolley car	3	3	5
Subway or elevated	15	17	35
Railroad	3	3	7
Ferryboat	0	1	2
% of households with access to vehicle	70	73	94
Average number of vehicles per household	1.09	1.18	1.88
Average number of vehicles per working age adult in household (ages 18 to 64)	0.71	0.75	1.05
From BATS			
% of employed persons with driver's license	(a)	85	96

SOURCES: Census 2000 Public Use Microdata Sample and 2000 Bay Area Travel Survey.

[a]Not reported because of small sample sizes.

We also looked at mode choice using the BATS dataset, and we arrived at qualitatively similar conclusions.[3] In addition, the BATS dataset allowed us to investigate the difference in mode choice between work-related and nonwork-related trips. The main difference that was found between work-related travel and nonwork-related travel was that for nonwork trips, both low-income and higher-income groups were less likely to use transit and more likely to walk.

Closely related to findings regarding mode choice, one prominent difference across income groups in the Bay Area pertains to the share of households with access to a vehicle. Ninety-four percent of households in the higher-income group report having access to a vehicle, but only 73 percent of low-income households and 70 percent of poor households report having access (Table 5.1).

The average number of vehicles in a household is 1.88 for higher-income households, 1.18 for low-income households, and 1.09 for poor households. However, the average number of vehicles per working-age adult may be a better measure of an individual's access to a vehicle because it reflects the possibility of competition for use of vehicles within the household. The average number of vehicles per potential driver (that is, vehicles per working age adult) is 0.71 for the poor group, 0.75 for the low-income group, and 1.05 for the higher-income group. Ninety-six percent of higher-income workers have driver's licenses, compared to 85 percent of low-income workers. For the higher-income group, the percentage of workers with driver's licenses is roughly the same as the percentage of households with access to a vehicle. For the low-income group, however, there is a gap of 12 percentage points between the two measures: Eighty-five percent of low-income workers have driver's licenses, but only 73 percent of low-income households report having access to a vehicle.

On average, low-income workers spend about a minute less than higher-income workers on their commutes (Table 5.2). Although the difference is small, it is statistically significant. There is more of a

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[3]However, the differences among the income groups in terms of the percentage who walk and the percentage who use a private vehicle were less pronounced in the BATS data.

Table 5.2

Commute Duration and Commute Schedules, by Income Group

	Low-Income	Higher-Income
Mean commute time (minutes)	28.4	29.5
Median commute time (minutes)	20.0	25.0
Departure time for work (%)		
Midnight–4:59 a.m.	4	3
5 a.m.–6:59 a.m.	22	23
7 a.m.–8:59 a.m.	42	51
9 a.m.–12:59 p.m.	17	13
1 p.m.–4:59 p.m.	10	6
5 p.m.–11:59 p.m.	5	3

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

difference with respect to median commute time, which is 25 minutes for the higher-income group, compared to 20 minutes for the low-income group.[4] The fact that the mean commute times are longer than the median commute times is an indication that both of these income groups include a subset of workers who have particularly long commutes compared to most of the workers in their income group.

One might have expected to see a shorter average commute time for the higher-income group than for the low-income group. Those in the higher-income group commute by car more often and cars generally travel faster than the modes that low-income workers are more likely to take (buses, bicycling, and walking). Using 1990 data, MTC found that average commute speed for workers in the Bay Area was 35.13 miles per hour, whereas workers with income below $25,000 had commute speeds of only 31.58 miles per hour.[5] So how is it that commute times are

[4]Using 1990 data, the Metropolitan Transportation Commission (1996) also found that commute time was longer as income increased. Specifically, they found that "the average commute duration for income '>$75K' (22.48 minutes from home-to-work) is 25 percent higher than the average commute duration for income '<$25K' (18.05 minutes from home-to-work, 11 percent higher than the average commute duration for income '$25K-$45K' (20.23 minutes), and 3 percent higher than the average commute duration for income '$45K-$75K' (21.83 minutes)" (pp. 4–5).

[5]Metropolitan Transportation Commission (1996), p. 11.

longer for higher-income workers if they are traveling faster? There are several explanations.

First, higher-income workers may be traveling about the same amount of time as low-income workers but traveling farther during that time, in part because of higher vehicle use rates. The PUMS Census data do not include information about distance traveled, but MTC's calculations using specially tabulated data from 1990 show that the median commute distance for those with income less than $25,000 is 5.87 miles, compared to a median of 8.58 miles for all workers.[6] This is a difference of only 2.71 miles, but it effectively doubles the area within reach.[7] Having access to a car may not buy a briefer commute, but it may buy a greater travel range, thereby providing a wider selection of job opportunities and services.

A second reason why higher-income workers have lengthier commutes is that when they do take transit, they often take the modes with the longest commute times (railroad or ferry, airplane, Caltrain, and Amtrak). The middle panel of Table 5.1 shows that of those higher-income workers who take transit to work, roughly half traveled by bus and half by other means. In contrast, more than three-quarters of low-income workers who take transit take the bus and less than a quarter take other forms of transit. The top two panels of Table 5.3 show that commute duration by bus is shorter than for other forms of transit in the Bay Area. The PUMS data indicate that the median bus commute duration is 35 minutes, compared to 40 minutes for street car or trolley car, 45 minutes for subway or elevated, and 60 minutes for railroad or ferry boat. In addition to this pattern where higher-income transit users

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[6]Metropolitan Transportation Commission (1996), p. 9.

[7]Following the example set forth by Murakami and Young (1997), we calculate the area accessible for higher-income commuters as $(8.58)^2 = 231$ square miles and the area accessible for low-income commuters as $(2.71)^2 = 108$ square miles. We then divide the former by the latter to arrive at a ratio of 2.13. The difference in commute distance is not solely attributable to greater private vehicle use for the higher-income group. Comparing just households that drove alone, households with income under $25,000 had a median commute distance of 7.07 miles, compared to a median of 9.09 miles for all households, for a difference of 2.02 miles. Note that if one income group has a larger "area within reach," this does not necessarily mean that those households have greater access to jobs and services—this depends on the relative density of jobs and services where each type of household is located.

Table 5.3

Median Commute Duration, by Mode, Work Schedule, and County
(in minutes)

	Low-Income	Higher-Income	Total
From PUMS			
Mode			
Drove alone	20	20	20
Carpool	20	30	25
Bus or trolley bus	35	35	35
Streetcar or trolley car	40	35	40
Subway or elevated	45	45	45
Railroad	60	60	60
Ferryboat	60	60	60
Bicycle	15	15	15
Walked	10	10	10
Taxicab	15	15	15
Motorcycle	15	20	20
Other method	25	30	30
From BATS			
Mode			
Car	(a)	(a)	30
Carpool	(a)	(a)	40
Bus	(a)	(a)	45
Local rail (including Muni Rail)	(a)	(a)	45
BART	(a)	(a)	60
Caltrain	(a)	(a)	80
Ferry	(a)	(a)	80
Bicycle	(a)	(a)	20
Walk	(a)	(a)	10
Taxi	(a)	(a)	20
From PUMS			
Work schedule			
Midnight–4:59 a.m.	20	25	25
5 a.m.–6:59 a.m.	30	30	30
7 a.m.–8:59 a.m.	20	25	25
9 a.m.–12:59 p.m.	20	20	20
1 p.m.–4:59 p.m.	20	20	20
5 p.m.–11:59 p.m.	15	20	20

Table 5.3 (continued)

	Low-Income	Higher-Income	Total
From PUMS			
County			
Alameda	20	25	25
Contra Costa	25	30	30
Marin	25	30	30
Napa	15	15	15
San Francisco	30	30	30
San Mateo	20	20	20
Santa Clara	20	20	20
Solano	20	25	20
Sonoma	15	20	20

SOURCES: Census 2000 Public Use Microdata Sample (Bay Area subsample), and 2000 Bay Area Travel Survey.

[a]Not reported because of small sample sizes.

take the transit modes with the longest commute durations, those in the higher-income group are also less likely than those in the low-income group to walk or bike, and walking and biking have very short median commute durations (15 minutes and 10 minutes, respectively). Note that commute durations are very similar across the income groups once mode is controlled for. Low-income and higher-income workers have exactly the same median commute durations for eight of the 12 modes. Commute time differs most between the income groups with respect to carpooling—20 minutes for low-income workers and 30 minutes for higher-income workers.

A third reason for longer commute times for higher-income workers may be that those in the higher-income group are relatively more inclined to commute during rush hour (Table 5.2). Half of those in the higher-income group leave for work between 7 a.m. and 9 a.m., whereas only 42 percent of those in the low-income group leave for work at that time. Both groups have about the same percentage leaving between 5 a.m. and 7 a.m. (about 23 percent), but in the low-income group a much higher share leaves for work after 9 a.m. (total of 32%, compared to 22%). The last column of the third panel down in Table 5.3 shows that commutes are 5 minutes shorter after 9 a.m. than they are between 7

a.m. and 9 a.m. However, controlling for time of day, low-income workers still appear to have shorter commutes.

Commute Patterns, by Length of U.S. Residency

Because over a third of the Bay Area's low-income residents are foreign-born, the travel behavior of immigrants may have important implications for transportation policies focusing on the low-income population. Table 5.4 shows how mode choice differs according to immigrant status and the length of time spent in United States. As length of residency increases for immigrants, the percentage who drive alone to work increases from 44 percent to 65 percent, the percentage who carpool to work decreases from 23 percent to 17 percent, and the percentage who use the bus decreases from 14 percent to 7 percent. Immigrants who arrived in United States before 1995 are still less likely than U.S. natives to drive alone and more likely to carpool or take the bus. Because of these trends, immigrants may have lower dollar expenditures on transportation and higher time costs than those born in the United States.

Table 5.4

Means of Transportation to Work, by Length of U.S. Residence
(in percent)

	Arrived in the United States After 1998	Arrived in the United States 1995–1997	Arrived in the United States Before 1995	Born in the United States
Drove alone	**44**	**54**	**65**	**71**
Carpool	**23**	**20**	**17**	**11**
Bus or trolley bus	14	11	7	4
Streetcar or trolley car	0	0	0	0
Subway or elevated	2	2	3	3
Railroad	1	1	0	1
Ferryboat	0	0	0	0
Public transit	**18**	**14**	**10**	**9**
Bicycle	4	2	1	1
Walked	7	6	3	3
Taxicab	0	0	0	0
Motorcycle	0	0	0	0
Other method	2	1	1	1
Worked at home	2	2	3	5

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

Table 5.5 depicts the share of the Bay Area's immigrant population that resides in each county. Thirty-one percent of Bay Area immigrants reside in Santa Clara County, 21 percent in Alameda County, between 10 percent and 15 percent in San Francisco, San Mateo, and Contra Costa Counties, and less than 5 percent in Solano, Sonoma, Marin, and Napa Counties. These proportions are very similar to the distribution of the entire population across these counties, although the share of immigrants is somewhat high for Santa Clara relative to its share of the entire Bay Area population, which is 25 percent.

Table 5.5

Share of Total Bay Area Immigrant Population, by County

	Share of Bay Area Immigrant Population (%)
Alameda	21
Contra Costa	10
Marin	2
Napa	1
San Francisco	15
San Mateo	12
Santa Clara	31
Solano	4
Sonoma	3

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

NOTE: Column does not sum to 100 percent because of rounding.

Geographic Differences

With a median commute time of 15 minutes, Napa County has by far the lowest average commute time in the Bay Area (Table 5.3). At the other end of the spectrum, Alameda County has a median commute time of 25 minutes and San Francisco, Marin, and Contra Costa Counties each have median commute times of 30 minutes. Generally speaking, counties with high median commute times also have a relatively high

share of the population taking transit and a low share commuting by car. Commute times are the same across the income groups for four counties (Napa, San Francisco, San Mateo, and Santa Clara), and lower for the low-income group in five counties (Alameda, Contra Costa, Marin, Solano, and Sonoma).

For all three income levels, most counties show somewhat similar distributions of mode choices. San Francisco is an extreme outlier, however, being much less vehicle-oriented than the other counties (Tables 5.6 through 5.8). Alameda and Marin have patterns that lie between the results for San Francisco and the results for the rest of the counties, but they are still closer to the rest of the counties than to San Francisco in mode choice patterns.

San Francisco has 39 percent of low-income households driving or carpooling to work, whereas Alameda has 68 percent, Marin has 67 percent, and the other counties have between 75 percent and 85 percent (Table 5.7). The variation in percentages for higher-income households is not quite as great, but the pattern is similar: San Francisco has 53 percent driving or carpooling, Marin has 77 percent, Alameda has 82 percent, and the rest of the counties have between 84 percent and 92 percent (Table 5.8).

The converse pattern holds for public transit use, which is much higher in San Francisco than elsewhere. Thirty-eight percent of low-income San Francisco commuters take public transit. The corresponding percentages in the other counties are 17 percent in Alameda, 15 percent in Marin, around 10 percent in Contra Costa, San Mateo, and Santa Clara, and below 5 percent in the remaining counties. Most of this transit use comes from bus ridership, but in Alameda, Contra Costa, and San Francisco, about 5 percent of low-income workers ride light rail. For higher-income workers, San Francisco again has the highest percentage of transit users, at 30 percent. Alameda and Marin Counties both have 10 percent, Contra Costa has 9 percent, San Mateo has 7 percent, and the rest are 3 percent or under. In Alameda and Contra Costa, light rail use is more common than bus use among the higher-income workers, which is different from what we saw for the low-income workers in those counties. Light rail also has high use in San Francisco

Table 5.6

Mode Choice and Vehicle Access Measures for the Poor Group, by County

	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Total Bay Area
Commute mode choice (%)										
Drove alone	46	55	53	62	30	54	59	61	60	51
Carpool	17	19	12	18	8	19	17	20	17	16
Drove or carpooled	**63**	**73**	**65**	**80**	**38**	**74**	**76**	**81**	77	**67**
Bus or trolley bus	12	8	11	4	31	10	9	4	4	12
Streetcar or trolley car	0	0	0	0	2	0	0	0	0	0
Subway or elevated	4	5	1	0	4	2	0	1	0	2
Railroad	0	0	0	0	1	1	1	0	0	0
Ferryboat	0	0	1	1	0	0	0	0	0	0
Public transit	**17**	**13**	**13**	**5**	**38**	**13**	**10**	**5**	**4**	**16**
Bicycle	3	1	3	4	2	1	3	2	1	2
Walked	11	4	6	6	14	5	5	3	7	8
Taxicab	0	0	0	0	0	0	0	0	0	0
Motorcycle	1	0	1	0	2	0	0	0	0	1
Other method	2	2	1	1	1	1	1	1	2	1
Worked at home	4	6	11	4	5	5	4	7	9	5
Number of poor workers	33,990	14,305	4,673	2,973	19,650	10,006	31,154	6,651	9,489	132,891
% of Bay Area poor workers	26	11	4	2	15	8	23	5	7	100
% of households with access to vehicle	69	75	89	84	45	78	81	75	83	70
Average number of vehicles per household	1.01	1.22	1.37	1.35	0.60	1.22	1.36	1.19	1.40	1.09
Number of vehicles per working age adult in household	0.66	0.80	1.01	0.89	0.41	0.78	0.80	0.80	0.91	0.71

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

Table 5.7

Mode Choice and Vehicle Access Measures for the Low-Income Group, by County

	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Total Bay Area
Commute mode choice (%)										
Drove alone	50	57	54	58	30	56	62	64	62	53
Carpool	18	21	13	26	9	20	18	21	18	17
Drove or carpooled	**68**	**78**	**67**	**84**	**39**	**75**	**79**	**85**	**80**	**70**
Bus or trolley bus	11	6	13	2	31	9	8	3	3	12
Streetcar or trolley car	0	0	0	0	2	0	0	0	0	0
Subway or elevated	5	4	0	0	4	1	0	0	0	2
Railroad	0	0	0	0	1	1	0	0	0	0
Ferryboat	0	0	2	0	0	0	0	0	0	0
Public transit	**17**	**11**	**15**	**3**	**38**	**11**	**9**	**4**	**3**	**15**
Bicycle	2	1	2	2	3	1	3	1	2	2
Walked	7	4	8	6	13	6	4	3	7	7
Taxicab	0	0	0	0	0	0	0	0	0	0
Motorcycle	0	0	0	0	1	0	0	0	0	0
Other method	2	1	1	1	1	1	1	2	2	1
Worked at home	4	4	7	4	5	4	3	5	6	4
Number of low-income workers	92,700	46,469	13,420	9,180	60,844	32,802	89,020	23,205	33,123	400,763
% of Bay Area low-income workers	23	12	3	2	15	8	22	6	8	100
% of households with access to vehicle	71	79	86	84	46	80	82	81	85	73
Average number of vehicles per household	1.10	1.30	1.38	1.39	0.65	1.32	1.42	1.35	1.40	1.18
Number of vehicles per working age adult in household	0.70	0.84	0.97	0.93	0.44	0.83	0.84	0.83	0.92	0.75

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

Table 5.8

Mode Choice and Vehicle Access Measures for the Higher-Income Group, by County

	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Total Bay Area
Commute mode choice										
Drove alone	69	72	66	75	42	75	80	76	78	70
Carpool	13	13	11	13	11	12	12	16	11	12
Drove or carpooled	**82**	**84**	77	**88**	**53**	**87**	**91**	**92**	**89**	**83**
Bus or trolley bus	4	1	7	1	20	3	2	1	2	5
Streetcar or trolley car	0	0	0	0	3	0	0	0	0	0
Subway or elevated	5	7	0	0	7	2	0	1	0	3
Railroad	0	1	0	0	0	2	1	0	0	1
Ferryboat	0	0	3	0	0	0	0	0	0	0
Public transit	**10**	**9**	**10**	**1**	**30**	7	**3**	**2**	**2**	**9**
Bicycle	1	0	1	1	2	1	1	0	1	1
Walked	2	1	2	3	8	2	1	1	2	3
Taxicab	0	0	0	0	0	0	0	0	0	0
Motorcycle	0	0	0	0	1	0	0	0	0	0
Other method	1	1	0	0	1	1	0	1	0	1
Worked at home	3	4	9	6	5	4	3	3	5	4
Number of higher income workers	580,876	392,279	112,773	48,616	353,409	317,793	736,221	150,802	189,000	2,881,769
% of Bay Area higher income workers	20	14	4	2	12	11	26	5	7	100
% of households with access to vehicle	94	96	97	97	81	96	96	97	97	94
Average number of vehicles per household	1.86	1.99	1.86	1.98	1.27	1.96	2.04	2.10	2.00	1.88
Number of vehicles per working age adult in household	1.03	1.13	1.14	1.17	0.75	1.10	1.08	1.14	1.17	1.05

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample)

(10%), but it is not more prevalent than bus use among higher-income San Franciscans (20%).

San Francisco is also an outlier with respect to walking or bicycling: 16 percent of low-income San Franciscans bike or walk to work. Around 9 percent of low-income workers in Alameda, Marin, Sonoma, and Napa walk or bike to work, and the percentage is below 7 percent for all the other counties. Among higher-income workers, 10 percent of those in San Francisco biked or walked to work, and the percentage ranged between 1 percent and 4 percent for the rest of the counties.

Commute duration also varies between counties, which may be linked to the variation in mode choice. Commute duration for Napa County was far shorter than in any of the other counties (Table 5.3), and Napa also has extremely low public transit use even for the poor workers (Tables 5.6–5.8). Public transit use in Napa ranges from 1 percent for the higher-income group to 5 percent for the poor group. Napa also has one of the highest vehicle use rates (84% for the low-income group) and a relatively high percentage of walking/biking (8% for the low-income group). Commute time is long for San Francisco, which, as we mentioned above has by far the highest public transit use rates and lowest vehicle use rates. However, commute time is the same for Marin and Contra Costa as it is for San Francisco even though car use is considerably higher in those two counties. In general, though, longer commute durations are associated with higher public transit use and lower car use.

The percentage of low-income households in each county reporting access to a vehicle is generally very similar to the percentage driving or carpooling to work (Table 5.7). In all counties but Marin, the percentage with access to a vehicle is within about 5 percentage points of the percentage who drive or carpool to work. In Marin County, the difference is much greater, where 86 percent of low-income households report having access to a vehicle, but only 67 percent drive or carpool. It is interesting to note that for higher-income households, there is a greater difference between the percentage reporting access to a vehicle and the percentage driving or carpooling to work, indicating that many higher-income households have vehicles but choose to use a different mode for commuting to work. In San Francisco, 81 percent of higher-income

households report having access to a vehicle, whereas only 53 percent drive or carpool to work. For the other counties, vehicle access is between 94 percent and 97 percent for higher-income households, and the share who drive or carpool to work ranges from 77 percent in Marin County to about 92 percent in Santa Clara and Solano.

For most counties, the vehicle access rates are roughly 15 percentage points higher for the higher-income households than they are for the low-income households, but Alameda and San Francisco Counties stand out from the others, with differences of 23 and 35 percentage points, respectively. San Francisco also has a lower average number of vehicles per household and a lower average number of vehicles per working-age adult than the other counties, regardless of income level.

Mode Choice for Workers Making the Same Commute

This section compares mode choice for low- and higher-income workers who have the same combination of county of residence and work county, to shed some light on how much of the overall differences in mode choice are due to differences in residential location. To do this, we look at mode choice for each of the intercounty commutes that were identified in our example commute analysis in Chapter 4. Below, we summarize the statistically significant findings on mode choice from Table 5.9:[8]

- Alameda to San Francisco: The main difference between the low-income and higher-income groups is in bus use. Seventeen percent of low-income workers take the bus, whereas only 10 percent of higher-income workers do.
- Contra Costa to Alameda: Those in the low-income group are less likely to drive alone (67 percent, compared to 77 percent for the higher-income group) and more likely to carpool (20% to 14%) or take the bus (5% to 1%).

[8]Hardly any of the differences in commute times were found to be statistically significant, so we do not discuss them in the text.

Table 5.9

Comparison of Mode Choice for Low- and Higher-Income Workers Making the Same Commute

Intercounty Commutes	% Using Each Mode		Median Commute Time (minutes)	
	Low-Income	Higher-Income	Low-Income	Higher-Income
Alameda to San Francisco				
Drove alone	28.5	29.9	40	45
Carpool	14.7	16.7	40	45
Bus or trolley bus	16.8	10.3	45	40
Streetcar or trolley car	0.2	0.3	50	35
Subway or elevated	33.5	36.7	45	45
Railroad	2.0	1.9	45	60
Ferryboat	0.5	1.3	20	45
Bicycle	0.2	0.2	35	45
Walked	0.5	0.2	20	5
Taxicab	0.6	0.0	45	—
Motorcycle	0.5	0.6	30	30
Other method	2.2	1.8	60	50
Worked at home	0.0	0.0	—	—
Contra Costa to Alameda				
Drove alone	66.5	77.3	30	35
Carpool	19.8	13.6	40	40
Bus or trolley bus	5.3	1.2	60	45
Streetcar or trolley car	0.0	0.1	—	45
Subway or elevated	5.0	6.3	60	45
Railroad	0.8	0.5	45	50
Ferryboat	0.0	0.0	—	—
Bicycle	0.8	0.3	30	25
Walked	0.5	0.2	5	10
Taxicab	0.0	0.1	—	45
Motorcycle	0.0	0.2	—	20
Other method	1.3	0.4	45	40
Worked at home	0.0	0.0	—	—
Marin to San Francisco				
Drove alone	53.2	51.3	45	40
Carpool	5.8	14.9	60	45
Bus or trolley bus	32.1	20.7	60	60
Streetcar or trolley car	0.0	0.0	—	—
Subway or elevated	0.0	0.2	—	90
Railroad	1.7	0.3	40	70
Ferryboat	7.2	10.5	60	60
Bicycle	0.0	0.7	—	60
Walked	0.0	0.1	—	30
Taxicab	0.0	0.1	—	—
Motorcycle	0.0	0.9	—	35
Other method	0.0	0.3	—	46
Worked at home	0.0	0.0	—	—

Table 5.9 (continued)

Intercounty Commutes	% Using Each Mode		Median Commute Time (minutes)	
	Low-Income	Higher-Income	Low-Income	Higher-Income
Napa to Contra Costa				
Drove alone	61.3	85.1	35	45
Carpool	38.7	14.9	55	45
Bus or trolley bus	0.0	0.0	—	—
Streetcar or trolley car	0.0	0.0	—	—
Subway or elevated	0.0	0.0	—	—
Railroad	0.0	0.0	—	—
Ferryboat	0.0	0.0	—	—
Bicycle	0.0	0.0	—	—
Walked	0.0	0.0	—	—
Taxicab	0.0	0.0	—	—
Motorcycle	0.0	0.0	—	—
Other method	0.0	0.0	—	—
Worked at home	0.0	0.0	—	—
San Francisco to San Mateo				
Drove alone	55.9	79.7	30	30
Carpool	15.6	12.6	25	30
Bus or trolley bus	18.5	3.4	45	49
Streetcar or trolley car	0.0	0.0	—	60
Subway or elevated	0.9	0.7	30	45
Railroad	4.4	1.2	90	75
Ferryboat	0.0	0.0	—	—
Bicycle	0.5	0.5	20	30
Walked	2.3	0.6	15	15
Taxicab	0.0	0.0	—	15
Motorcycle	0.0	0.4	—	30
Other method	1.9	0.8	45	35
Worked at home	0.0	0.0	—	—
San Mateo to San Francisco				
Drove alone	50.2	61.7	30	30
Carpool	23.8	16.9	30	30
Bus or trolley bus	14.9	6.5	45	50
Streetcar or trolley car	0.0	0.3	—	40
Subway or elevated	4.7	8.5	40	40
Railroad	4.5	4.9	60	60
Ferryboat	0.0	0.0	—	95
Bicycle	0.2	0.0	10	—
Walked	0.8	0.3	25	10
Taxicab	0.0	0.0	—	25
Motorcycle	0.0	0.4	—	20
Other method	0.9	0.5	20	30
Worked at home	0.0	0.0	—	—

Table 5.9 (continued)

Intercounty Commutes	% Using Each Mode		Median Commute Time (minutes)	
	Low-Income	Higher-Income	Low-Income	Higher-Income
Santa Clara to Alameda				
Drove alone	63.0	86.2	30	30
Carpool	30.6	11.8	25	30
Bus or trolley bus	5.1	0.4	35	30
Streetcar or trolley car	0.0	0.0	—	—
Subway or elevated	0.0	0.3	75	75
Railroad	0.5	0.1	82	70
Ferryboat	0.0	0.0	—	—
Bicycle	0.0	0.3	0	15
Walked	0.2	0.2	15	10
Taxicab	0.0	0.0	—	—
Motorcycle	0.5	0.3	35	60
Other method	0.2	0.4	20	60
Worked at home	0.0	0.0	—	—
Solano to Contra Costa				
Drove alone	77.0	80.8	30	30
Carpool	18.9	18.1	45	40
Bus or trolley bus	2.9	0.6	60	90
Streetcar or trolley car	0.0	0.0	—	—
Subway or elevated	0.0	0.0	—	80
Railroad	1.2	0.0	37	—
Ferryboat	0.0	0.0	—	—
Bicycle	0.0	0.1	—	15
Walked	0.0	0.0	—	1
Taxicab	0.0	0.0	—	—
Motorcycle	0.0	0.2	—	35
Other method	0.0	0.2	—	43
Worked at home	0.0	0.0	—	—
Sonoma to Marin				
Drove alone	72.0	78.0	45	45
Carpool	23.7	17.7	45	45
Bus or trolley bus	1.5	3.0	157	60
Streetcar or trolley car	0.0	0.0	—	—
Subway or elevated	0.0	0.0	—	—
Railroad	0.0	0.0	—	—
Ferryboat	0.0	0.0	—	—
Bicycle	0.0	0.1	—	15
Walked	0.0	0.2	—	15
Taxicab	0.0	0.0	—	—
Motorcycle	0.0	0.6	—	55
Other method	2.8	0.3	60	40
Worked at home	0.0	0.0	—	—

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

- Marin to San Francisco: As with the Alameda to San Francisco commute and the Contra Costa to Alameda commute, the low-income group is more likely to take the bus. However, the difference is larger: 32 percent of the low-income group take the bus, compared to 21 percent of the higher-income group. Low-income workers are quite a bit less likely to carpool (6% to 15%). The differences in ferryboat use were not statistically significant.
- Napa to Contra Costa: Virtually everyone in Napa travels by private vehicle, but low-income workers are more likely to carpool than higher-income workers (39% to 15%).
- San Francisco to San Mateo: For this commute, there are huge differences in mode choice across the income groups. The low-income group is much less likely to drive alone (56%, compared to 80% for the higher-income group), and much more likely to take the bus (19%, compared to 3%). Possibly low-income commuters to San Mateo are traveling to portions of San Mateo that are much closer to San Francisco than the destinations to which the higher-income commuters are commuting.
- San Mateo to San Francisco: It is interesting to see that when workers travel in the reverse direction, the distribution of mode choices is quite different. Higher-income workers commuting from San Mateo to San Francisco take transit at much higher rates than higher-income workers going in the other direction. Even so, low-income commuters from San Mateo still drive alone less frequently than the higher-income commuters (50% to 62%) but are more likely to carpool (24% to 17%). Low-income workers are more likely to take the bus, and higher-income workers are more likely to take the subway.[9]
- Santa Clara to Alameda: The low-income workers drive alone less often than higher-income workers (63%, compared to 86%) and take the bus more often (5%, compared to 0%).

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[9]Because the Census PUMS is a national survey, it does not ask about specific regional or local transit providers such as BART or Caltrain. The mode choice reported

- Solano to Contra Costa: Although car use rates are over 95 percent for both groups, low-income workers are still more likely to take the bus, and they also use the railroad more often than the higher-income group.
- Sonoma to Marin: This commute has results similar to the commute between Napa and Contra Costa in that virtually everyone takes a car for this commute, although here there is less difference in the distribution between driving alone and carpooling. There are no statistically significant differences for transit usage between the income groups.

In sum, we cannot conclude either that the different income groups always make the same mode choices when faced with the same commute or that mode choices will always be quite different. Some counties had very similar mode choice distributions across income levels, whereas other counties showed very disparate mode choice distributions. In general, the least densely populated counties had very similar distributions for low- and higher-income commuters because virtually everyone drives. However, it should be noted that Alameda and Contra Costa have fairly similar mode choice distributions across income levels as well.

Interactions Between Mode Choice and Commute Duration

The relatively long commute times in Alameda, Marin, and San Francisco Counties (25 minutes, 30 minutes, and 30 minutes, respectively) might be attributable to higher rates of public transit use and lower rates of private vehicle use than in other counties (Table 5.3). However, Contra Costa also has a 30 minute median commute time, but has a car commute rate and public transit commute rate that are closer to that in San Mateo than to Alameda, Marin, and San Francisco.

Table 5.10 illustrates some of the counterbalancing forces that affect the relative commute times between low-income and higher-income workers. Among public transit takers, higher-income workers often have

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reflects the respondent's understanding of which of the listed modes best matches the transit provider that he or she uses.

Table 5.10

Median Commute Durations by County and Income Group, Controlling for Mode and Time of Day
(in minutes)

	Low-Income	Higher-Income
Commuters using car, truck, or van between 7 a.m. and 9 a.m.		
Alameda	20	20
Contra Costa	20	20
Marin	25	25
Napa	15	15
San Francisco	25	25
San Mateo	20	20
Santa Clara	20	20
Solano	20	20
Sonoma	18	20
Commuters using public transit between 7 a.m. and 9 a.m.		
Alameda	40	45
Contra Costa	45	50
Marin	60	60
Napa	40	35
San Francisco	30	30
San Mateo	30	45
Santa Clara	40	45
Solano	45	60
Sonoma	45	45

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

longer commute times. But those who commute by private vehicle have much shorter commute times than public transit takers, and higher-income workers are more likely to commute by private vehicle. Table 5.10 limits the analysis just to those who commute during peak commute times, to control for differences in commute duration stemming from differing traffic levels at different times of the day. The results in the top panel show that, for each county, low-income drivers and higher-income drivers have the same commute times. However, the bottom panel illustrates that low-income public transit takers have commute durations that are on average about five minutes shorter than commute times for higher-income transit takers.

Commute Patterns and Residential Location

How are differences in mode choice across the income groups determined by differences in residential location? We address this question by measuring the extent to which differences in mode choice for the entire Bay Area compare to the differences in mode choice between low- and higher-income workers who live in the same neighborhood.[10]

When we look at the entire Bay Area as a whole, we find that low-income workers have drive alone rates that are 12 percentage points lower than higher-income workers; but if we compare the differences in drive alone rates for each neighborhood and then take the average of that difference across neighborhoods, we find that after accounting for residential location the difference in the drive alone rate is only 4 percentage points rather than 12 (Table 5.11). Roughly speaking, this means that differences in residential location between low- and higher-income workers explain two-thirds of the difference in their tendency to drive alone. For both bus or trolley and bicycle or walking, the process of controlling for residential location reduces the difference in mode use between the income levels from about 6 percentage points to 2 percentage points.

One might expect households to pay more for housing to be closer to work, thereby saving on the time costs and the variable monetary costs of commuting. However, we find no evidence of tradeoffs between housing costs and trip durations. Median commute times for those in the poor and low-income groups are exactly the same regardless of where they fall in the upper, middle, or lower third of the housing price distribution for their income group (Table 5.12). Higher-income households with the lowest housing costs actually have shorter commutes than those who pay more on housing.

It may be that some people with higher housing costs choose to live closer to work but choose modes that take longer but could save them money on vehicle costs (particularly if by living closer to work they need

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[10]The actual unit of analysis here is the TAZ. TAZs are areas defined for the purpose of analysis of traffic-related data. There are over 3,000 TAZs in the Bay Area.

Table 5.11

Differences in Mode Choice Between Income Groups, Controlling for Residential Location

	Low-Income (Weighted Average Across TAZs)[a]	Higher-Income (Weighted Average Across TAZs)[b]	% Point Difference Between Higher-Income and Low-Income (Not Adjusted for Residential Location)[c]	% Point Difference Between Higher-Income and Low-Income (Adjusted for Residential Location)[d]
% using each mode				
Drove alone	57.8	69.9	–12.1	–4.0
Two-person carpool	9.4	9.5	–0.1	–0.9
Three-person carpool	2.3	2.2	0.2	–0.2
Four-or-more-person carpool	1.0	1.1	0.0	–0.2
Bus or trolley bus	10.4	4.8	5.6	2.2
Streetcar, trolley car, subway, or elevated	3.2	3.4	–0.2	–0.9
Railroad or ferryboat	0.5	0.8	–0.2	–0.2
Bicycle or walked	8.9	3.5	5.5	2.0
Taxicab, motorcycle, or other means	1.6	1.1	0.5	0.3
Worked at home	4.8	3.8	0.9	2.0

SOURCE: 2000 Census Transportation Planning Package, Part 1 Residence Files (Bay Area subsample).

[a]The percentage using each mode is weighted by the number of low-income workers in the TAZ.

[b]The percentage using each mode is weighted by the number of higher-income workers in the TAZ.

[c]This column shows the difference between the averages from the previous two columns.

[d]For each TAZ, the difference in mode use between low-income and higher-income workers is calculated. This column shows the average of those differences. The percentage using each mode is weighted by the number of total workers in the TAZ.

Table 5.12

Tradeoffs Between Housing Cost and Commute Duration

Housing cost tercile	Poor	Low-Income	Higher-Income
Low housing cost			
Median commute time (minutes)	20	20	20
Median housing cost ($)	417	454	737
Medium housing cost			
Median commute time (minutes)	20	20	25
Median housing cost ($)	834	847	1,331
High housing cost			
Median commute time (minutes)	20	20	25
Median housing cost ($)	1,649	1,614	2,491

SOURCE: Census 2000 Public Use Microdata Sample (Bay Area subsample).

not own a car at all). If this is the case, then the tradeoffs that people actually make may be mainly an exchange of expenditures on housing for expenditures on transportation, without actually reducing the length of the commute. This is merely conjecture. However, results from Chapter 3 did indicate that when transportation costs were high, the main budget component that decreased was housing, which suggests that monetary tradeoffs are being made between housing and transportation, at least for the low-income group (Table 3.6).

We also compared commute durations between those who own their own housing and those who rent. For higher-income workers, median commute times were five minutes longer for homeowners than for renters (25 minutes, compared to 20 minutes), but for low-income workers, we found that median commute times were exactly the same (20 minutes) for both homeowners and for renters.

Household Composition and Variation in Travel Patterns

Workers in households with children are much more likely than workers in households without children to commute via car, truck, or van, regardless of the income level of the household (Table 5.13). However, the mode choice of low-income workers is notably more responsive than the mode choice of higher-income workers to the

Table 5.13

Mode Choice, Work Schedule, and Commute Time, by Presence of Children in the Household

	Low-Income		Higher-Income	
	No Children	With Children	No Children	With Children
From PUMS				
Commute mode (%)				
Car, truck, or van	62	76	80	87
Transit	18	12	10	6
Taxicab	0	0	0	0
Motorcycle	1	0	0	0
Bicycle	3	2	1	1
Walked	9	5	3	2
Worked at home	6	3	4	4
From PUMS				
Departure time for work (%)				
Midnight –4:59 a.m.	3	4	3	4
5 a.m.–6:59 a.m.	19	25	23	25
7 a.m.–8:59 a.m.	44	40	52	50
9 a.m.–12:59 p.m.	21	15	15	12
1 p.m.–4:59 p.m.	10	10	5	7
5 p.m.–11:59 p.m.	5	6	3	4
From BATS				
Median commute time (minutes)	25	30	30	30
From PUMS				
Median commute time (minutes)	20	20	25	25
From PUMS				
% with vehicle in household				
Head of household ages 18–25	79	86	89	94
Head of household ages 26–35	78	88	92	97
Head of household ages 36–50	80	89	94	98
Head of household ages 51+	78	88	96	98

SOURCES: Census 2000 Public Use Microdata Sample (Bay Area subsample), and 2000 Bay Area Travel Survey.

presence of children. For the higher-income group, 87 percent of workers in households with children commute by private vehicle in contrast to 80 percent of workers in households without children. For the low-income group, 76 percent of workers in households with children commute by private vehicle as opposed to only 62 percent of workers in households without children. In fact, the auto use rate for low-income workers with children is closer to that of higher-income

workers (with or without children) than it is to low-income workers without children.

Families with children may choose to use automobiles because of the increased complexity of travel needs when children are present. Dropping off children at a school or day care center on the way to work can be time-consuming if one is commuting via public transit, particularly if transit service does not run frequently. Using two datasets, we arrive at different conclusions about whether commutes take longer for low-income households with children. (With both datasets, commute times appear to be the same for higher-income workers regardless of whether they have children.) The BATS data indicate that commutes for low-income workers with children take about five minutes longer than the commutes of those who do not have children. However, the PUMS data do not show any difference in commute times between low-income households with or without children. If commute times for households with children are in fact the same as for households without children, it would be likely that higher auto use rates for those with children are helping to mitigate the time cost burden of complex child-related transportation needs.

To isolate the effect of children from the effect of age, the bottom section of Table 5.13 looks at the percentage of households with access to a vehicle, by age categories and by the presence of children. Vehicle access is essentially the same for the low-income group, regardless of the age of the head of household. Put another way, the difference between households with and without children in the percentage with access to a vehicle still holds even after controlling for the age of the head of the household. This pattern strengthens the argument that auto use is higher for low-income households with children because of the transportation complications imposed when children are present. In a separate analysis using CTPP data, we investigated whether mode choice differed by the age of the children in the household. The results showed virtually no variation in mode choice by the age of the youngest child.

Commuting behavior may differ by gender, particularly because women often bear the burden of transporting children to child care or to school. Blumenberg (2002) states that low-income women differ from low-income men in that they commute shorter distances, make more

trips, make more household-supporting trips, and chain trips together more often. However, our examination of PUMS data for the San Francisco Bay Area revealed median commute times of 20 minutes for both low-income women and low-income men, regardless of the presence of children. If women commute shorter distances, yet their commutes take as long as men's commutes, this may be evidence that they are making extra stops along the way to transport children to school or child care.

Using PUMS data, we find that employed women with children are more likely than employed women without children to commute by car, regardless of income level. However, the link between car use and the presence of children is even stronger for men. One main difference between the genders is the way car use plays out: Having children in the home is associated with higher rates of driving alone for men, but for women, the presence of children is associated with an increase in carpooling. These findings suggest that caretakers of both genders tend to accommodate their children's transportation needs by taking advantage of the speed and flexibility of an automobile—in spite of the greater monetary costs associated with private vehicles.

The results from Chapters 3 and 4 indicated that monetary transportation costs differ markedly by mode of transportation. In this chapter, we found that higher-income workers are less likely to walk or bike, and that higher-income workers who use public transit have relatively long commute times. These factors help explain why higher-income households have somewhat longer commute times than low-income households. Although commute times are longer for higher-income commuters, the distance information from the MTC report indicates that higher-income commuters travel longer distances, which may compensate for the greater time costs by increasing access to key destinations. Policymakers must consider monetary costs in conjunction with time costs and access issues as they develop plans for addressing the transportation needs of low-income communities.

6. Conclusions from the Data Analysis

This report addresses a lack of research on the topic of transportation costs for low-income households. Drawing on several existing datasets, it examines transportation expenditures for California households, estimates costs for specific example commutes within the Bay Area, and investigates travel behaviors in the Bay Area and how they may relate to transportation costs.

The expenditure data demonstrate that transportation is an important budget component for low-income households—the third-largest spending category after housing and food. Median transportation expenditures for low-income households in California amount to $2,164 annually, or 13 percent of the household budget. However, compared to higher-income households, low-income households' transportation spending represents a slightly smaller percentage of total household expenditures. At the median, higher-income households spend $6,569 annually on transportation, or 15 percent of total household expenditures.

For several reasons, these findings cannot be interpreted as a signal that transportation is more affordable for lower-income households than for higher-income households. First, expenditures should not be confused with costs. A household may have low expenditures on certain budget items precisely because the cost of the item is so high that the household cannot afford to buy more of it. Second, low-income households have less left over for transportation after paying 63 percent of their budget toward food and housing, whereas higher-income households pay only 51 percent of their budget toward these two priority budget items, leaving higher-income households with more available in their budget to pay for transportation. Third, when discussing affordability, one should assess the quality of the service received and not

only expenditures. Paying a given number of dollars or a given budget share for transportation may or may not be considered an affordable amount depending on the level of access to jobs and services that it provides.

The finding that transportation expenditures constitute a smaller share of the budget for low-income households than for higher-income households is confirmed by other research. The Bureau of Labor Statistics (2001) reports that the 10 percent of households with the lowest overall expenditures spend 8 percent of total outlays on transportation in contrast to 17 percent for all other households (p. 2). Rogers and Gray (1994) report that households that rank in the bottom fifth with respect to total outlays spend 9.4 percent of total expenditures on transportation, compared to 13.8 percent for those in the second quintile of outlays, 15.5 percent in the third quintile, 15.9 percent in the fourth quintile, and 16.8 percent in the top quintile (p. 36). Similarly, Passero (1996) finds that households receiving public assistance spend $2,347 annually on transportation (15 percent of their total household expenditures), and households that do not receive public assistance spend $5,739 annually, or 19 percent of household expenditures (p. 24).

Lower vehicle ownership rates are a key reason that transportation budget shares are smaller for low-income households than for higher-income households. Low-income families that do own vehicles have significantly higher transportation budget shares. The expenditure data indicate that for low-income households with regular vehicle use, vehicle expenditures account for roughly 20 percent of total household expenditures, with median vehicle-related expenditures at $3,586. In addition, the estimated costs of the example commutes suggest that private vehicle costs are relatively high. These findings, in conjunction with the large differences in auto ownership rates between low-income and higher-income households, imply that the costs associated with private vehicles are prohibitive for many low-income households. (The expenditure data show that 66 percent of low-income households own vehicles, compared to 90 percent of higher-income households.)

The findings on public transit expenditures are not clear-cut. The expenditure data suggest that public transit costs are unlikely to pose a problem for low-income households, because median transit

expenditures for transit users are only $360 per year and take up only 2 percent of the household budget. On the other hand, public transit costs for our example commutes take up as much as 10 percent of the median income for low-income households. One possible explanation for the difference in results could be that the transit costs for our example commutes are prohibitive and therefore would not be reflected in the expenditure data.

However, other research seems to support the CES results in suggesting that transit costs are probably not a major transportation barrier for most low-income families. A survey of welfare recipients in Fresno County found that "very few welfare recipients stated any concern regarding the costs of public transit,"[1] and a survey of welfare recipients in Los Angeles found that "more frequent bus service is the preferred choice for improvement and cost was a lower consideration than other improvements, such as frequency of service, being on time, and closer bus stops" (Moreno et al., 2000, p. vi). When asked to identify their two biggest problems with respect to transit, only 7 percent of respondents listed the cost of transit as a concern.[2] In the Bay Area itself, 12 percent of welfare recipients in Alameda County reported being unable to use public transportation at some point during the year because they lacked sufficient funds to pay for it.[3] Taken together, these reports indicate that for the large majority of welfare recipients, the cost of transit is not a serious problem. Most likely this is true for the broader low-income population as well. However, for those who do have problems meeting the cost of transportation, assistance with transit fares may be crucial.

Transportation research suggests that the demand for public transit is less sensitive to price than to other transportation characteristics. Cervero (1990) reports that transit riders are approximately twice as responsive to changes in service quality as they are to changes in fares. Ridership appears to be particularly sensitive to waiting time and schedule reliability. Cervero suggests that transit operators focus on

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[1]Blumenberg and Haas (2001), p. 46.

[2]Moreno et al. (2000), p. 41.

[3]Green et al. (2000), p. 22.

improving service quality rather than reducing fares. He states, "Critics are quick to note that the delivery of higher premium services at substantially higher fares will price poor people off transit. Although this might be the case, such inequities can be redressed through various 'circuit-breaker' mechanisms, like discount passes (targeted at low-income users) or the introduction of travel vouchers for the poor" (p. 126). If policymakers choose to pursue high-quality service at higher prices, care must be taken to ensure that those for whom price is a critical issue receive support, such as discount passes or travel vouchers. Anecdotal evidence indicates that some low-income workers at the San Francisco-Oakland (SFO) airport could no longer afford the commute once the BART extension to the airport replaced cheaper bus service. Although improvements in pubic transit quality may allow some households to replace private vehicle use with less expensive transportation, the SFO airport example illustrates the need to provide some sort of fare relief for the subgroup of people who cannot afford higher quality public transit service.

The results from the data analysis (in combination with the findings from the research literature) point to several broad strategies to cut transportation costs for low-income families.

- Because so many low-income households in the Bay Area own vehicles, and because vehicle expenditures are fairly high, finding ways to reduce vehicle costs for low-income vehicle owners could provide large benefits in terms of relief from transportation costs.
- On the other hand, one of the most promising ways to reduce transportation costs may be to focus on features of transportation other than price. Improving the quality of transit service, paratransit, and other alternative means of transportation may enable travelers to meet their transportation needs through less-expensive transportation modes than the private vehicle.
- Further work should be done to identify those within the low-income group who may have trouble paying for transit services.

This work will help target transit subsidies to those who need them most.

A comprehensive approach to transportation affordability will require strategies that address multiple modes. Given the great geographic variation in mode use across counties, transportation affordability strategies should be tailored to local needs. Transit-oriented solutions may be most appropriate for high-density areas, whereas vanpools, shuttle services, and vehicle-ownership supports may be more appropriate in low-density areas. Although the data analysis in this report focuses primarily on the monetary costs of transportation, affordability planning efforts should also weigh the benefits associated with each option, in terms of time costs, mobility, and other aspects of transportation quality.

Part II
Policy Strategies and Areas for Future Research

7. Policy Strategies for Affordable Transportation

In response to MTC's request for a menu of strategies, this chapter presents and discusses a variety of policy options for addressing transportation affordability. The data analyses in Part I focused on costs and expenditures, and although the resulting findings help illuminate the issue of affordability, information on costs and expenditures alone cannot provide definitive answers about the extent to which transportation is affordable. The essence of the notion of transportation affordability is that the cost of transportation should not be a barrier to access to essential destinations, such as jobs and health care. Although the cost of transportation plays a key role in transportation affordability, the ability of households to pay for transportation is also affected by other factors that were not included in the data analysis in Part I—such as household wealth, access to credit, the cost of competing budget items, the geographic relationship between home and basic destinations, and the quality of transportation services available for a given price. The policy menu developed in this chapter therefore takes a broader perspective than the first part of the report. Because the options presented in this chapter do not flow from the earlier data analysis, we do not offer any strong policy recommendations.

When evaluating strategies to make transportation affordable, one must examine the overall benefits of each course of action. Some policy options listed below may require greater out-of-pocket expenses than others yet provide enough gains in mobility or reductions in travel time to yield a larger net gain for low-income households. Policymakers must also consider the social costs and benefits of the policies. Certain options might improve transportation affordability for low-income households yet decrease the monies available for competing priorities, including other services that benefit low-income families. In addition, other

potential social costs such as pollution and congestion must be taken into account. In short, the estimated total benefits and costs of a project should be taken into consideration and compared to the total benefits and costs of the alternatives. However, when choosing among several projects that all have positive benefits, policymakers should pay attention to the distribution of the benefits as well as to the overall net gain from each potential project.

In some cases, particularly for new, untested approaches, it may be difficult to get precise estimates of the costs and benefits. Lack of precise estimates should not necessarily preclude a policy from being considered, but if a policy with unknown costs and benefits is undertaken, policymakers should seriously consider implementing a formal evaluation, so that a more accurate understanding of the costs and benefits can be acquired for the future.

It should be kept in mind that the options discussed in this chapter are not mutually exclusive; indeed, an optimal approach will include a mix of strategies. Blumenberg and Hess (2002) provide a useful four-part structure for tailoring programs to the geographic areas to which they are best suited. The article is specifically about welfare recipients, but the following recommendations can easily be extended to the wider low-income population:

- For job-rich areas with a high density of welfare recipients, they suggest focusing on fixed-route public transit service.
- For job-rich areas with a low density of welfare recipients, they recommend employer-sponsored vanpool or shuttle services and a focus on housing mobility policies to enable welfare recipients to move into the area.
- For job-poor areas with a high density of welfare recipients, they suggest an emphasis on private vehicle ownership, nonfixed-route service, rapid buses and freeway flyers, and local economic development.
- Last, for job-poor areas with a low-density of welfare recipients, they recommend concentrating on increasing private vehicle ownership.

An appropriate mix of strategies will also need to evolve over time, because some policies may take longer to implement whereas others are more easily implemented in the short-term and might be phased out when the longer-term projects come to fruition.

The policies discussed in this chapter span a broad range and are not targeted to any single level of jurisdiction. The menu includes strategies that could be implemented variously at the community, city, county, regional, state, and national levels. The policy options address not only the arena of transportation, but also housing, land use, social services, child care, and education. Similarly, the authority to implement the different options is spread across many different groups, including regional and state transportation planning organizations, transit providers, social services agencies, legislators at various levels of government, community organizations, and private citizens. We do not identify which group or groups would be best suited to take on responsibility for pursuing a given idea, but in many cases, a collaborative approach would probably work best.

Policy responses to the transportation needs of low-income groups are often classified into three general approaches:

- Enabling low-income households to live in places where jobs, services, and educational opportunities are easily accessible;
- Increasing the number of jobs that are accessible to low-income communities; and
- Improving transportation links between home and work.

The first two of these three options operate to make transportation more affordable by allowing people to use less-expensive forms of transportation (walking, biking, or public transit) or by reducing the variable costs associated with driving. The third option can reduce monetary costs either by directly reducing the costs of transportation or by enabling individuals to meet their transportation needs by relying on cheaper forms of transportation.

Below we also discuss two additional approaches:

- Reducing the extra costs associated with having to transport children to and from school or child care; and

- Increasing income directly, to compensate for the budgetary burden of transportation expenditures.

The list below is not exhaustive but is meant to outline the main approaches available for addressing transportation affordability issues. Many of the policy strategies listed below are already being implemented in the Bay Area or elsewhere in the United States. Although we occasionally mention concrete examples of programs that exist in the Bay Area, we generally stick to a somewhat more theoretical discussion of the advantages and disadvantages of each approach, as information on programs in the Bay Area is available elsewhere.[1]

Expansion of Housing Options

We start by discussing policies that focus on housing. If families can locate near job opportunities and other frequent destinations, they may be able to reduce their monetary expenses by walking, biking, taking public transit, or reducing the variable cost component of their private vehicle expenses. In addition, by increasing access to job opportunities, employment and income may rise, which indirectly makes transportation more affordable to low-income households.

Beginning in the 1970s with the Gautreaux program and continuing with the "Moving to Opportunity" demonstration sites implemented in the 1990s, there have been several programs designed to enable low-income families to move out of urban public housing. The five-year results from the Moving to Opportunity program showed that personal safety, housing quality, and mental health all improved, compared to a control group, and obesity among adults, school dropout rates, delinquency, and risky behavior all declined. However, there were no statistically significant effects on employment outcomes.[2] Although these programs may be worthwhile on the basis of other outcomes, by themselves they do not appear to be sufficient for improving access to jobs. Given the dispersed nature of jobs throughout the suburbs, moving

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[1] See, for example, Scholl (2002) and the county welfare-to-work transportation plans.

[2] Orr et al. (2003).

out of the central city does not necessarily solve the problem of getting to work easily.

Other approaches to improving housing mobility may be more politically viable than such programs as Moving to Opportunity. Better access to credit for homeownership and more effective programs to end racial discrimination in the housing market would help to enable households to choose housing with convenient access to work.[3] A Location Efficient Mortgage (LEM)—facilitating the ownership of homes in "location efficient communities"—is now offered in several cities.[4] In addition, support of policies to increase the supply of affordable housing in areas of high job growth or near public transit hubs is another strategy to consider. Reform of urban zoning laws could be key to facilitating the creation of more high-density, multiunit housing.

Boushey et al. (2001) describe a national approach to the development of affordable housing that state and local governments might wish to tap into or emulate: "The National Low-income Housing Coalition is spearheading an effort to create a National Affordable Housing Trust Fund. The goal of the fund is to use excess Federal Housing Administration and Ginnie Mae revenue as the primary source of revenue to produce, rehabilitate, or preserve 1.5 million units of affordable housing by 2010, estimated to cost $75 billion over 10 years. . . ." These authors also advocate smart growth policies that will inhibit sprawl and ensure that housing and jobs are located near one another.

MTC's Transportation for Livable Communities (TLC) program supports efforts that integrate transportation and land-use planning, with the aim of producing compact development near public transit hubs. To meet this goal, the TLC program offers community planning grants and capital improvement grants. In addition, it administers the Housing Incentives Program (HIP), which provides local jurisdictions with capital

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[3]See Yinger (1998) and Ladd (1998) for evidence on discrimination in housing markets.

[4]Surface Transportation Policy Project (2003).

grants for developments that meet certain housing density levels. Additional bonuses are provided for affordable housing units.[5]

Creation of Accessible Jobs

The reverse side of the housing approach is to encourage the development of jobs in areas where low-income workers live or can easily access. This path offers the same transportation affordability benefits as the housing approach: potential reductions in commute costs and potential increases in income as a result of better job opportunities. The creation of urban enterprise zones in low-income areas—using such incentives as tax credits, financing assistance, and technical support to induce business activity—is one example of a job-oriented approach. The evidence on the efficacy of California's enterprise zones is mixed. Dowall, Beyeler, and Wong (1994) found that the performance of enterprise zones in California had been disappointing, but this may have been in part because of inadequate funding for the enterprise zone programs. In contrast, results from O'Keefe (2004) suggest that enterprise zone designation raises employment growth about 3 percent annually but that the effect recedes after the first six years. Both papers note that employment effects vary dramatically across enterprise zones. Dowall et al. suggest that job training, job matching, and technical and financial assistance may be even more important than tax credit incentives for promoting business activity.

Boushey et al. observe that in addition to the option of creating jobs in low-income neighborhoods, "Another policy is reforming urban zoning laws to allow for job creation near transit hubs." A separate possibility that is rarely discussed in transportation circles is to increase the number of opportunities to work from home, and in particular, to increase opportunities for telecommuting. Although a personal computer may seem expensive for a low-income family, the price of a basic computing system is usually substantially less than the purchase price of a vehicle, and maintenance costs are also less.

The creation of affordable housing and accessible jobs are both goals that could take a very long time to achieve, whereas transportation

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[5]Kinsey (2003).

strategies can generally be implemented much more quickly. A wide variety of transportation policies are available to address the gap between home and work.

Linking Home to Work via Public Transit

The most common approach to addressing transportation affordability problems has been to provide discounted public transit. Discounted (or subsidized) tickets or passes are often provided in bulk to organizations that serve targeted populations. Similarly, public transit agencies have discounts for seniors, disabled persons, and sometimes for students as well. We first discuss group discounts and then individual discounts.

Transit Discounts for Specific Groups

Social services agencies serving TANF clients distribute transit vouchers to help recipients with their transportation needs. Vouchers are frequently distributed at homeless centers as well.[6] Another example of group discounts would be the ECO PASS program offered by the Valley Transportation Authority. This program sells bus passes at discounted bulk prices to employers and property managers, including affordable housing developers. Scholl (2002) states that currently about seven affordable housing complexes participate in this program. The ECO PASS program could be expanded to other affordable housing developments and to firms that employ a large number of low-income workers, and the program could be replicated by other transit agencies in the Bay Area. The idea of selling discounted public transit services in bulk might also be extended to agencies that serve immigrant populations, who are much more likely than U.S. natives to use public transit.

Once it is fully implemented throughout the Bay Area, the TransLink® system—wherein a TransLink® "smart card" with a microchip can store transit fares from multiple transit agencies—may

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[6]Scholl (2002).

make it easier for various entities to purchase group-discounted fares.[7] Potential participants include, but are not limited to, social services agencies, employers, schools, and other government entities. Through the TransLink® system, the organization can be billed directly for the value placed on an individual's card, and the rider will be able to pick up the credited value at a fare payment device; that is, it will be automatically added to the card when the person uses the card to pay for his or her next ride. Currently, there do not appear to be any standard techniques for pricing group discounts, but Nuworsoo (2004) has proposed a methodology that could be used for determining how to best price discount passes based on a variety of criteria.[8]

Transit Discounts for Eligible Individuals

In addition to public transit discounts that are provided to groups, there is also the option of providing discounts directly to individuals, provisional upon eligibility. All transit agencies currently have discounts available for seniors and disabled individuals (due to federal requirements). Public transit agencies often have discounts for students as well.[9]

One option to consider is the creation of such a discount program targeted to low-income individuals. A transit subsidy program based on income could be implemented in much the same way that other means-tested programs such as TANF or Food Stamps are operated. There may be fiscal reasons to prefer to piggy-back on the infrastructure already built into the other means-tested programs; however, the tradeoff is that fewer public transit users will receive assistance. With our PUMS data for the Bay Area, we found that only 7 percent of the low-income group and only 11 percent of those below poverty level are receiving public

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[7]TransLink® is scheduled to be fully implemented with AC Transit and Golden Gate Transit in 2004, with BART, Caltrain, and Muni in 2005, with SamTrans, Vallejo Transit, and VTA by 2006, and with other transit operators in the Bay Area by 2007.

[8]These criteria include "the number of existing riders and associated revenue earned from a target group and the accessibility of the primary location of transit use by the group." (Based on personal correspondence with the author about his dissertation research on deep discount group pass programs.)

[9]AC Transit recently ended a one-year pilot project that provided free bus passes for students.

assistance, so relying on current social service programs to distribute public transit discounts would leave a large portion of these groups unserved.

The TransLink® smart card system could potentially be used to apply individual low-income discounts when the user boards the transit vehicle. TransLink® itself would not have the administrative capacity to process and verify eligibility for the program, so this aspect would have to be handled by an existing social service agency, or a new structure would have to be created to provide that role. If eligibility is not determined by participation in a public assistance program, then another avenue might be to base eligibility on annual tax returns. Unfortunately, this strategy would miss that segment of the low-income population that does not file tax returns.

Reducing the Cost of Transfers

One practical idea would be to remove or reduce the price of transfers for agencies that do not already have free transfers. Our analysis of commute costs in Chapter 4 found that transfers were a main contributing factor to high commute costs. Decreasing or eliminating the cost of transfers would reduce the strain on households whose transportation costs are greatly amplified by the need to drop off and pick up children from school and child care. The elimination of transfer costs would also help workers with long commutes.

Greater coordination between transit agencies to provide free or discounted transfers would help workers who make interagency transfers on the way to work, and might enable other workers to get better jobs in other counties. Efforts to coordinate transfers across agencies will likely be greatly facilitated by the implementation of the TransLink® fare cards.

Multi-Ride Discounts

Another policy to consider would be to make it easier for individuals to purchase monthly passes. The Sonoma County Welfare-to-Work plan states, "Although buying a monthly pass or ticket book can bring significant monthly savings, workers earning entry-level wages may not have sufficient funds at the beginning of the month to purchase a

pass."[10] Perhaps discounts could be made available in smaller increments of 10 or 20 days, or another innovative way could be found to smooth out the relatively large expenditure of a monthly pass. Expanding the number of employers participating in the Commuter Checks program (where employees can pay for a monthly pass with pretax earnings) may also help in this regard.

Again, the TransLink® smart cards may make it easier to implement various kinds of multi-ride discounts, and the cards can keep track of multiple discounts with different agencies. If vehicles are equipped with an "accumulator," then a TransLink® card could allow low-income riders to enjoy the benefits of a multi-ride pass without having to pay the full price up front. An accumulator could keep track of the accumulated value of the rides that the individual has taken so far during the month, and once that value exceeded the value of a monthly pass, every trip after that would be free. Essentially, the rider would be paying for a monthly pass, but in small installments until the pass was paid off. This may make monthly passes more accessible for households that ordinarily have trouble saving up for a monthly pass. Note that this is a *potential* use of the TransLink® cards and is not a use that is currently planned. (VTA currently has accumulators in use, but on a daily basis, so that riders do not have to pay for more than a certain number of fares in a day.) Depending on the cost of implementing accumulator-based monthly passes, it may well be worth investigating whether paying for a monthly pass up front is a significant barrier to buying the passes.

TransLink® is currently working to create a distribution system to ensure that all Bay Area residents can access TransLink® fare payment options. TransLink® includes an Autoload feature where a certain amount can be automatically loaded to the card regularly or when the balance gets low, and a Remote Add Value feature where value can be added to the card by charging the value to a credit card over the telephone. However, MTC estimates that 13 percent of potential TransLink® cardholders will not be able to use these two payment options because they do not have a bank account. To add value to a TransLink® card, these households will need to use Add Value

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[10]Crain and Associates, Inc. (2000), pp. ES-2–ES-3.

Machines (AVMs), Ticket Office Terminals (TOTs), or Third Party Distributors (TPD), or obtain TransLink® benefits through their employers. MTC plans to increase the availability of AVMs and TOTs for all transit customers throughout the Bay Area. However, AVMs and TOTs may not be particularly convenient for those bus users who do not usually make stops at BART stations or bus terminals. TransLink® is planning to contract with 400 TPDs throughout the Bay Area to vend TransLink® cards and value, primarily to serve the needs of those who are unable or unwilling to use the other options. MTC has undertaken a study to identify potential TPDs, with special attention to merchants who have locations in low-income areas, such as check-cashing outlets. Locations for TPDs will need to be carefully selected. The distribution plan for TPDs is now under development.[11]

Systemwide Free or Reduced Fares

Private spending on transportation could be reduced by cutting or eliminating transit fares systemwide—however, the wisdom of decreasing or eliminating fares depends on the farebox recovery rate. Perone (2002, p. 11) makes the following observations:

> In larger transit systems, fareboxes generate much more of an agency's operating revenue than smaller systems. . . . Comparatively, in many smaller systems the farebox recovers less than ten percent of the yearly operating cost. Removing the fareboxes might make fiscal sense in smaller systems. In fact, the costs associated with farebox collection and farebox maintenance might equal the revenue collected in some smaller systems, making fare collection an exercise in fiscal futility. However, in larger transit systems, the actual cost of removing the fareboxes will leave the system with a very large revenue shortfall, which will need to be filled by some type of public funding.

If the costs associated with fare collection are close to the amount of revenues collected through fares, then simply abolishing fares altogether might be a reasonable course of action. However, the Statistical Summary of Bay Area Transit Operators reports that total farebox revenue accounts for 19 percent of total operating revenue for AC Transit. For BART, the percentage is 48 percent, indicating that fare-

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[11] See Bernheim (2003) for details on plans regarding TransLink® distribution channels.

free transit is most likely not appropriate for these transit systems.[12] Fare-free transit might be more feasible for smaller agencies; however, to be eligible for Transportation Development Act (TDA) State Transit Assistance (STA) funds, an operator's fare revenues must cover 10 percent of operating costs if serving a nonurbanized area and 20 percent of operating costs if serving an urbanized area.[13] In this environment, fare-free transit does not seem very feasible.

Regarding the less dramatic idea of fare reductions, one must still consider the tradeoffs in service provision that would need to be made or the additional sources of funding that would have to replace the lost fares. If outside funding is available that could be used to reduce fares or provide discounts—for example, from a social services agency—then a reduction in fares would almost certainly make low-income travelers better off as long as the other aspects of transit service could be kept at the same level. However, if funding is not available to support fare reductions, then the tradeoffs between price and other facets of transportation will have to be weighed carefully. It may be more beneficial to low-income transit users to have frequent service along a route that runs close to their home and to their job opportunities, even if fares must be higher to support that level of service. If fares are reduced, service quality may suffer and commute time may lengthen. This may make low-income workers worse off if the value of time lost by longer commutes is worth more than the savings from reduced fares. Likewise, the length of the commute may become so onerous that they drop out of the labor force or take worse jobs closer to home. Cervero (1990) claims that "There can be little doubt that higher price/high quality services, supplemented by discounted passes and vouchers for the poor, are preferable to low price/low quality services" (p. 126).

Evidence from the Nationwide Personal Transportation Survey (NPTS) suggests that price is not what the public feels is the most important problem with transit. For those who use transit, the biggest problems cited were, in order of significance: "crime on public transit, time spent on public transit, having access to a car when they need it,

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[12]See Metropolitan Transportation Commission (2003).

[13]See California Public Utilities (n.d.).

difficulty with crowding or getting a seat, cost of travel by public transit, time of day availability when they need to use it, transit stations and vehicles not being clean, and time and aggravation with transfers."[14] Although these NPTS results are for the general public and therefore may not be applicable to low-income households, surveys of welfare recipients in Fresno and in Los Angeles arrive at similar results. [15] Surveys of the low-income population in the Bay Area to determine which facets of transportation service affect them most (including price) would be helpful for understanding the implications of the tradeoffs that must be made when transportation funding is limited.

Flexible Pricing

Creating transit pricing schemes that vary with distance and time of day would align fares more closely with the actual cost of the trip and shift the burden of fares away from low-income riders. (Higher-income riders are more likely to take longer trips and ride during peak hours.) Taylor (1998) notes that "[L]ower-income riders disproportionately consume off-peak, relatively inexpensive-to-provide services, while higher-income riders are more likely to consume expensive peak service. The net effect is a regressive cross-subsidy from low-income to high-income riders. Transit-dependents pay more per-mile and per-hour for the transit service they consume, while per-rider subsidies tend to increase with ability to pay" (p. 33). Linking fares to distance and time of day would mean that riders who receive more in services (i.e., traveling longer distances) and riders who impose higher costs on the transit system (by contributing to congestion during peak hours and decreasing seat turnover on long trips) would pay more. BART currently has distance-based pricing, as do several of the bus systems. The TransLink® fare payment system may make it easier to provide distance-based fares on buses, particularly if a global positioning system (GPS) is installed.[16] None of the transit agencies in the Bay Area are known to

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[14]Polzin, Rey, and Chu (1998), p. 5-3.

[15]Moreno et al. (2000), p. vi., and Blumenberg and Haas (2001), p. 46.

[16]Golden Gate Transit already has GPS installed on its buses.

have fares based on the time of day, but TransLink® may also make such a pricing scheme easier to implement.

Limitations of Public Transit Price Reduction Strategies

If fare reductions result in increased mobility and higher access to jobs, we might expect transit discounts to have an indirect effect on affordability by raising household earnings. However, this seems unlikely. The research literature indicates that public transit use is not very sensitive to price and is even less sensitive for those with low-incomes.[17] In a survey of the literature on elasticities, Small (1992) reports, "As a rule of thumb, a one percent increase in transit fare reduces transit demand by 0.33 percent: that is, transit's own-price elasticity is approximately -0.33 on average" (p. 11). This means that price reductions will ease the financial burden of transportation expenses but they cannot be expected to increase mobility by much, because travel behaviors are unlikely to change substantially in response to shifts in price.

Results from a recent study of CalWORKs recipients in Alameda County support the idea that transit subsidies alone are an insufficient way to increase access to jobs. Although transportation was considered a barrier to work by a third of welfare recipients, only 15 percent actually made use of the public transit vouchers that were provided. The researchers concluded that "transportation vouchers do not appear to address a severe barrier to employment."[18]

If the primary goal is to improve mobility, transit vouchers are unlikely to be particularly helpful for *most* low-income households. However, vouchers may provide critical support for some of those who do use them. If, on the other hand, the main goal is to ease the financial burden imposed by transportation costs, this goal might be more efficiently achieved through a direct income subsidy program, where the subsidy is not limited to transportation expenses.

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[17]Small (1992), p. 11, Cervero (1990), p. 123.

[18]Dasinger et al. (2002), pp. 76 and vi.

Improving the Non-Monetary Aspects of Public Transit Service

General improvements to the public transit system can affect transportation affordability in two ways. First, improvements may reduce commute times for those who take transit, resulting in time savings. Polzin (2003) estimates the value of time invested in transportation and reports that the value of time spent traveling exceeded the dollar value of the amount spent on transportation over the year.

Second, if transit is improved in a way that allows a fair number of low-income travelers to switch away from cars, then these improvements—whether directly related to the *cost* of transit or not—could substantially reduce transportation expenses for those low-income households that switch. Transit expenditures for low-income California households that use transit are $360 per year, whereas annual vehicle-related expenditures for those who use vehicles are $3,586 per year (Table 3.7). The difference represents a considerable savings to a low-income household.

Most likely, many households that currently have vehicles would not give them up completely. But one might see reduced automobile use, and because gasoline and motor oil are a very large component of vehicle expenses, this reduction in use could result in nontrivial savings to the household. In addition, over time, as children come of age to drive, one might see fewer of them choosing to buy private vehicles if they find that public transit is meeting their transportation needs. Those who choose to commute by car do so because they have decided that the benefits in terms of shorter commute times, greater geographic mobility, greater schedule flexibility, and a greater feeling of personal safety outweigh the costs of the private automobile. However, if improved transit service makes households feel that the relative advantage of the automobile is small, then households may switch to transit and see monetary savings as a result.

The Welfare-to-Work transportation plans assembled by each county have identified numerous areas where service quality could be adjusted to better meet the needs of welfare recipients. Many of these areas are probably applicable to the general low-income population as well. The areas identified include expansion of service areas, extended

hours for late night and graveyard shifts, weekend service, increased frequency of service (particularly at night and on weekends), coordination of transfer times, and increased safety.

Linking Home to Work via Vehicle Ownership

Waller and Hughes (1999) claim that "In most cases, the shortest distance between a poor person and a job is along a line driven in a car." Although vehicle ownership may not always be a cost-effective solution for transportation problems, it is undeniable that the private vehicle affords great advantages in terms of geographic range, speed, schedule flexibility, and general convenience. Only 14 percent of the low-income population in the Bay Area use transit to get to work, whereas 53 percent drive alone, and another 17 percent carpool (Table 5.1). This means that a transportation affordability strategy that focuses solely on transit-oriented policies will likely affect less than half of the population of interest. A comprehensive approach to transportation affordability in the Bay Area must deal with the reality that most low-income households rely extensively on automobiles.[19]

Vouchers for Operating Expenses

In light of the large numbers of low-income households with private vehicles, many CalWORKs agencies provide mileage reimbursements for their clients to cover the vehicle operating costs of getting to training sites, job interviews, and jobs. Parking expenses and auto repairs are sometimes covered as well. These subsidies are by far the most common vehicle-related approach to transportation affordability currently in use.

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[19]In addition to the other approaches mentioned in this section, reducing asset value limits as criteria for eligibility for means-tested programs is another way to facilitate vehicle ownership. Although not directly related to transportation affordability, this policy can improve household finances by allowing participants greater access to jobs through vehicle ownership. In recent years, many states have changed their asset requirements to reduce this barrier to vehicle ownership. In California, $4,650 of the value of a vehicle is currently excluded from the calculation of assets. California might consider further raising this amount or removing the limit altogether on the value for one vehicle. In addition, it may be useful to institute a regular review of the vehicle-related portion of the asset value policy to account for inflationary changes in the cost of living over time. See Waller and Hughes (1999) for more information on this option.

Loans or Grants for Vehicle Purchase, Maintenance, and Repair

Another strategy that has been gaining momentum in recent years is the provision of loans or outright grants for vehicle purchases and repairs. Low-income families generally have less access to credit than the general population, and these services fill in that gap and help low-income families smooth out large, infrequent expenditures and those arising from unexpected events. The Family Service Agency in San Mateo County, the Ways to Work Family Loan Program in Santa Clara, the Sonoma County Human Services Department (in conjunction with Jewish Family and Children's Services), the KEYS program in Contra Costa County, the Alameda Corridor Jobs Coalition, and the Napa Valley Workforce Investment Board all provide loans for vehicle purchase and vehicle-related expenditures.[20] Partnerships with mainstream financial institutions may also be a successful approach to the provision of loans to low-income vehicle buyers.

A randomized experiment of subsidized purchases of refurbished, donated used cars has shown a statistically significant increase in earned income and in the probability of employment, suggesting that this approach may be a promising course of action.[21] However, the study was done in Vermont, a highly rural state. The results may not be the same in the more urbanized sections of the Bay Area, and the merits of such a program relative to transit-based approaches may be quite different given the differences in population density. Implementing similar studies in the Bay Area would provide valuable information about how well loan and grant programs work in this region and where they work best. Solano County's Car Adoption and Roads to Success (CARS) program recently began providing donated vehicles to low-income households. The National Economic Development and Law Center in Oakland has a document describing several similar car ownership programs and a summary of best practices. Its recommendations include providing case management, training car recipients in financial literacy, planning for all ownership costs, partnering with banks to help rebuild

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[20]Scholl (2002).

[21]Lucas and Nicholson (2002).

credit ratings, assisting with insurance costs, and tracking success. In addition, it suggests that JARC funding be used for car ownership programs, that TANF funding for car ownership programs be increased, and that asset value limits be raised.[22]

A bill that has fairly recently been introduced to the California Assembly by Assemblywoman Cindy Montanez contains several items that may help keep purchase costs low for low-income households buying used vehicles. The provisions include

- An official definition of certification for certified used cars, including a required inspection by a qualified technician;
- A cooling off period, where buyers of used cars could return a vehicle after three days for a full refund; and
- A requirement that car dealers disclose to buyers their credit scores and the lowest interest rate that they qualify for.

The Assembly approved the bill on May 27, 2004, and the Senate will be considering it this summer.[23]

Because the maintenance and repairs category was a sizable component of vehicle-related costs, constituting about 10 percent of annual vehicle expenditures for low-income households (Table 3.3), programs that support vehicle maintenance and repairs would be another reasonable way to facilitate vehicle ownership. TANF programs often help cover repair costs, and loan funds are often available for maintenance and repair costs as well as vehicle purchases. In addition, some TANF programs provide training in maintenance and repairs to their clients. If these classes are found to be beneficial, such training could be extended to a broader audience of low-income car owners, perhaps by providing free or reduced-price classes at community colleges or community centers.

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[22]Hayden and Mauldin (2002).

[23]Note that California's Lemon Law covers only new cars or used cars that are still under warranty.

Targeting Insurance Costs

Insurance costs were found to amount to 15 percent of annual vehicle expenditures (Table 3.3). Some programs for welfare recipients seek to link participants with insurance companies that charge reasonably low rates, but such programs seem relatively rare. The California Low Cost Automobile Insurance Program (LCA) is a pilot program available only to residents of San Francisco and Los Angeles Counties.[24] This program officially began in 2000, and the pilot program is schedule to continue until January 1, 2007. The program is administered by the California Automobile Assigned Risk Plan, or CAARP. In the first few years of implementation, policies did not sell very well. In efforts to boost participation, rates were lowered (from $410 to $314 for San Francisco County), the eligibility level was raised from 150 percent to 250 percent of the federal poverty threshold, and a new payment option allowed participants to put down a deposit of 15 percent of the total premium, followed by six monthly installments. In addition, the option to buy additional uninsured motorist bodily injury coverage and medical payments coverage was added. Between 2002 and 2003, the number of applications increased from 2,390 to 5,631. Depending on the success of the LCA program, it may be worthwhile to make the program permanent and extend it to the rest of the Bay Area counties and perhaps throughout the state. Another option for the program would be to have the insurance be publicly subsidized.

Litman (1997) advocates tying insurance rates more closely to the distance driven. This could be implemented through "mileage-pricing," by "pay-at-the-pump measures," or by increasing the distance weights that are already used by insurance companies, but Litman considers mileage-pricing to be the most equitable of the three strategies. "The strategies should benefit most lower-income vehicle owners, who tend to drive less than wealthier vehicle owners" (p. 132). Progressive Casualty Insurance Company (the nation's fourth-largest insurance company) ran a mileage-based pilot program in Texas from 1998 to 2000, using GPS to measure vehicle mileage. Participants in Progressive's Autograph program were reported to have saved 25 percent compared to what they

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[24] Low (2002).

would have paid with traditional auto insurance (Progressive Casualty Insurance Company, 2000). Litman notes, however, that an individual insurance company has little incentive to take on the costs of implementing a new program with any of these three distance-related strategies. Linking insurance costs more closely to distance may be more feasible on a large scale: Litman states that "Mileage-pricing could be implemented at the state, provincial, or federal level by simply specifying in insurance law that the unit by which coverage is sold shall be distance related." Perhaps, in the future, programs such as the California Low Cost Automobile Insurance Program could incorporate one of the distance-based strategies described by Litman.

One final qualifier regarding vehicle-oriented strategies: Although private vehicles provide many advantages over other forms of transportation, there are those who will not be able to use a private vehicle, including those who are too old, too young, or physically unable to drive. A comprehensive transportation affordability strategy needs to keep in mind the needs of these constituencies and pursue other options as well as vehicle options.

Linking Home to Work via Paratransit and Other Alternatives

"Paratransit" is an umbrella term that covers shuttles, vanpools, dial-a-ride services, jitneys, and shared-ride taxis. Some paratransit services operate at regularly scheduled times, others are on-demand, either by phone or by hailing the vehicle on the street. Sometimes paratransit services have a fixed route, sometimes they pick up passengers at several locations to drop them off at one common destination (such as an employer or the airport), and sometimes they provide individualized door-to-door service.[25] These systems provide some of the scheduling flexibility and geographic mobility of private vehicles with some of the economies of scale of a public transit system.

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[25]For a useful typology of paratransit services, see Cervero (1997), p. 15.

Vans and Shuttles

Demand-response seems best suited for situations where a group of people have either the same origin (say, a public housing project) or the same destination (a large employer or group of employers, a social services center, a health center, etc.). One option for making transportation more affordable would be for the employer or agency to which the individual is traveling to subsidize the shuttle service.

Jitneys

Jitneys combine the characteristics of taxi service, carpooling, and formal paratransit services. They generally have semi-fixed routes, carry several passengers at a time, and are much cheaper than taxis. Because they are often faster and cheaper than public transit as well, jitney services can take a fair bite out of transit revenues, and transit providers often show strong opposition to jitney service.

San Francisco once had a thriving jitney fleet, but as Cervero (1997) reports, "[b]ecause of mounting public transit deficits and pressures to protect Municipal Railway (Muni) trolleybuses and streetcars from competition, the city issued no new jitney permits after 1972" (p. 41). Moreover, after Proposition K passed in 1978, jitney permits were not allowed to transfer from one operator to another. In addition, increases in liability insurance requirements and in insurance premiums helped to shut down the industry. Today, only one jitney service is left in the City of San Francisco, running between the Montgomery BART station on Market Street and the Caltrain depot at Fourth and Townsend.[26]

Reducing the barriers to operating jitney services would very likely reduce monetary and time costs for some low-income individuals. An article in the *Harvard Journal on Legislation* concludes that,

> [J]itneys can contribute invaluably and permanently to efforts to improve the economic prospects of America's inner-city residents. Of course, in some cities, jitneys may be a total flop. Perhaps their remarkable success in New York and Miami is attributable to the presence of large numbers of immigrants accustomed to relying on jitneys to serve their transportation needs. However, the question for legislators ought not to be whether jitneys will in fact successfully augment the transportation services available to our poorest

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[26]San Francisco County Transportation Authority (2002).

> citizens. Rather, the question should be whether it makes sense to maintain legal restrictions that hinder the development of transportation services that hold so much promise of improving the economic prospects of the very poor (Garnett, 2001, pp. 228–229).

However, jitneys would also take riders and money out of the public transit system. If jitney services could be effectively incorporated into the public transit system, this might serve the needs of the riders and generate revenue for the transit system at the same time.

Ride-Sharing and Car-Sharing

Carpooling or ride-sharing can be a very effective way for low-income households to take care of their transportation needs, and carpools are sometimes organized through social services agencies and schools or through programs directed at the general public.

Car-sharing is a more novel way of spreading the costs and benefits of private vehicle ownership across numerous households. City CarShare, which operates in San Francisco, Oakland, Berkeley, Palo Alto, and Mountain View, is an innovative system of short term car rental for members at a rate of $4 per hour for peak hours and $2 per hour for off-peak hours. With funding from the Metropolitan Transportation Commission, City CarShare is now offering 300 CalWORKs memberships, with the usual $30 membership fee and $300 deposit waived for eligible applicants. Although City CarShare is not intended for commuting purposes, it can provide the benefits of vehicle ownership for occasional trips. Evaluation of the success of this program would help policymakers decide whether the program should be implemented on a wider scale and what modifications might be necessary.

Transportation for Short-Term Needs

One of the most important roles that needs to be filled is that of transportation for emergency situations. Welfare-to-work programs are generally aware of this and often offer vouchers for "guaranteed ride home" services for workers who usually take transit but who may need an occasional taxi ride home to take care of a sick family member or when

they have to work past the hours of transit service. Emergency rides are also useful in cases where a private vehicle breaks down. One possibility to consider is the expansion of guaranteed ride home programs to the broader low-income population.

The MTA in Los Angeles County oversees a program that provides taxi vouchers and bus tokens for urgent short-term transportation needs. The Immediate Needs Transportation Program[27] covers its $5 million cost through funding from two local sales tax measures. Two community-based organizations (First African Methodist Episcopal Church and the International Institute of Los Angeles) administer the program, supervising 600 social services agencies throughout the county that distribute taxi vouchers and tokens to roughly 14,000 clients each month. The individual agencies determine clients' eligibility for receipt of services. Trips are subsidized for medical purposes, grocery shopping, job training and interviews, case management appointments, various emergencies, and other reasons. The program originally focused on providing taxi vouchers, but now 48 percent of the trips rely on bus tokens. MTC could consider searching for appropriate community-based partners and funding streams to implement a similar program in the Bay Area.

Providing Options for Job Search

The job search situation has its own unique transportation issues. It is much easier to figure out commute logistics once a worker has a job than it is to figure out transit routes and time requirements for multiple destinations when seeking a job. Short-term rentals or vehicle loans for the purpose of job search and other occasional uses could be a useful supplement to regular public transit services. On the other hand, this can be counterproductive if a job-seeker finds a job and then discovers that it is not feasible to travel there without a car. The Solano County Welfare-to-Work Transportation Plan Final Report mentions that Solano County had considered a program that "would allow participants the opportunity to borrow county vehicles for a limited period of time," but this program was put on hold because of liability issues.

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[27] See Transportation Research Board (1998) for more details on this program.

Facilitating Bicycling or Walking

About 10 percent of low-income workers already walk or bike to work (Table 5.1), but finding ways to make walking or biking easier could decrease monetary costs for other low-income commuters. Smart-growth strategies are meant to encourage development growth in a way that would keep jobs and homes in walking or biking distance of one another. Programs to facilitate bicycle ownership for low-income populations are rare, although some small programs donate bicycles, subsidize bicycle maintenance and repair, or teach bicycle maintenance. Low-income communities could be targeted for bicycle lanes. However, bicycle and walking strategies may not be very practical for households with young children.

Involving Employers

Employers could be involved with many of the approaches mentioned above. One approach that has met with some success is to encourage employers to set up or help establish shuttle services for their employees—either from home to work or from a main transit hub to work. Another employer-related strategy is to encourage participation in the Commuter Check program, which allows workers to pay for transportation with pre-tax dollars. Employers with large numbers of low-wage employees could be particularly encouraged to participate. Incentives could be extended to employers to provide Commuter Check benefits as an addition to salary rather than just having the money come from the employee's pre-tax salary.

Improving Information and Convenience

Nearly all of the county welfare-to-work transportation plans mentioned that program participants often were unaware of transportation services or had difficulty making use of them. Scholl (2002) mentions that BART offers a special 50 percent reduced-rate pass to youths ages 13 through 17 but notes that "this program is not well known or advertised, and is mostly offered through private high schools at this time" (p. 59). Low-income households need to understand their alternatives to make informed transportation

decisions. Efforts to distribute information might include the provision of information kiosks in low-income neighborhoods, community centers, and social service provider offices. Limited English proficiency is sometimes a barrier to the dissemination of information about transportation programs, but this can be addressed by making sure that information is available in various languages. An additional strategy is to include transit route information as part of job listings, thereby facilitating the job search process.

Simplifying fare structures and transfer policies as well as streamlining processes in general would help low-income persons take advantage of the transportation options available to them. Two findings from the Alameda County Welfare to Work Transportation Planning Project illustrate the need for simplification and clarity: First, the document reports that "Using transit in Alameda County requires deciphering five different sets of rules for adult fares, child fares, transfers and passes on five different transit systems," and second, that "the process for getting transportation assistance is complicated" (p. 10). In a similar vein, a study of 100 low-income parents from Alameda and Santa Clara Counties concluded that caseworkers need mandatory, up-to-date training regarding transportation services, and that monetary transportation allotments should be mailed directly to clients before the beginning of the month.[28]

Widespread participation of transit providers in the TransLink® smart card system may reduce some of the complexity of dealing with different sets of fares. It might also present an opportunity to implement greater uniformity of fares across providers. Trip planning services are often provided to CalWORKs participants; these services could be extended to the broader low-income population as well.

Assistance for Child-Related Travel

The empirical results from this report suggest that parents face a different set of transportation needs than people without children. One possibility for addressing this issue is to encourage employers to provide child care at the place of employment. Placing child care centers at

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[28]CalWORKs Transportation Access and Advocacy Coalition (2001), p. 2.

transportation hubs may be another useful strategy. A third approach is to help households find quality child care facilities near their homes or workplaces. In this regard, publicity and support for existing county child care referral networks would be useful. An alternative method, currently used by the Contra Costa Department of Human Services, is to provide a shuttle specifically to transport children.[29]

As a result of growing budgetary pressures, some school districts around the state have required that parents pay for their children to ride the bus to their public schools. Districts are not required by law to provide any transportation except for certain special education students, and provision of transportation services is locally determined. Districts that do provide transportation service can either use district buses, contract out for services, or provide vouchers for public transportation.

The shift over time away from provision of transportation for students adversely affects low-income families with children. Legislation at the state level might be used to redress this shift. Alternatively, monies might be set aside to provide "scholarships" to families for whom school bus fees would impose a hardship.

Increasing Household Income Directly

A completely different approach to transportation affordability would be to increase household income directly with a tool such as the Earned Income Tax Credit (EITC). An income subsidy could offset some or all of the burden imposed by transportation costs. However, it must be understood that households may spend only part of this money on transportation. Unless the subsidy is quite large, it would probably not facilitate car purchases and therefore would probably not affect mobility substantially. Thus, the main effect would be to ease stress on the household budget.

Using the tax system as the point of service might provide an efficient mechanism for identifying low-income people and sending them their income subsidy. In this sense, working through the tax system may be a more cost-effective way to address the financial well-being of low-income households than implementing a means-tested

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[29]Contra Costa Transportation Alliance (1999), pp. 6–11.

transportation assistance program. Although many low-income households do not file taxes, more have been filing since the EITC became available, and providing further incentives such as transportation credits might encourage even higher filing rates. One limitation to bear in mind is that income credits provide assistance only to those who are already employed. Those seeking employment would not find it any easier to cover their transportation costs.

Another way to ease household budgets is to reduce taxes and fees, especially for transportation. This approach has already been used with the rollback of the vehicle license fee (VLF), which was intended to provide relief for California households regardless of income level. Our findings from the expenditure data indicate that a fair portion of the low-income group will not benefit from the VLF rollback because they do not own cars (see Table 3.2). For those who do own private vehicles, state and local registration fees account for only 1 percent of total vehicle-related expenditures (Table 3.3). Therefore, changes in vehicle license fees are not likely to make a significant difference to low-income families.

One way to lighten the tax burden on low-income households without reducing overall tax revenue would be to shift the current mix of revenue sources toward more progressive taxes. Transportation funding in recent years has shifted more and more toward local sales taxes, which are regressive; that is, low-income households pay a higher percentage of their income on these taxes than other households. Gasoline taxes, another common source of transportation funding, are also regressive, because low-income households spend a higher share of their income on gasoline than higher-income households do. However, Wachs (2003) states that fuel taxes are more equitable than sales taxes, as well as being more efficient.

As mentioned at the outset of this chapter on policy options, these strategies can be used in combination with each other and in different proportions according to specific local needs. Balance should be sought between the gains to be made through efficiencies of scale from implementing statewide or regional projects and the gains to be made by

allowing flexibility at the local level. The next chapter suggests some areas for future research that will help policymakers identify which policy approaches merit the most attention.

8. Priorities for Future Research

To ensure timeliness, this report has relied upon existing data. In analyzing those data, we were able to identify some priorities for future research. In this chapter, we discuss two particularly promising directions for research: (1) assessing the transportation needs of low-income households through surveys; and (2) formally evaluating programs designed to make transportation more affordable.

Assessing the Transportation Needs of Low-Income Households

A better understanding of the transportation needs of low-income families in the Bay Area would provide insights valuable for crafting well-targeted transportation affordability policies. Large-scale surveys could be used to ask low-income individuals about their transportation needs, how they rank those needs, and what strategies they feel would be most beneficial. The resulting data could help gauge the relative importance of monetary costs, transit service hours and days, service frequency, and safety issues. This information could be very useful to transportation planners as they evaluate tradeoffs among different policy approaches.

Ideally, the survey data would allow researchers to link monetary cost information to time costs and quality of service. Survey questions should cover vehicle ownership, mode usage, commute length and duration, place of work and place of residence, and transportation costs and spending. Collecting data on residential location would allow researchers to address the fact that mode choice occurs in conjunction with housing location decisions. Linking data on transportation costs and income levels to the distance traveled and the density of key destinations would be valuable to researchers trying to measure the level of access that families are able to obtain for a given percentage of income. Surveys could shed light on transportation needs for travel to both work and nonwork destinations (e.g., child care, school, training, social

services, health care, drug treatment facilities, and shopping areas). Low-income individuals will find it difficult to have successful work lives if their child care, health care, and other needs are not met because of lack of transportation.

Information on personal characteristics (for example, geographic location, employment status, income, household composition, race and ethnicity, language fluency, and participation in such means-tested programs as Food Stamps and CalWORKs) would be useful for tailoring programs to the specific needs of different groups. In particular, the data could identify populations for whom the cost of transit presents a barrier to transit use or a financial hardship. Households could report on whether they have trouble paying for multi-ride discount passes and whether spreading the payments out over the course of the month would make a significant difference for them. Surveys could also be used to assess how well information about transportation affordability programs is being distributed and absorbed.

Because data collection is expensive and time-consuming, one cost-efficient way to gain more information about transportation affordability issues would be to piggy-back on data collection efforts already in place. Several relevant surveys and questionnaires have already been fielded in the Bay Area—for example, the needs assessment for Alameda County welfare recipients done by the Public Health Institute, the transportation survey fielded by the LIFETIME grassroots organization, and various transit ridership surveys. Although these studies have provided many useful insights into transportation behaviors and needs, future research could address the monetary costs of transportation more thoroughly.

Health and human services agencies frequently survey program participants, and transportation planning agencies could collaborate with HHS agencies to ask useful questions about transportation on welfare-to-work surveys. Some past surveys of TANF recipients have asked such questions as "Is transportation ever a barrier to getting to work?" The answers are informative, but it would be even more helpful to identify which specific aspects of transportation are serving as barriers to employment (for example, monetary costs, time costs, or lack of mobility). The questions posed in the Green et al. (2000) study of Alameda County, the Moreno et al. (2000) study in Los Angeles

County, and the Blumenberg and Haas (2001) study of Fresno County provide good examples of transportation questions that could serve as a starting point for designing future surveys of welfare recipients.[1] Another possibility for collaboration with social services agencies would be to add transportation information to their administrative databases. One advantage of administrative program data is that such data allow researchers to link information on residential location and workplace location. Adding information about such items as monetary costs, mode choice, travel time, and transportation assistance would expand research options even further.

Another way to extend current research would be to bring greater emphasis on low-income populations to transportation planning data collection efforts. MTC and individual transit agencies within the Bay Area periodically conduct ridership surveys. Efforts could be made to oversample low-income and nonwhite populations to ensure that sample sizes are large enough to do statistically valid analyses on specific subgroups (for example, low-income Hispanic married households with children). In addition, ridership surveys could ask respondents to rank their concerns regarding transit service, including monetary costs. Adding affordability questions to the ridership surveys could help identify those groups for whom the cost of transit is problematic, by looking at differences with respect to demographic characteristics, transfer behavior, transit providers and routes.[2]

Another avenue for possible extensions to ongoing research is to add more information on monetary costs to national transportation surveys. The National Household Travel Survey, the Census long form, the American Community Survey, and the American Housing Survey all contain helpful data on transportation but do not address monetary

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[1]Further information is also available in Blumenberg et al. (2003).

[2]In the future, the TransLink® card will become a useful mechanism for collecting data and will be able to link information on travel behavior to information about the cost of the trip. However, as the TransLink® system is currently set up, its relevance for analyzing the low-income population is somewhat limited because it does not link the travel information to any passenger characteristics (such as income level). One could instead do analyses at the neighborhood level—however, it will not be possible to identify where bus trips originate or end unless GPS is installed on the buses.

costs. Efforts to incorporate information on monetary costs into surveys like these would help researchers nationwide to address affordability issues.[3]

In addition to the option of expanding current data collection efforts, there is the possibility of fielding a unique survey with the specific goal of assessing the transportation needs of low-income households in the Bay Area. Such a survey could deliver all the benefits discussed above and might have several further advantages. First, researchers would be able to look at a broader spectrum of the low-income population than is possible with welfare-to-work surveys. In addition, researchers could look at other subgroups of interest, such as the elderly, immigrants, disabled persons, children, and the homeless. Differences by race would be particularly interesting to examine, because nonwhites may have even less residential mobility than other low-income groups, because of discrimination in the housing market. A second advantage to fielding a specifically targeted survey is that it could ask more detailed questions on affordability issues than is usual for ordinary ridership surveys. Third, with a Bay Area survey, information could be analyzed at a local level of geography (in contrast to national datasets, which often have broad geographic identifiers).

Such a survey could be supplemented by focus groups. Focus groups can illuminate the patterns seen in the survey data, even as the survey data can indicate how representative the insights gained from the focus groups are likely to be.

Evaluation of Transportation Affordability Programs

Another promising area for future research is to evaluate transportation affordability strategies implemented in the Bay Area. A wide variety of programs already exist in the region, and assessment of their success could identify profitable projects for expansion and

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[3]Another opportunity for adding cost information to larger transportation analyses would be to incorporate monetary costs into studies that identify geographic gaps in service (such as MTC's Lifeline Transportation Network Report, 2001b), by assessing the fares needed to travel between the identified residential and job locations.

replication. In addition, new transportation affordability programs could be established as demonstration projects.

One example of a constructive program evaluation is the 2002 Lucas and Nicholson study of a car loan program in Vermont. This study found that loans to purchase cars were associated with statistically significant increases in both employment and earnings. One strength of Lucas and Nicholson's results is that they rely on a comparison of groups that were randomly assigned to participate or not participate in the program (a "treatment" group and a "control" group). The City CarShare program is one program where random assignment might be applied in an evaluation setting. The program is highly innovative, and a thorough evaluation of it could benefit transportation and social services planners not just in the Bay Area but around the country.

New pilot programs for projects that have not yet started could incorporate random assignment evaluations as part of the project design. The promise of a careful analysis might help attract funding from foundations to support the program. Certainly, random assignment is neither a necessary nor a sufficient condition for a rigorous evaluation of a project, and other research methods may apply as well or better with respect to a given program. Regardless of the specific methods used, care should be taken to ensure that evaluations are rigorous. One caveat is in order: New programs often require a learning period in which to iron out the wrinkles. Evaluating a new program during this initial period may not give it a fair test. In this sense, some of the long-standing car loan programs in the area may be better candidates for evaluation at this time.

Another project that would shed light on how to address transportation affordability would be an investigation of what happens to CalWORKs recipients once their transportation benefits expire. If an evaluation of this kind were set up with more than one "treatment" group, it might provide information on the optimal length of time for providing transportation benefits after a job is acquired. Although random assignment is helpful for creating a clean comparison between groups, a researcher might alternatively be able to investigate this issue by exploiting differences between counties in the length of benefits (if there

are differences) and by looking at differences in length of benefits over the course of time as policies have changed.

Taken together, these two research areas—the assessment of transportation needs and the evaluation of existing and emerging programs—will contribute to a better understanding of what works, what does not, and which new strategies hold the most potential. In addition, these research efforts would provide information useful for tailoring policies effectively to specific groups and geographic areas. As a preliminary step toward understanding transportation affordability, this report has focused specifically on investigating monetary costs. However, given that policymakers need to consider the tradeoffs and interactions between monetary costs and other features of transportation, future studies would do well to link cost information to quality of service. Research along these lines would help policymakers shape, target, and promote programs to meet the transportation needs of the Bay Area's low-income households.

Appendix A

General Information on Methods

Details on the Methods Used to Define the Income Groups

The income groups we created across the four datasets are built on the federal poverty thresholds, which account for the size of the family and the number of children present.[1] Generally speaking, we use household characteristics to group the data into those below the poverty level (poor), those below 200 percent of the poverty level (low-income), and those at or above 200 percent of the poverty level (higher-income). PUMS data show that the poor group accounts for the poorest 11 percent of the metropolitan California population; the low-income group accounts for the poorest 27 percent; and the higher-income group accounts for the top 73 percent of the income distribution.

Because the data available on the four datasets varied widely, we were not able to use precisely the same definitions for each, rather, we used the methods described below to approximate similar groupings across the four datasets. The table below summarizes the cutoff points we used to designate our poor, low-income, and higher-income groups, and further details are provided in the text.

We use the poverty status variable available in the PUMS data to categorize households or workers into the three income categories. The PUMS poverty status variable incorporates the structure of the official poverty thresholds, based on family income and family structure. The value of the poverty status variable ranges from 1 to 501, with 1 indicating that income constitutes 1 percent of the poverty threshold for that household, and 501 indicating that income constitutes more than 500 percent of the poverty level. Therefore, a person or household with

[1]The official poverty thresholds can be found at http://www.census.gov/hhes/poverty/threshld.html.

Dataset	Poor	Low-Income	Higher-Income
PUMS	Family income is below the official federal poverty threshold (which accounts for size of family, number of children present, and, for small households, whether the householder is over age 65).	Family income is below 200 percent of the official poverty threshold.	Family income is 200 percent of the official poverty threshold or more.
CTPP	Household income is less than $15,000.	Household income is less than $30,000.	Household income is $30,000 or more.
BATS	Household income ranges were recoded to their midpoint; if the midpoint value was below the official federal poverty threshold, the household is coded as poor.	Household income ranges were recoded to their midpoint; if the midpoint value was below 200 percent of the official federal poverty threshold, the household is coded as low-income.	Household income ranges were recoded to their midpoint; if the midpoint value was 200 percent of the official federal poverty threshold or more, the household is coded as higher-income.
CES	Total annual expenditures are divided by the federal poverty threshold relevant for the household. Consumer Units with an expenditure-to-poverty-threshold ratio below 1.15168 are classified as poor. The ratio cutoff point was determined by taking the 11th percentile of the distribution of the expenditure-to-poverty ratio (where the 11th percentile was derived from the fact that PUMS shows 11 percent of households in poverty).	Total annual expenditures are divided by the federal poverty threshold relevant for the household. Consumer Units with an expenditure-to-poverty-threshold ratio below 1.75536 are classified as low-income. The ratio cutoff point was determined by taking the 27th percentile of the expenditure-to-poverty ratio (where the 27th percentile was derived from the fact that PUMS shows 27 percent of households are low-income).	Total annual expenditures are divided by the federal poverty threshold relevant for the household. Consumer Units with an expenditure-to-poverty-threshold ratio at or above 1.75536 are classified as higher-income. The ratio cutoff point was determined by taking the 27th percentile of the expenditure-to-poverty ratio (derived from the fact that PUMS shows 27 percent of households are low-income).

a value less than 100 for their poverty status variable is considered poor by the official federal definition. We defined the low-income group as anyone whose poverty score is less than 200 (i.e., less than 200 percent of

the poverty level). Those with a poverty score of 200 or above are classified as higher-income.

CTPP data are in a tabulated format and cannot be disaggregated into smaller income units. Because we have no way to assign income categories to individual households, we instead had to label aggregate data reported by income range to best match the other datasets. We used the income ranges provided in the "household income" variable, which has 26 categories ranging from "less than $5,000" to "$150,000 or more." We classified households with annual income less than $15,000 as poor, those with annual income less than $30,000 as low-income, and those with income at or above $30,000 as higher-income.

BATS data provide income ranges rather than exact income amounts. We assigned each household the midpoint of the income range that it had reported, and then took that recoded income amount and divided by the federal poverty threshold. If that ratio was below 1, the family was classified as poor; if the ratio was below 2, the family was classified as low-income; if the ratio was at or above 2, the family was classified as higher-income.

With the CES dataset, we classified households on the basis of their total expenditure level, not their income level, but otherwise the classification method is similar to that used with PUMS.

BLS explains in detail the problems inherent in using income data to classify households:

> Consumers may spend more or less in response to income gains or losses, but will not make long-term adjustments to spending if they believe that the changes in their income are temporary. Thus, expenditure levels are less variable over time than income levels and may be a better indicator of the economic welfare of the consumer unit. This has been discussed extensively in the economic literature pertaining to what is known as the permanent-income hypothesis. According to this hypothesis, as a result of transitory income losses and gains, low-income consumers will include those consumers with temporary reductions in their incomes that result in high ratios of expenditures to income, and high-income consumers will include those with temporary increases in income that result in low ratios of expenditure to income.
>
> As regards practical drawbacks, respondents may be unable to recall some of their income from one or more sources, or they may be reluctant to report some or all of their income. Incomplete reporting and underreporting of

> income, problems common to most household surveys, limit the usefulness of income as a classifying variable. . . .
>
> Also, some consumer units report income losses from a business they own, which may result in low or negative incomes, even if they report income from other sources. Because these consumer units may have expenditures levels that are more typical of higher-income consumers, the losses they report affect both the average income and the average expenditures in the income quintile and income level table. Specifically, their low or negative incomes may depress the average income level, while their higher expenditures raise the average expenditure level. These consumers are not what are considered to be typical low-income consumers. . . .
>
> Results from the CE Survey have typically shown that when the data are classified by income quintile, the expenditures-to-income ratio is quite high for the lowest income quintile. . . . That expenditures exceed income in these quintiles is not unreasonable, given consumers' access to savings, borrowing, and credit, mentioned earlier. However, the degree by which expenditures exceed income—a factor greater than 2 for the lowest quintile—seems extreme. . . .
>
> Total outays were well above income for the two lowest income quintiles. This can be attributed to problems discussed earlier: underreporting income and consumers reporting income losses who have expenditures typical of higher-income consumers.[2]

Because we wanted a categorization system that adjusted for household structure and that would be comparable to our other datasets, we created expenditure categories based on the federal poverty thresholds. We divided the household's total annual expenditures by the official poverty threshold for that particular household based on family size, number of children, age of children, and family income. This method provides the variable that is used to rank the households—however, we then needed a way to identify cutoff points so that we would have groups that represented the same proportion of the total population as the income-based poverty thresholds do. With PUMS data, we determined that 11 percent of California households meet the official definition of poor, and 27 percent can be classified as low-income. We then looked at the distribution of the ratio of total

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[2]Rogers and Gray (1994), pp. 32–33 and 35.

expenditures to the poverty threshold, and we calculated the 11th and 27th percentiles of that distribution, which were 1.15168 and 1.75536, respectively. We classified households with an expenditure-to-poverty-threshold ratio less than 1.15168 as poor, those with a ratio below 1.75536 as low-income, and those with a ratio at or above 1.75536 as higher-income.

Appendix C contains a sensitivity analysis that demonstrates how the results change under several different treatments of the data.

Sample Sizes for the Datasets

The following table summarizes the information on sample sizes for the datasets:

	Poor	Low-Income	Higher-Income	Total
PUMS Bay Area				
Households	8,850	22,267	98,845	121,112
Persons	26,314	64,474	259,665	324,139
BATS[a]				
Households	275	742	12,449	13,191
Persons	533	1,816	28,626	30,442
CES metropolitan California Consumer Units	1,215	2,984	8,069	11,053
CES metropolitan California vehicle users	561	1,867	7,170	9,037
CES metropolitan California vehicle purchasers	40	127	605	732
CES metropolitan California transit users	237	466	628	1,331

[a]BATS income data are missing for 1,873 households and 3,917 persons. Of those households with incomplete income data, 919 households reported that their income was $40,000 or higher, 153 reported that their income was below $40,000, and 801 were missing all income data. We did not include these incomplete income reporters in our analyses.

Weights

Sample weights are used with each of the datasets to make the data representative of the desired entity. In CES and PUMS data, the weights are designed to represent the entire United States, rather than California

or the Bay Area specifically. We used a variable called "FINLWGT21" in CES data and "PWEIGHT" or "HWEIGHT" in PUMS, depending on whether we were analyzing persons or households. BATS data are weighted with a variable called "HHWGT2" for households, "PFACTOR5" for persons, and "TRIPFACTOR" for weekday linked trip data. CTPP data are tabulated and already constructed to be representative of the universe (e.g., all households, workers in households, and all workers) so we did not weight with any specific variable.

Average of the Ratios Versus the Ratio of the Averages

Many of the main findings from the CES chapter are ratios: transportation expenditures as a percentage of total expenditures, specific vehicle-related costs as a percentage of total vehicle-related costs, etc. We report the average of the ratio rather than the ratio of the average. That is, we calculate the ratio at the household level and then take the average across households, rather than calculating the average of the numerator and the average of the denominator across households and then taking the ratio of these two numbers.[3] In many cases, the two calculations provide similar answers. However, the average of the ratios gives each household equal weight, whereas taking the ratio of the averages tends to give greater weight to households with higher expenditures. Although the ratio of the averages may be an appropriate calculation for some purposes, we feel that using the average of the ratios provides a better measure of what is going on at the household level. In the CES sensitivity analysis in Appendix C, we include a comparison of budget shares calculated both ways.

Significance Tests

Wherever differences between means are discussed in the text, we used t-tests to determine if the reported differences between groups are

[3]In a few cases where we have aggregate data (such as the CES metropolitan area dataset), the ratios cannot be calculated at the household level, and we are obliged to report the ratio of the averages instead.

significant. (We also used t-tests to confirm that our results are significantly different from zero.) A SAS procedure called "npar1way" was used to test differences of medians between groups.

Appendix B

Information on Specific Datasets

Census Public Use Microdata Sample 2000

The PUMS 5 percent state-level file provides individual data from the long form of the 2000 Census. The data that we use from PUMS do not include institutionalized persons or persons living in group quarters. For the mixed-mode commutes, respondents to PUMS were asked to mark the mode that they used for the greatest distance during their commute.

Census Transportation Planning Package 2000

We also use the residence files from the CTPP, a tabulated dataset that has been aggregated for transportation planning purposes from the individual-level data on the long form of the 2000 Census. The CTPP provides data at a much finer level of geography than in other available datasets, and we make use of tabulations at the TAZ level to look at commute characteristics within the Bay Area.

MTC Bay Area Travel Survey 2000

The BATS dataset covers the nine counties in the MTC region. For many of the travel behavior measures that we analyze in this report, we had the option of using either PUMS data or BATS data. We often calculated results using both datasets but reported only the PUMS results, primarily because PUMS had larger sample sizes. (This becomes particularly important when trying to obtain statistically valid results for small subgroups within the poor and low-income groups.) Where there were statistically significant results that were markedly different between the datasets, we report both sets of results. For our commute duration calculations using BATS data, we excluded anyone with commute time greater than 3.5 hours.

Consumer Expenditure Survey 1999–2001

The CES, maintained by the Bureau of Labor Statistics (BLS), collects information on household spending behavior. Most of the analysis in this report uses the household microdata for the years 1999–2001. We adjusted 1999 and 2001 expenditures to 2000 dollars, using the Consumer Price Index (CPI) for All Urban Consumers produced by the Bureau of Labor Statistics. The unit of analysis is the "consumer unit," or CU, which represents an independent financial decisionmaking unit within the household. In over 95 percent of cases, there is only one CU per household, and therefore we stick with the more user-friendly term "household" throughout this report rather than referring to consumer units. CES data include civilian, noninstitutionalized persons.

The CES microdata allow us to examine expenditure patterns for approximately 11,000 consumer units living in metropolitan areas of California. With the public use microdata, we are able to ascertain whether the household resides in California only if it is within an MSA. There are nonmetropolitan California households in the CES national sample, but in the public-use microdata, BLS has set the state identifier on these nonmetropolitan observations to missing. As a result, all households in CES that are associated with the California state identifier reside in an MSA and are defined as "urban." We also cannot identify where within metropolitan California each household lives (e.g., whether it is in the Bay Area, or Los Angeles, or Bakersfield), because BLS removes the MSA identifiers from the public use microdata. To compare San Francisco to other metropolitan areas, we also made use of the CES MSA tabulated data for 1999–2000. However, the MSA-level data do not allow us to look at expenditures by income level.

We exclude some items from our measure of transportation expenditures that CES includes in its summary measures of transportation expenditures, usually because these expenditures do not represent regular daily travel patterns. We excluded all costs associated with out-of-town travel because we wanted to concentrate on issues of access to jobs and services rather than occasional trips and vacations.

We also excluded expenditures on bicycle purchases because we had no way of differentiating between bicycles bought for transportation and bicycles bought for recreation. (CES lists bicycle expenditures under "mini-appliances" rather than "transportation.") Not very many households purchased bicycles, and because the dollar amounts spent on bicycles were small enough that they would barely affect our estimates, we chose to exclude bicycle purchases from the analysis. We did include the purchase prices of motorcycles, scooters, and mopeds in the purchase price and capital cost calculations for vehicles. However, we excluded expenditures on automobile leases and rentals because very few (about 1%) of the low-income households had any expenditures reported for leased or rental vehicles. All items that CES includes as transportation expenditures but which we exclude from our numbers were put into "other expenditures" instead.

To calculate the capital cost of the vehicles in a household, we took the purchase prices of all vehicles purchased by the household within the last five years, divided those purchase prices by five, and summed the capital costs for the individual vehicles to the household level. This calculation uses five-year straight-line depreciation, which is one method of depreciation allowable by the IRS for tax-reporting purposes.

Because we had actual purchase price information only on vehicles that were either purchased during the interview period or still had money owed on them, we imputed values for missing purchase prices based on the following consumer and vehicle characteristics:

- Vehicle new or used when purchased;
- Race, age, and gender of the householder;
- Size of the household;
- Number of earners;
- Before-tax income; and
- Dummy indicator for the state of California.

Using straight-line depreciation, we then took the imputed price, divided by five, and allocated that amount to the five years following the purchase of the vehicle. If the vehicle was purchased more than five years ago, we assigned a value of zero for the capital cost. This process

determined the capital cost of each vehicle, which was then summed across vehicles for each household to obtain the total "capital cost" for the household.

We excluded from the sample households that had extremely high or extremely low values for total expenditures. Specifically, we eliminated cases with total annual expenditures below $1,000 or above $500,000. These outliers represent approximately the 1st and 99th percentiles of the distribution of total expenditures.

It should be noted that the payment of mortgage principal is counted by CES as "reduction in liabilities" rather than "expenditures," and so mortgage principal payments are not included in our housing expenditure number. However, the CES housing expenditure numbers used in this report include mortgage interest, property taxes, maintenance, repairs, insurance, and other expenses for homeowners, as well as rent for renters. The housing expenditures numbers also include utilities, household operating expenses, and home furnishings and equipment, regardless of homeownership status.

The CES MSA-level data used in Table 3.11 define the Metropolitan Statistical Areas differently, depending on the particular metropolitan area. Some areas are CMSAs, some are a combination of Primary Metropolitan Statistical Areas (PMSAs), and others are strictly MSAs. The following list shows what each metropolitan area in Table 3.11 represents:

Northeast:
New York: New York-Northern New Jersey-Long Island, NY-NJ-CT-PA CMSA
Philadelphia: Philadelphia-Wilmington-Atlantic City, PA-DE-NJ CMSA
Pittsburgh: Pittsburgh, PA MSA
Boston: Boston-Worcester-Lawrence, MA-NH-ME-CT CMSA

South:
Washington, D.C.: Washington, DC-MD-VA-WV PMSA and Hagerstown, MD PMSA
Baltimore: Baltimore, MD PMSA

Atlanta: Atlanta, GA MSA
Miami: Miami-Fort Lauderdale, FL CMSA
Tampa: Tampa-St. Petersburg-Clearwater, FL MSA
Dallas-Fort Worth: Dallas-Fort Worth, TX CMSA
Houston: Houston-Galveston-Brazoria, TX CMSA

West:
Los Angeles: Los Angeles-Riverside-Orange County, CA CMSA
San Francisco: San Francisco-Oakland-San Jose, CA CMSA
San Diego: San Diego, CA MSA
Portland: Portland-Salem, OR-WA CMSA
Seattle: Seattle-Tacoma-Bremerton, WA CMSA
Honolulu: Honolulu, HI MSA
Anchorage: Anchorage, AK MSA
Phoenix: Phoenix-Mesa, AZ MSA
Denver: Denver-Boulder-Greeley, CO CMSA

Midwest:
Chicago: Chicago-Gary-Kenosha, IL-IN-WI CMSA
Detroit: Detroit, MI PMSA
Milwaukee: Milwaukee-Racine, WI CMSA
Minneapolis-St Paul: Minneapolis-St. Paul, MN-WI MSA
Cleveland: Cleveland-Akron, OH CMSA
Cincinnati: Cincinnati-Hamilton, OH-KY-IN CMSA
St. Louis: St. Louis, MO-IL MSA
Kansas City: Kansas City, MO-KS MSA

Comparison of Demographic Characteristics Across Samples

Appendix Table B.1 compares demographic characteristics of the CES metropolitan California sample, the PUMS metropolitan California sample, and the PUMS Bay Area sample to gauge how well the CES results are likely to represent patterns in the Bay Area. The CES California sample characteristics are quite similar to the PUMS metropolitan California sample but somewhat less similar to the Bay

Table B.1

Demographic Comparison of California Samples in CES and Census PUMS Data

	CES Metropolitan California Sample[a]		PUMS Metropolitan California Sample		PUMS Bay Area Sample	
	Low-Income	Higher-Income	Low-Income	Higher-Income	Low-Income	Higher-Income
Race and ethnicity[b](%)						
White	39	69	39	65	43	64
Hispanic	39	14	38	16	21	11
Asian/Pacific Islander	12	11	10	10	18	16
Black	9	6	9	6	13	6
American Indian	1	0	1	0	1	0
Multirace			3	2	4	3
Other			0	0	0	0
% female	49	41	46	30	51	32
% employed at least one week	58	78	58	82	51	83
% married	46	57	40	59	32	56
% divorced, widowed, or separated	31	25	35	24	39	24
% never married	23	18	25	17	29	20
Age of householder	47.36	47.79	46.46	48.99	49.35	48.47

Table B.1 (continued)

	CES Metropolitan California Sample[a]		PUMS Metropolitan California Sample		PUMS Bay Area Sample	
	Low-Income	Higher-Income	Low-Income	Higher-Income	Low-Income	Higher-Income
% receiving public assistance[c]	9	1	8	1	7	1
% homeowner	36	64	33	67	31	65
Sample size	2,984	8,069	155,633	394,756	22,267	98,845

[a]CES data are weighted using the replicate weights for the final U.S. sample; unweighted results are nearly identical to these results.

[b]The racial and ethnic categories do not correspond perfectly between the CES and PUMS datasets. CES categories are based on a combination of origin and race, wherein anyone with Spanish origin is classified as Hispanic. Respondents not of Spanish origin are classified based on race. PUMS data are derived from Census 2000 data and respondents were allowed to identify as multiracial. However, if a respondent indicated any Hispanic origin, regardless of race, we reclassified him or her as Hispanic to more closely match the CES categories.

[c]Public assistance in the CES data includes "public assistance or welfare including money received from job training grants such as Job Corps." CES public assistance does not include those who receive Food Stamps or other non-cash benefits. Public assistance in PUMS is described as "public assistance or welfare payments" and, as with CES, does not include Food Stamps or other noncash subsidies.

Area sample. The CES low-income sample has more Hispanics, fewer Asians, fewer blacks, more employed, more with their own homes, and slightly more receiving public assistance than the Bay Area PUMS sample. Also, the percentage of householders who are married is quite a bit higher in the CES data than in the Bay Area PUMS data. Given that the percentage of married householders is not very different between the CES data and the metropolitan California PUMS data, this pattern seems to be more a factor of differences between the Bay Area and other areas of metropolitan California than it is a factor of differences between the CES and PUMS datasets.

Appendix C

Sensitivity Analysis for Key CES Results

Table C.1 shows the results of a sensitivity analysis for some of the main results from Chapter 3. We present this in part to explain the difference between our results and the results of other researchers who have used the CES to look at transportation expenditures—for example, the Surface Transportation Policy Project (2003) and Blumenberg (2003). Case 1 shows our "base case," that is, the basic results that we reported in the chapter. There is little difference between means and medians for either dollar amounts or transportation budget shares, except that the median for poor households is somewhat less than the mean (8% versus 11%).

Case 2 shows how the results differ when the ratio of averages is used rather than the average of ratios (these two measures are discussed in Appendix A). Here, the difference from our base case is not large but when calculated this way, the results show that the transportation budget share is larger for the low-income group (16 percent) than for the higher-income group (15 percent), although the budget share is still smallest for the poverty group (13 percent).

The main drawback to using total expenditures rather than income in the denominator is that this method does not provide any sense of the extent to which a household might have to borrow or draw on savings to finance expenditures. In case 3, we investigate how the results change when we calculate transportation expenditures as a percentage of income instead of as a percentage of total expenditures. One technical problem with respect to calculating transportation as a percentage of income rather than as a percentage of expenditures is that some households reported having zero income, which produces an error when transportation expenditures are divided by zero. To get around this problem, we recoded negative and zero income values to $1. We find

Table C.1

Sensitivity Analysis for Key CES Results

	Poor	Low-Income	Higher-Income
1. Base case results (as reported in Chapter 3)			
Mean transportation expenditures	$1,719	$2,906	$7,606
Median transportation expenditures	$765	$2,164	$6,569
Mean transportation budget share	11%	14%	16%
Median transportation budget share	8%	13%	15%
2. Same as base case but using ratio of averages rather than average of ratios			
Ratio of mean transportation expenditures to mean total expenditures	13%	16%	15%
3. Same as base case but using income as the denominator			
Median ratio of transportation expenditures to before tax income[a]	9%	15%	16%
Median ratio of transportation expenditures to after tax income[a]	9%	15%	17%
4. Using income rather than expenditures to categorize the households, recoding those with zero or negative income to income of $1[b]			
Mean transportation expenditures	$3,119	$3,760	$7,716
Median transportation expenditures	$2,265	$2,774	$6,702
Median transportation budget share	11%	13%	15%
Median ratio of transportation expenditures to before tax income	26%	19%	11%
Median ratio of transportation expenditures to after tax income	26%	19%	12%
5. Using income to categorize the households, excluding those with zero income, but including negative income values[b]			
Median transportation budget share	11%	13%	15%
Median ratio of transportation expenditures to before tax income	24%	19%	11%
Median ratio of transportation expenditures to after tax income	23%	19%	12%

Table C.1 (continued)

	Poor	Low-Income	Higher-Income
6. Using income to categorize the households and using the ratio of the averages rather than the average of the ratios (which allows us to include those with zero income)[b]			
Ratio of mean transportation expenditures to mean total expenditures	14%	16%	15%
Ratio of mean transportation expenditures to mean before tax income	37%	24%	11%
Ratio of mean transportation expenditures to mean after tax income	39%	25%	12%
7. Using income to categorize the households, recoding negative and zero income values to $1, and excluding households with total expenditure to income ratios greater than 1.5 (n = 7,363)[b]			
Mean transportation expenditures	$1,892	$3,153	$7,659
Median transportation expenditures	$1,137	$2,462	$6,660
Median transportation budget share	10%	14%	15%
Median ratio of transportation expenditures to before-tax income	10%	13%	11%
Median ratio of transportation expenditures to after-tax income	10%	13%	12%

SOURCES: CES 1999–2001, metropolitan California sample.

[a]Negative, zero, or missing values for income were recoded to $1.

[b]Consumer units with incomplete income data were not included in this analysis (complete income reporters = 8,989).

that the results are very similar to those we reported in the body of the report, although 1 or 2 percentage points higher for all income categories.

For the analysis presented in the report, we classify households according to expenditure levels rather than income because we feel that expenditures are a better measure of the long-term financial resources of the household and the expenditure data are more accurate. (See the Rogers and Gray, 1994, quote in Appendix A for further details.) To allow comparison of our results with the results of other researchers, cases 4 through 7 in Table C.1 show results where households are classified by income rather than expenditures.

Case 4 is the same as our base case except that groups are classified by income rather than expenditures. This method necessarily limits the sample to those with valid values for the income variable. (We also recode zero or negative income values to $1.) Using this classification method, we find that median transportation expenditures are much higher for the poor group than they were in our base case. That is, grouping households by income rather than expenditures changes the distribution of households across income levels so that those at the very bottom now have higher transportation expenditures than in our base case. The budget shares, however, are very similar to our base case scenario: 11 percent, 13 percent, and 15 percent, compared to 8 percent, 13 percent, and 15 percent in our base case calculations. In contrast, transportation calculated as a share of income jumps dramatically for the poor and low-income groups, compared to our case 3 calculations (26% and 19%, compared to 9% and 15%).

Case 5 uses an alternative method of dealing with households with zero values for income by simply excluding them from the analysis. We leave in negative values for households with negative income but the results are virtually identical to the results in Case 4.

In Case 6, we include values of zero for the income variable—the only way to manage this is to take the ratio of the averages rather than the average of the ratios. (Using this method, zero values for income just become subsumed into the average income number, where they no longer cause problems in the denominator.) Using this method, we arrive at results fairly similar to those reported by STPP, with

transportation expenditures constituting 39 percent of income for the poor group, 25 percent for the low-income group, and 12 percent for the higher-income group. (The STPP results show the following percentages for transportation as a percentage of income after taxes: 40.2 percent for those with income from $0 to $13,908; 25.3 percent for those with income from $13,909 to $27,176; 22.1 percent for those with income from $27,177 to $44,461; 18.2 percent for those with income from $44,462 to $71,897; and 13.1 percent for those with income of $71,898 and above.)

To address the problems with underreported income, an alternative approach to our base case expenditure-based methods would be to rely on the income variable but exclude likely income underreporters from the calculations. To do this, we make an assumption about what constitutes a "reasonable" level of income for a given level of total expenditures. For case 7 in Table C.1, we exclude all households with expenditures over 150 percent of their reported income level. When we exclude these households, we find that transportation expenditures as a share of income are 10 percent for poor households, 13 percent for low-income households, and 11 to 12 percent for higher-income households (depending on whether we use before- or after-tax income as the denominator). Although this method produces a percentage that is higher for the low-income group than the higher-income group, these numbers are still quite similar to our base case results.

We conclude that our analysis methods are preferable to the other methods described above for the following reasons:

- Expenditure data are better than income data as a measure of long-term household financial resources;
- Using expenditure data rather than income data allows us to make use of data on households with missing income data—a fifth of the California CES sample;
- As cited in the BLS quotation in Appendix A, the income values are underreported by some households, whereas the expenditure data are more reliable; and,
- Using the average of the budget shares across the households is a more accurate representation of what is going on at the

household level than taking the average of transportation expenditures and dividing by the average of total household expenditures.

Appendix D

Methods Used for the Example Commute Analysis

We used the following steps to identify and cost out the illustrative commutes for Chapter 4.

1. **Identify the origins of the commutes.**
   a. Use CTPP data to identify two neighborhoods (TAZs) in each county with the highest number of low-income residents.
   b. Use ArcGIS software to identify the geographic centroid of each low-income TAZ polygon as the exact point to use for the origin of the commute.

2. **Identify the destinations of the commutes:**
   a. Use PUMS data to identify the most common place of work (county) for low-income workers who work outside their county of residence.
   b. Use ABAG 2000 job projections for Bay Area cities to identify the city with the most jobs in each county as the destination for our commutes. For each of the nine counties in the Bay Area, these cities are:

County	City	Number of Jobs
Alameda	Oakland	193,950
Contra Costa	Concord	59,720
Marin	San Rafael	42,110
Napa	City of Napa	30,810
San Francisco	San Francisco	634,430
San Mateo	Redwood City	60,940
Santa Clara	San Jose	423,040
Solano	Fairfield	41,030
Sonoma	Santa Rosa	56,036

   c. Use GIS to determine the geographic center of the destination city.

3. **Identify the public transit and private vehicle routes and calculate the costs of each route:**
    a. Public transportation: Use ArcGIS maps to identify which public transit routes run through the low-income TAZ to the work destination. Use information from transportation agency websites to determine the costs for using the routes identified. Confirm cost information with phone calls to each transit agency.
    b. Private vehicle: Use ArcGIS to measure the approximate mileage from the center point of the low-income TAZ to the center point of the place of work destination. (The calculated distances are based on straight lines between the origin and destination points, not actual distance traveled.) Use IRS, FHWA, and AAA mileage rates to determine the cost of travel.

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