Economic Benefits of Employment Transportation Services

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Disclaimer  The analysis and views presented in this report are the sole responsibility of the authors.
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Abstract

EMPLOYMENT TRANSPORTATION

ECONOMIC BENEFITS AND USER OUTCOMES

This report examines the benefits that accrue from employment transportation services implemented as a result of changes in welfare policy, namely the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996. Employment transportation services were developed to provide access to jobs for people who otherwise have few transportation options, either because public transportation is not available to their work locations (or for employment-supportive trips such as daycare, schools, job-training or for job search activities) or because they cannot afford to own and operate a private vehicle.

The employment transportation services examined in this study have been funded by the Federal Transit Administration (FTA) of the U.S. Department of Transportation, human service agencies, labor and workforce development agencies, other federal, state, and local agencies, as well as non-profit organizations and private sector companies. Employment transportation services include: traditional fixed-route bus or demand-responsive services operated by local transit agencies; rideshare programs, shuttle, or charter services provided by non-profit organizations, employers or employment agencies; information services and mobility brokers that link information on jobs with transportation to those jobs; and car programs that fund ownership and use of private vehicles by low-income workers.

Employment transportation services provide valuable service to users. The services are being appropriately targeted and the individuals who use them are greatly dependent on them. Although program costs are high, benefits to the users are high as well and are likely to persist over time. Quite possibly, down the line, major societal costs would be avoided as a result of the boost to worklife afforded by these services. Our empirical analysis has shown that it is not likely that many users will stay in the transit system over the long haul but that the transient boost that these services provide is likely to make a significant difference in their lives and their work. Non-users and society in general benefit due to potential alternative uses of tax dollars and avoidance of societal costs of private automobiles, which users might otherwise have taken. The negative impacts on local labor markets are likely to cancel out some of these non-user and societal benefits. However, since these negative impacts are dependent on local unemployment rates, the non-user benefits from these services are ultimately likely to depend on economic cycles.

MAJOR FINDINGS

The major findings of the study are summarized as follows:

1) Employment transportation services funded by the JARC program and matched 50 percent from other sources, are reaching the target population as stipulated by legislation.

2) JARC users are of lower-income and less educated than users of other transit services in their area; they are also more likely to be without a valid drivers’ license and without an automobile.
Abstract

3) Users report undergoing a variety of travel behavior and work-related changes as a result of using the services, which have an economic benefit to them.

4) These services have helped many users overcome the psychological barrier to obtaining and maintaining jobs imposed by the lack of transportation to job locations.

5) Users were surveyed on travel and work-related outcomes in multiple locations; there are statistically significant site-to-site differences in labor market and travel outcomes of JARC service users.

6) The Cost Per Ride (CPR) of all JARC services surveyed was $11.40 per ride. In contrast, the CPR for non-JARC transit services in the same sites (as available from the National Transit Database, NTD) is $9.77.

7) The average cost per ride of JARC Fixed Route services is $8.25 per ride, compared with $3.86 per ride for Fixed Route Services operating in the same geographic area. The average cost per ride of JARC paratransit services is $16.36 per ride, compared with $19.36 per ride for paratransit services operating in the same geographic areas.

8) The average operating cost of providing JARC service to an individual for one year is $3,202 per year; this amount is comparable to the annual per capita program costs of other federal government programs that seek to provide employment opportunities to low-income persons.

9) For every dollar of program cost, a return of $1.9 in net economic gains accrues to the user. The rate of return varies considerably by type of user, type of location where the service is operating and type of service. It also varies by the manner in which the analysis treats the opportunity costs of time – when we factor in the value of “leisure time” foregone by transitioning from a state of joblessness to work, the rate of return is estimated to drop from $1.9 to $1.6.

10) In any Cost-Benefit Analysis (CBA), the magnitude of the benefits to users or non-users depend on the assumptions regarding who is affected and who is not – when only the benefits to the tax-paying public and commuters in the region alone are considered, for every dollar of JARC investment, there is a return of about $1.5 to non-users, due to changes in income taxes generated by the users, alternative use of taxpayer funds on welfare and other public assistance payments, as well as the external costs of non-transit modes of transportation that might have been previously used. Societal benefits are close to $3.5 when users’ value of leisure time foregone are not taken into account; societal benefits drop to $3.1 when estimates of such user impacts are taken into account.

11) As JARC increases the supply of labor in the local labor market, a number of localized employment-related events are triggered including deflation of wages or vertical movement of current workers up or down the job chain; when such labor market impacts are factored in, the final societal benefits of the JARC program are estimated to be $1.65 for a dollar of program investment.

12) New workers in the workforce have cost the program higher ($3,534 per rider annually) compared to those who worked before (at about $3,100); the average rate of return to new workers in the base year of 2002 is close to $2.5.

13) Employment transportation programs are also likely to jump-start a wage growth trajectory that may persist over the individual’s worklife. We have forecasted that average worklife benefit that might be facilitated in this manner, to base year program cost is $15.87 i.e., every dollar spent in these employment transportation services is expected to catalyze a return of about $15 in the future, over the remainder of the users’ worklife.
RECOMMENDATIONS OF THE STUDY

The most sustainable policies relating to employment transportation for disadvantaged individuals are likely to be those that build upon broader transportation, social services and tax policies, have a multi-model emphasis that enhance demand management polices and, at the same time, leverages local land-use, affordable housing and economic development strategies. The study makes the following recommendations to address the main issues facing employment transportation:

**Recommendation #1:** Structural inequities in the transportation system should be addressed by a much larger set of policy and programmatic mechanisms including equity set-asides of larger highway and transit transportation programs that can be to integrate land-use, housing and employment options.

**Recommendation #2:** Special program emphasis to employment transportation should continue but should be integrated with programs other disadvantaged segments of society with the goal of alleviating gaps in the mobility of such populations.

**Recommendation #3:** Policies should focus on a combination of infrastructure, service and financial instruments that facilitate a low-income person’s seamless access to a productive worklife and are adaptive to the changing conditions of the person’s lifecycle.

**Recommendation #4:** Investments are needed for programs to transport low-income children and young adults in their economically formative years.

**Recommendation #5:** Greater guidance is required to link planning processes that started under JARC and continue with the current coordinated Human Services Transportation Plan to regional transportation planning (including Regional Transportation Plans, Transportation Improvement Program, Environmental Justice review, public participation process).

**Recommendation #6:** Employers should be leveraged in significantly improved ways in employment transportation funding and operations.

**Recommendation #7:** Performance measures associated with employment transportation should be broadened to include process and outcome-oriented measures.

**Recommendation #8:** Since employment transportation has managed to bring together so many non-traditional partners and stakeholders, information networks on employment transportation should be strengthened and more easily accessible.
CHAPTER 1: Introduction

1.1 Access Conditions and Low-Income Workers

The need for transportation stems from many factors. From a socio-economic standpoint, the provision of access to jobs is a primary function of transportation. While the transportation network across the country caters to meeting the needs of the majority, it is not feasible to expect comprehensive service for all population groups and trip purposes. In particular, the accessibility needs of the low-income and those in poverty are different from other strata of society.

Before looking into the reasons for what causes accessibility difficulty among the poor, it is imperative to have a good understanding of poverty in the United States. While there is no single universally standard definition of poverty, it is generally understood to be a condition in which a person or community is deprived of, or lacks the essentials for, a minimum standard of well-being and life. The poverty rate in the country has hovered around the 12-15% mark over the last 40 years. The causes for poverty are many, but the implications of poverty are more telling. People in poverty do not get the same opportunities for education and skill, and that has a direct impact on the type of jobs that they can compete for. It is in this context that the spatial location of jobs (suitable for this population group) and the residences of people in poverty/low-skill become important. The concept of a spatial mismatch (Kain, 1968, 1992) between homes and jobs has been studied by many researchers with the goal of improving the situation. A key component of improving the situation of low-income workers is to provide reliable and affordable transportation services to meet the needs of these groups.

The geographical pattern of low-income households and entry-level jobs suitable for the skill levels of low-skilled workers has been extensively researched in the last decade. Dramatic changes in the last decade in the structure of the public assistance (welfare) system in the United States, which were designed to move increasing numbers of welfare recipients into the job market, gave a particular boost to this type of research. The vast literature on economic and social well-being of low-income individuals can be grouped into two categories. (I) Those that focus on the personal attributes and life conditions of workers and (II) those that are related to the spatial attributes of these individuals relative to opportunities that lead to desirable economic and social outcomes.

In the first category of studies, the barriers to welfare reform, employment and earnings are viewed to be personal (attributes of the individuals including education, skills and social/attitudinal) and structural (attributes of the system including lack of entry-level jobs, supportive social networks to sustain an economically independent life-style, characteristics of the neighborhood, peer influences and so on). Of these barriers, personal attributes and possible corrective measures have received an enormous amount of attention. The workforce development literature is replete with studies on the

---

1 Entry-level jobs are defined as jobs that are appropriate for or accessible to one who is inexperienced in a field or new to a market (http://www.thefreedictionary.com/entry-level)
importance of skill-development and education on employability. Skill, according to these writers, is the critical ingredient to welfare reform. Barriers imposed by problems such as transportation, childcare issues, social/attitudinal difficulties, domestic violence and substance abuse are viewed to be “less permanent” impediments to economic self-sufficiency (Carnevale and Desrochers, 1999).

The second category of studies links the needs of the urban poor to their residential and locational conditions. The “geography of opportunity” means “where people live affects their opportunities and life outcomes” (Ihlanfeldt, 1999). The spatial concentration of poverty has been documented since the 1960’s. This idea, initially generated by Kain and Persky (1969), was more recently articulated by Wilson (1987, 1996). Wilson has written that an urban underclass population has grown in central-city neighborhoods. This is due to the decline in economic opportunities in these areas and the exodus of working and middle-class blacks to better neighborhoods. Research has shown that neighborhoods with high rates of concentrated poverty tend to experience problems like high rates of crime and poor public schools (Krivo and Petersen 1996). The effect of subsidized housing policies on the spatial distribution of poverty has become a major concern in discussions of housing policy (Turner 1998). The causative factor, it is held, is the increasing decentralization of jobs from the inner city to the suburbs and housing market segregation. Other writers have highlighted the more intangible “neighborhood” effects, including factors such as negative peer influences, lack of public service and lack of effective role models (Jencks and Mayer, 1990) as the causative factors in joblessness. The effects of all these factors play out with lack of affordable housing near job-rich areas, lack of appropriate jobs near areas with low-income individuals and potentially, long commutes using inadequate transportation services between residential locations and destinations with jobs.

One observation that arises regarding the current distribution of jobs and low-income group residences is that jobs in close proximity to locations with low-income individuals are either scarce or low paying. This has been termed in the literature as the spatial mismatch hypothesis (Kain, 1968), although that original concept was given in the context of race. Further, given that public transportation connections to urban or suburban job centers are not available or not reliable and automobile ownership among the urban poor is very low, access to job-rich suburbs remain difficult and therefore, the job-search space remains spatially constrained. One likely outcome of the “job gap” in urban centers is that the number of low-income individuals competing for available jobs can be very large so that the individual probabilities of employment are reduced compared to areas where the supply of jobs are higher. Also, jobs for which many low-income individuals are qualified for are particularly scarce given the competition for these jobs being intense. This competitive nature is crucial to take into account because it is not so much that jobs have disappeared from the urban core as that the number of individuals seeking those jobs is relatively much larger. This job-to-worker ratio impacts job tenure and employment agility (the ability to move from one position to another in search of more desirable employment opportunities).
According to fundamental economic principles, market forces should have corrected this labor market disequilibrium. One mechanism by which this disequilibrium may have been corrected under the current distribution of residential location is with commutes from the city to the suburbs or other job-rich areas. But due to a variety of reasons such as unavailable or difficult public transport connections, lack of automobiles, unavailable travel information, perceived or actual hiring discrimination in the suburbs and the perception that low-income inner-city residents are not welcome in many affluent areas where the jobs are located, this mismatch of jobs in the suburbs and residential locations have continued to persist. For example, as of 1998, more than 75 percent of all Temporary Assistance to Needy Families (TANF) clients in the Chicago six-county area are residing in Chicago. However, only about 17 percent of the entry-level jobs are located in the Chicago central business district, and 13 percent in the rest of the city (Thakuriah, et al, 1998).

Another mechanism that would have served a corrective purpose is the greater integration of low-income housing in job rich sites. However, economic development and infrastructure development affects land prices, with consequent impacts on the affordability of housing by low-income groups in areas of close proximity to the development. This and other mechanisms such as exclusionary zoning in job-rich areas very often result in the lack of affordable housing nearby with the consequent outcome of the persistence in the gap between job-rich locations and locations of low-income groups.

1.1.1 Employment Transportation

Employment transportation is a broad range of transportation services that intend to address such spatial gaps. These services were developed to provide access to jobs for people who otherwise have few transportation options, either because public transportation is not available to their work locations (or for employment-supportive trips such as daycare, schools, job-training or for job search activities) or because they cannot afford to own and operate a private vehicle. The employment transportation services examined in this study have been funded by the Federal Transit Administration (FTA) of the U.S. Department of Transportation, human service agencies, labor and workforce development agencies, other federal, state, and local agencies, as well as non-profit organizations and private sector companies. Employment transportation services include: traditional fixed-route bus or demand-responsive services operated by local transit agencies; rideshare programs, shuttle, or charter services provided by non-profit organizations; employers or employment agencies; information services and mobility brokers that link information on jobs with transportation to those jobs; and car programs that fund ownership and use of private vehicles by low-income workers.

A fundamental problem facing low-income workers is that the cost of automobile ownership is high and that public transportation services are either of poor quality (in terms of number of connections, transfers and wait) or completely absent (for any reasonable travel time threshold) between the origin-destination pairs that low-income workers need to travel in to access jobs and for the times when they need to travel. This is the case for even those residing in large metropolitan American regions that have
adequate public transportation for a typical commuter. During the time of welfare reform, several studies across many localities demonstrated that large spatial gaps exist between the location of entry-level jobs and the residential location of public assistance clients, posing strong barriers in accessing jobs (for example, see Coulton et al., 1998, for the case of the Cleveland area; Thakuriah et al. 1998 for the Chicago metropolitan area; Lacombe, 1998 for the case of Boston). Public transit services between these origins and destinations were limited, too time-consuming or simply non-existent as far as most reasonable travel time budgets are concerned. At the same time, the start times of many jobs that are appropriate for the skill levels of individuals receiving public assistance do not match the schedules of existing public transit services (Sinha and Thakuriah, 2004). Further, many informal modes of transportation that welfare clients use, such as ridesharing with family or neighbors can be too unreliable for the journey to work.

In many smaller areas and rural locations, the problem is exacerbated (Stommes and Brown, 2001). While 60 percent of rural residents have access to public transit, roughly two-thirds of these publicly funded systems are single-county or city/town in scope (Community Transportation Association of America, 2001a; 2001b). This limits the range of employment destinations available to the individual. Since not many jobs are usually located in sparsely populated rural areas, such locations are even less likely to have public transportation in the first place, leaving residents there with little choice but to travel long distances to work (Dewees, 1998; Kaplan, 1998).

Resultant transportation programs are two-pronged: those that target the transportation system and those that target the “client/recipient/worker”. System-oriented programs are usually funded and managed by transportation agencies while the “client/recipient/worker” programs are funded by agencies to which transportation is an ancillary service; this is in keeping with the traditional roles of transportation and human/workforce development agencies.

1.1.2 The Role of Public Transportation

The social service role of public transportation has always received attention. The “entry fees” of auto ownership (for example, down payment, insurance, interest and taxes) form a significant barrier to the acquisition and maintenance of a private car for people just starting out on their careers, newly arrived immigrants and workers with very low incomes (Lewis and Williams, 1999) and also some people with disabilities and older adults who are not able to drive and must rely on alternative transportation. Due to market forces and a shift in jobs from the central city to the suburbs, it becomes imperative to look toward a multitude of solutions to maximize economic opportunities. The traditional transit services have catered to peak periods and high densities, but with the shift in job start times, low densities of population, and differing skill sets, the needs of the low-income population demand newer alternatives to traditional transit.

The establishment of transit services from disadvantaged neighborhoods or near the residential location of socially excluded or economically marginalized families to job rich areas or employment and training service centers can have various short-term and long-
The most immediate of these is the potential accessibility of neighborhood residents to new employment sites not previously accessible within feasible time and cost constraints. As a result of this new access availability, a previously unemployed individual might be able to obtain a job or an employed individual might be able to switch jobs to one that pays better salaries and benefits. Further, individuals currently employed may enjoy better job security by being able to avoid tardiness and scheduling conflicts due to reliable transportation service. In addition, the service may allow adjustment of schedules such that household or social activities better fit the individual’s desired activity schedules and in general, increase the individual’s quality of life in perhaps some immeasurable way.

Such specially targeted transportation services have important economic benefits as they increase the economic opportunities of low-income workers. As a result of these economic opportunities, there is a possibility that such transit users are given a boost to a different economic ladder. As their economic opportunities increase, society benefits because of reduction of payments into public assistance programs or unemployment benefit programs, which increases the potential for alternative uses of these funds. The purpose of this report is to ultimately capture these dynamics in the economic well-being of transit service riders.

1.2 Policy Context for the Current Study

In response to the above type of accessibility challenge, the surface transportation legislation, Transportation Equity Act for the 21st Century (TEA-21, PL 105-178, 1998) included the Job Access and Reverse Commute (JARC) program among its transit initiatives. The JARC program was carried forward and modified under SAFETEA-LU. JARC is an innovative program to leverage federal, state and local dollars, as well as private funding, to establish transportation programs to facilitate access to jobs. As per TEA-21 an individual whose family income is at or below 150 percent of the poverty line is defined as an eligible low-income individual. Eligible projects under JARC would be “Access to Jobs” projects or “Reverse Commute” projects (defined in greater detail in Chapter 3).

1.2.1 Program Structure and Funding

TEA-21 authorized up to $150 million annually from FY 1999 through FY 2003 for the Access to Jobs program. Total expenditures for Reverse Commute projects were capped at $10 million per year. The program required a dollar for dollar match, such that 50 percent of the project cost would be generated from DOT’s JARC and the remaining 50 percent from non-DOT sources, thus doubling the amount that DOT would invest in a transportation project. The SAFETEA-LU JARC program allows for an 80% Federal share for capital projects and a 20% local match for these projects.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act - A Legacy for Users (SAFETEA-LU, P.L. 109-59, 2005) increased annual funding for the JARC program but also changed the JARC program to become a formula program rather than
the competitive discretionary grants program established by TEA-21. The formula is based on ratios involving the number of eligible low-income and welfare recipients with 60 percent of funds going to urban areas with more than 200,000 population, 20 percent going to the states for use in urban areas with fewer than 200,000 population, and 20 percent going to the states for use in non-urbanized areas. States may transfer funds between urbanized and non-urbanized area programs.

SAFETEA-LU also contains report language directing the FTA to continue its practice of providing maximum flexibility to job access projects designed to meet the needs of individuals who are not effectively served by public transportation. SAFETEA-LU also required that states and designated recipients must select projects competitively, that projects must be included in a locally developed human service/transportation coordinated plan beginning in FY 2007, that 10% percent of funds may be used for planning, administration, and technical assistance and that sources for matching funds are expanded to encourage coordination with other programs such as those funded by the Department of Health and Human Services.

1.2.2 JARC Grants By State

Figure 1.1 shows a distribution of JARC grants by state as well as the locations for the user survey and the partnership research. The figure is color-coded to indicate the number of JARC grants that were active in 2002, when the majority of the data were collected. A look at the map reveals that the funding is sparse or zero in the Mountain states of Montana, Wyoming, Idaho, Utah, and the Dakotas. These states have the lowest population density of all the 50 states in the country. The majority of the grants were awarded to states in the coasts, the Midwest, and the south, where the population densities are significantly higher. A comparison of the allocation of JARC grants with the sites included in our surveys reveals that the sites selected for inclusion in these surveys are predominantly from those states with at least 10 grants.

1.2.3 Types of Programs

In the period of time since the JARC program came into existence, a variety of transit and transportation-related services have been funded to facilitate the access to job locations and jobs-supportive services such as child-care and educational and training centers. Funded JARC projects can be grouped into four main categories: fixed route services, demand responsive or paratransit services, automobile ownership programs and finally, information services linking riders to travel assistance information. Figure 1.2 shows the sub-categories of the services that have been funded under these four major groupings.

\[\text{User Survey and Planning Partnership Survey – Chapter 3.}\]
Figure 1.1: JARC Grants By State
Through the fiscal year 2001, the program had allocated 60% of the funds to fixed route services, 33.5% towards demand responsive services, with the remaining funds allocated almost equally between the ride-sharing (car oriented) programs and programs geared to promoting information services (FTA, 2002b). Given the wide range of services/programs that have been funded under the auspices of the JARC program, it is a rather complex task to evaluate the impact of the program.
1.3 JARC Performance Measurement and Program Evaluation: Background

As operating costs of transit escalate at faster rates than operating revenue, and as federal operating assistance (in current dollars) towards transit declines, the financial burden placed on state, regional, and local government units is becoming heavy (Hartman, et al., 1994). Therefore, public transit today operates in an environment sensitive to strategic planning and performance-measurement. But transit programs, once implemented, are rarely evaluated for outcomes on a systematic basis. Osborne and Gaebler (1992) indicate that service agencies (e.g., transit agencies, hospitals) focus on inputs instead of outcomes. “Traditional bureaucratic governments fund schools based on how many children enroll; welfare based on how many poor people are eligible; police departments based on manpower needed to fight crime.” Governments, Osborne and Gaebler assert, “pay little attention to outcomes—results”.

Over time, however, transportation services have increasingly had to deal with strategic management and to develop meaningful strategic indicators. As such, program performance assessment has become increasingly important. The Government Accounting Office (GAO, 1998) notes that government program performance assessments are of two kinds: performance measurement (which is the ongoing monitoring and reporting of program accomplishments, particularly towards pre-established goals) and program evaluation (which are studies to assess how well a program is working). While the concepts appear to be similar, there is a difference in focus in the sense that program evaluations examine a broader range of information on program performance and its context than is feasible to monitor on an ongoing basis. Uses are also different; whereas performance measurement, because of its ongoing nature, can serve as an early warning system to management and as a vehicle for improving accountability to the public, a program evaluation’s typically more in-depth examination of program performance and context allows for an overall assessment of whether the program works and identification of adjustments to improve its results.

There is no unique perspective regarding transit performance. The same service might be doing well on measures relevant to some perspectives while not so well on other measures. In fact, a Transit Cooperative Research Program (2003) report by Kittelson and Associates notes that what is important and vital in the performance and delivery of transit service depends significantly upon perspective. They identify four different perspectives—customer, community, agency, and vehicle/driver. In general, the literature suggests that performance measurement and evaluation in transit may be used for the following: as aids for assessing management performance expectations of the transit system in relation to community objectives; as mechanisms for assessing management performance and diagnosing problems, such as disproportionate cost in relation to service; as methods to allocate resources among competing transit properties, on the basis of relative cost effectiveness or other criteria; and as management and monitoring tools to facilitate continued and improved performance by management and personnel, perhaps accompanied by a program of technical assistance.
The purpose of this study is to focus on program evaluation and to assess the economic benefits of employment transportation services funded by the JARC program and matched, at 50 percent, by a variety of other public, private and non-profit sources of funding. The evaluation framework adopted in this report integrates the economic benefit approach that is typified by evaluation of social programs, welfare to work and employment training programs with that, which is used typically in the evaluation of transportation projects. While the fundamental research designs and concepts used in both approaches are similar, there are differences in the degree to which emphasis is laid on different data and concepts to be measured in the process of evaluation. The Job Access and Reverse Commute program is ultimately a social program targeted to poverty alleviation using transit as the mechanism. Yet, because it is also a transportation program, elements of traditional transportation-oriented CBA used in estimating costs and benefits should be used to realistically quantify economically and socially relevant outcomes.

### 1.3.1 Current Evaluation Activities

A comprehensive evaluation is defined in the literature as an evaluation that includes monitoring, process evaluation, cost-benefit evaluation, and impact evaluation (Baker, 2000). Monitoring helps to assess whether a program is being implemented as was planned. Process evaluation is concerned with how the program operates and focuses on problems in service delivery. Cost-benefit or cost-effectiveness evaluations assess program costs in relation to benefits derived. Impact evaluations tend to explore consequences, intended or unintended and whether positive or negative, on beneficiaries. While all four steps are necessary for a comprehensive evaluation, none, by itself, gives a complete picture of the success of a social program. Some aspects of such an evaluation have been attempted regarding the JARC program. There are three major sources of information on the JARC program. The performance of the program is monitored by means of reports that funded recipients should file with the Federal Transit Administration. The Government Accounting Office (GAO) has conducted a series of assessment studies. Finally, case studies based Best Practices reports have been developed by some sources. Collectively, these sources have given an idea of the impact of the program, as discussed below.

#### 1.3.1.A Monitoring and Output Evaluations

Monitoring helps to assess whether a program is being implemented as was planned. A program monitoring system enables continuous feedback on the status of program implementation and helps to identify specific problems as they arise. The JARC administrative reporting system yields data on Measures of Effectiveness such as the number of employment locations and employment-supportive sites (such as training and child-care centers) reached, ridership data, cost effectiveness measures such as cost per ride, service quality measures such as time of service, area of operation and so on. These key indicators serve as criteria or benchmarks against which to evaluate whether the program is being implemented as intended by Congress.
FTA has undertaken a multi-year program monitoring effort with the assistance of consultants. The major strategy that the FTA has taken in monitoring the JARC program is to require grantees to submit data on specific factors related to the service, including type of service, the number of riders, employment sites served and so on. A report by Multisystems (2005) described findings from a survey of grantees and their perspectives on the reporting requirements. Several respondents believed that the current reporting system was too oriented toward fixed route systems, particularly the requirement to calculate jobs reached within ¼ mile of a new stop. Other respondents felt it did not address rural issues and made the recommendation that rural and urban reporting should be completely separate, as transportation in rural and urban areas cannot be compared. Yet others noted that the reporting process did not easily accommodate support programs, like mobility managers, Internet trip planners, and transportation training. Several respondents also suggested that the reporting process should allow more room for grantees to include narrative or comments: “The biggest issue is the need to include more narrative space to allow grantees to elaborate on the status of projects as well as cite difficulties encountered.” At least one recipient noted that the forms do not easily accommodate the differences among grantees, which limit highlighting the success of the JARC program because it limits reports on the program since JARC services tend to vary widely.

The monitoring process has changed over time, with changes in the types of projects that have been funded. According to the 2007 evaluation of JARC services in 2006, efforts are being made to include non-traditional services such as information services and auto-ownership programs (Bregman et al, 2007). For FY 2006, 155 grant recipients reported on 645 JARC-funded services. Key findings from these reports include the following: (a) JARC-funded services provided access to approximately an estimated 43.4 million jobs, including 21.2 million low-wage jobs; (b) JARC-funded services provided 22.9 million one-way trips in FY 2006; (c) about three out of four JARC-funded services were traditional transit services – either fixed route (44%) or demand response (28%); (d) information-based services accounted for 8% of the programs and capital investment programs made up 7%; (e) fixed route services accounted for 44% of the services and 82% of the one-way trips; (f) demand response programs comprised 28% of the services and 11% of the trips; (g) in rural areas, demand response made up 51% of the programs and carried 38% of the trips; (h) in large cities, fixed route was responsible for 47% of the programs and 88% of the trips; (i) about 31% of JARC-supported services cover counties and 26% operate in cities or towns; (j) some 25% are regional in nature and 12% serve multiple jurisdictions; (k) about 40% of trip-based services were intended to expand geographic coverage and 29% extended days or hours of service; (k) most information-based programs were developed to improve customer information (58%) or increase system access (32%) and (l) almost all capital investment services (98%) were intended to improve access.

Stakeholders appear to have limited consensus on which goals are the “right” goals for targeted transportation services. Or, project “goals” differ according to who the stakeholders are. Thakuriah et al (2003) report on the results of a focus group of
transportation, human services, workforce development and other program managers of job access services where the following goals were articulated: “Get people to work, rectify the geographic imbalance of high employment/low labor availability and vice versa, get low-income people to self-sufficiency, make higher wage placements, make transit available to access second and third shift jobs without geographical limitations, make sure people are able to retain high-paying jobs”. How this broad goal of access to jobs was translated into an actual operational project varied greatly. Consequently, the right outcomes to evaluate the program are difficult to pin down. In traditional transportation studies, a goal that is often used is time saved by riders as a result of using the service. Welfare-to-work programs often strive to increase the employment of participants, reduce their dependence on welfare, reduce their poverty, and improve the quality of their lives and the lives of their children. Professionals from other sectors are likely to articulate other goals.

1.3.1.B Process Evaluation

An evaluation of process evaluation is equally important in any evaluation exercise. A key process initiated by the JARC program is the requirement for planning, financial and operating partnerships among agencies, non-profit and private sector organizations that jointly plan, match financial resources and finally operate services that meet mobility needs of low-income individuals, with a focus on access to jobs. Our analysis, as part of a separate stream of studies undertaken for the FTA has found that the partnership process has been invaluable in coordinating activities and partnering with organizations that are not traditionally involved in transportation (Thakuriah et al., 2003; Thakuriah et al., 2005, Soot et al., 2006, Thakuriah et al., 2008).

One issue with process is that a significant number of JARC grants under TEA-21 were congressionally designated. Beginning in FY 2000, Congress began designating specific projects and recipients to receive JARC funding in the conference reports accompanying the annual appropriations acts, and directed FTA to honor those designations with statutory language specifying that “notwithstanding any other provision of law, projects and activities designated [in the conference reports] shall be eligible for funding.” Each year, more projects were Congressionally designated until finally, all JARC project funding was allocated to Congressionally-designated projects and recipients (FTA, 2007). A total of $680,221,366 was awarded through the earmark process under TEA-21. SAFETEA-LU changed JARC from a competitive program to a formula program in 2005.

SAFETEA-LU also required the establishment of a locally developed, coordinated public transit-human services transportation plan for all FTA human service transportation programs: Section 5310 Elderly Individuals and Individuals with Disabilities Program, Section 5316 JARC and Section 5317 New Freedom Program. The purpose of the coordinated Human Services Transportation Plan (HSTP) is to ensure that communities coordinate transportation resources provided through multiple federal programs. The HSTP planning process should include representatives of public, private and nonprofit transportation and human services providers and participation by the public. At the time
of writing the report, 759 organizations across the country were taking the lead in developing the HSTP – about 36 percent of the lead organizations were a Metropolitan Planning Organization (MPO) or Council of Governments (CGO), while an additional 32 percent were transit agencies. Approximately 290 organizations had completed the plan development process, 96 organizations reported that they were nearing completion of the plan, while an additional 216 reported that they were well underway.

1.3.2 Gaps in Current Evaluation Activities – Outcome Evaluations

The reporting system does not allow the evaluation of outcomes. Outcome evaluations refer to the assessment of program goals to determine if discernable changes to behavior, attitudes, or knowledge have been attained as a result of the intervention and to assess the extent to which a program achieves its outcome-oriented objectives. It focuses on outputs and outcomes (including unintended effects) to judge program effectiveness but may also assess program process to understand how outcomes are produced. Outcome evaluation might be contrasted with impact evaluation; impact evaluation is a form of outcome evaluation that assesses the net effect of a program by comparing program outcomes with an estimate of what would have happened in the absence of the program. This form of evaluation is employed when external factors are known to influence the program’s outcomes, in order to isolate the program’s contribution to achievement of its objectives. Impact evaluation is intended to determine more broadly whether the program had the desired effects on individuals, households, and institutions and whether those effects are attributable to the program intervention. Impact evaluations can also explore unintended consequences, whether positive or negative, on beneficiaries.

Three issues arise in the context of outcome evaluation: which outcomes are important to evaluate, (in the light of the responses to the Multisystems report); are the same outcomes meaningful for the case of the universe of JARC projects and finally, can the outcomes be monetized to estimate the economic benefits of the program.

Program Targeting: A key component of monitoring is program targeting: whether the program’s resources are continually reaching the target population for which the resources are intended. While FTA currently administers a process for monitoring the program on relevant measures, there was, previously, no study that had analyzed whether JARC services reached the target population identified in TEA-21. One purpose of this study is to address targeting aspects of the JARC program (more details are given in Section 2.3; the program targeting analysis is given in Chapter 4).

Multi-Site Evaluations: Another issue with evaluation is that JARC was designed to address employment transportation needs and local areas were given a great deal of flexibility to design programs that suited their needs. As our results show, a great deal of variation is found in the riders’ labor market outcomes and benefits level, due to the fact that many factors affect these outcomes, including the effect of the local economic and labor market environment as well as the broader policy context of...
local welfare-to-work programs, job training and employment programs. Spatial characteristics of the service (urban versus rural location), operating characteristics (demand-responsive versus fixed route) and temporal characteristics (time of day of operation) also affect the magnitude of outcomes. Hence, arriving at nationally generalizable results is a significant difficulty. A similar conclusion was reached regarding the program evaluation, at a national level, of the Congestion Mitigation and Air Quality (CMAQ) program (Transportation Research Board, Committee for the Evaluation of the Congestion Mitigation and Air Quality Improvement Program, 2002). Whereas there have been numerous evaluations of federal programs based on multi-site studies, difficulties in controlling for these local variations do not lend easily to generalization of the results. One of the goals of the current study is to assess the extent of site-to-site variations in user outcomes (see Chapter 5).

Assessment of Intended and Unintended Program Consequences: Cost-benefit evaluations assess program costs (monetary or non-monetary) to program benefits. Impact evaluation is intended to determine more broadly whether the program had the desired effects on individuals, households, and institutions and whether those effects are attributable to the program intervention. In this study, an attempt has been made to capture a wider range on societal impacts than those typically considered in transportation studies. Another matter that complicates the analysis undertaken here is that many of the labor market outcomes that JARC services could have impacts upon, will presumably take place over a long time period. Whether or not the riders of these services are able to access jobs or training centers that will assist in bringing about stability in employment and earnings (and thus, entry into a more productive economic ladder), can only be verified over time. In fact, as in the case of several other social and workforce development programs, the larger gains might accrue over the work life of the riders, since the role of the JARC-funded service is to give a boost to individuals to reach a different economic ladder than what might have otherwise been the case. An attempt has been made in this study to forecast economic gains that persist over the expected duration of the work life of riders and to create a Potential User Worklife Benefit Index, which reflects the types of long-term outcomes that riders might be expected to experience. These issues are given in Chapter 7.

1.3.3 Gaps in Current Employment Services Programs

From a planning perspective, the scope of employment transportation services is limited in nature, given the real size of the transportation mobility problem. Counting only individuals on generational poverty and welfare dependence using measures such as population earning at or below 150 percent of the federal poverty level paints an incomplete picture of the extent to which there is a need for alternative transportation...
Economic Benefits of Employment Transportation Services

Poverty can be dynamic, and families who are not counted through measures such as earnings at or below 150% of the federal poverty level may also need mobility assistance. Based on the Survey of Income and Program Participation (SIPP), an estimated 32.3 percent of the U.S. population experienced “episodic” poverty wherein they were poor 2 or more consecutive months during 2001 through 2003; however, only 2.4 percent suffered “chronic” or long-term poverty where they were poor every month throughout the 36 month period (Stern, 2008). Job losses during difficult economic times can be very disruptive. In 2003, about 40% of unemployed workers received unemployment benefits and workers received that benefit for an average of only 16.4 weeks (Economic Policy Institute, 2004).

The recent spate of home foreclosures has received a great deal of visibility. Bankruptcy filings in the federal courts rose 38 percent in calendar year 2007, according to data released by the Administrative Office of the U.S. Courts (U.S. Courts, the Federal Judiciary, 2007). The number of bankruptcies filed in 2007 totaled 850,912, up from 617,660 bankruptcies filed in 2006. Industry estimates put involuntary or voluntary repossessions of vehicles, from families faced with the inability to afford a vehicle during periods of unemployment, overextending on credit and other life circumstances, at 2.25 million nationwide in 2002, which is double the number of vehicle repossessions in 1998 (Crain’s Chicago Business, 2003). And in 2007, the U.S. auto-loan balance was at an all-time high (at $772.3 billion up from $281.8 billion in 1998) and the auto-loan delinquency rate was at 3.4 percent up from 2.6 percent in 1999 (Moody’s Economy.com, 2007). Record-high gas prices have cut into household budgets and in the wake of an inability to sell off fuel-inefficient vehicles, people have experienced a great deal of difficulty fulfilling their travel needs due to lack of travel alternatives. These statistics show that a safety net for mobility is required for a much larger group of individuals consisting not only of the traditionally defined “low-income” individuals but also middle-class individuals who are facing extreme hardships as a result of the loss of a job, home, or vehicle, or trends in the global economy. As such, the employment transportation services that currently exist are limited in scope.

Employment transportation services were designed to primarily transport low-income workers to jobs or to employment-supportive services such as schools, job-training centers, career counseling centers and for conducting job searches. Our analysis of employment services show that these transportation services have been used for a variety of travel destinations and not just jobs. However, a worklife consists of a “travel package” that includes trip chaining to retail opportunities, child-care centers, and the like. The thrust of employment transportation services has not been towards supporting such chained travel behavior. Employment transportation is not likely and was not intended to be a solution to a low-income worker over their worklife; the goal of these programs was to position users in an economic ladder towards self-sufficiency and economic stability whereby they would be in a financial situation to make and afford their own transportation choices (including dropping out of the employment transportation system to transit, ride-sharing, acquiring and using their own private vehicles, by relocating to a different (and better-connected) neighborhood, or in some cases, to another metropolitan or even rural area. Our analysis showed that 11 percent of
low-income individuals acquire a car by the end of the first year of their first job and that the average duration for which a low-income individual remains carless after entering the first job is about 5.56 years.

1.4 Overview of Research Framework and Methods

To date, there has been no attempt to conduct a comprehensive, nationwide cost-effectiveness and cost-benefit analysis of employment transportation services funded by the JARC program and matched by other sources. While the JARC program is a transportation program, it is intended to augment human capital by giving “program participants” (i.e., users of the JARC-funded transportation services) access to economic opportunities that they otherwise would not have. Economic opportunities could include access to employment sites with jobs that match the skill sets of riders, work schedules that better match their lifestyles, better earnings, benefits, and work experience as well as an inexpensive and reliable travel option. At the same time, all of these outcomes have important impacts on the economy and society in general through greater work productivity and reduced dependence on other social programs that might otherwise have to augment incomes.

As described earlier, in making national level inferences of program benefits, one must also be cognizant of the fact that there are significant variations in local labor market conditions and the broader economic and social context in which these services operate, all of which can induce substantial site-to-site variations in benefit estimates. Further, many of the labor market outcomes resulting from the use of employment transportation services will presumably take place over a long time period. Additional complications arise due to the fact that employment transportation, unlike many other educational, social, and job training programs, is not to directly impart job skills and training - its goal is to transport people to jobs or destinations with other economic or meaningful social opportunities. The program operates on the premise that riders already have a certain level of human capital that makes them employable or amenable to further training. Hence, attribution of correct program benefits becomes a challenge. Literature indicates that there can be significant overstatement of impacts unless some of the gains can be appropriately allocated. A methodology was specifically adopted in this study to ensure that the “counting” of benefits is justifiable.

Identifying these dynamics and quantifying them is the subject of this report. In order to do so, we have drawn upon a variety of methodologies in the transportation as well as the program evaluation literature. The “gold standard” of program evaluation is random assignment of similar prospective program participants into experimental (treatment) and control groups. The difference in outcome between these two groups is the mean treatment effect or program impact. For example, in a cost-benefit analysis of the National Job Corps which is administered by the U.S. Department of Labor, impacts were estimated by comparing the experiences of randomly assigned program and control groups using data from periodic interviews conducted over a four-year follow-up period (Burghardt, et al, 2001). A dollar value was placed on the individual impact estimates in order to calculate total program benefits, which were then compared to program costs in
the benefit-cost analysis. However, even in this case there was no way to control non-
participants from entering alternative training programs or to restrain program
participants from dropping out of the program. Overall, such a design is clearly not
possible in the context of a transportation study. Program evaluations of transportation
services are typically conducted with the help of before and after studies. These studies
measure the monetized value of the change in consumer surplus to estimate the societal
and user benefits.

In this study, we have used elements of quasi-experimental design (especially matching)
and non-experimental methods. Administrative data collected by the FTA could not be
used for this purpose. This necessitated the collection of several primary data as well as
the use of multiple sources of secondary data. The final results of the study links
transportation investments to specific labor market outcomes and highlight the role that
public transportation plays in augmenting human capital.

1.5 Goals of the Report

The purpose of this study is to supplement the ongoing evaluation of the JARC program
by examining the economic and social outcomes of service users and thereby to
contribute to the improvement of the design, implementation and administration of the
program. Towards this end, the report examines the relationships between the
socioeconomic profiles and travel patterns of employment transportation service users
and the economic value of these services to users, non-users and to society. By
quantifying such relationships, the goal of the report is to identify strategies and best
practices by which outcomes of service users and impacts on society in general might be
improved as a result of investments in employment transportation services.

The process of obtaining these economic valuations involves answering several sub-
questions, some of which are listed below.

- What is the socioeconomic profile of individuals that are using JARC-funded
  transit services?
- What types of travel behavior changes have been enabled as a result of using
  these services and what is the economic value of these changes?
- What are the appropriate labor market outcomes to consider in the study of such
  services and have the services brought about such labor market outcomes
  (including but not limited to transition from unemployment or public assistance to
  jobs and increases in wages and hours worked)?
- Have the services facilitated other outcomes such as changes in trip-making
  behavior, mode of transportation used to work, commuting time or perceptual
  barriers to work, which also have economic value?
- What are the costs to transit operators associated with providing such services?
- What are the benefits to individual users and to society that result from these
  services?
- What potential do such services have to benefit users over their worklife?
The range and variety of questions provides a glimpse into the complexity embedded in this exercise. The responses to these questions will serve as the basis for understanding the economic and social impact of the JARC-funded transportation services on the communities in which they operate.

### 1.6 Organization of the Report

The report is organized as follows: In Chapter 2, we present the scope of the economic benefits study. This is followed by a description of the primary data collection activities undertaken for the study in Chapter 3. The core of our study is a survey administered to riders of selected fixed-route bus and demand-responsive employment transportation projects funded by the JARC program and matched by a wide variety of other programs, across the 10 Federal regions of the United States. Program managers and vehicle operators were interviewed informally and also a cost and operations survey was administered.

Chapter 4 explores the problem of program targeting and analyzes the travel behavior and labor market changes reported by the users of employment transportation services. Chapter 5 examines the types of travel behavior and labor market outcomes that might be appropriate for use in the evaluation of employment transportation services and assesses the level of site-to-site variation in user outcomes. Chapter 6 presents a Cost-Effectiveness Analysis (CEA) of the services while Chapter 7 presents a Cost-Benefit Analysis (CBA) of the program, which includes user (base year and lifecycle) benefits estimates as well as societal benefits estimates.

Finally, Chapter 8 summarizes the major findings of the study and makes recommendations for future policy decisions regarding the employment transportation for low-income workers. Details of the analysis are given in a series of appendices (Appendix A through P).
CHAPTER 2: Scope of Employment Transportation Economic Benefits Assessment

2.1 Scope of the Study

The study consists of the following tasks: a literature review on the employment transportation, program targeting, a cost-effectiveness analysis and finally, a cost-benefit analysis. Figure 2.1 gives a schematic representation of the study.

Figure 2.1: Schematic Representation of the Study

2.2 Research Objectives

The study consists of the following research objectives:

1) To review studies on economic benefit assessment of human services and economic development programs and to compile information on the need for transportation services for low-income individuals from the published literature;
2) To identify the socioeconomic profiles of JARC-funded transit service users, understand types of travel behavior and labor market changes that have been enabled as a result of using these services and to determine if the program has been appropriately targeted;
3) To identify appropriate labor market outcomes to consider in the study of such services and to determine site-to-site variation in the extent to which services have brought about labor market outcomes;
4) To assess the costs to transit operators associated with providing such services, compare these costs to transit services operating in the same areas and also to costs of other social, economic and human services programs;
5) To quantify economic benefits to individual users, non-users and to society that result from these services.
### Table 2.1: Research Objectives and Research Tasks

<table>
<thead>
<tr>
<th>Research Objective</th>
<th>Research Task</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To review studies on economic benefit assessment of human services and economic development programs and to compile information on the need for transportation services for low-income individuals from the published literature.</td>
<td><strong>Problem 1:</strong> Undertake a literature review.</td>
<td>Incorporated into each chapter</td>
</tr>
<tr>
<td></td>
<td><strong>Problem 1A:</strong> Review methodologies and research designs utilized for outcome and impact evaluation</td>
<td>Appendix A.3</td>
</tr>
<tr>
<td></td>
<td><strong>Problem 1B:</strong> Develop a list of the non-transportation literature that cite lack of adequate transportation as a major barrier to work</td>
<td>Appendix A.2</td>
</tr>
<tr>
<td>2. To identify the socioeconomic profile of JARC users, the types of travel behavior and labor market changes that have been enabled as a result of using these services and to determine if the program has been appropriately targeted.</td>
<td><strong>Problem 2:</strong> Determine if JARC services are serving the target population.</td>
<td>Chapter 4</td>
</tr>
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<td></td>
<td><strong>Problem 2A:</strong> Compare socio-demographics of JARC service users with non-users in selected areas</td>
<td>Chapter 4; Section 4.2</td>
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<tr>
<td></td>
<td><strong>Problem 2B:</strong> Behavioral Changes and Economic Indicators of JARC service users in selected areas</td>
<td>Chapter 4; Section 4.3</td>
</tr>
<tr>
<td>3. To identify labor market outcomes that are appropriate for JARC evaluation and to determine the extent to site-to-site variations exist in such outcomes.</td>
<td><strong>Problem 3:</strong> Identify outcomes that are relevant to study.</td>
<td>Chapter 5; Section 5.3</td>
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<td></td>
<td><strong>Problem 3A:</strong> Identify relevant labor market outcomes from review of literature</td>
<td>Chapter 5; Section 5.4</td>
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<td></td>
<td><strong>Problem 3B:</strong> Assess the extent of site-to-site variations in labor market outcomes achieved by JARC users.</td>
<td>Chapter 5; Section 5.4</td>
</tr>
<tr>
<td>4. To assess the costs associated with providing services to achieve desirable labor market outcomes and to compare these costs to transit services operating in the same areas as well as to the costs of other social, economic and human services programs.</td>
<td><strong>Problem 4:</strong> Conduct a Cost-Effectiveness Analysis of JARC services.</td>
<td>Chapter 6; Section 6.3</td>
</tr>
<tr>
<td></td>
<td><strong>Problem 4A:</strong> Estimate cost-per-ride of JARC services and compare to that of peer services.</td>
<td>Chapter 6; Section 6.4</td>
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<td></td>
<td><strong>Problem 4B:</strong> Estimate JARC Annual Program Cost Per Rider for different trip types, labor market outcomes and user subgroups.</td>
<td>Chapter 6; Section 6.5</td>
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<td></td>
<td><strong>Problem 4B:</strong> Compare JARC cost-effectiveness estimates to that of other social, economic and human services programs.</td>
<td>Chapter 6; Section 6.5</td>
</tr>
<tr>
<td>5. To quantify the economic benefits to individual users, non-users and to society that result from these services.</td>
<td><strong>Problem 5:</strong> Conduct a Cost Benefit Analysis of JARC Services.</td>
<td>Chapter 7; Section 7.3</td>
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<td></td>
<td><strong>Problem 5A:</strong> Estimate base year benefits and costs for JARC Service Riders</td>
<td>Chapter 7; Section 7.5</td>
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<td></td>
<td><strong>Problem 5B:</strong> Estimate longitudinal benefits and costs for JARC service riders.</td>
<td>Chapter 7; Section 7.5</td>
</tr>
<tr>
<td></td>
<td><strong>Problem 5C:</strong> Estimate the societal benefits of the JARC program.</td>
<td>Chapter 7; Section 7.5</td>
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</table>
The five research objectives are achieved by means of five main tasks. Table 2.1 lists the research objectives and organizes research tasks by objectives. The details of the tasks are given in the next section.

2.3 Details of Tasks

This study consists of the following tasks:

**Task 1: Literature Review:** The literature review, which was conducted as a part of this study, consisted of two sub-problems:

**Problem 1A:** Review of methodologies and research designs utilized for outcome and impact evaluation: Rather than presenting the review of methodologies in a separate chapter, we have integrated elements of the review into the body of the report. The review also drove the research design and methodologies we have adopted for the entire study as shown in Figure 2.1.

**Problem 1B:** Develop a list of the non-transportation literature, which cite lack of adequate transportation as a major barrier to work: What does the labor economics, workforce development, employment and training programs, welfare-to-work program literature say about transportation barriers and benefits of transportation programs? Appendix A gives a detailed review of the studies in the non-transportation literature, which cite transportation as a major barrier to work.

**Task 2: Program Targeting Study:** The goal of this task was to analyze whether the JARC program has reached the target population. Well before considering cost-benefit analysis or impact evaluation of a program, the question needs to be asked whether the program is serving the group of people or the types of areas for which it was established.

The purpose of the JARC program is to provide funding for local programs that offer job access and reverse commute services to provide transportation for low income individuals\(^4\) who may live in the city core and work in suburban locations\(^5\) (PL 105-178, TEA-21, 1998).

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\(^4\) TEA-21 (PL 105-178) defined an eligible low-income as an individual whose family income is at or below 150 percent of the poverty line (as that term is defined in section 673(2) of the Community Services Block Grant Act (42 U.S.C. 9902(2)), including any revision required by that section) for a family of the size involved (TEA-21, 1998).

\(^5\) Section 3067 of the Transportation Equity Act for the 21\(^{st}\) Century defined ELIGIBLE PROJECT AND RELATED TERMS as follows: (A) IN GENERAL.—The term “eligible project” means an access to jobs project or a reverse commute project. (B) ACCESS TO JOBS PROJECT.—The term “access to jobs project” means a project relating to the development of transportation services designed to transport welfare recipients and eligible low-income individuals to and from jobs and activities related to their employment. The Secretary may make access to jobs grants for— (i) capital projects and to finance operating costs of equipment, facilities, and associated capital maintenance items related to providing access to jobs under this section; (ii) promoting the use of transit by workers with nontraditional work schedules; (iii) promoting the use by appropriate agencies of transit vouchers for welfare recipients and eligible low-income individuals under specific terms and conditions developed by the Secretary; and (iv) promoting the use of employer-provided transportation, including the transit pass benefit program under section 132 of the Internal Revenue Code of 1986. (C) REVERSE COMMUTE PROJECT.—The term “reverse commute project” means a project related to the development of transportation services designed to transport residents of urban areas, urbanized areas, and areas...
Funds were to have been distributed to local areas based on a competitive review process. FTA spent $27,770,000 during 1999-2002 on competitively selected grants. However, starting in FY 2000, the funds were increasingly spent on congressionally designed projects. The current task asks the question: given the competitive and the non-competitive processes that were followed in the allocation of funds, have program funds reached the target population as intended by TEA-21 in terms of the sociodemographics of users?

An indicator of job accessibility adopted by the FTA as a part of their JARC evaluation process is the number of jobs that can be accessed by JARC transportation services. This is a type of program targeting measure in the sense that it gives the potential of the service to provide access to economic opportunities by workers. The FTA also has amended the JARC program measures to capture the number of one-way trips provided by JARC services (FTA, 2007). According to a GAO report published in 2002, 53% of the grantees (out of 173 sites surveyed) reported that they are using number of jobs served by a Job Access service as an indicator on the performance of such a service (Government Accounting Office, 2002).

However, this indicator measures only one aspect of the program-targeting picture. An equally important measure is whether the program is being used by riders of the profile described in Section 3025 of the enabling legislation, TEA-21. As a result, the following problem is defined:

**Problem 2A:** Compare socio-demographics of users of JARC services with other auto and transit users in selected areas and determine how riders of JARC services compare to non-JARC service users in terms of key indicators such as income, educational attainment vehicle ownership levels.

**Problem 2B:** Track the behavioral changes induced by access to new transit (JARC service) and the subsequent impact of the service on key economic indicators for users of these services.

The primary source of data for evaluating program targeting is a special survey that was administered to riders of JARC services in 23 locations across the country by the researchers as a part of this study in 2002. Details of the survey are given in Chapter 3. In order to compare the attributes of these riders to that of the general population in the 23 locations, we used the 2000 5-percent Public-Use Microdata Samples (PUMS) data of the U.S. Bureau of Census and the Census Transportation Planning Package (CTPP) (Ruggles et al., 2004).

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other than urbanized areas to suburban employment opportunities, including any project to—(i) subsidize the costs associated with adding reverse commute bus, train, carpool, van routes, or service from urban areas, urbanized areas, and areas other than urbanized areas, to suburban workplaces; (ii) subsidize the purchase or lease by a nonprofit organization or public agency of a van or bus dedicated to shuttling employees from their residences to a suburban workplace; or (iii) otherwise facilitate the provision of mass transportation services to suburban employment opportunities (TEA-21, 1998).
Task 3: Since non-traditional outcome measures such as changes in employment status or work schedules matter in the JARC program, it becomes pertinent to analyze which outcome measures would be useful to consider in evaluating the program.

Problem 3A: Identify Relevant Labor Market Outcomes: Determine labor market outcomes that are desirable in the context of employment transportation services for low-skilled workers.

Problem 3B: Assess the Extent of Site-to-Site Variations in Labor Market Outcomes: Transit services operate within a larger labor market and policy context, which might cause site-to-site variations in outcomes for similar types of riders. It is natural to attempt to determine what it is that causes program effects to differ from place to place. At first glance, simple measures of site-to-site variations such as urban-rural locations and type of service might appear to explain site-to-site differences in employment outcomes. However, as in the case of other human services and development programs, we can expect that several other factors might affect the economic and non-economic outcomes of JARC service riders. With this task, we quantify how site-level factors such as characteristics of the local labor market and local unemployment and welfare-to-work policies as well as service-related characteristics and partnership goals might affect outcomes. This analysis gives an idea of the variations to consider in making national-level estimates of the benefits of the JARC program.

Task 4: Cost-Effectiveness Study: Cost-effectiveness measures are typically used as efficiency measures for transit program evaluation. However, most such measures are restricted to measures such as cost per ride or cost per new transit trip. What are the average and marginal costs to achieve desirable labor market outcomes and how does cost-effectiveness of JARC services compare with other transit services in the same area? Nationally, how do JARC cost effectiveness estimates compare to cost per worker or client from other social, health and human services and economic development programs? These topics are the subject of analysis for the cost-effectiveness study undertaken as a part of this study. We focus only on operational costs.

The cost-effectiveness analysis consists of the following problems:

Problem 4A: Compare CE Estimates to that of Peer Services: We estimate the cost per desirable outcome achieved and compare the Cost Per Ride of surveyed JARC-funded services to that of peer transit services operating in the same area. Also, break down differences in cost-effectiveness estimates by type of service (Fixed-Route versus Demand-Responsive) and type of location (large urban, small urban and rural locations).

Problem 4B: Compare Annual Program Cost Per Rider Estimates for Different Trip Types, Labor Market Outcomes and for Different Subgroups of Users: Annual Program Cost Per Rider ($PCOST$) or the costs expended by the program per rider (which depends on the level of use by riders) were estimated for new work trips, trips to higher wage destinations, trips by education levels of the trip-maker and trips that were perceived by the user to be inaccessible without the services. Service users were also
Economic Benefits of Employment Transportation Services

divided into six subgroups, based on the nature of their destination activity and by the employment status of the riders, including new workers in the labor force, existing workers in new job locations, existing workers in same job locations, non-workers in school or training, non-workers looking for jobs and discretionary riders. The $PCOST$ measure was estimated separately for each of the six user subgroups.

**Problem 4C:** Compare CE Estimates to those of Peer Human Services, Workforce Development, Economic Development and other Social Programs: Compare these cost-effectiveness measures to cost-effectiveness measures of other social, health and human services, workforce development and economic development programs.

**Task 5: Cost-Benefit Study:** Cost-benefit analysis attempts to measure the economic efficiency of program costs versus program benefits, in monetary terms. For many projects, especially in the social sectors, it is not possible to measure all the benefits in monetary terms.

**Problem 5A: Base Year Benefits and Costs for JARC Service Riders:** The major question driving the CBA for this report is identification of the user and societal benefits and costs. At the level of the user, benefits might be increases in earnings as a result of transition from public assistance or unemployment benefits dependence to a job for a rider who was previously not employed or due to a higher-paying job by someone who was previously employed but changed jobs as a result of improved accessibility by the service. Access to job-training programs or educational centers would have the outcome of placing a rider on a different economic ladder in terms of future earnings. At the same time, a work-life has costs. These include the out-of-pocket cost of commuting by the service, the monetized value of travel time, tax payments and/or childcare payments, if there are young children in the family. Our goal is to “reconstruct” these benefits and costs at the user level, using data on the riders’ socioeconomic outcomes and commuting trends from the user survey and a variety of site-level welfare payments, tax rates, childcare costs and unemployment benefit data.

**Problem 5B: Potential Longitudinal Benefits and Costs for JARC Service Riders:** These “base year” estimates are enhanced by two additional components of the CBA. The first is an analysis of the rider’s potential benefits and costs over the expected work-life of the rider. We develop an index termed the Potential Worklife Benefit Index by extrapolating longitudinal benefits that accrue to low-income individuals who do not face transportation problems in the economically formative periods of their lives. The Potential Worklife Benefit Index uses expected work-life estimates of the Bureau of Labor Statistics (BLS) and data on expected growth in earnings and changes in transportation use over time from the National Longitudinal Survey of Youth (NLSY) also collected by the BLS. A dynamic microsimulation model was developed for the purpose of estimating the index. While not a measure of the effectiveness of the JARC program, the measure indicates the importance of employment transportation services to provide a “boost” to the chances of low-skilled workers to achieve more economically successful worklives.
Part 5C: Societal Benefits: These benefits are a summation of the user benefits and the non-user benefits. Non-user benefits are a combination of the benefits evidenced by the non-users from three different groups: (1) the general tax paying public; (2) the non-users in the local labor market; and (3) the general commuting public in the area of service operation.
CHAPTER 3: Data Collection and Data Sources

3.1 Data Collection: Background

This chapter describes a series of primary data collection efforts in support of the economic benefit analysis of employment transportation services. The data were primarily collected during the summer and fall of 2002 and has been previously reported (Soot, et al., 2002 and FTA, 2002\textsuperscript{6}). However, to make this current report self-contained, we present the details here as well.

3.2 Components of the Primary Data Collection Effort

It was determined early on in the project that the types of outcomes we wanted to investigate would not be available from administrative databases. Hence, a decision was taken to undertake a primary data collection effort. The data collection included the following three elements:

1) An on-board survey of riders with questions on their socio-demographics, use of the service, travel information prior to use of the service and currently, previous employment and earnings information and current employment and earnings information; this survey will be called the JARC User Survey and was administered in the summer and fall of 2002;

2) Interviews of program managers and vehicle operators on the service and partnership aspects also during the same survey period;

3) A survey which included questions on the financials of the service such as total annual operating cost, JARC share and match source as well as operational characteristics such as total annual ridership, route miles, route trip travel time for the routes and hours of service; this survey will be called the Cost and Operations Survey and was administered by email retroactively in late 2006 and early 2007.

3.2.1 JARC User Survey Design

The following were the key considerations in developing the JARC User Survey:

1) Users should be able to complete the survey on-board the transit vehicle within 10 minutes – this safeguards against missing data from riders making short trips;

2) The survey should provide enough information to enable the construction of a reflexive before-and-after comparison research design for the economic benefits analysis – questions on transportation modes, travel times, travel behavior and employment outcomes (employment status, wages, hours worked, location of work)

\textsuperscript{6} The report titled “Job Access and Reverse Commute Program: Report to Congress” is available from the FTA website at \url{http://www.fta.dot.gov/funding/grants/grants_financing_7175.html}.
in the period “prior to use of the employment transportation service” and “after use of the service” would enable us to conduct such comparisons;

3) There should be enough variables in the survey that are common to secondary sources of data, which will enable the linkage of the JARC User Survey to these other sources of data.

Gathering information on the participation and potential impacts of other factors and programs is always a complex task, but is especially so in the case of fixed-route riders, with whom onboard surveys need to be short, in order to ensure that potential selection biases with surveying only long-distance fixed-route riders are avoided. Demand-responsive services, on the other hand, are in some cases, attached to specific employment sites, One-Stop centers or job-training centers, and cater to point-to-point riders. In such cases a longer survey that more exhaustively inventories concurrent participation in other social programs or job-related events that have a bearing on changes in economic indicators such as wages and hours worked could potentially be administered off-board. But in order to ensure that suitable comparisons can be drawn between fixed-route and demand-responsive services, the same questionnaire needs to be administered to riders of both types of services.

Recognizing that the reading level of the target population may be limited, we worked with Literacy Chicago, which is the largest provider of free, individualized adult literacy services in Illinois, to ensure that the survey instrument met the seventh grade reading standard. The survey instrument was pre-tested in two sites in Illinois: on a JARC-funded bus service run by the Chicago Transit Authority, and also in Literacy Chicago. The final compromise version was developed in both English and Spanish. The survey instrument includes question on rider socio-demographics, use of the service, travel information prior to use of the service and currently, previous employment and earnings information and current employment and earnings information. The before-and-after questions would enable the research team to analyze the changes in travel patterns or employment outcomes before and after the use of the survey and make inferences regarding changes in key indicators. This feature is directly utilized in the benefit estimation.

3.2.2 Selection of Sites

Within the funding available for the data collection effort, a total of 23 sites were possible to cover. Figure 1.1 showed the distribution of JARC grants by state as well as the locations for the user survey and the partnership research. The figure is color-coded to indicate the number of JARC grants that were active in 2002, when the majority of the data were collected. A look at the map reveals that the funding is sparse or zero in the Mountain states of Montana, Wyoming, Idaho, Utah, and the Dakotas. These states have the lowest population density of all the 50 states in the country. The majority of the grants were awarded to states in the coasts, the Midwest, and the south, where the population densities are significantly higher.
The FTA region where the site is located, the name of the service provider, the type of service and the area size are given in Table 3.1. A comparison of the allocation of JARC grants with the sites included in our surveys reveals that the sites selected for inclusion in these surveys are predominantly from those states with at least 10 grants.

<table>
<thead>
<tr>
<th>FTA Region</th>
<th>Service Provider</th>
<th>Type of service</th>
<th>Area size**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brockton Area Transit, MA</td>
<td>FR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>2</td>
<td>Westchester Transit Authority, NY</td>
<td>FR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>2</td>
<td>Monmouth County, NJ Transit, NJ</td>
<td>FR</td>
<td>Rural</td>
</tr>
<tr>
<td>3</td>
<td>Weirton, Change Inc., WV</td>
<td>DR</td>
<td>Rural</td>
</tr>
<tr>
<td>3</td>
<td>Howard County Transit, MD</td>
<td>FR</td>
<td>Rural</td>
</tr>
<tr>
<td>4</td>
<td>Spartanburg, SC</td>
<td>DR</td>
<td>Rural</td>
</tr>
<tr>
<td>5</td>
<td>Chicago Transit Authority, IL</td>
<td>FR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>5</td>
<td>Bloomington YWCA, IL</td>
<td>DR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>5</td>
<td>Seed Transportation, Hennepin County, MN</td>
<td>DR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>5</td>
<td>La Crosse Transit, La Crosse, WI</td>
<td>FR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>5</td>
<td>MTA, Minneapolis, MN</td>
<td>FR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>6</td>
<td>Jefferson Parish, LA</td>
<td>FR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>6</td>
<td>Island Transit, Galveston, TX</td>
<td>FR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>7</td>
<td>Neighborhood Transportation Service, Cedar Rapids, IA</td>
<td>DR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>8</td>
<td>Transfort, Fort Collins, CO</td>
<td>FR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>8</td>
<td>Loveland, CO</td>
<td>FR</td>
<td>Rural</td>
</tr>
<tr>
<td>9</td>
<td>Santa Rosa Transit, CA</td>
<td>FR</td>
<td>Small Metro</td>
</tr>
<tr>
<td>9</td>
<td>Outreach, San Jose, CA</td>
<td>DR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>9</td>
<td>Alameda Contra Transit, CA</td>
<td>FR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>10</td>
<td>PacifiCab, Hillsboro, OR</td>
<td>DR</td>
<td>Rural</td>
</tr>
<tr>
<td>10</td>
<td>Mt Hood Com. College, Portland, OR</td>
<td>DR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>10</td>
<td>North Seattle Community College, WA</td>
<td>DR</td>
<td>Large Metro</td>
</tr>
<tr>
<td>10</td>
<td>King County Workforce Training, Seattle, WA</td>
<td>DR</td>
<td>Large Metro</td>
</tr>
</tbody>
</table>

* FR – Fixed-route; DR – Demand-responsive.
** Based on the size of the city operating service; rural is population less than 50,000; small metro is population greater than 50,000 and less than 100,000; large metro is population greater than 100,000.

We selected at least one representative site from each of the ten FTA regions. Further we also considered the population (size) of the area, the grant amount received by the provider, and the type of service offered (fixed route and demand responsive, whether paratransit or vanpools). Recognizing that we would receive more responses from users of fixed routes (which have higher ridership levels), we visited almost as many demand responsive services, even though the majority of JARC funds are applied to fixed routes.
During the first three years of the program (FY 1999, 2000 and 2001), 368 JARC projects were selected for grants totaling $159.1 million (Federal Transit Administration, U.S. DOT, 2002). Since 2001, JARC grants have totaled $698.4 million. Forty-seven percent of the JARC funds were awarded to Major Urban Areas, and Non-Urbanized Areas and Medium Urban Areas split the remainder almost equally. (http://www.fta.dot.gov/documents/DSFY06_Analysis_Final_20070928(1).doc)

Surveyed grantees have used JARC funds for a wide variety of services that range from the expansion of fixed route bus systems to the establishment of centralized customer information systems that provide individuals information regarding their transportation options to reach employment and other destinations. Sixty percent of JARC funds were obligated for fixed route services, 34 percent for demand response services, 3 percent for ride sharing, and 3 percent for information services.

In the sample, approximately 57 percent of the services were fixed route whereas close to 43 percent were demand-responsive, which is close to the 60-40 percent split between fixed route and non-fixed route services (including demand responsive) in funding allocation. Roughly 44 percent of the sites in the sample were large metro areas, 26 percent were non-urbanized (rural) areas while 30 percent of the sites were in small urban areas.

Aside from these factors, the selection of sites also reflected the type of operation such as time-of-day of operation, weekday/weekend day service, route deviation, route extension, extended hours of service and other operational considerations.

A look at the most recent report of JARC services in operation in FY 2006, reveals that this ratio between fixed-route and demand-response services is largely the same as revealed in Table 3.2. (FTA-VA-5001-2007)

<table>
<thead>
<tr>
<th>Type</th>
<th>From User Survey Percent</th>
<th>From FTA Evaluation 2006 Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed-route</td>
<td>52%</td>
<td>44%</td>
</tr>
<tr>
<td>Demand-response</td>
<td>39%</td>
<td>39%</td>
</tr>
<tr>
<td>Information-based</td>
<td>9%</td>
<td>8%</td>
</tr>
</tbody>
</table>

3.2.3 Administration of the JARC User Survey

For each visit there were two phases. In the first phase, we contacted the service provider and discussed with them, usually in person, the nature of their operation. In some cases, the vehicle operators were interviewed and at the same time their help was solicited to distribute the surveys to riders.

The second phase was to ride the supported service and administer the surveys. At most sites we rode the service for six to twelve hours trying to cover at least one if not both
rush-hour periods and where appropriate, off-peak hours including late night and owl services. In a few cases, surveys were administered over multiple days to ensure that enough respondents were surveyed at each site, after taking care that no single respondent was approached twice to complete the survey. In some cases, the research team had to organize impromptu translation of the survey instrument when the respondent did not understand English or Spanish. The survey yielded 534 usable responses from the 23 sites across the country.

### 3.2.4 Cost and Operations Survey and JARC Quarterly reporting System Database

The user survey provided outcome measures for the users. This was augmented with a survey of the providers to obtain specific cost information pertaining to the service. This survey was administered by email and followed up with telephone reminders. The objective of the survey was to elicit information pertaining to the operational (route-miles, passenger miles, trip time, hours of service, etc) and financial (operating cost, fare structure, farebox return, etc.) characteristics of the service.

We supplemented the information collected from program managers with data from an FTA maintained JARC reporting system. This JARC reporting system has details about operations, cost and related data, as submitted by the grantees. This system was especially helpful for cases where we did not receive a completed survey from the provider.

### 3.3 Other Sources of Data

The study used a number of data sources. These are listed in Table 3.3 and will be introduced, as necessary, throughout the document.
### Table 3.3: Other Sources of Data Used in the Study

<table>
<thead>
<tr>
<th>Program Targeting Study (Chapter 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) JARC User Survey</td>
</tr>
<tr>
<td>2) Census 2000 PUMS data on the 23 locations</td>
</tr>
<tr>
<td>3) Census Transportation Planning Package 2000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost-Effectiveness Analysis (Chapter 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) JARC User Survey</td>
</tr>
<tr>
<td>2) Census 2000 PUMS data on the 23 locations</td>
</tr>
<tr>
<td>3) Census Transportation Planning Package 2000</td>
</tr>
<tr>
<td>4) National Transit Database 2002</td>
</tr>
<tr>
<td>5) Cost and Operations Questionnaire</td>
</tr>
<tr>
<td>6) FTA JARC Quarterly Reporting Database 2002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost-Benefit Analysis (Chapter 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Consumer Expenditure Survey (CEX) 2002</td>
</tr>
<tr>
<td>2) National Longitudinal Survey of Youth (NLSY) 1979</td>
</tr>
<tr>
<td>3) JARC User Survey 2002</td>
</tr>
<tr>
<td>4) Cost and Operations Questionnaire</td>
</tr>
<tr>
<td>5) FTA JARC Quarterly Reporting Database 2002</td>
</tr>
<tr>
<td>6) Census 2000 PUMS data on the 23 locations</td>
</tr>
<tr>
<td>7) Census Transportation Planning Package 2000</td>
</tr>
<tr>
<td>8) Panel Study of Income Dynamics</td>
</tr>
<tr>
<td>9) Site-specific public assistance, unemployment benefit and other data</td>
</tr>
</tbody>
</table>
CHAPTER 4: An Analysis of Program Targeting and Travel Behavior impacts

4.1 Socio-demographic Profiles of Riders and Extent of Transit Dependency

The JARC program was established to provide funds for transit services and information services and mobility managers in support of low-income workers and former public assistance clients’ access to jobs. In order to ensure that program funds reached the target population, the FTA started by following a process of competitive review of state and local agencies and organizations and then moved into a dual-track project funding process where projects were competitively chosen based on whether they met project selection criteria from congressionally designated projects (GAO, 2001). Irrespective of the process followed, there is value in assessing, ex-post, whether the funds have reached the target population.

The objective of this chapter is to examine the socio-demographic attributes of JARC program participants or transit riders and to determine how they compare to the population at large in the service areas. We start by describing the characteristics of the respondents on the following socio-demographic indicators: income, vehicle ownership, age distribution, employment status, employment tenure for those currently working, part-time or full-time employment and education levels. In addition, we include responses to two perceptual questions in the survey, which attempted to directly assess the level of dependency on the JARC service as perceived by the riders. Results of statistical tests to assess whether JARC service riders are statistically different from the population at large on certain socio-demographic indictors are presented in Appendix I.

4.2 Socio-demographic Indicators

Rider Income. The typical transit user is of lower income than the auto rider; however, there are gradations in income even among transit riders, with bus riders typically being of lower income than train riders. Figure 4.1 shows the income distribution of the surveyed riders, contrasted with the income distributions of (a) commuters driving to work (using personal vehicles), (b) using all forms of transit and (c) those using bus transit only. Data on the commuters’ driving and using transit to work were obtained from the 5 percent Public Use Microdata Sample (PUMS) of the decennial Census for the 23 locations where the survey was administered (10). We used the Consumer Price Index (CPI) to account for the income difference in the two years between the decennial census data collection and our survey data collection.
Nationally, there is a steady increase in the proportion of low-income riders (those earning less than $15,000 per year) as we consider, consecutively, those commuting by personal automobiles, transit in general, bus riders only and JARC service riders. This can be seen from the four bars titled “Total” in Figure 4.1. Nationally, only about 20% of those driving to work earn less than $15,000. In comparison, 24% of those using transit in general and 34% of those using the bus earn that amount. In contrast, about 37% of riders using JARC services in the 23 sites earn less than $15,000. Close to 42% of JARC riders in small metro areas earn less than $15,000 per year, followed by rural areas (36%) and then large urban areas (31%).

**Vehicle Ownership and Drivers License.** A comparison of zero vehicle ownership among JARC riders and those commuting by personal vehicles, transit in general and bus is given in Figure 4.2. Only 16% of the JARC respondents indicated that they owned a personal automobile compared to a considerably higher percentage of those using bus or transit for commuting (Figure 4.2). This indicates that the JARC riders are more mobility-limited than the regular transit or bus users and are more likely to be dependent on public transit or shared rides for transportation.
**Educational Attainment.** Only 28% of the JARC respondents indicated that they had at least completed high school (Figure 4.3). By contrast, the PUMS data for these same regions indicates that 57% of the bus riders and 69% of those using any form of transit had completed at least 12 years of school. Many of the JARC services provide access to not just employment locations, but also to job training centers and other skill-enhancing centers. This underscores the importance of the JARC-funded services in helping the users to enhance their skill set. The fact that 10% of the respondents indicated that they used the JARC service for job training or for job seeking purposes serves to reinforce this idea.

Figure 4.2: Vehicle ownership rates for commuters and JARC riders
Figure 4.3: Educational attainment of JARC riders versus general commuters in the same service area

**Employment Tenure and Welfare Assistance.** As a whole the respondents did not reflect a stable labor force. Employee tenure conditions of the respondents are lower than the workforce in general. Nationally, the median number of years that wage and salary workers had been with their current employer (referred to as employee tenure) was 3.7 years. Workers in lower-paid occupations in the service industries have substantially shorter employee tenure, of 2.4 years and within the service industries, food service workers have the lowest median tenure (1.4 years). Among the survey respondents, only 23% of workers had been with the same employer for more than two years, 21% had the job between one and two years, about 27% reported employee tenure of 6 months to a year and another 29% reported tenure of less than 6 months. The median tenure among the survey respondents was less than one year. Further, about 31% of the respondents indicated that they had received some form of public assistance in the last five years.
**Full-time or Part-time worker.** Close to 56 percent of the riders indicated that they worked full-time, about 25 percent worked part-time and about 13 percent were unemployed and were looking for a job whereas the remainder were unemployed but not looking for jobs. The results varied with the type of service and the area of operation. Demand-responsive service riders who were employed are less likely to be part-time workers compared to fixed-route riders; unemployed demand-responsive riders were more likely to be looking for work compared to unemployed fixed-route riders, indicating that demand-responsive services are more likely to be used by the unemployed for job search and interviews.

### 4.3 Behavioral Changes Induced by Access to New Transit and Changes in Key Economic Indicators

Access to a new service may allow riders to access new destinations, change their time of departure for trips and also to change their mode of transportation (from car to transit or from non-motorized modes to transit). New services can allow riders to participate in new work or non-work activities that are economically and socially meaningful or allow riders to conduct their work or non-work activities in which they are currently engaged in, in ways that is more convenient and economically meaningful to them.

These activity impacts, that have economic or social value to the rider, are enabled by changes in the use of the transportation system by riders. For riders who are using the new service to access destinations, to which they used to travel activities or existing work and non-work activities in new locations.

Table 4.1 illustrates these activity and travel changes from the ridership survey. The main activity changes that we focus on, described under “Work Activity Impacts” are reported changes in employment status and in earnings. The main travel changes reported, described under “Travel Impacts”, are changes in destinations accessed, trip purpose and mode changes. to before, the most immediate travel impacts are the ability to change the mode of travel. Service hour extensions, off-peak services and other temporal service strategies may also enable change of departure times even to the same work or non-work location. The majority of JARC services are new routes, feeder services, route deviations and route extensions; these transportation services may enable new destinations to be reached, which induce, in turn, new work and non-work.
Table 4.1: Work Activity and Travel Changes from Survey of Riders

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Fixed Route Services</th>
<th>Demand-responsive Services</th>
<th>Large Metro</th>
<th>Small Metro</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>New workers in the labor force (did not work before)</td>
<td>27.3%</td>
<td>25.9%</td>
<td>31.5%</td>
<td>21.9%</td>
<td>24.4%</td>
<td>35.7%</td>
</tr>
<tr>
<td>Existing workers earning more after using service</td>
<td>40.8%</td>
<td>36.5%</td>
<td>54.1%</td>
<td>47.6%</td>
<td>39.6%</td>
<td>34.7%</td>
</tr>
<tr>
<td>Workers accessing new destinations (new job locations after having switched jobs)</td>
<td>12.0%</td>
<td>14.9%</td>
<td>7.6%</td>
<td>17.3%</td>
<td>7.3%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Workers switching from other modes:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From auto</td>
<td>14.2%</td>
<td>12.6%</td>
<td>17.9%</td>
<td>10.5%</td>
<td>12.4%</td>
<td>20.2%</td>
</tr>
<tr>
<td>From bus or train</td>
<td>23.6%</td>
<td>18.9%</td>
<td>34.3%</td>
<td>44.4%</td>
<td>18.0%</td>
<td>11.9%</td>
</tr>
<tr>
<td>From walking</td>
<td>17.0%</td>
<td>22.2%</td>
<td>5.2%</td>
<td>4.8%</td>
<td>28.1%</td>
<td>13.9%</td>
</tr>
<tr>
<td>From taxi</td>
<td>22.3%</td>
<td>23.5%</td>
<td>19.4%</td>
<td>30.7%</td>
<td>16.9%</td>
<td>21.6%</td>
</tr>
<tr>
<td>From rideshare</td>
<td>22.3%</td>
<td>22.2%</td>
<td>22.2%</td>
<td>9.9%</td>
<td>24.2%</td>
<td>31.3%</td>
</tr>
<tr>
<td>“Employment-supportive” trips</td>
<td>71.2%</td>
<td>65.9%</td>
<td>84.0%</td>
<td>91.2%</td>
<td>63.4%</td>
<td>61.7%</td>
</tr>
<tr>
<td>Work trips</td>
<td>62.6%</td>
<td>61.9%</td>
<td>64.9%</td>
<td>73.6%</td>
<td>73.6%</td>
<td>56.8%</td>
</tr>
</tbody>
</table>

**Work Activity Impacts.** About 27 percent of riders traveling to work indicated that they were new workers in the labor force; close to 32 percent of workers riding demand-responsive services and about 26 percent of workers riding fixed-route did not work before using the service. There is variation by type of area as well; close to 36 percent of workers using rural services are new in the labor force, compared to about 22 percent of large metro workers and 24 percent of small metro workers.

About 41 percent of workers who were already in the labor force before starting use of the service reported earning more after starting use of the service. As indicated before, this data does not account for the effect of other possible program interventions or life/job events external to the JARC program. Increases in earnings could have accrued by being able to switch to a better paying job at a new location or a different shift in the same location. A greater share of existing workers using demand-responsive services reported earning more (54 percent) compared to fixed-route workers who were already employed. Also, a greater share of riders in large metro areas (48 percent) reported earning more since using the service, compared to already-employed workers in smaller metro areas (about 40 percent) and rural areas (35 percent).
Travel Impacts. About 12 percent of all riders (traveling to both work and non-work destinations) reported that the destination of their trip was a new destination, to which they had not traveled to prior to starting use of the service. A greater share of fixed-route riders (15 percent) indicated this to be the case, compared to demand-responsive riders (8 percent). Also, a greater share of riders in large urban areas were using the transit service to access new destinations, followed by rural riders and then smaller metro area riders.

Riders reported that prior to using the service they drove, used public transportation including bus or train, walked, and used taxis or rideshared with others, in order to get to the destinations to which they were traveling to at the time of being surveyed. About 24 percent of riders switched to the current JARC service from other public transit modes, followed closely by taxis and ridesharing (at 22 percent each). Riders in large metro areas were more likely to have changed from other public transit (44 percent) compared to other modes, although a large share of large metro riders also reported using taxis (31 percent) previously. Rural riders were more likely to have changed from ridesharing arrangements (31 percent) and driving (20 percent) compared to other modes. Finally, riders currently using demand-responsive services are more likely to have changed from other public transit modes (34 percent reported using bus or train previously) than current fixed-route riders (who are more likely and almost equally likely to have changed to the JARC fixed-route service from walking, taxis and ridesharing).

Riders also reported that JARC services were being used to satisfy a variety of social and economic trip purposes. Work trips, trips to educational centers, child-care centers, trips for job-seeking, interviewing or job-training activities may be defined as “employment-supportive” trips. We find that close to 71 percent of all trips were employment supportive trips; of these 63 percent were work trips alone. The vast majority (91 percent) of trips in large metro areas were employment supportive compared to 63 percent in smaller metro areas and 62 percent in rural areas, indicating that riders in the latter types of areas were using the services for social, recreational or household-chore type purposes more than in large metro areas. A greater share of demand-responsive trips are for employment-supportive; this is naturally the case because demand-responsive services are more targeted services usually attached to specific employment and training centers, schools, job centers and so on.

4.3.1 Changes in Trip and Mode Characteristics

Figure 4.4. shows travel times saved by switching from previously used mode of transportation to the JARC-funded service. Overall, riders lost time by switching from all auto modes (driving, taxis and ridesharing) to the JARC transit service. In particular, former taxi users and ride-sharers lost time by switching to fixed route services (slightly more than a minute) as well as to demand-responsive services (where the loss was more substantial, with a loss of more than 12 minutes for former taxis users and close to 7 minutes for riders who formerly shared rides). Former drivers lost time (about 4 minutes) by switching to fixed route services but gained time savings of about 3 minutes by switching to demand-responsive services. While there was no gain in travel time most
JARC riders were unable to continue using their previous modes. Several had cars that they could not afford to repair or no longer were able to carpool.

Figure 4.4: Time savings Incurred by Switching from Other Modes to JARC Service (in minutes)

![Time savings Incurred by Switching from Other Modes to JARC Service](image)

The biggest gains came from switching to the JARC service from walking (about 18 minutes) followed by those who switched from transit (an average of almost 8 minutes). While these travel-time savings have been computed, one has to be cognizant of the fact that these are aggregated responses from a nation-wide survey of different regions and services. Thus it is necessary to look at these travel times in the context of the travel times incurred by the general public in the areas where the survey was administered. This was possible to do by comparing the travel times incurred by riders in, say, area $A$, with the travel times of commuters in general, as reported in area $A$ by the decennial Census. This process of normalized comparison is explained next along with the results.

### 4.3.2 Travel Time Distributions

Our purpose in this section is to show how the travel times of JARC service riders compare with the travel times incurred by general commuters in the same region.

**Distribution of Travel Times:** The median travel time for each survey site was estimated from our dataset and compared with the census tract median travel times in the county of service and is shown in Figure 4.5. The procedure for this comparison is illustrated using one site, Westchester County, in Appendix I. Figure 4.5 shows that in about 25% of the sites, median JARC rider travel times are very short compared to the travel times of general commuters (in the first quintile of the distribution of travel times for the general commuters). However, JARC rider median travel times in a large
The U-shaped nature of the travel times is typical of low-income neighborhoods. Many workers, in the absence of transportation services, work close to home, although often in low-paying jobs. Conversely, those that commute outside the community frequently need to travel great distances to reach well-paying jobs. In many areas, especially rural areas, there are no jobs at all near where individuals riding the service reside. Our own analysis and conversations with program managers confirmed that in some urban regions, jobs are sometimes available close to home locations of low-income workers but in many cases, stable, well-paying jobs that low-skilled workers seek, are located only far away from residential locations.

Figure 4.5: Comparison of JARC travel times with the regional travel times
Distribution of Travel Times by Trip-Type: Table 4.2 gives the distribution of travel times by type of trip. In general, work trips are the longest (with close to 78 percent of the trips taking less than 30 minutes) while work-supportive trips are the second-longest (with 79 percent taking less than 30 minutes). Non-work trips tend to be the shortest (with close to 84 percent taking less than 30 minutes).

### Table 4.2: Travel times for Different Trip Types

<table>
<thead>
<tr>
<th>Travel Time (in minutes)</th>
<th>Work trips</th>
<th>Work-Supportive Trips</th>
<th>Non-Work Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent</td>
<td>Cumulative Percent</td>
<td>Percent</td>
</tr>
<tr>
<td>0 to 5</td>
<td>2.46</td>
<td>2.46</td>
<td>3.69</td>
</tr>
<tr>
<td>6 to 15</td>
<td>25.12</td>
<td>27.59</td>
<td>30.33</td>
</tr>
<tr>
<td>16 to 30</td>
<td>50.25</td>
<td>77.83</td>
<td>79.10</td>
</tr>
<tr>
<td>31 to 45</td>
<td>15.27</td>
<td>93.10</td>
<td>93.44</td>
</tr>
<tr>
<td>46 to 60</td>
<td>2.96</td>
<td>96.06</td>
<td>96.31</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>3.94</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Comparisons of before and after travel times: Table 4.3 gives the trip length distributions from trip origins to trip destinations before and after the service. The “after” period is presented in two ways: the columns under (II) give the distributions for riders who previously accessed the same location by some other travel mode or at another time of day whereas the columns under (III) are composed of all riders to their current destination, whereas they previously accessed that destination or not. For all three cases, a very large share of service users incur travel times that are less than the regional travel time, indicating that for most riders, trips are quite short compared to what is expected for the area. The share of riders who previously traveled to the same destination and who experienced trip times that are less than the regional average travel times increased from 44% to about 60% indicating that, for these riders, the JARC service provides faster travel times. The share of all riders who incur travel times less than the regional average is about 56%.
Table 4.3: Difference in Service Area Mean Travel Time for Before and After Service

<table>
<thead>
<tr>
<th>Difference from service area mean travel time (minutes)</th>
<th>Percent</th>
<th>Cumulative Percent</th>
<th>Percent</th>
<th>Cumulative Percent</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; regional mean by 16 or more</td>
<td>13.64</td>
<td>13.64</td>
<td>16.67</td>
<td>16.67</td>
<td>15.38</td>
<td>15.38</td>
</tr>
<tr>
<td>15 to 0 less than mean</td>
<td>30.11</td>
<td>43.75</td>
<td>43.40</td>
<td>60.06</td>
<td>40.79</td>
<td>56.18</td>
</tr>
<tr>
<td>0 to 5 more than mean</td>
<td>10.80</td>
<td>54.55</td>
<td>11.64</td>
<td>71.70</td>
<td>10.49</td>
<td>66.67</td>
</tr>
<tr>
<td>6 to 15 more than mean</td>
<td>15.91</td>
<td>70.45</td>
<td>16.67</td>
<td>88.36</td>
<td>19.35</td>
<td>86.01</td>
</tr>
<tr>
<td>16 to 30 more than mean</td>
<td>10.23</td>
<td>80.68</td>
<td>6.92</td>
<td>95.28</td>
<td>8.39</td>
<td>94.41</td>
</tr>
<tr>
<td>31 to 45 more than mean</td>
<td>12.78</td>
<td>93.47</td>
<td>2.52</td>
<td>97.80</td>
<td>2.80</td>
<td>97.20</td>
</tr>
<tr>
<td>46 to 60 more than mean</td>
<td>2.27</td>
<td>95.74</td>
<td>0.94</td>
<td>98.74</td>
<td>1.17</td>
<td>98.37</td>
</tr>
<tr>
<td>&gt; regional mean by 61 or more</td>
<td>4.26</td>
<td>100.00</td>
<td>1.26</td>
<td>100.00</td>
<td>1.63</td>
<td>100.00</td>
</tr>
</tbody>
</table>

There is no a priori reason to believe, from our analysis, that low-income workers prefer to work close to home and there are no differences in the level of riders’ perceptions regarding the level of importance of the service to them, whether jobs are nearby or far away from home locations (i.e., whether riders have short or long commutes relative to general commuters in their regions). The structure of the JARC program is such that it allows local stakeholders flexibility in designing services that are most relevant to their region. The local JARC planning process has consequently led to services where travel times of JARC service riders can be either very short or very long, depending very much on the local spatial distribution of entry-level jobs relative to residential locations of low-income workers.

4.4 Perceptual Indicators

The impact of employment transportation on users might be quantified by using measures such as time saved from using alternative modes, increase in the number of destinations reached, changes in earnings and so on, accruing to riders after use of the service. However, due to the reasons given in the next section, these “hard measures” give only a partial picture of the value of these services to the ridership group. For low-income workers who were previously unemployed or on public assistance, the trip to work can
potentially pose a great psychological barrier due to lack of reliable transportation to job or job-related sites, unfamiliarity with often far-away job locations, lack of travel information and options to get to work and general lack of experience with long commutes. Because of these reasons, riders often become highly dependent on the service, with the consequence that riders place an intrinsic value on the service that is over and above the types of objective impact measures mentioned above. Cognitive or subjective distances to trip destinations also determine travel choices. Researchers have been studying this type of perceived, subjective or cognitive distance in order to understand the impact of new services or even the performance of existing transportation services.

Cognitive or subjective distance is defined as a measure of the perceived (rather than just physical) distance that takes into account mental maps and the symbolic features of the environment. The concept of subjective distance has implications on health care access, tourism, as well as the journey to work. Studies have shown that a perceived transportation barrier (absence of affordable means of transportation) by minorities was the reason for forgoing needed care for cancer treatment (Guidry, et al, 1997).

The concept of cognitive distance has also been acknowledged as a better indicator of the behavior of tourists and their decision-making process. Cognitive distance is influenced by individual social, cultural and general life experiences. Several researchers have studied the perception of distance and its relationship to destination decisions by tourists (Ankomah and Crompton, 1992; Walmsley and Jenkins, 1992; Ankomah et al, 1996). They argued that cognitive distance, a mental representation of actual distance was a better indicator when studying the decision making process about destination. The discrepancy of the two distance indicators will result in false perceptions being used in their decision making process. For example, if the tourists inflate distance, they may decide to cancel the travel, due to the perception of excess costs and longer travel time (Harrison-Hill, 2001).

Many researchers have explicitly admitted the importance of subjective measures of distance (Golledge and Zannaras, 1973; Collantes and Mokhtariah, 2003; Ory et al, 2004). It has been noted “...the traveler may understand the same number of miles in a different way” (Collantes and Mokhtariah, 2003). They studied the cognitive mechanisms of distance traveled through an empirical, regression analysis based on a survey conducted in the San Francisco Bay Area. Their research showed that people’s perception of distance was not only associated with the objective measures of traveling, but also built on “events of travel and circumstances related to that travel, through recollection of memories and perceptions of those trips” (Collantes and Mokhtariah, 2003). They hold the opinion that educational background and income level tend to deflate people’s perception of short distance travel (work, school or grocery shopping trip). That is, low-income commuters might perceive the same travel distance to be longer than high-income commuters; higher educated people might be less sensitive to the stress of commute required to reach the job. These subjective concepts of travel/trip related attributes more often than not have a significant impact on the decision to make a trip. While the body of
research on the objective measures is vast and extensive, the impact of subjective measures has not yet been clearly captured.

Anecdotal evidence from professionals such as case workers who deal with low-income workers and public-assistance clients cite perceived lack of adequate transportation, great distances to jobs and commuting times to areas with which clients are unfamiliar, as key barriers to the transition from a state of unemployment and/or public assistance to jobs. In a survey of local welfare officers in the Chicago metropolitan area, for example, it was found that public assistance clients routinely seek travel information from case workers and that clients often lack spatial cognition of entry-level job locations that are far away from home locations, thus imposing a psychological cost to potential job-seekers and hindering the job search process (Thakuriah, 1999b). Reliable and affordable transportation services and travel information to job locations are highly important to clients wishing to transition to a work-life and are a part of the “package” of services required by such individuals.

4.4.1 Perceptual Difficulties

Nearly two-thirds (66 percent) of the respondents indicated that they would not be able to access their destination without the JARC service that they were currently using. About 68 percent of riders on work-bound trips noted that they would not be able to reach their (job) destination without the service. Riders in smaller metropolitan areas (about 80 percent) and rural areas (about 70 percent) are more likely to indicate that they would not be able to reach their destination without the service, compared to riders in large metropolitan areas (where 55 percent indicated that they would not have access without the service). This suggests that the JARC program is providing service where none exists and the riders are highly dependent on its existence.

To further explore this, respondents were also asked to rank the importance of the service to them, on a Likert-type scale. An overwhelming majority (93%) indicated that these services were either “very important” or “important” to them. Again, a much greater share of riders in smaller metropolitan areas and rural areas are likely to rank the service as very important compared to riders of services in large metropolitan areas.

Of all the riders that incurred lower travel times to their trip destination than the mean travel time in the service area, close to 63% indicated that they perceive their trip destination to be inaccessible without the service. This is somewhat surprising because one would expect perceived inaccessibility of destinations to increase with trip cost. Of the 43% of riders who experienced longer travel times than the area average, only about 6% experienced travel times that are half an hour or more than that experienced by commuters in general on the average. The share of riders who perceive that their destinations are inaccessible without the service of this 6% is the same as those experiencing shorter trips, ie about 63%. These results indicate that the share of riders perceiving their destinations to be inaccessible remain fairly constant over all trip lengths.
Riders who perceived their destinations to be inaccessible without the service overwhelmingly learned about the service from informal networks such as friends and social contacts, employment agencies and employers in contrast to other referral outlets like advertising or social workers. These individuals also are the most frequent users of the service; more than 76% use the service more than 10 times a month. The greatest majority of these users are employed full-time (59%), with fewer who are employed part-time, unemployed but looking for work and unemployed but not looking for work, in that order. The majority (33%) of those who reported that their trip destination was inaccessible without the service were new workers in the labor force and were unemployed prior to using the service and were using the trip to travel to work or to return home from work at the time they were surveyed. Also users in the 20-40 year age group were more likely to perceive destination inaccessibility without the service while men and women seem to share such a perception equally.

Qualitative comments that riders were allowed to write in their survey forms drove home the fact that even JARC riders who previously commuted by cars were very much dependent on the service and that riders commuted under the apprehension that the service might be terminated thus leaving them with more difficult alternatives or no alternative to travel to work.

4.4.2 Variations in Perceived Service Importance of Workers

What factors contribute to variations in the perceived importance of employment transportation services by commuters? To study contributors to variations in subjective importance, we estimated statistical model of Perceived Service Importance (PSI). The details of the model are given in Appendix I. Of those commuting to work, about 62% of the respondents reported being unable to go to their work destination without the service and about 87% perceived the trip as being very important. However, socio-demographic factors such as age or gender were not statistically significant. Not surprisingly, owning a car reduced the probability of perceiving the service as very important; the model indicates that perception of the JARC service to be very important decreases by 4 percent for car-owners. Education level and full-time employment increases the probability of perceiving the service to be very important by about 8 percentage points. Residents of rural areas are about 5 percent more like to very strongly perceive the service to be very important.

Service characteristics and usage patterns play an important role in rating the service as very important. The frequency with which the service is used is significantly related to PSI. Particularly, using the service at least ten times a month adds 13.55 percentage points to the highest PSI rating. Trip time also has a significant effect on PSI, albeit smaller than the other service characteristics and usage patterns. The average trip time on fixed-route services is 28 minutes and that using demand-responsive services in 24 minutes. The average travel time to work destinations is 28 whereas travel to non-work destinations is 27 minutes. The negative sign of the coefficient indicates that as time taken by the service to reach the respondent’s destination increases, perceived importance...
decreases. Each additional minute of travel time decreases the marginal effect of a very important rating by only 0.01 percentage points.

The employment-related factors entered into the model offer additional insights into the perceived importance of the service. Low-income workers (earning less than $7.00 per hour) are 1.35 percentage points more likely to rank the service as extremely important. On the other hand, those work trip riders earning more than $9.00 per hour are about 4 percentage points less likely than lower-wage earners to rank the service as very important.

Employee tenure increases the rating of the service as very important by almost 7 percentage points. Those riders who worked before using the service (by using some other mode of travel to work, which may have been an alternative transit route or service) are marginally more likely than new workers to rate the service as very important. Finally, an increase in earnings after using the service marginally increases the probability of ranking the service as very important (by 1.64 percent).

### 4.4 Conclusions

The objective of this chapter was to develop a comprehensive profile of JARC service users. The typical JARC user is of lower income than auto, general transit and bus riders in the same region. They are also more likely to be without a valid drivers license and without an automobile. Prior to use of the services, they had either driven, rideshared, used taxis, traveled by public transportation or walked to meet their travel needs. The results indicate that the program, while serving the target population, has also achieved success in attracting people who had previously depended on a car. We found that a substantial percent of the respondents who had driven to their current location had switched modes because they found the service was useful in meeting their travel needs (Figure 4.4). By means of this analysis, we are able to conclude that the program has targeted a pool of riders, who, without the service, would either be unable to commute to work or would face tremendous hardship in doing so.

Further, the study finds that employment transportation services fill an important gap in the national transit network. While there are understandably many gaps in the national network, especially in rural areas, it is critical that any effort to address this be well planned and implemented. We found that the riders harbored perceptions of large distances between job and residential locations and significant barriers due to lack of alternatives to travel to work. This has naturally led to a great deal of dependency on the service, which allowed them to traverse these distances and overcome significant spatial barriers. Whereas only 12 percent of rides reported that the destination of this trip has a “new destination”, nearly two-thirds of the respondents indicated that they would not be able to access their destination without the service that they were currently using. Riders in smaller metropolitan areas and rural areas are more likely to indicate that they would not be able to reach their destination without the service, compared to riders in large metropolitan areas. An overwhelming majority of riders indicated that these services were either “very important” or “important” to them. Again, a much greater share of
riders in smaller metropolitan areas and rural areas are likely to rank the service as very important compared to riders of services in large metropolitan areas. Qualitative comments that riders were allowed to write in their survey forms drove home the fact that even JARC riders who previously commuted by cars were very much dependent on the service and that riders commuted under the apprehension that the service might be terminated thus leaving them with more difficult alternatives or no alternative to travel to work.

We also found that it might be difficult to make generalizations regarding travel times that riders are incurring by using these services when compared to that incurred by general commuters. Indeed, the median travel times of JARC riders compared to the travel times of general commuters is U-shaped, indicating that in several sites, JARC riders are incurring short commutes compared to general commuters but that also in a large number of sites, riders were incurring very long trips compared to regional commuters. This trend is reflective of the local, spatial distribution of jobs relative to home locations; in some areas, jobs are in close proximity to home and in other areas, desirable, well-paying jobs are located at great distances from home locations due to which service users are willing to tolerate large commuting times.

Discussions with service providers provided valuable insight and perspective about the services as well as the program. The most important nugget obtained from these discussions was that of the importance of building and sustaining partnerships. These partnerships not only facilitate service operation, but also provide means to sustain the service with alternate, non-traditional streams of funding. At the same time, concerns about the cost of providing service as well as recruiting and retaining qualified drivers still need to be addressed in order to ensure a viable and efficient service that will result in addressing the mobility needs of the working poor. Regarding the riders, vehicle operators (drivers) were almost unanimous in voicing the importance of the services in socializing marginalized workers into a “mainstream” lifestyle, where the presence of other workers during the ride, many of similar backgrounds, provide motivation in retaining the job and in continuing the commute to work.
CHAPTER 5: Outcome Measures Relevant to JARC

5.1 Introduction

The objective of this chapter is to describe potential measures for an outcome evaluation of riders of the JARC program. Broadly speaking, outcome evaluations attempt to determine if discernable changes in behavior, attitudes, or knowledge have been attained as a result of the intervention and to assess the extent to which a program achieves its outcome-oriented objectives. Congress had established the JARC program in order to enable low-income workers access to jobs (irrespective of where jobs appropriate for the skill levels of such workers might be located) and also to connect city residents to suburban jobs. This objective connotes that, in addition to the usual performance measures used in transit, the assessment of outcomes incurred by users of the services funded are necessary. Stakeholders in the process, while not in complete agreement regarding which outcomes are important, articulate that assistance towards the ability to obtain and retain jobs, movement to higher-paying jobs, ability to access employment-supportive services such as educational sites, daycare centers and so on are important to consider.

5.2 Outcomes of Relevance to the Study

Since an outcome evaluation of employment transportation services connotes measuring how the circumstances of users change and whether the services have been a factor in leading to this change, a first step is to identify which types of circumstances would be of interest. The outcomes of relevance to the evaluation of employment transportation services may be categorized into:

1) Employment-related: Some questions that might be addressed in the context of employment-related outcomes include: have unemployed or welfare dependent users obtained jobs as a result of the service, have employed users been able

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7 The definitions for performance measures (a specific numerical measurement for one aspect of performance of the program or project under consideration) are adopted from two reports (Hatry, Morley and Rossman, 2003 and Government Accounting Office, 1998) and are as follows: Input measures: Indicators of resources (expenditures or employee time) used to produce outputs and outcomes. Output measures: Indicators of products and services provided or delivered. Outputs are completed products of internal activity: the amount of work done within the organization or by its contractors (such as passenger miles of transit service or riders served). Outcome measures: A numerical measure of the amount or frequency of a particular event, occurrence, or condition that is outside the activity or program itself and is of direct importance to program customers or the public. We also include indicators of service quality, those of importance to customers, under this category. Intermediate outcome measures: A measure of outcome that is expected to lead to a desired end but is not an end in itself (such as travel time which is concern to the rider undertaking the trip but gives no indication of the meaning or success of the activity undertaken at the end of the trip). A program may have multiple intermediate outcomes. End outcome measure: The end result that is sought (such as higher-paying jobs for riders or participation in a training program to improve skills). A program may have more than one end outcome. Effectiveness measures: Numerical measure of how well resources are being used in terms of dollars or personnel hours per unit of output or outcome; this type of measure is focused on productivity or cost-effectiveness.
achieved increased earnings after using the service or have employed users been able to increase the number of hours worked? These types of questions attempt to discern changes in the users employment context as a result of service use.

2) Travel-related: Employment transportation services might also enable a variety of changes in the users’ travel-related situation. Examples include: have users been able to incur time-savings as a result of the service, have employed users been able to reach new job locations after using the service or have users been able to shift to low-cost transit from higher-cost personal transportation?

3) Perception/cognitive related.: Perceptual factors are also important to consider since perceptions of unfamiliarity, great distances and related factors act as a significant barrier to work. Examples include: has the service enabled access to destinations that were perceived to be previously inaccessible, or have users been able to undergo change in their perception of reliability of travel?

5.3 Assessment of Site-to-Site Variations

JARC was designed to address employment transportation needs and local areas were given a great deal of flexibility to design programs that suited their needs. A great deal of variation is found in the riders’ labor market outcomes and benefits level, due to the fact that many factors affect these outcomes, including the effect of the local economic and labor market environment as well as the broader policy context of local welfare-to-work programs, job training and employment programs. Spatial characteristics of the service (urban versus rural location), operating characteristics (demand-responsive versus fixed route) and temporal characteristics (time of day of operation) also affect the magnitude of outcomes. As describe in Chapter 1, arriving at nationally generalizable results is a significant difficulty. A similar conclusion was reached regarding the program evaluation, at a national level, of the Congestion Mitigation and Air Quality (CMAQ) program (Transportation Research Board, Committee for the Evaluation of the Congestion Mitigation and Air Quality Improvement Program, 2002).

Whereas there have been numerous evaluations of federal programs based on multi-site studies, difficulties in controlling for these local variations do not lend easily to generalization of the results. The issue of site-to-site variations in outcomes is not unique to transportation. Greenberg et al. (2003) note that findings from multi-site evaluations of employment and training, human services and related programs also often vary across sites. The Child Assistance Program (CAP) was found to be more successful in one of the counties in which it was tested than in the other two; the Greater Avenues for Independence (GAIN) appears to have worked.

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8 See Transportation Research Board, Committee for the Evaluation of the Congestion Mitigation and Air Quality Improvement Program (2002). The Congestion Mitigation and Air quality Improvement Program: Assessing 10 Years to Experience. Special Report 264. “It is not possible to undertake a credible scientific quantitative evaluation of the cost-effectiveness of the CMAQ program at the national level” (p. 8 of the Executive Summary).
much better in one county in California (Riverside County) than in another (Los Angeles County); the National Evaluation of Welfare-to-Work Strategies (NEWWS) evaluation found considerably larger effects for the program that operated in Portland, Oregon, than for the remaining 10 programs; the Minority Female Single Parent intervention seemed to be effective in only 1 of 4 test sites, San Jose, California; and positive effects on earnings were found in some Food Stamp Employment and Training Program Evaluation and National Job Training Partnership Act (JTPA) Evaluation sites and negative effects in others.

One of the goals of the current study is to assess the extent of site-to-site variations in user outcomes. In the following sections, we discuss what might lead to such variations and then we attempt to quantify the extent of variation in a selection of illustrative employment-related, transportation-related and perceptual outcome measures.

5.3.1 Potential Contributors to Site-to-Site Variations in Outcomes

Transit services operate within a larger labor market and policy context, which might cause site-to-site variations in outcomes of similar types of riders. It is natural to attempt to determine what it is that causes program effects to differ from place to place. At first glance, simple measures of site-to-site variations such as urban-rural locations and type of service might appear to explain site-to-site differences in employment outcomes. However, as in the case of other human services and development programs, we can expect that several other factors might affect the economic and non-economic outcomes of JARC service riders. In this section, we speculate on how site-level factors such as characteristics of the local labor market and local unemployment and welfare-to-work policies as well as service-related characteristics and partnership goals might affect outcomes.

5.3.1.A Local Economic Environment

That the local economic environment can affect the performance of welfare-to-work and employment/placement programs seem almost self-evident. Nevertheless, there are two diametrically opposed views about the expected direction of this effect. One view is that program performance is likely to be better where unemployment rates are lower (i.e., in tighter labor markets) than where unemployment rates are higher (i.e., in looser labor markets). The argument for this is as follows. With low unemployment rates, there are more job openings for JARC riders to fill. Therefore, if a program can motivate and prepare additional recipients to seek and qualify for employment, a greater proportion of them will find and take jobs than would be the case if unemployment rates were high and there were fewer available job openings.

The opposing view is that program performance is relatively worse where unemployment rates are lower. The argument for this derives from the expectation that where unemployment rates are lower and thus the demand for workers is higher, it is easier for welfare recipients to find jobs even without the help of a program; thus, even though the...
program may have higher placement rates, the program may actually offer its clients little extra advantage in the labor market. This especially may be the case among recipients who are the most job-ready. At the same time, recipients who cannot find jobs where unemployment rates are lower may have personal characteristics or situational barriers that make them harder to employ. If this is the case, it will be harder than otherwise for a program with limited resources per client to increase employment.

A second version of this argument appeals to the intuition of “ceiling effects.” It posits that the larger the proportion of a group that finds employment on its own is, the smaller the margin will be for any program to make a difference. This argument is only plausible, however, when the underlying counterfactual is near the relevant ceiling, which often is not the case for welfare-to-work programs—especially those for long-term recipients, whose likelihood of fulltime employment can be well below 50 percent and who typically get only low-paying jobs.

The current empirical basis for assessing these competing views is extremely limited given the very small number of prior systematic attempts to compare site-level program impact estimates from randomized experiments to corresponding measures of the local economic environment. Furthermore, the few previous attempts to do so (for example, Riccio and Orenstein, 1996) are based on small numbers of sites, which seriously limits the statistical power of their comparisons and their ability to control for other site-level factors.

5.3.1.B Broader Welfare-to-Work and Unemployment Policy Context

Services also operate within a broader context of local welfare-to-work programs and employment programs. Some of these programs put special emphasis on placing participants into jobs as quickly as possible so that the there is a reduction in welfare rolls or unemployment rates. On the other hand, other programs encourage participants to wait until they could find a so-called good job. Almost all states now require adult welfare recipients to work or prepare for work, but there is much debate about the best way to do this (Bloom and Michalopoulous, 2001). These authors synthesized the results from studies of 29 welfare reform initiatives conducted by the Manpower Demonstration Research Corporation (MDRC) and the effects of these programs on the employment and earnings of adults. Over the past two decades, the authors note, the pendulum has swung between an emphasis on rapid job placement and a focus on education or training. Side-by-side tests of programs at opposite ends of the spectrum — those requiring most recipients to look for work (“job search first”) and those requiring most to enter education or training (“education first”) — in three counties revealed that they ultimately produced similar overall gains in employment and earnings. However, the job-search-first programs produced larger immediate gains and, in the medium term, led to larger gains for more disadvantaged groups, such as people without a high school credential. The most effective programs fell in the middle of the spectrum. In these programs, some recipients started by looking for work, while others started with education or training. This finding suggests that a more individualized approach may be most promising, but — given that not all the programs that used the mixed approach
were highly successful — the types of services provided and the basis on which people are assigned to services appear to be also critical. The implication of these results on our earlier discussion would be that depending on which broader context the services operated in, the economic outcomes of riders might vary.

5.3.1.C Spatial Characteristics of the Region

Many authors have underscored the importance of transportation for low-income workers in seeking and maintaining steady employment. A number of earlier studies (for example, Coulton, et al., 1999 and Thakuriah, et al. 1999) had had shown that there are substantial gaps in the ability of existing transit services to address the commuting needs of low-income workers. An additional stream of research, using welfare caseload data to which measures of proximity to existing transit systems and/or regional economic accessibility using spatial interaction modeling were appended, showed that such transportation-related measures had little or minimal relationships to employment-related outcome measures such as transition to work or job tenure (Thakuriah, et al., 2000).

An important dimension of spatial characteristics is the urban or rural location of the services. Carter and Lomax (1992) assert that significant service and demographic differences exist between rural and urban transit systems. Some such differences are as follows: (i) rural transit providers operate over vast geographic expanses that tend to have low populations (ii) residents of rural areas generally have lower income levels than their urban counterparts (iii) rural transit providers often do not operate a fixed route service. Operations are usually demand responsive or subscription service (iv) the objectives of rural systems are more concerned with providing transportation to transit-dependent groups (e.g., elderly, youth, low income, handicapped) than with reducing traffic congestion. Stommes and Brown (2001) note that appropriate economic opportunities in rural areas may only be found in great distances, in neighboring towns and counties. While 60 percent of rural residents have access to public transit, roughly two-thirds of these publicly funded systems are single-county or city/town in scope (Community Transportation Association of America, 2001a; 2001b). This limits the range of employment destinations available to the individual. Since not many jobs are usually located in sparsely populated rural areas, such locations are even less likely to have public transportation in the first place, leaving residents there with little choice but to travel long distances to work (Dewees, 1998; Kaplan, 1998)

5.3.1.D Operating Characteristics of Service

We have only considered fixed route (FR) and demand responsive (DR) services here, leaving aside auto ownership programs and information and marketing services. FR and DR services also vary tremendously in the nature of their operations. The JARC program has funded expanded service periods, feeder services, increased service frequency, route deviations and route extensions for FR services. New fixed route services have also been funded. The JARC program has also funded carpool/vanpool type DR services, as well as expanded DR service periods, guaranteed ride home programs, increase service frequencies and supplements to fixed route services. From our 23-site survey, we found
that DR service riders are more typical of economically disadvantaged riders; FR riders make better wages (34 % earn more than $9/hour compared to only 25% for DR riders) and FR riders were with their employers longer (25% had more than 2 years of employee tenure compared to 16% for DR riders). Many more DR riders are likely to have been informed about the transportation service by social workers and informal sources compared to FR riders. While DR services have the ability to directly transport individuals from homes to job locations, they are also more expensive. The 2002 national average operating expense per unlinked bus passenger trip was $2.09 compared to $16.83 for demand-responsive services (National Transit Database, 2002). In the 23 sites, the operating expense per unlinked bus trip ranged from $1.85 to $7.33 while the range for demand-responsive operations was from $2.83 (for a vanpool service) to $25.48.

The above discussion shows that several factors need to be considered in evaluating outcomes of JARC service riders. Individual “preparedness” to experience positive outcomes do play a role but the ability of these individual-level attributes in making a difference in outcomes might be mediated by macro/site-level labor market and local human services policy characteristics along with characteristics of the transit service and the spatial characteristics of the service area.

5.3.2 Extent of Site-to-Site Variations

In this section, we consider a selection of illustrative outcome relevant to employment transportation programs and assess the extent of cross-site variations in the outcomes.

5.3.2.A Employment-Related Outcomes

Figure 5.1 shows employment outcomes for riders in twelve of the services surveyed. Four different employment outcomes are depicted in the picture: proportion who did not work prior to using the service (i.e., proportion which reported moving from unemployment to employment), proportion which worked prior to using the service but earned less than at the current job, that which worked and reported earning about the same as prior to starting use of the service and finally, the proportion that reported earning less than prior to using the service. Both demand responsive (DR) and fixed route (FR) services operate at these sites and the sites themselves are either urban or rural locations. For example, Mount Hood Community College in Portland, OR operates a demand-responsive service called the PCC-Mt. Hood Workforce Shuttle. The purpose of the Workforce Shuttle was to transport Portland Community College students between training facilities. This was not really a service to assist in commuting. This service appears to have been quite successful in serving riders who did not work prior to using the service. But for those who did work previously, the service does not seem to have been able to lead to placements in higher paying jobs. However, this was not the intent of the service.

In contrast to this service are two fixed-route services operated by Change Inc., which provides two main adaptable fixed routes, a local route which operates 7am
to 1am north-south along the West Virginia panhandle between Ohio and Pennsylvania and the Robinson route which operates 6am to 1am from Follansbee via Steubenville and Weirton to the Robinson Town Mall complex in west suburban Pittsburgh. The service area is very large and in approximate terms, the two lines carry fifty passengers per day and 14,000 passengers annually. The number of high-paying industrial jobs in the area has decreased over time from 20,700 jobs in 1980 to 13,200 jobs in 1995, or a decline of 7500 jobs. This 36% drop in high-paying manufacturing jobs has been slightly offset by low-paying industrial jobs. Bureau of Labor Statistics data shows that in 2002 the unemployment rate in the area is over 5 percent and that in 1999, close to 27% of the families residing in the area were under poverty. This service appears to have been successful at targeting individuals who did not work prior to using the service (“new” workers) or those who increased or maintained their earnings levels.

\[9\] The unemployment rates are calculated based on data from the Local Area Unemployment Statistics (LAUS) program, Bureau of Labor Statistics. These data are available at: iwww.bls.gov/LAU
Figure 5.1: Site-to-site variations in employment outcomes

Other sites appear to have been successful in targeting riders in all four groups. For example, the fixed route services operated by the Brockton Area Transit, MA, the Bee-Line System in Westchester County, NY, Howard County Transit, MD and the Chicago Transit Authority, Chicago, IL, all appear to have relatively even proportions of riders with the four employment outcomes. However, the DR services operated by the YWCA in Bloomington, IL and the Pacific Can, Hillsboro, OR as well as the fixed route services operated by Jefferson Parish, LA, the Metro Transit Authority (MTA) in Minneapolis, MN have a smaller proportion of “new” workers. Yet, these services seem to be doing well in making higher-wage placements or in enabling riders to retain earnings levels.
Indicators of Employment Outcomes

An examination of these 12 sites showed that riders incurred wide variations in employment-related outcomes. Against this backdrop, two indicators of economic outcome measures are considered in the site-to-site variation assessment. Intuitively it would seem that if services are being able to transport previously unemployed individuals to jobs and also enable people to work in higher-paying positions, then those services are contributing meaningfully to people’s lives. It follows that two reasonable indicators which could be examined in order to evaluate if a service is successful from an outcome evaluation point of view are the proportion of riders who were unemployed prior to using the service and proportion who earned more after using the service.

Propensity of previously unemployed workers to use the service: This measure is especially beneficial because one of the primary goals of the JARC program is to assist in placing welfare clients and unemployed individuals within reach of jobs. However, using this measure as an indicator of a successful service also has several difficulties. First, the targeted service might have as its end goal not only access to jobs but also to employment supportive services such as education, day-care and destinations with other activities to jobs but also to employment supportive services such as education, day-care and destinations with other activities. While the latter types of goals are as important as the access to jobs goal, such employment-supportive services might not do as well on this indicator. Second, many projects attempted not to provide new, dedicated service for welfare clients and the like, but chose to modify existing services used by commuters by means of extensions in service hours, extra stops and so on to cater to the target population such that the service could continue to operate in the event that JARC funds dried up. In such cases, the proportion of new workers might be low, but the service might enable existing riders to complete their trip efficiently, and also perhaps increase or at least retain their earnings levels.

Propensity of users to earn higher wages after using service: The proportion of riders who earned more after using the service as an indicator is also problematic. While access to higher-paying jobs is ideal and services that rank high in the proportion of riders that increase their wage rate by using the service might be deemed successful, this measure downplays the fact that riders might be economically benefiting from the service by managing to stay on in the labor force even if by means of working for the same or lower wages or simply by looking for jobs or by improving their skill levels through training programs. In addition, the measure downplays the quality of the work experience which might be better captured by indicators such as the number of hours worked or number of days per week at the same job (greater time spent on the same job obviates the need to travel to multiple, part-time jobs) and job tenure or length of stay at the same job (which is indicative of job stability).
This discussion points to the need to have multiple indicators of employment outcomes. Sites that are successful on certain indicators might be doing badly in others. The indicators would be very much specific to the goals of the partnership that finances and operates the service, which in turn should reflect the needs of the target population. These two indicators are tested along with lack of access to services, higher education attainment of users, and the travel time saved as a result of using the service to tease out the site-to-site variations in employment outcomes (Appendix J).

5.3.2.B Indicators of Non-Employment Outcomes

The Transit Capacity and Quality of Service Manual (TCRP, 2003) notes that from the perspective of the customer, comfort and convenience factors such as passenger load, reliability, travel time, safety and security, cost and appearance of comfort are important indicators of service quality. Indicators such as these are equally relevant in the case of JARC services. In particular, two measures are important indicators of such services: travel time incurred as a result of using the service and the level of dependency on the service.

Propensity to save travel time after using the service: The travel time incurred to fulfill work or non-work activity would be an important outcome measure and would serve as a proxy for the level of effort and psychological comfort required to access jobs. A reduction in travel time compared to that incurred prior to using the service could be considered to be a positive outcome. This outcome is meaningful in the case of riders who were in the labor force or participated in the same employment-supportive activity prior to using the service, the travel time incurred for which can be used as a baseline. Change in travel time is not a meaningful indicator for new workers accessing jobs or for new trip purposes enabled by the service for which there is no baseline travel time. Thus, it is not universally applicable to all riders.

Respondents reported that they used private automobiles, taxis, shared rides, used public transportation or walked prior to using the service in order to fulfill the same work or non-work purpose either in the same or an alternative destination. We found that riders lost time overall by switching from all auto modes (driving, taxis and ridesharing) to the JARC transit service. In particular, former taxi users and ride-sharers lost time by switching to fixed route services (slightly more than a minute) as well as to demand-responsive services (where the loss was more substantial, with a loss of more than 12 minutes for former taxis users and close to 7 minutes for riders who formerly shared rides). Former drivers lost time (about 4 minutes) by switching to fixed route services but gained time-savings of about 3 minutes by switching to demand-responsive services. While there was no gain in travel time most JARC riders were unable to continue using their previous modes. Several had cars that they could not afford to repair or no longer were able to carpool. The biggest gains came from switching to the JARC service from walking (about 18 minutes) followed by those who switched from transit (an average of almost 8 minutes).
**Propensity to perceive lack of travel alternatives:** In addition to a “hard measure” of the level of effort of spatial separation such as travel time, the cognitive aspects of the level of effort and the lack of alternatives to overcome such barriers are an important to gauge. It may be argued that if riders perceive no other means of getting to their destinations, then the service is leading to a positive outcome on the part of the riders. The perception of large distances between job and residential locations, low vehicle-ownership rates, low rates of drivers licenses and lack of experience navigating information on linking trips and transfers by existing public transit systems create a psychological barrier towards the trip to work.

Anecdotal evidence from professionals such as case workers who deal with low-income workers and public assistance clients cites perceived lack of adequate transportation, great distances to jobs and commuting journeys to areas which clients are unfamiliar as key barriers to the transition from a state of unemployment and/or public assistance to jobs. In a survey of local welfare officers in the Chicago metropolitan area (Thakuriah et al., 1999) for example, respondents noted that public assistance clients routinely seek travel information from case workers and that clients often lack spatial cognizance of entry-level job locations that are far away from home locations, thus imposing a psychological cost to potential job-seekers and hindering the job search process.

Nearly two-thirds (66 percent) of the respondents indicated that they would not be able to access their destination without the service that they were currently using. About 68 percent of riders on work-bound trips noted that they would not be able to reach their (job) destination without the service. Riders in smaller metropolitan areas (about 80 percent) and rural areas (about 70 percent) are more likely to indicate that they would not be able to reach their destination without the service, compared to riders in large metropolitan areas (where 55 percent indicated that they would not have access without the service). This suggests that the JARC program is providing service where none exists and the riders are highly dependent on its existence.

**5.4 Hierarchical Linear Models of Selected Ridership Outcomes**

In order to statistically assess the extent of site-to-site variations in the four indicators discussed above and to ascertain the contribution of different factors in this variation, four binary variables are constructed from the survey data, two of which are illustrative of economic outcomes and two of non-economic outcomes. The former includes (i) EMP_BEF, which takes a value of 1 for those who were unemployed prior to using the service and 0 otherwise and (ii) WAGE_HIGHER which indicates those riders who earn more after using the service. Non-employment related measures include (i) T_SAVINGS, which indicates those riders who experienced a reduction in travel time to destination after using the service and (ii) N_ACCESS, a perceptual indicator that indicates those riders who perceive an ability to get to their travel destination without the services and is thus indicative of the availability of travel alternatives.
Our ultimate objective is to analyze factors that contribute to a propensity of riders to experience a positive outcome on these indicators. This propensity is assessed using site-level and individual-level factors and modeled using Hierarchical Linear Models (HLM) for binary outcomes.

The models themselves and details of the results are given in Appendix J. We summarize the results in the next section.

### 5.5 Extent of Site-to-Site Variations in Outcomes

Overall, significant site-to-site variations were found in the propensity of riders to experience positive outcomes on the four indicators. The intra-site correlation for EMP_BEF is estimated to be 0.16 indicating that 16% of the variance in the dichotomous EMP_BEF outcomes can be attributed to the differences between sites. The intra-site correlations for WAGE_HIGHER, T_SAVINGS and N_ACCESS are .10, .12 and .15 respectively. Secondly, the significance of some of the individual and site-specific interaction terms show that the strength of the association between individual attributes and outcomes are mediated by the presence of site-level effects.

These results have the following implications:

1) No single measure is adequate to evaluate the effectiveness of all employment transportation projects and hence projects should be evaluated for outcomes on a variety of measures.

2) Different site-level factors affect the four different measures differently indicating that outcomes would vary as a result of site-level factors. However, a large proportion of the variation is explained by the location of the area, the type of service and local unemployment rates. These findings lend support to recent concerns articulated by program managers of JARC projects that reporting requirements should be different for fixed route and demand-responsive services. Other respondents had felt it did not address rural issues and made the recommendation that rural and urban reporting should be completely separate, as transportation in rural and urban areas cannot be compared.

3) We also find that areas with higher unemployment rates allow services to make a difference at the margin and that when unemployment rates are higher, it is possibly difficult for the target audience to find good jobs on their own and the only jobs left unfilled are those that are at great distances from where they live, access to which is enabled by the service, thus allowing services in such areas to enable higher-placement jobs than otherwise possible.

4) Given that underlying factors greatly appear to affect outcomes in different locations, evaluation, which intends to capture the true effects of the program, might be difficult.
The question then becomes: how should the monitoring system work? The current monitoring system requires grantees to report employment sites reached by the service as an indicator of the potential for “job reach”. While this indicator is a good measure of the overall JARC program goal of enabling access to jobs, as per our discussion in this chapter, it might not be a relevant measure for many services because of differences in service-level goals, which might be to support access to child-care facilities, educational centers and so on. Second, if local employment rates are high, the employment sites reached might not be a good indicator of job reach, as the jobs in the sites may not be available to service riders or might be available only after displacing other workers. Third, employment sites and jobs reached are not the same as smaller employers might be able to offer only a few jobs to service users. These issues, coupled with the difficulty of measuring employment sites (especially for demand responsive services) point to the need to look at additional outcome measures, especially those that are able to measure changes in the economic and non-economic characteristics of riders. But as we have seen, the illustrative measures considered here are themselves not equally relevant in all cases and there are substantial site-to-site variations.

A strategy is needed that balances the reporting burden on grantees and also degree of relevancy of the measures. It might be possible to split the universe of transit services funded by the program into type of service, type of area, unemployment rates and then to select a statistically representative sample of sites within each cluster. Data on multiple outcomes experienced by riders could be collected by means of an onboard survey instrument (the same survey instrument to be used at all sites). Site-to-site comparisons can then be made within each cluster in contrast to across the universe of transit services. These would allow the performance measurement process to control for the extraneous effects imposed by the site-level factors on the outcomes of riders. However, administration of onboard surveys, data entry, the eventual analysis of the data and finally, recommendations to improve services based on the data would be a much bigger burden than the current reporting requirements of the program. It is true that many services already survey their riders and many sites have a process in place. Using a combination of federal resources and such site-level processes, such a task might be accomplished. Further study is needed of how these activities might be integrated.
CHAPTER 6: Cost-Effectiveness Analysis

6.1 Introduction

Once implemented, transit programs are rarely evaluated for outcomes on a systematic basis. In particular, the benefits of the important and complex social service role of public transportation have received ample attention but has rarely been subject to monetization and cost-benefit valuation. Two types of measures are important: Cost-Effectiveness (CE) measures and Cost-Benefit Analysis (CBA) measures. Cost-effectiveness analysis provides decision-makers with information on costs to achieve non-monetary objectives. While a Cost-Benefit Analysis (CBA) might be more desirable from the point of view of decision-making, difficulties with monetizing benefits and costs renders CBA to be a difficult method of program valuation in many cases.

This chapter attempts a CE analysis of employment transportation focusing on the JARC program. CE measures costs in monetary terms but measures the accessibility benefits in natural units that are meaningful to public transportation such as trips or rides taken annually and jobs accessed. CE measures are useful because it avoids the challenge of monetizing benefits by keeping benefits in their natural units. Possibly the most widely used CE measure used in reporting and evaluation of public transportation programs and services is Cost per Ride (CPR). This number is estimated by dividing total annual cost by annual ridership. CPR is an important criterion that the Federal Transit Administration (FTA) uses to rank new proposals submitted for consideration under the New Starts program. These measures enable transit agencies to monitor how efficiently outputs such as riders and new transit trips can be served. As operating costs of transit escalate at faster rates than operating revenue, the financial burden placed on state, regional, and local government units are becoming heavy (Hartman, et al., 1994). Therefore, public transit today operates in an environment sensitive to strategic planning and performance-measurement.

In CBA measures, however, the benefits are explicitly quantified and the full range of benefits emanating from user, non-user and societal benefits of transportation for low-income workers should be taken into consideration. This is undertaken in this report in the next chapter. That chapter also lists the assumptions of such an exercise and comes to the conclusion that many factors affect whether a transit program is beneficial including the time horizon under consideration.

The chapter is organized as follows: in Section 6.2, we state the objectives of the CE analysis. Then in Section 6.3, we develop CE measures of the JARC services and compare to other (FR and DR) services operating within the same area. In Section 6.4, we examine program costs by labor market outcomes achieved and by subgroups of riders. Section 6.5 compares JARC program costs for serving low-income populations compared to non-transportation programs. Conclusions are drawn in Section 6.6.
6.2 Objectives of Cost-Effectiveness Analysis

Three measures are used to study costs associated with the JARC program:

1) Cost Per Ride (CPR) which is the total program costs in a site, as obtained from the Cost and Operations Survey described in Chapter 3, divided by the total annual ridership; this quantity is further disaggregated by factors such as type of service and location;

2) Annual Program Cost Per Rider (PCOST) or the costs expended by the program per rider (which depends on the level of use by riders, information on which was obtained from the JARC User Survey – details on this measure are given in Section 6.4);

3) Annual Subsidy per Rider (SUBSIDY) or the difference between annual program costs and annual transit fares paid by the rider, which also depends on the level of use by the rider and is described in Section 6.4.

The cost-effectiveness analysis consists of the following problems:

Problem 6A: Compare CE Estimates to that of Peer Services: We compare Cost Per Ride of surveyed JARC-funded services to that of peer transit services operating in the same area. We have also disaggregated the results by type of service (Fixed-Route versus Demand-Responsive) and type of location (large urban, small urban and rural locations).

Problem 6B: Compare Annual Program Cost Estimates for Different Labor Market Outcomes and for Different Subgroups of the Population:

First, we examine the costs related to trips that have desirable labor market outcomes. The trips of interest include:

a) New Work Trips: Work trips by those unemployed prior to using the service,

b) Trips to Higher Wage Destinations: (for newly employed riders as well as previously employed individuals who incurred a change by taking a new job in some other location that has become accessible with the service, change in job shift and so on),

c) Trips by Education Levels of Trip-Maker: especially those undertaken by those with no high school degree and who might previously have been on public assistance and finally,

d) Trips to Inaccessible Destinations: Trips to destinations, which were perceived to be out of, reach or inaccessible by means of the transportation options available prior to the service by the riders.

Secondly, we divide JARC service riders into six subgroups, based on the nature of their destination activity and by the employment status of the riders. Based on these considerations, we arrive at the following six subgroups of riders:

a) Subgroup 1: New Worker in the Labor Force

b) Subgroup 2: Existing Workers in New Job Locations
c) Subgroup 3: Existing Workers in Same Job Locations  
d) Subgroup 4: Non-Workers in School or Training  
e) Subgroup 5: Non-Workers Looking for Jobs  
f) Subgroup 6: Discretionary Riders

**Problem 6C: Compare Annual Program Cost Estimates to those of Peer Human Services, Workforce Development, Economic Development and other Social Programs:** Compare these cost-effectiveness measures to cost-effectiveness measures of other social, health and human services, workforce development and economic development programs.

### 6.3 Cost Per Ride Estimates and Comparisons

In this section, we compare the CPR estimates of JARC services to that of other transit services operating in the area. Three main sources of data were used for this purpose:

**Cost and Operations Survey:** Service costs were obtained during the site visits as well as from a Cost and Operations Survey, that was described in Chapter 3. This survey was administered by email and followed up with telephone reminders. The objective of the survey was to elicit information pertaining to the operational (route-miles, passenger miles, trip time, hours of service, etc) and financial (operating cost, fare structure, farebox return, etc.) characteristics of the service.

**JARC Quarterly Reporting System:** Where possible, the JARC Quarterly reporting system, (maintained by FTA) into which grantees submit operations, cost and related data, was also utilized to supplement information collected from program managers.

**National Transit Database (NTD):** The National Transit Database is a program administered by the Federal Transit Administration and is the primary national statistical database on the transit industry. Transit providers obtaining funds through the formula programs (5307 or 5311) are required to submit performance data annually. The financial and operational data for the regular transit service for the 23 JARC-funded sites are compared against those of the 23 JARC-funded services. CPR estimates of peer services were obtained from this database.

Figure 6.1 shows that, overall, the CPR of the surveyed JARC-funded programs is $11.40 per ride. In contrast, the CPR for non-JARC transit services in the same sites as available from the NTD is $9.77.
Figure 6.1: Cost per Ride (in US dollars) of sampled JARC funded services and comparisons with other services for the same area as obtained from the NTD

* The JARC-funded services in rural areas seemingly have lower cost per ride than the regular transit services in those areas. A closer look at the sample indicates that this could be because of the definition of the service area as well as the duplicity in service providers for the region and for the study area. For example, Monmouth County in New Jersey (Asbury Park) is a “rural” site as far as the JARC service is considered. However, the regular transit provider for the area is New Jersey Transit and their service area is the entire state of New Jersey. So a comparison of the JARC service with the regular transit is skewed in such cases.

Practitioners and program managers have been most interested in differences in outcomes of fixed-route versus demand-responsive services. It is well known that FR services are much less expensive to operate than DR services. Therefore, from a cost-efficiency standpoint, fixed route operations might be deemed to be more desirable\textsuperscript{10}.

The 2002 national average operating expense per unlinked bus passenger trip was $2.09 compared to $16.83 for demand-responsive services (National Transit Database, 2002). The JARC CPR for FR services was $8.25 and for DR services, $16.36. In contrast, the

\textsuperscript{10} In the case of JARC, this is not always clear since in some cases, private or non-profit operating partners might already have a van that they have put to use with JARC funds, without the start-up organizational issues of coordinating with the local transit agency. Hence, a desire to implement DR services might stem partly from considerations of convenience. However, private and non-profit stakeholders have expressed concern in some cases in operating DR services (Thakuriah et al, 2004). Regulatory issues including drug and alcohol programs and the JARC reporting requirements have created difficulties in keeping smaller operators involved. JARC projects, being funded out of FTA, are also required to meet drug and alcohol programs. Some faith-based organizations who have been partners in JARC projects have also relied heavily on volunteer drivers. This led to concerns about liability, competency and reliability regarding vehicle operations and maintenance, making the transit board uncomfortable and leading to the eventual termination of the service.
non-JARC NTD-reported for the same services were $3.86 for FR and $19.06 for DR services.

However, 50% of the JARC FR services had a CPR of less than $6; the extreme values are from a few FR services, which are mostly owl-services with lower ridership. In particular, one JARC-funded FR service in a small metro area was operating at a CPR of almost $21 per ride. However, this particular service was also transporting the highest percentage of riders who were unemployed prior to using transit services, indicating that cost-effectiveness should be benchmarked against specific labor market outcome.

Figure 6.2: Cost per Ride of sampled JARC-funded services and peer service as obtained from the NTD by type of area

Figure 6.2 also shows the contrast between the JARC programs and the NTD programs in terms of the area of operation. The trends are similar. For the sites selected, both types of services are highest on a CPR basis for large urban areas, followed by rural areas and then by smaller urban areas. DR services for rural areas are more expensive than FR services.

6.4 JARC Program Cost (PCOST) and JARC Subsidy (SUBSIDY) Analysis

Following the CE measures presented in Section 6.3, we examine two other measures that are relevant to understand the cost structure of JARC services. As described in Section 6.2, these additional measures are Annual JARC Program Cost (PCOST) and Annual Subsidy per Rider (SUBSIDY).

These quantities are defined and estimated as follows:
1) Annual Program Cost Per Rider \( (PCOST) \) is the estimated funds spent annually on a rider and depends on the level of use of the service by the rider. It is a function of Cost per Ride \( (CPR) \) and RIDES or the estimated number of annual trips taken using the service. \( PCOST \) is therefore \( CPR \times RIDES \). The variable \( RIDES \) is estimated using data from the JARC User Survey, which collects data on the frequency of use per month.

2) JARC Subsidy Per Rider \( (SUBSIDY) \) is the annual subsidy per rider, which also depends on the level of use. \( SUBSIDY \) is calculated as the difference between \( PCOST \) and annual cost of transit fares using the service. The data on transit costs are estimated using data collected from program managers during the site visits.

The above quantities are presented for labor market outcomes that are considered to be desirable (in Section 6.4.1) as well as subgroups of riders, which are defined on the basis of their employment/economic attributes, and purposes for which they are using the JARC service (in Section 6.4.2).

### 6.4.1 Cost Analysis by Labor Market Outcomes

Cost and subsidy figures for the following labor market outcome measures were considered:

1) Average \( PCOST \) and \( SUBSIDY \) Per Rider by those unemployed prior to using the service;
2) Average \( PCOST \) and \( SUBSIDY \) Per Rider by those reaching higher wage destinations (for newly employed as well as previously employed individuals who incurred a change by taking a new job in some other location that has become accessible with the service, change in job shift and so on)
3) Average \( PCOST \) and \( SUBSIDY \) Per Rider with no high school degree and who were previously have been on public assistance
4) Average \( PCOST \) and \( SUBSIDY \) Per Rider who perceived their destinations to be out of, reach or inaccessible by means of the transportation options available prior to the availability of the service.

Figure 6.3 gives the \( PCOST \) estimates by previous employment status of riders. New workers in the workforce cost the program higher (at $3,534 per rider) compared to those who worked before (at about $3,100). The trends are similar for FR and DR services, although program costs of serving new workers by DR are over $1,000 higher than that of serving existing workers by DR services. Female riders in small urban and rural areas, who reported being on public assistance and to making a large number of work trips dominate the previously unemployed group served by DR services. This is truly a hard-to-serve population.
Figure 6.3: Mean Annual Program Cost Per Rider (PCOST) by Prior Employment Status of Rider and Service Type

Figure 6.4: Mean Annual Program Cost Per Rider (PCOST) by Education Status of Rider and Service Type

Figure 6.4 gives the Annual Program Cost Per Rider by educational status. According to the survey data, only 28% of the JARC respondents indicated that they had at least completed high school. By contrast, the PUMS data for these same regions indicates that
almost half of the bus riders and two-thirds of those using traditional transit (57% and 69% respectively) had completed at least 12 years of school. Many of the JARC services provide access to not just employment locations, but also to job training centers and other skill-enhancing centers.

The average \( PCOST \) values for those who possess a high-school diploma and higher is more (at about $3,300 per year per rider) than that of riders who have not graduated high-school (at about $2,700 per year per rider). This fact stems from the higher trip frequencies of those with high-school degrees, as these individuals are also more likely to use the service for full-time employment.

The research reported in the previous chapters showed that the perception of large distances between job and residential locations, low vehicle-ownership rates, low rates of drivers licenses and lack of experience navigating information on linking trips and transfers by existing public transit systems create a psychological barrier towards the trip to work. Many JARC service riders incur travel times that are very long compared to the travel times incurred by typical commuters in their area (Thakuria, et al. 2004). These factors increase the need for reliable transportation to work and the riders’ psychological dependency on the service. Further, nearly two-thirds (66 percent) of the respondents indicated that they would not be able to access their destination without the service that they were currently using. About 68 percent of riders on work-bound trips noted that they would not be able to reach their (job) destination without the service. Riders in smaller metropolitan areas (about 80 percent) and rural areas (about 70 percent) are more likely to indicate that they would not be able to reach their destination without the service, compared to riders in large metropolitan areas (where 55 percent indicated that they would not have access without the service). This suggests that the JARC program is providing service where none exists and the riders are highly dependent on its existence.

Figure 6.5 breaks down the average \( PCOST \) by trips to destination that were perceived to be inaccessible prior to availability of the JARC service. Overall, there is not much difference between the \( PCOST \) averages by perception of destination accessibility. However, after controlling for type of service, average program costs of DR users who perceived the destinations to be previously inaccessible, is in fact lower than those who did not have such perceptions. The trend is similar for FR users. These trends can be attributed to the fact that for both FR and DR riders, the average CPR of riders taking trips considered to be previously inaccessible are lower (at $8.94 per trip) than those riders undertaking trips considered to be previously accessible (at close to $10 per trip).
Several riders in the sampled services also indicated that they were able to take higher wage jobs after they started use of the JARC service. About 41 percent of workers who were already in the labor force before starting use of the service reported earning more after starting use of the service. Increases in earnings could have accrued by being able to switch to a better paying job at a new location or a different shift in the same location. A greater share of existing workers using demand-responsive services reported earning more (54 percent) compared to fixed-route workers who were already employed. Also, a greater share of riders in large metro areas (48 percent) reported earning more since using the service, compared to already-employed workers in smaller metro areas (about 40 percent) and rural areas (35 percent).

Figure 6.6 shows that the average PCOST expended on riders who are making trips to higher wage destinations is higher (at an average of $3,806 per rider reporting such trips) than those on riders who did not report access to higher wage destinations (at $3,014 per rider). The differential in PCOST for DR trips for these two types of riders is close to $1,800, while for FR riders the differential is only about $110.
6.4.2 Cost Analysis by Subgroups

JARC service users are far from being a homogeneous group with respect to the private benefits and costs that accrue – in fact, based on what we count as benefits or costs, several JARC user sub-groups might be identified, each with different magnitudes of benefits and costs. One way to identify these sub-groups is by the purpose of the trips for which they use the services. Since a major goal of JARC is to improve the economic opportunities of service users, a second way is by the employment status of the riders. There are various other ways to generate the subgroups; Table 6.1 presents the sub-groups of JARC service riders and the types of changes that these riders potentially experienced as a result of using the service. Because one of the basic sources of data for the entire CBA is the JARC User Survey, the last column identifies the variables in the dataset that might potentially be harnessed for the purposes of benefit estimation.
Table 6.1: JARC User Sub-Groups and Implications for CE and CB Analysis

<table>
<thead>
<tr>
<th>Nature of Trip</th>
<th>Potential Impacts</th>
<th>JARC User Survey Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work Trips</strong></td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>New Workers in Labor Force: Subgroup taking work trip to location to which rider did not go before because rider did not work before</td>
<td>A new trip for the purpose; impacts could be on earnings (difference between annual wages at the new job and previous earnings from public assistance or unemployment benefits) and transportation costs accrued and value of changes to leisure time</td>
<td>Duration of job; whether part-time or full-time, hours worked at job, categorical data on wages; travel time</td>
</tr>
<tr>
<td>Subgroup 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Workers Working in Jobs in New Locations: Subgroup using JARC service for work trip to location to which rider did not go before because rider changed job location</td>
<td>A trip diverted from another work location; possibly changes in travel time, out-of-pocket transportation costs and annual wages earned</td>
<td>Duration of job; whether part-time or full-time, hours worked at job, categorical data on wages, whether earnings are same, more or less than before; travel time</td>
</tr>
<tr>
<td>Subgroup 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Workers Working in Same Locations as Prior to using JARC Service: Subgroup using JARC service for work trips to existing work location</td>
<td>Possibly changes in travel time and out-of-pocket transportation costs and also wages earned by shifting to another job start time</td>
<td>Duration of job; whether part-time or full-time, hours worked at job, data on wages, whether earnings are same, more or less than before, travel time difference relative to prior mode, type of prior mode; travel time</td>
</tr>
<tr>
<td>Subgroup 3</td>
<td></td>
<td></td>
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<tr>
<td>Employment-Related Trips</td>
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<td>Non-Workers in School or Job Training: Subgroup using service for trips to school, education and employment training</td>
<td>Deferred earnings and possibly new trips or changes in time or mode for existing trip</td>
<td>Unemployed and looking for work, unemployed and not looking for work, prior mode if trip is to same location, travel time</td>
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<td>Subgroup 4</td>
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<tr>
<td>Non-Workers Looking for Jobs: Subgroup using JARC service for employment-seeking trips</td>
<td>Deferred earnings and possibly new trips or changes in time or mode for existing trip</td>
<td>Unemployed and looking for work, unemployed and not looking for work, prior mode if trip is to same location, travel time</td>
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<td>Subgroup 5</td>
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<td>Non-Work (Discretionary) Trips</td>
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</tr>
<tr>
<td>Discretionary Users: Subgroup using JARC service for trips to health care centers, social visits, shopping</td>
<td>Benefits to quality of life improvements as a result of such trips being enabled especially if such destinations were not previously accessible, possibly changes in travel time and out-of-pocket transportation costs</td>
<td>Employed or unemployed individuals, prior mode if trip is to same location, travel time</td>
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Table 6.2: Sociodemographic Information on Six Different Subgroups

<table>
<thead>
<tr>
<th>Sub-group</th>
<th>Previous Employment Condition</th>
<th>Gender</th>
<th>Previously on public assistance</th>
<th>Percent High School Graduate &amp; Higher</th>
<th>Percent who rated service as very important</th>
<th>Percent unable to reach destination without service</th>
<th>Percent without license</th>
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<td>40.00</td>
<td>60.00</td>
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<td>29.09</td>
<td>3.00</td>
<td>20.49</td>
<td>45.54</td>
<td>54.46</td>
</tr>
</tbody>
</table>

* Income from public assistance, job training stipends or unemployment benefits programs.
Table 6.3: Travel and Program Characteristics of Subgroups

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Average Cost Per Ride ($)</th>
<th>Subsidy Per Trip</th>
<th>Travel Time (in Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.44</td>
<td>6.94</td>
<td>28.46</td>
</tr>
<tr>
<td>2</td>
<td>5.19</td>
<td>3.68</td>
<td>24.73</td>
</tr>
<tr>
<td>3</td>
<td>9.26</td>
<td>7.76</td>
<td>29.70</td>
</tr>
<tr>
<td>4</td>
<td>13.38</td>
<td>11.88</td>
<td>23.42</td>
</tr>
<tr>
<td>5</td>
<td>14.23</td>
<td>12.74</td>
<td>27.64</td>
</tr>
<tr>
<td>6</td>
<td>8.62</td>
<td>7.12</td>
<td>22.20</td>
</tr>
</tbody>
</table>

User Subgroup 1: Subgroup 1 users are workers, who use the service for their work trip and who were unemployed prior to the service. As Table 6.2 shows, a very small fraction of these riders own cars. Close to 25 percent of these individuals reported receiving some form of public assistance in the 5 years prior to starting use of the service. Eighty-five (85) percent perceived the service to be very important to them and 82 percent reported that they would be unable to reach the job destination without the service. About 70 percent of this group does not have a driver’s license.

The average cost per ride, given the service they were using, is $ 8.44 bringing the per trip subsidy to close to $7. On the average, these riders traveled long distances to their job destinations, with mean travel time of about 28 minutes.

User Subgroup 2: Subgroup 2 users are representative of workers who are able to change the location of their employment as a result of new job destinations that the transit service enabled them to reach. As shown in Table 6.2, they too underwent changes regarding post service use. About 88 percent of these riders reported that with the change in jobs, they either earned more or the same as their previous job. Although close to 33 percent of riders in this subgroup reported being able to access their new job destination by other means, 85 percent ranked the service as very important. Their average cost per ride is $5.19 and average subsidy per trip is $3.68.

User Subgroup 3: Subgroup 3 users are workers who either changed their previous mode of travel or departure time or both, in order to access the job location where they were employed prior to starting use of the service. If employed in shift jobs, they might also have undergone changes in earnings as a result of being able to change to jobs starting during non-traditional times. About 85 percent of these riders reported that with the change in jobs, they either earned more or the same as their previous job. As a group, these riders incur the longest average travel times of almost 30 minutes.

User Subgroup 4: Subgroup 4 users are non-workers who are currently enrolled in school or job-training programs. As Table 6.2 shows, 40 percent did not work before and reported no current wages while 60 percent of these non-workers reported that they are earning about the same as they were before using the service, most likely from public assistance, training stipends or unemployment benefits programs. Their higher cost per ride indicates that they are mostly DR users, requiring greater subsidy per ride.
**User Subgroup 5:** These are non-workers who are looking for employment. About 33 percent did not work prior to using the service, while others did but currently earn more or about the same from non-work sources. This subgroup has the highest car-ownership rates (close to 30 percent) among all subgroups. Average trip times for those looking for jobs are also high: about 28 minutes. Like Subgroup 4, these riders also have higher cost per ride than the other subgroups, indicating that they are mostly DR users, requiring greater subsidy per ride.

**User Subgroup 6:** These riders are using the service for non-work purposes. The vast majority are shopping trips. As a group, they travel the shortest average travel times.

Figure 6.7 gives the breakdown of mean Annual Program Cost Per Rider \((PCOST)\) by subgroup and type of service. Overall, all subgroups using FR have lower \(PCOST\) on the average than all subgroups using DR services. The figure shows that in both the FR category, Subgroups 1, 2 and 3 have the highest average \(PCOST\). Table 6.3 showed that the average CPR for these three groups are among the lowest of all subgroups; the high \(PCOST\) values shown in Figure 6.7 is the result of much larger number of annual riders taken by these three subgroups, all of which are using the services for work trips. Subgroup 4, those using the service for job-training or school trips have the fourth highest PCOST for both types of services, again a function of greater trip-making than Subgroups 5 and 6, but also fairly high average CPR.

Figure 6.7: Mean Annual Program Cost Per Rider by Subgroup and Type of Service

We next examine how program costs for the subgroups vary type of area. Figure 6.8 displays these figures. \(PCOST\) are the highest for Subgroups 1, 2 and 3 in small urban areas, while those of Subgroup 3, who are commuters who have primarily changed modes of transportation to go to work in those locations where they previously worked, are the higher
than all other groups in rural areas. Subgroup 4’s program costs are the highest in urban areas.

Figure 6.8: Mean PCOST by Subgroup and Type of Area

6.5 Comparison of JARC Program Costs with Costs of Non-Transportation Programs

In this section, we examine how the Annual Program Cost Per Rider compares to other social and human service programs that also serve low-income populations. Figure 6.9 gives the distribution of \( PCOST \) or the Annual Program Cost Per Rider. The mean value of \( PCOST \) is $3,202 - however, the distribution is long-tailed, with 90 percent of the values at less than $7,200 per year indicating that the median value, $1,540, might be more reflective of the typical costs.

If we view JARC riders as “clients” who are given services throughout the year, then \( PCOST \) is a measure that can be used to benchmark JARC program costs against other human, social and economic programs, which traditionally measure costs on a per participant, client, job or trainee basis. In this section, we make such comparisons, to arrive at an understanding of how transportation costs to serve low-wage clients compare with those of other programs. The estimated costs per output of these programs are superimposed on the distribution of \( PCOST \) in Figure 6.9.
Figure 6.9: JARC Average Annual Program Cost Compared to those of other programs

- Mean Cost Per Workforce Investment Act Participant: $2,033
- Cost Per Temporary Assistance with Needy Families (TANF) Adult Recipient: $2,396
- Mean Annual JARC Program Per Rider: $3,202
- Unemployment Insurance Benefits per TANF Leaver: $4,244
- Jobs Corps Cost Per Participant: $17,586
- Mean Cost Per Job created by HHS Job Opportunities for Low-Income Families (JOLI) Program: $6,586
- Mean Cost Per Job created by U.S. Dept. of Commerce Economic Development Administration Investment Programs: $6,500
Economic Development Agency’s Cost Per Job Created: The Economic Development Agency (EDA) of the U.S. Department of Commerce makes a number of program expenditures that results in the creation of jobs. Glasmeier (2002) examined the differences in job creation costs of EDA program expenditures in rural (< 20,000), small urban (20,001–49,999), and urban areas (50,000 and above). Two datasets, one for jobs created in 1990 and another in 1993, were examined. Jobs were in a variety of industries and across multiple urban, small urban and rural areas. Cost per job varies by year of project completion and geography. For example, the cost per job is lower in rural areas in the 1993 cases. For 1993 projects, the average cost per job for EDA funding in rural areas is $6,904, compared to an average cost per job of $7,399 in urban areas. In contrast, for the 1990 cases, the average cost per job (EDA funding) in rural areas is $5,938 is almost three times higher than the cost per job in urban areas ($1,988). On the basis of the 1990 and 1993 data presented in this paper, we have estimated that the average nationwide cost per job associated with EDA expenditures is $5,221 or $6,500 in CPI-adjusted 2002 dollars.

Job Opportunities for Low-Income Individuals Cost Per Job Created: The Job Opportunities for Low-Income Individuals (JOLI) Program is authorized under Section 505 of the Family Support Act of 1988, Public Law 100-485, as amended by Section 112 of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, Public Law, 104-193. The Office of Community Services' (OCS), located in the Administration for Children and Families of the U.S. Department of Health and Human Services, administers the program. The program helps create jobs to be filled by low-income individuals. Based on a sample of 1994 programs, we estimate the cost per job created to be $6,586 in 2002 dollars. At the current time, each year, approximately 10 grants are awarded with the maximum grant award being $500,000. A minimum of 20 percent of the total JOLI funds must be used toward the provision of direct financial assistance to participants. Financial assistance may be provided through the use of revolving loan funds or the provision of direct cash assistance to a micro enterprise or self-employed business owner. Costs per job estimates of newer grant programs were not readily available to the researchers of this report.

Workforce Investment Act Adult Employment and Training Cost Per Participant: The purpose of the WIA Adult Employment and Training Program is to provide workforce investment activities such as employment counseling and assessment; and job search, training, and placement activities that prepare adults who seek services to achieve successful employment outcomes including employment, job retention, and earnings.
The program finances these activities through formula grants to States. Statewide and local workforce investment systems provide the services. The cost-effectiveness measure used by this program is the Cost Per E&T Participant, which is the average cost for each participant which is calculated by dividing the total annual appropriation for the program by the number of participants. In 2002, 467,000 participants were trained at an average cost of $2,033 per participant.

**Temporary Assistance for Needy Families (TANF), Department of Health and Human Service:** The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) amended title IV-A of the Social Security Act by terminating the Aid to Families with Dependent Children (AFDC, the prior welfare program), the Job Opportunities and Basic Skills Training (JOBS) and the Emergency Assistance (EA) programs and creating a single block grant program entitled Temporary Assistance for Needy Families (TANF). TANF is the only Federal program that provides cash assistance to meet the basic needs of families with children and is also the only Federal program statutorily charged with encouraging the formation and maintenance of two-parent families. A measure used by the TANF program is the Annual Cost Per Adult Recipient: the numerator is the total Federal TANF and state maintenance of effort (MOE) expenditures on work-related activities/expenses, transportation, and a proportional amount on administration and systems and the denominator is the number of adult TANF recipients. This quantity is estimated to be $2,396 per adult recipient in 2002 dollars, extrapolated backwards from 2004.

**Unemployment Insurance Program:** The Unemployment Insurance (UI) Program is not a federally funded program like the other programs we have discussed to date. Yet, it is of critical importance to low-wage workers and is therefore examined in the transportation context. The UI program is the largest worker protection or insurance program for job loss and was designed to help cushion the impact of an economic downturn, and to provide temporary wage replacement for people who have been laid off from their jobs (Rangarajan and Razafindrakoto, 2004). It is available to all workers who qualify. In most states, benefits are financed by employer taxes, and firms are required to contribute to an unemployment fund, based on some percentage of each employee’s wage. The federal government sets broad guidelines, but states may define their eligibility requirements and establish benefit levels. The data used for the analysis on the basis of which unemployment expenditures per TANF leaver is reported here (Rangarajan and Razafindrakoto, 2004), was obtained from the National Evaluation of

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the Welfare-to-Work (WtW) Grants Program Evaluation. This study focused on welfare recipients who exited the welfare rolls within one year of the reference month and who were employed at the time of their exit, in five sites. The study found that the UI program paid on the average $4,244 in 2002 dollars per TANF leaver, 8 quarters after exiting the TANF program\textsuperscript{16}.

**National Job Corps Program’s Cost Per Participant:** The Employment and Training Administration of the U. S. Department of Labor administers the National Job Corps Program. “Since its inception in 1964, Job Corps has been a central part of our country’s efforts to improve the economic self-sufficiency of disadvantaged youths. Participants are between 16 and 24 years old; most come to the program without a high school diploma. The program’s goal is to help youths become more responsible, employable, and productive citizens” (Burghardt \textit{et al.}, 2001). Costs per participant-year are the costs of a student attending Job Corps for one year and are equal to the total annual costs divided by the average number of students enrolled in Job Corps (McConnell and Glazerman, 2001). Costs per participant are the costs that take into account the amount of time the student stays in Job Corps. They were calculated by multiplying operating costs per participant-year by the proportion of a year the participants were enrolled in Job Corps. This quantity was estimated to be $14,898 per participant in 1995 dollars ($17,586 in 2002 dollars). Operating costs are composed of academic instruction costs including salaries and fringe of instructors, vocational training, counseling/residential advisors and other instructors, support services including food, clothing and other, health services, center administration, center capital expenses, pay for students, outreach, admissions and placement costs, non-local transportation and national and regional office support.

### 6.6 Conclusions

One of the goals of the JARC program is to provide access to jobs for disadvantaged population groups. The results presented in this chapter show that when compared with data from the NTD for peer services in the same area, JARC-services cost more than regular transit in the area but are still within the same order of magnitude and at the same time, serving important labor market outcomes that the program was specifically designed for. The 2002 national average operating expense per unlinked bus passenger trip was $2.09 compared to $16.83 for demand-responsive services (National Transit Database, 2002). The JARC CPR for FR services was $8.25 and for DR services, $16.36. In contrast, the non-JARC NTD-reported for the same services were $3.86 for FR and $19.06 for DR services. Further, for the sites selected, both types of services are highest on a CPR basis for large urban areas, followed by rural areas and then by smaller urban areas. DR services for rural areas are more expensive than FR services.

\textsuperscript{16}This number is the average maximum potential cumulative benefit amounts, 8 quarters after TANF Exit. The reference months at the five sites ranged from September 1999 to August 2000. The site-specific estimates were $3,710 for Phoenix, AZ, $4,018 for Cook County, IL, $5,176 for Baltimore County, MD, $4,856 for Philadelphia, PA and $3,374 for Tarrant County, TX.
Annual program costs per rider vary in complex ways with respect to the type, area of service, labor market outcomes considered and subgroup of riders. New workers in the workforce cost the program more (at $3,534 per rider) compared to those who worked before (at about $3,100); the trends are similar for FR and DR services. The average PCOST values for those who possess a high-school diploma and higher is more (at about $3,300 per year per rider) than that of riders who have not graduated high-school (at about $2,700 per year per rider). This fact stems from the higher trip frequencies of those with high-school degrees, as these individuals are also more likely to use the service for full-time employment.

Overall, there is not much difference between the PCOST averages by perception of destination accessibility. However, after controlling for type of service, average program costs of DR users who perceived the destinations to be previously inaccessible, is in fact lower than those who did not have such perceptions. The trend is similar for FR users. These trends can be attributed to the fact that for both FR and DR riders, the average CPR of riders taking trips considered to be previously inaccessible are lower (at $8.94 per trip) than those riders undertaking trips considered to be previously accessible (at close to $10 per trip). Moreover, the average PCOST expended on riders who are making trips to higher wage destinations is higher (at an average of $3,806 per rider reporting such trips) than those on riders who did not report access to higher wage destinations (at $3,014 per rider). The differential in PCOST for DR trips for these two types of riders is close to $1,800, while for FR riders, the differential is only about $110.

The sample of riders was divided into six groups based on their previous employment status and the purpose of the trip for which they routinely use the service. All subgroups using FR have lower PCOST on the average than all subgroups using DR services. Subgroups 1, 2 and 3, which are workers commuting to jobs, have the highest average PCOST. Subgroup 4, those using the service for job-training or school trips have the fourth highest PCOST for both types of services, again a function of greater trip-making than Subgroups 5 and 6 (which are individuals using the service for job searches and discretionary purposes such as shopping and social visits), but also fairly high average CPR.

Finally, the average annual cost per rider of the JARC program (at an estimated $3,202 in 2002 dollars) was compared to that of several non-transportation social, employment training, human services and economic development programs and was found to be in the ballpark of the cost per participant, client, job created or trainee served by these programs. This indicates that the level of investment by FTA on low-income individuals is comparable to the leading federal programs. The next chapter will examine the returns to those transportation dollars, in terms of user, non-user and societal benefits.
CHAPTER 7: Cost-Benefit Analysis

7.1 Introduction

The previous chapter, on cost-effectiveness analysis, presented estimates of costs for trips made by riders of JARC-funded services as a whole as well as for riders that attained different labor market outcomes. However, no attempt was made to monetize the value of the trip. In fact, as a result of the trips that are enabled by the service, JARC riders might have been able to enter the workforce, increased their earnings, worked more hours, incurred reductions in their travel times, enjoyed greater reliability in their travel options or attained a variety of other outcomes that are meaningful from a labor market perspective. In this chapter, we attempt valuations of such labor market outcomes and compare these to the costs that went into providing/undertaking the trips.

The chapter is organized as follows: in Section 7.2, we present a few CBA studies of social, workforce development and health and human services programs that have conceptual and methodological bearing on our study. Section 7.3 presents the CBA framework that is used in the transportation literature. Section 7.4 describes the framework and design of the JARC CBA, including data preparation and critical preprocessing that were needed as inputs into the methodology. Section 7.5 presents the analysis and results of the base year user benefits. Section 7.6 presents the base year estimates of societal and non-user benefits. Sections 7.7 through 7.9 focus on parsing the benefits and costs by area, gender, and other socio-demographic attributes of the users as well as by the type of service offered. Section 7.10 analyzes the labor market outcomes of the cost-benefit analysis. Sections 7.11 through 7.14 are devoted to describing the longitudinal estimates of the analysis as well as the use of the National Longitudinal Survey of Youth 1979. Section 7.11 describes the longitudinal impact estimation process for JARC services followed by a discussion of selecting the appropriate discount rate in Section 7.12. Then in Section 7.13, we provide a brief description of the National Longitudinal Survey of Youth dataset, which was used for the purpose of estimating longitudinal benefits of adequate transportation for respondents who are “similar” to the JARC respondents. Section 7.14 describes the method used to estimate growth rates in wages over the estimated worklife of the JARC respondents and ways in which these growth rates are applied to the JARC service riders. Then in Section 7.15, we turn to cost modeling, ie, how costs are expected to change over time. We deal with three different cost scenarios in the longitudinal analysis. Section 7.15 looks at the growth in costs over time based on the longitudinal analysis. Section 7.16 presents the analysis and results of the longitudinal analysis or forecasts of benefits over the expected worklife of JARC-service users. Conclusions to the CBA are given in Section 7.17.

7.2 Review of CBA Approaches Relevant Current Design

The purpose of the Cost-Benefit Analysis (CBA) presented in this chapter is to enable policymakers to compare the diverse benefits that accrue from the JARC program with
their associated costs. As in any other CBA, the findings will vary depending on the perspective from which costs and benefits are measured. The Federal Transit Administration (FTA) incurs the program costs, with a 50 percent match for non-DOT sources. Program benefits are enjoyed by program participants (JARC service users) and some of these benefits might have spill-over effects to non-users (or the rest of society who are not using the services). Spill-over effects might include increased tax revenues due to new workers in the labor force as a result of using the services or higher earnings of previously employed workers, reduced dependence on programs such as Temporary Assistance for Needy Families (TANF) or unemployment benefit programs and even lower crime.

At the same time, while many of the user, non-user and societal benefits of the program might be realized during the base year (in this case, the first three years of the program), others might become apparent only over time. The transit programs might have a short-term effect of connecting low-income or previously unemployed workers to jobs or training centers but might also have long-term effects of enhancing their human capital with work, training and education experience and putting these individuals on a different economic ladder that they might not be able to access otherwise. The process of forecasting life-cycle labor market outcomes is fraught with uncertainty under any circumstances but especially in the case of estimating public transportation benefits. One purpose of this study is to forecast potential worklife gains that might accrue from the JARC program.

In summary, the JARC CBA has the following major goals:

1) To estimate user, non-user and societal benefits of the JARC;
2) To estimate base year as well as potential longitudinal effects of the program;

Several federal, state and local programs targeted at disadvantaged populations have published cost-benefit analysis. Appendix A, Section A.3 gives the studies most relevant here. These are an evaluation of the National Job Corps Program (Mathematica, 2003), a study of employment programs for people with disabilities (Hemenway and Rohani, 1999) and a method for capturing local labor market dynamics: the job chain approach (Persky, Fieldstein and Carlson, 2004).

7.3 Framework for JARC Cost Benefit Analysis

The CBA approach here consists of estimating the user (private), non-user and societal benefits and costs that can be attributed to the services. This necessitates that we develop an approach for the following:

17 Administered by the U.S. Department of Labor, Job Corps serves disadvantaged youths between the ages of 16 and 24, primarily in a residential setting. It provides comprehensive services—basic education, vocational skills training, health care and education, counseling, and residential support. Each year, Job Corps serves more than 60,000 new participants in about 120 centers nationwide, at a cost of about $1.5 billion.
1) Identify the users, non-users and society;
2) Identify the classes of impacts including benefits, costs and transfers that might accrue to each group;
3) Estimate base-year and longitudinal impacts;
4) Estimate net user benefits over the expected worklife of the riders under scenarios of different wage growth and cost growth trajectories;
5) Discount all impacts to present values;
6) Estimate the Net Present Value (NPV) and the Benefit-Cost Ratio (B/C Ratio) for each group.

7.3.1 User (private), Non-User and Societal Benefits and Costs

As in any CBA study, one of the first questions that need to be answered is that of standing: whose benefits and costs matter for the purposes of evaluation. It is fruitful to conceptualize three main groups with standing:

1) Users of the JARC services to who benefits and costs accrue as a result of using the services;
2) Non-users are the rest of society who are affected by the benefits and costs that accrue to the users;
3) Society is the sum of users and non-users.

JARC Users

Six different user subgroups were defined in the previous chapter. The trip-making, employment background as well as sociodemographics of these groups differ greatly. Benefit estimates will be determined separately for these subgroups.

JARC Service Non-Users (Rest of Society)

This group refers to everyone else in society other than JARC service users. As in the case of JARC users, non-users are also not homogeneous. While private gains might accrue to JARC users, the rest of society bears most of the costs. Comparing the benefits and costs from the perspective of rest of society allows us to understand how the financial investment made to transport low-income individuals to jobs and other economic opportunities are offset by gains to rest of society. There are non-users who might benefit as a result of alternative uses of their tax revenues while there are non-users who might face different consequences as a result of additional supply of labor in destinations where they are currently working.

We can identify three different categories of non-users, which are identified in Table 7.1. In the Cost Benefit Analysis, the impacts on these subgroups are estimated and monetized, which are used to finally arrive at a composite non-user benefit measure.
Non-User Subgroup 1: This subgroup of non-users is the general tax-paying public. As JARC transports riders to various jobs, other economic opportunities and discretionary activities such as shopping, income tax revenues or sales tax revenues increase and transfer payments such as welfare payments are freed up for alternative uses. At the same time, this subgroup also bears the cost of subsidizing JARC services.

Non-User Subgroup 2: This subgroup of non-users is the “regional” public or non-users in the area where the JARC service operates. A large literature points to the societal costs, in terms of pollution, accidents, congestion and other externalities of private transportation modes. Many of the JARC riders previously used private auto-based transportation, whether private cars, shared rides or even taxis, to access the destination to which they are now using the JARC transit service. These non-users gain as a result of societal costs averted due to trips diverted to transit.

Non-User Subgroup 3: This subgroup consists of non-users in the local labor market. As JARC changes the supply of labor in the local labor market, a number of employment-related events are triggered including deflation of wages, vertical movement of current workers and others. Our approach to measuring the gains of programs connecting work sites with residential areas emphasizes that the gains do not accrue only, or even primarily, to the individual using the transit program. Rather this placement opens a probabilistic chain of labor market moves involving several other people. As these chain members move up they each make modest gains based on their next best alternatives. Appendix D describes the simulation of local labor market events that are triggered by JARC in the sample sites. This non-user subgroup can be further divided into non-users in the local labor market at the residential origin of the JARC user and non-users in the job destination of the user.

Table 7.1: Non-user Subgroups and Types of Potential Impacts

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Non-users</th>
<th>Types of Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Public</td>
<td>Tax revenues generated, transfer payments for alternative uses, subsidy to JARC program</td>
</tr>
<tr>
<td>2</td>
<td>Regional Public</td>
<td>Societal costs of private transportation averted with trips diverted to JARC transit</td>
</tr>
<tr>
<td>3</td>
<td>Local Labor Markets&lt;br&gt;Local Labor Market at trip origin&lt;br&gt;Local Labor market at destination</td>
<td>Deflation of wages, vertical movements of current works, displacement of current workers and other effects due to job chain perturbations generated by JARC</td>
</tr>
</tbody>
</table>

Society in the Context of JARC Service CBA

Benefits and costs to society are the algebraic sum of benefits and costs to users and non-users because society is the sum of these two groups. Analyzing benefits from society’s
perspectives will enable policy-makers to determine if the societal benefits of JARC outweigh the investments allocated to JARC. Because this perspective is the sum of users and non-users, it is probably the most beneficial for policy-making.

The potential impacts to users, non-users and society that result from the use of the JARC service by these JARC sub-groups are discussed in Section 7.3.2 and the approach to estimate the magnitude of the impacts is discussed in Section 7.3.3.

7.3.2 Identification of Impacts

Perhaps no CBA can fully account for all the changes that accrue as a result of a program. We do not purport to do so either, in the case of the JARC program. But since our end goal is to estimate a total net benefit or benefit-cost ratio for each JARC service we sampled, it is necessary to identify the array of impacts that is likely to result from using the service, to clearly list all assumptions and indicate which impacts, if any, were excluded from the analysis, the reasons for doing so as well as the consequent likelihood of overestimation or underestimation of the final Net Benefit or B/C Ratio.

For the purposes of the CBA, we divide up JARC users into the sub-groups mentioned in the previous section and estimate user, non-user and societal benefits that might accrue as a results of trips undertaken by each subgroup in order to arrive at an aggregate measures of net benefits (and benefit-cost ratio) for each sub-group. This necessitates having a clear and transparent approach to identify the classes of impacts that might result for trips undertaken by each subgroup.

7.3.2.a Categories of Impacts

The use of JARC services can potentially lead to differing categories of impacts on labor market outcomes. Different categories of impacts are likely. Based on the literature and our experience with the JARC programs, we have identified six major categories of impacts. Following Boardman et al. (2001) in valuating impacts of job training demonstration projects and Burghart et al. (2003) in valuating the impacts of the National Job Corps program, we follow an “accounting” framework to display the various costs and benefits that might accrue to users, non-users and society. The four categories of impacts considered in this study are:

a) Participants’ output-related factors including earnings and fringe benefits;

b) Participants’ work-related expenditures such as tax payments and transportation costs including monetized value of travel time, out-of-pocket costs and change to leisure time of previously unemployed workers; Participants’ use of transfer payments including public assistance (Temporary Assistance for Needy Families, TANF), unemployment benefits and other transfer payments;

c) Program costs, which in this case are the cost of the JARC program to transport the individual;

d) Three groups of secondary impacts, including impacts on societal costs of private transportation avoided and local labor market dynamics.
Yet another way of accounting for benefits and costs must be noted here, one that is laid out explicitly in the transportation literature (Weisbrod and Weisbrod, 1997; Cambridge Systematics, Cervero and Aschauer, 1998). These considerations also entered our analysis as needed.

7.3.2.b Impact by Group

The magnitude of some of the impacts will naturally be far greater than others. Further, there will be a great deal of variation in the consequent impacts due to travel by different JARC user subgroups. For example, individuals who use JARC services to go shopping or for social visits (Subgroup 6) might accrue no impacts on earnings and fringe rates, use of transfer payments or tax revenues paid; their major impacts might be on transportation costs. On the other hand, riders using the service to work might also vary in their outcomes: for example, Subgroup 1, new workers in the labor force, would potentially undergo changes in earnings and fringe rates, their use of transfer payments as well as several other categories of impacts. Yet at the same time, Subgroup 2, another group of users for work trips who were employed prior to using the JARC service might also undergo changes in earnings and fringe benefits and tax payments and transportation costs but would likely much lesser changes in their use of transfer payments.

Table 7.3 schematically represents the categories of impacts considered in the program and the perspectives from which these impacts are considered. The objective of the CBA is to populate the cells of such a table, for each subgroup of users. While the inclusion of the impacts might be obvious to readers in the human services or in the transportation fields, to make the report more or less complete, we describe the impact categories described above by the groups identified previously and attempt to provide the rationale behind why we are considering them.

7.4 How are Impacts Measured?

The effectiveness or benefits of a program cannot be assessed by simply looking at outputs or outcomes of those involved in the program. This is because there may be other factors or events that are correlated with the outcomes but are not caused by the project. For example, a JARC rider might have enjoyed an increase in earnings after starting use of the service but she might have recently completed a job-training program as well. The attribution of the change in earnings entirely to the JARC program would be incorrect because the job-training program has also most likely contributed to the improved wages. Valuation of net benefits require a definition of the impacts that will be measured. Therefore to assess program effectiveness effectively and to ensure adequate attribution, “an impact evaluation must estimate the counterfactual, that is, what would have happened had the project never taken place or what otherwise would have been true” (Baker, 2000).

The “gold standard” in determining the counterfactual is through the use of comparison or control groups (those who do not participate in a program or receive benefits), which
are subsequently compared with the treatment group (individuals who do receive the intervention). Control groups are selected randomly from the same population as the program group, whereas the comparison group is more simply the group that does not receive the program being evaluated – however, both the comparison and the control groups should resemble the treatment group in every way. It is critical that the treatment and the control group do not differ in any systematic way, except that the former is “enrolled” in the program under study. The premise of controlled studies is that the randomization minimizes any selection biases due to systematic differences between the treatment and control groups.

In the National Job Corps Study, for example, impacts were estimated by comparing the experiences and outcomes of randomly assigned treatment and control groups using data from periodic interviews conducted over a four-year follow-up period (Mathematica, 2003). A dollar value was placed on the individual impact estimates in order to calculate total program benefits, which were then compared to program costs in the benefit-cost analysis.

The use of randomization as an evaluation design is technically possible in the evaluation of certain transit systems. For example, in ADA services, of all disabled individuals who are eligible for “treatment”, ie, to participate in ADA paratransit programs, some might be randomly assigned to be able to use such services (the treatment group) whereas others are randomly assigned to the control group and the outcomes of these two groups might be compared to ascertain the net benefits that accrue to users. However, in vast majority of cases, use of such randomization in determining the counterfactual is not possible in transportation programs.

We determined that such a design would also not be available for a general evaluation of the JARC program, given the diversity of programs funded although it might be used in the case of specific programs, for example, to determine how employment transportation services improve employment outcomes of job-training enrollees. Hence we have used other methods to construct the counterfactual necessary for measuring impact. This impact is then monetized in order to assess net benefits.

7.4.1 Evaluation Designs

Two different, but complementary approaches were used to determine the counterfactual in the case of the base year CBA estimates and the longitudinal estimates. These are depicted in Table 7.2.

Base Case Evaluation Design

Figure 7.1 shows the schematic representation of base year net benefit estimation. In the case of the base year estimates, a reflexive comparison evaluation design was used, which consisted of constructing a profile of each JARC service rider’s conditions prior to use of the service and after use of the service. Thus, for the base year, a “before” and “after” study design was utilized. The incremental difference between the before and
after benefits and before and after costs is an illustrative measure of benefits that is estimated. Other summary measures are described in Section -.

The JARC User Survey was a 2-page survey that could be completed in 10 minutes. Needless to say, this is not enough to capture a wide-variety of data that are necessary to fully estimate impacts. For this reason, we use data matching as a solution to incorporating a wide variety of information into the benefits estimation process.

Longitudinal Evaluation Design

In contrast, in the case of the longitudinal analysis, the counterfactual, as the JARC sample is aged, is what their economic situation would have been like, if they did not have access to the service. The projection of expected benefit trajectories over the worklife of JARC service riders makes use of a longitudinal dataset, the National Longitudinal Survey of Youth (1979). The NLSY79 is an ongoing data program of the Bureau of Labor Statistics. It is comprised of a nationally representative sample of more than 12,000 young adults aged from 14 to 22 in 1979 when they were first surveyed. The survey then followed these respondents each year between 1979 and 1994 and biennially since 1994. We have used data from the period 1979 till 2002.

The NLSY79 sample can be partitioned into two groups of respondents – those with transportation problems (to be defined later in Section 7.14) and those without transportation problems. Under the assumption that the JARC service addresses the transportation problem of the riders, we are able to allocate to them wage and cost growth trajectories that pertain to similar NLSY79 respondents without transportation problems. Hence, this group is the basis for the construction of the “treatment” group in the JARC longitudinal analysis. Similarly, in the case of the baseline, ie, what would have happened over time, had the JARC riders not been able to access the service and thus continue to face transportation problems, we are able to assign wage and cost growth trajectories of those NLSY79 respondents facing transportation problems. Hence, the latter group is the basis for construction of the “control” group. Thus, in the case of the base year estimates, the baseline condition is the constructed “before” period of the JARC riders whereas in the case of the longitudinal estimates, the baseline is what the JARC rider would have faced, had he or she not have access to the service.
Figure 7.1: Schematic Representation of Benefit Estimation for Users, Non-Users and Society

- Divide sample of JARC users into six User Sub-groups on the basis of trip purpose & impact
- Link JARC User Survey to Current Population Survey by matching JARC users to CPS respondents
- Construct before and after conditions for each user and aggregate to subgroup level
- Estimate base year Net Incremental User Benefit, ratio of Incremental Net User Benefit to JARC program cost
- Non-User Benefit by Sub-Group
  - Estimate impact of each User Sub-group on Non-User Sub-group 1 – general tax-paying public
  - Estimate impact of each User Sub-group on Non-User Sub-group 2 – the regional commuting public
  - Determine base year Net Societal Benefit
  - Implement dynamic microsimulation model to estimate Potential Worklife Benefit Index (expected worklife or longitudinal benefits, costs and net benefits of JARC Users)
- Base Year Impact Estimates
- Worklife Estimates
### Table 7.2: Evaluation Designs and Construction of “Base” Cases

<table>
<thead>
<tr>
<th>Estimate</th>
<th>Evaluation Design</th>
<th>Description</th>
<th>Illustrative Measure of User Net Benefit</th>
<th>Data Source</th>
</tr>
</thead>
</table>
| Base year estimates | Before and after comparison                    | Base case or counterfactual is the condition of the rider before they used the transit service | - Incremental net user benefit at base year: (Incremental change in benefit between before and after condition) – (Incremental change in costs between before and after condition)  
- Net user benefit at base year  
- Incremental net user benefit to JARC annual investment per user | JARC User Survey and variety of other data and models to construct “before” and “after” conditions for service users |
| Longitudinal estimates | Synthetic “treatment” group and “control” group comparison | Base case or counterfactual is the condition of the rider over time, if they face the “before” conditions during the base year and continue to face conditions of transportation difficulty throughout their worklife | - Incremental Net Benefit: (Difference in benefit between treatment and control group) – (Difference in costs between treatment and control group) | National Longitudinal Survey of Youth (1979), JARC User Survey and variety of other data and models to construct “treatment” and “control” group conditions for service users |
7.5 Summary Measures Estimated

The steps in the CBA are given in Appendices C and D. In this section, we describe the primary performance measures used for users, non-users and society, for the base year of the analysis.

7.5.1 Measures Estimated for Users in the Base Year

As described in Section 7.3, the evaluation framework used for the base year of the CBA is a before and after analysis. That is, for each subgroup, we estimate a variety of base year performance measures by comparing each user group during the base year (time \( t \)) to what their economic situation was like in the time period prior to using the JARC service (time period \( t-\delta \)).

The base year user benefit measures considered are Incremental Net User Benefits, \( \Delta NUB_t \) and Average of Per User Benefit to Program Cost Ratio (\( APUBC_t \))

Change in Net User Benefits (or Incremental Net User Benefits, \( \Delta NUB_t \)) for each service user at base year is:

\[
\Delta NUB_t = \left( \sum_{i=1}^{I} UB_{t,i} - \sum_{i=1}^{I} UB_{t-\delta,i} \right) - \left( \sum_{i=1}^{I} UC_{t,i} - \sum_{i=1}^{I} UC_{t-\delta,i} \right)
\]

where \( UB_{t,i} \) are subgroup-specific benefit components in the “after” period such as earnings from annual wages, job training stipend and, unemployment benefits or public assistance for those individuals using the JARC service who are dependent on such payments. The \( UB_{t-\delta,i} \) are subgroup-specific benefit components in the “before” including earnings, welfare or other transfer payments and other sources of incomes. Costs \( UC_{t,i} \) in the “after” period include the current travel costs (dollar cost of the fare that riders are currently paying to use the JARC service and monetized value of travel time). In the “before” period, costs \( UC_{t-\delta,i} \) depend on the mode of transportation previously used and is a function of both dollar cost and monetized value of travel time; for those who did not undertake the trip with that purpose previously, a cost factor included in the monetized value of leisure time in the prior period.

Average of Per User Benefit to Program Cost Ratio (\( APUBC_t \)): or the average of the ratio of Incremental Net User Benefit to total JARC program cost (\( PCOST_t \)) expended annually on each service user:

\[
APUBC_t = \frac{\left( \sum_{m=1}^{M} \frac{\Delta NUB_{t,m}}{PCOST_{t,m}} \right)}{M}
\]

where \( M \) is the total number of service users in the sample. From the user’s perspective, this quantity gives an estimate, on the average, of the level of output (benefits) related to program investments, i.e., “what do users get on the average from JARC investments on
him or her?” It does not give the average return on investment for average dollar of program costs invested.

### Change in User Incomes or User Surplus?

Table 7.3 gives the details of how the base year estimates of $\Delta NUB_t$ were obtained. Details are given in Appendix C. Two fundamental measures of user benefits are possible in the evaluation of JARC services: change in user incomes or change in user surplus. Using *changes in net user incomes* is common practice in the evaluation literature. For example, in the evaluation of employment and training programs, increases in earnings that result from the program minus decreases in transfer payments and increases in work-related expenditures that result from the program is standard (Boardman, *et al.* 2001). However, the conceptually correct measure is *changes in net user surplus* (Boardman *et al.* 2001; Boardman *et al.* 1996; Gramlich 1990; Pearce 1983; Sugden and Williams, 1978) and not changes in net user incomes.

A key factor that will cause a divergence between changes in net user incomes and changes in net user surplus is the mechanism by means of which earnings increase as a result of using the JARC service to reach jobs – whether their earnings after use of the service increases due to increases in their the rate of earnings (dollars per hour) or whether their earnings increase due to increases in hours of work. If their earnings increase due to increases in hours of work, then the likelihood increases that they will have to pay for activities that they used to do in their “free” time and the surplus left over due to income increases will reduce.

However, a measurement of the surplus, which is effectively a correction to the change in net user incomes, is difficult. We have addressed a proxy measure of this correction by developing an estimate of the value of the “leisure time”\(^{18}\). Factoring in the value of leisure time foregone allows us to approximate what changes to user surplus might be, beyond changes to user incomes.

#### 7.5.2 Measures Estimated for Non-Users in the Base Year

As per our previous discussion, we are interested in knowing how much the JARC program benefits others in society. The “non-users” of interest are the general tax-paying public, commuters in the region where the service operates and other low-wage workers in the local labor market.

The net non-user benefits generated by each user are summarized by three measures:

- Incremental Net Non-User Benefit ($\Delta NNoUB_t$): Construct subgroup-specific Non-User Benefits ($\text{NoUB}_{T,i}$) and User Costs ($\text{NoUC}_{T,i}$) for times periods $T = t, t-\delta$ and for impact

---

\(^{18}\) The concept of leisure time and th details of estimation in the context of the valuation of user benefits of JARC services are given in Appendix -.
categories I=1,2,3… to estimate $\Delta N_{N Ub}$, or Incremental Net Non-User benefit as follows:

$$
\Delta N_{N Ub} = (\sum_{j=1}^{l} N_{U B_{i,j}} - \sum_{j=1}^{l} N_{U B_{r,s,j}}) - (\sum_{j=1}^{l} N_{U C_{i,j}} - \sum_{j=1}^{l} N_{U C_{r,s,j}})
$$

Two “benefit-cost” measures are also calculated for non-users.

Average Non-User Benefit to Program Cost Ratio ($AN_{UBC}$): This is the average of the ratio of Incremental Net Non-User Benefit generated by each user to total JARC program cost ($PCOST$) for each service user:

$$
AN_{UBC} = \frac{\left( \sum_{m=1}^{M} \Delta N _{N Ub_{r,m}} / PCOST_{r,m} \right)}{M}
$$

where $M$ is the total number of service users in the sample. From the user’s perspective, this quantity gives an estimate, on the average, of the level of benefits that he or she generates to others in society, related to program investments, i.e., “what do non-users of the tax-paying public, commuters in the area or workers in the local labor markets, get on the average from JARC investments on a user”?

**7.5.3 Summary Measures Estimated for Society in the Base Year**

Three similar measures are considered for society in general:

Incremental Net Societal Benefit ($\Delta NSB$): The $\Delta NSB$ is simply the sum of Incremental Net User Benefits and Incremental Net Non-user Benefits:

$$
\Delta NSB = \Delta NUb + \Delta N_{N Ub}
$$

Average of Societal Benefit to Cost Ratio ($ASBC$): This is the average of the ratio of Incremental Net Societal Benefit generated by each user to total JARC program cost ($PCOST$) for each service user:

$$
ASBC = \frac{\left( \sum_{m=1}^{M} \Delta NSB_{r,m} / PCOST_{r,m} \right)}{M}
$$

where $M$ is the total number of service users in the sample. From the user’s perspective, this quantity gives an estimate, on the average, of the level of benefits that he or she generates to all others in society including themselves, related to program investments. In other words, this quantity describes, “what does the entire society that is relevant to a user gain or lose on the average from JARC investments on that user”? It does not give the average return on investment for average dollar of program costs invested nor does it give the total societal benefits to total program costs.
7.5.4 Issues with Interpretation of Benefit to Cost Ratios

Confusion might arise regarding what the returns to society might be, for the investments in the transportation program. In general, whereas $\Delta NSB_t = \Delta NUB_t + \Delta NNoUB_t$, the Average of Societal Benefit to Cost Ratio or $ASBC_t$ will not be equal to the sum of Average of Per User Benefit to Program Cost Ratio ($APUBC_t$) and Average Non-User Benefit to Program Cost Ratio ($ANoUBC_t$). For example, if $APUBC_t = 2.5$ and $ANoUBC_t = 1.5$, then $ASBC_t$ will not, in general, be equal to 4. This is due to Simpson’s Paradox (or the Yule Simpson effect) – when two averages are combined, the result is lower than each of the average. Hence, the ratio results presented in Section 7.6 might appear counter-intuitive.

One way to avoid this phenomenon in the CBA considered here is to calculate:

$$TSBC_t = \frac{\sum_{m=1}^{M} \Delta NSB_{t,m}}{\sum_{m=1}^{M} PCOST_{t,m}} = \frac{\sum_{m=1}^{M} \Delta NUB_{t,m}}{\sum_{m=1}^{M} PCOST_{t,m}} + \frac{\sum_{m=1}^{M} \Delta NNoUB_{t,m}}{\sum_{m=1}^{M} PCOST_{t,m}}$$

where the quantity on the left hand side is the Total Societal Benefit to Total Program Cost. However, the quantity of interest here is the level of benefits that users generates themselves and to all others in society, in return for the program costs incurred on that user. In other words, we are interested in what the entire society that is relevant to a user gain or lose on the average from JARC investments on that user. We have presented the quantity $TSBC_t$ in Appendix M with further explanation of why $ASBC_t$ is presented here.
Table 7.3: Incremental Net Benefit Estimation for Six Different Subgroups

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Scenario</th>
<th>User</th>
<th>Non-User</th>
<th>Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Change in Net User Incomes:</td>
<td>Scenario I Incremental Net User Benefits (Δ(NUB_i))</td>
<td>Scenario I Incremental Net Non-User Benefit (Δ(NNoUB_i))</td>
<td>Scenario I Incremental Net User Incomes and Net Benefits to General and Regional Non-Users:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[\text{Net Annual Income} – \text{Annualized Generalized cost of trip} - {\text{Annual Welfare or Unemployment Benefits Earnings}^{19}} ]</td>
<td>[{\text{Tax Revenues from User} + \text{Transfer Payments Diverted from user} + \text{Monetized Value of Societal Cost of Prior Transportation Saved}}]</td>
<td>[\text{Scenario I Incremental Net Societal Benefit (Δ(NSB_i))}]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[{\text{Gross Annual Income} – \text{Tax Payments} + \text{Fringe Benefits}^{20} – \text{Monetized Value of Travel Time}^{21}}]</td>
<td></td>
<td>[\text{Scenario I Incremental Net Non-User Benefit (Δ(NNoUB_i))} + \text{Scenario I Incremental Net Non-User Benefit (Δ(NNoUB_i))}]</td>
</tr>
<tr>
<td></td>
<td>Change in Net User Surplus:</td>
<td>Scenario II Incremental Net User Benefits (Δ(NUB_i))</td>
<td>Scenario II Incremental Net Non-User Benefit (Δ(NNoUB_i))</td>
<td>Scenario II Incremental Net User Incomes and Net Benefits to General and Regional Non-Users:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[{\text{Net Annual Income} – \text{Annualized Generalized cost of trip} - {\text{Annual Welfare or Unemployment Benefits Earnings} + \text{Monetized Value of Leisure Time}}]</td>
<td></td>
<td>[\text{Scenario II Incremental Net Societal Benefit (Δ(NSB_i))}]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[{\text{Gross Annual Income} – \text{Tax Payments} + \text{Fringe Benefits} – {\text{Monetized Value of Travel Time}}]</td>
<td></td>
<td>[\text{Scenario II Incremental Net Non-User Benefit (Δ(NNoUB_i))} + \text{Scenario II Incremental Net Non-User Benefit (Δ(NNoUB_i))}]</td>
</tr>
<tr>
<td></td>
<td>Change in Net User Surplus:</td>
<td>Scenario III Incremental Net User Benefits (Δ(NUB_i))</td>
<td>Scenario III Incremental Net Non-User Benefit (Δ(NNoUB_i))</td>
<td>Scenario III Incremental Net User Incomes and Net Benefits to General and Regional Non-Users and Local Labor Markets:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[{\text{Net Annual Income} – \text{Annualized Generalized cost of current trip} - {\text{Annual Welfare or Unemployment Benefits Earnings} + \text{Monetized Value of Leisure Time}}]</td>
<td></td>
<td>[\text{Scenario III Incremental Net Societal Benefit (Δ(NSB_i))}]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[{\text{Gross Annual Income} – \text{Tax Payments} + \text{Fringe Benefits} – {\text{Monetized Value of Travel Time}}]</td>
<td></td>
<td>[\text{Scenario III Incremental Net Non-User Benefit (Δ(NNoUB_i))} + \text{Scenario III Incremental Net Non-User Benefit (Δ(NNoUB_i))}]</td>
</tr>
</tbody>
</table>

19 When available, state-specific data were used for unemployment benefits and public assistance payment rates. Otherwise, national averages were used. Wherever possible, these numbers were crosschecked with the Current Population Survey (CPS) sub-sample that was matched to the JARC sample in the JARC User Survey.

20 Gross annual income was calculated from wage rate data obtained from JARC User Survey and smoothed using Wage Imputation Method given in Appendix B. Tax rates and fringe benefits were taken from the Current Population Survey (CPS) sub-sample that was matched to the JARC sample, whenever there was a match in the CPS sample – otherwise national rates were used. Fringe benefits are available to a very small sample of the working poor – for example, Koonce et al. (2000) report that only 43% of the working poor had some form of medical insurance and 51% had paid vacation time, which are significantly different from the “working non-poor”

21 Taken to be 60% of wage rate.

22 Details on the calculation of the monetized value of leisure time is given in Appendix -.

23 Details on the calculation of the labor market impacts due to the user is given in Appendix -.
### Subgroups 2 and 3

<table>
<thead>
<tr>
<th>Scenario</th>
<th>User</th>
<th>Non-User</th>
<th>Society</th>
</tr>
</thead>
</table>
| I & II   | *Change in Net User Incomes:*<br>Scenario I Incremental Net User Benefits ($\Delta NUB_i$)<br>$= \{\text{Net Annual Income} - \text{Annualized Generalized cost of current trip}\} - \{\text{Prior Annual Income} - \text{Annualized Generalized cost of prior trip}\} = \{(\text{Gross Annual Income} - \text{Tax Payments + Fringe Benefits}) - (\text{Prior Gross Annual Income} - \text{Tax + Fringe})\} - \{(\text{Annual Expenditures on Previous Mode of Transportation}) + \text{Monetized Value of Travel Time}\}$ | *Change in net benefits to general and regional non-users:*

Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_i$)

$= \{\text{Tax Revenues from User + Monetized Value of Societal Cost of Prior Transportation Mode}\}$ | *Change in Net User Incomes and Net Benefits to General and Regional Non-Users:*

Scenario I Incremental Net Societal Benefit ($\Delta NSB_i$)

$= \text{Scenario I Incremental Net User Benefits ($\Delta NUB_i$)} + \text{Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_i$)}$

| III      | *Change in Net User Surplus:*<br>Scenario III Incremental Net User Benefits ($\Delta NUB_i$)<br>$= \{\text{Net Annual Income}\} - \{\text{Prior Annual Income} - \text{Annualized Generalized cost of prior trip}\}$ | *Change in net benefits to general and regional non-users as well as to local labor markets:*

Scenario III Incremental Net Non-User Benefit ($\Delta NNoUB_i$)

$= \{\text{Tax Revenues from User + Monetized Value of Societal Cost of Prior Transportation Mode}\} - \{\text{Labor Market Impact due to User}\}$ | *Change in Net User Incomes and Net Benefits to General and Regional Non-Users and Local Labor Markets:*

Scenario III Incremental Net Societal Benefit ($\Delta NSB_i$)

$= \text{Scenario III Incremental Net User Benefits ($\Delta NUB_i$)} + \text{Scenario III Incremental Net Non-User Benefit ($\Delta NNoUB_i$)}$

---

24 Annual expenditures on modes of transportation previously used:

a) For private cars, [per mile personal cost of driving X distance driven X estimated annual number of round trips] where the per mile personal cost of driving is calculated using data from the American Automobile Association for a small sedan at $0.534 per mile that is driven 10,000 miles annually;
b) For transit, [site-specific fares X estimated annual number of round trips] where the site-specific fare data were collected during the site visits;
c) For taxi, [taxi fare per mile X distance driven X estimated annual frequency of use] where taxi fare per mile (at $2.12 per mile) is the average of five US cities on a per mile basis reported in [http://www.sfgov.org/site/uploadedfiles/rg_web/rg_web/Taxi_0806.pdf](http://www.sfgov.org/site/uploadedfiles/rg_web/rg_web/Taxi_0806.pdf);
d) For non-motorized modes, the out-of-pocket costs are assumed to be $0.

25 The monetized value of the societal cost of the prior transportation mode is composed of mode-specific external costs including the following:

a) For private autos including taxi, these are the costs paid for by society, taxpayers and other non-drivers and is calculated as: [per mile societal cost of driving X distance driven X frequency of use] where per-mile cost of driving includes cost of accident risk, cost of providing parking, air pollution damage, congestion costs and other congestion cost categories (see Commute Solution, Santa Cruz County Regional Transportation Commission at [http://www.commutesolutions.org/TCODBro.pdf](http://www.commutesolutions.org/TCODBro.pdf) which summarizes these costs); these costs are assumed to be $0.329 per mile.
b) For ride-share, these costs are halved and then annual societal costs are estimated using the same formula (in italics as for private autos) above, under the assumption that there are on the average two passengers per vehicle used for ride-sharing (we could not locate a national estimate of the average number of riders in a ride-sharing vehicle among low-income commuters, so this is a conservative estimate).
c) For non-motorized modes and public transit previously used, the societal cost is set at $0.
### Subgroups 4 and 5

<table>
<thead>
<tr>
<th>Scenario</th>
<th>User</th>
<th>Non-User</th>
<th>Society</th>
</tr>
</thead>
</table>
| I, II & III | **Change in Net User Incomes:**  
Scenario I Incremental Net User Benefits ($\Delta NUB_t$)  
= {Annualized Generalized cost of current trip}  
- {Annualized Generalized cost of prior trip to same destination or trip purpose}  
= {Monetized Value of Travel Time} - {Annual Expenditures on Previous Mode of Transportation + Monetized Value of Travel Time} | **Change in net benefits to general and regional non-users:**  
Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_t$)  
= {Monetized Value of Societal Cost of Prior Transportation Mode}  
+ Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_t$) | **Change in Net User Incomes and Net Benefits to General and Regional Non-Users:**  
Scenario I Incremental Net Societal Benefit ($\Delta NSB_t$)  
= Scenario I Incremental Net User Benefits ($\Delta NUB_t$)  
+ Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_t$) |

### Subgroups 6

<table>
<thead>
<tr>
<th>Scenario</th>
<th>User</th>
<th>Non-User</th>
<th>Society</th>
</tr>
</thead>
</table>
| I, II & III | **Change in Net User Incomes:**  
Scenario I Incremental Net User Benefits ($\Delta NUB_t$)  
= {Annualized Generalized cost of current trip}  
- {Annualized Generalized cost of prior trip to same destination or trip purpose}  
= {Monetized Value of Travel Time} - {Annual Expenditures on Previous Mode of Transportation + Monetized Value of Travel Time} | **Change in net benefits to general and regional non-users:**  
Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_t$)  
= {Monetized Value of Societal Cost of Prior Transportation Mode + Sales Tax Generated for Shopping Trips at New Destinations}  
+ Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_t$) | **Change in Net User Incomes and Net Benefits to General and Regional Non-Users:**  
Scenario I Incremental Net Societal Benefit ($\Delta NSB_t$)  
= Scenario I Incremental Net User Benefits ($\Delta NUB_t$)  
+ Scenario I Incremental Net Non-User Benefit ($\Delta NNoUB_t$) |
7.6 Scenarios Considered and CBA for Transportation and Labor Markets

This section given the scenarios considered in the study and a rationale for using the approach in the study.

7.6.1 Scenarios Considered

The results of the study are given for three scenarios – these are given in Table 7.4.

Table 7.4: Base Year CBA Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>User</th>
<th>Non-User</th>
<th>Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Change in Net User Incomes: Does not include estimates of leisure time foregone</td>
<td>Change in net benefits to general and regional non-users: Does not include labor market impacts</td>
<td>Change in Net User Incomes and Net Benefits to General and Regional Non-Users: Does not include leisure time estimates for users and labor market impacts for non-users</td>
</tr>
<tr>
<td>II</td>
<td>Change in Net User Surplus: Includes estimates of economic value of leisure time foregone</td>
<td>Change in net benefits to general and regional non-users: Does not include labor market impacts</td>
<td>Change in Net User Surplus and Net Benefits to General and Regional Non-Users: Includes leisure time estimates for users but does not include labor market impacts for non-users</td>
</tr>
<tr>
<td>III</td>
<td>Change in Net User Surplus: Includes estimates of leisure time foregone</td>
<td>Change in net benefits to general and regional non-users as well as to local labor markets: Includes labor market impacts</td>
<td>Change in Net User Surplus and Net Benefits to General and Regional Non-Users and Local Labor Markets: Includes leisure time estimates for users and labor market impacts for non-users</td>
</tr>
</tbody>
</table>

The scenarios vary with two fundamental conditions: whether change in net user incomes or net user surplus is being measured in the case of user benefits and whether changes in net non-user benefits to the general public or the regional traveling public alone are being estimated or whether the impacts on local labor markets are also included.

Scenario I: Change in Net User Incomes and Net Benefits to General and Regional Non-Users: Scenario I provides a baseline estimate of user, non-user and societal benefit. In this scenario, the value of the leisure time foregone is not included in the estimation of user benefits. “Leisure” is an economic term, which means the time spent in all activities that take place outside the labor market (Greenberg, 1997). Many of these activities (for example, education and various forms of home production such as child care and home repair) may be quite productive. For example, when Subgroup 1 riders substitute a state of public assistance
dependence or unemployment for work, activities, they incur several costs due to what they could do “for free” when they remained on public assistance. Costs of going to work, which includes transportation, child-care, eating out and other expense categories, which could technically be averted if the individual remained dependent on public assistance and at home. If an estimate of time spent in leisure is not introduced into the CBA, there is a possibility that the final net user benefit will be overestimated unless all unpaid activities previously undertaken by the JARC riders remain unpaid for. Since societal benefits are the sum of user and non-user benefits, ignoring the economic value of leisure time foregone would also lead to an overestimate of the final societal benefits.

Scenario I also does not include the labor market impacts. As described earlier, JARC services change the supply of labor in the local labor market as a result of which a number of employment-related events are triggered including deflation of wages, vertical movement of current workers and others. Ignoring this effect would likely lead to an overestimate of non-user benefits as well as the final societal benefits.

**Scenario II: Change in Net User Surplus and Net Benefits to General and Regional Non-Users:** Scenario II includes estimates of the economic value of leisure time foregone. Hence, this scenario measures user “surplus”, which is an appropriate measure of impacts. But the scenario excludes labor market impacts of JARC services. This scenario depicts user benefits accurately but possibly overestimates non-user and societal benefits.

**Scenario III: Change in Net User Surplus and Net Benefits to General and Regional Non-Users and Local Labor Markets:** The most conservative of the three scenarios is III, where the value of leisure time foregone is explicitly modeled and the impacts on non-users in the local labor market due to the increased supply of labor are also explicitly modeled. The societal benefits thus reflect that there is a cost to certain users for going to work and that the level of benefits that accrue to non-users depend on the type of labor market in which the JARC service is operating.

### 7.6.2 CBA in the Context of Transport and Labor Markets

It is a general rule that in a well functioning perfectly competitive economy the benefits or surplus generated by a public project that does not change prices in secondary markets can be fully measured in the primary market. When applied to transportation projects, this rule means that the surplus generated from say a new bus route can be fully measured by the willingness to pay of the riders on that bus route. In general this willingness to pay can be approximated by the value riders put on their time savings. It is well known that the provisos to the general rule are numerous. In particular, if by increasing ridership on the bus route a community experiences a real reduction in an externality such as auto pollution then that benefit will not be reflected in riders’ willingness to pay and hence must be computed separately. In much the same way, transport programs can create real externalities in labor markets.

When transport improvements link previously poorly connected competitive labor markets, demanders’ willingness to pay is still a sufficient measure of benefits, although in general
that willingness to pay will be less than a mechanically calculated value of time savings. This is because the trip was not previously undertaken so a calculation of the implicit value of time savings would actually be an upper bound to the benefit. A better estimate would be the change in earnings achieved less additional costs incurred, the measure used for user benefits in the present study. But if one or more of the newly linked markets is imperfect then a more careful analysis of surpluses is called for.

In the present case JARC services are by design meant to link highly imperfect labor submarkets that experience substantial involuntary unemployment with markets that are much closer to the goal of full employment. Now the user benefits are still very much the same as before with willingness to pay measured by increases in user earnings. Now, however, the trip will generate real (not pecuniary) externalities in labor markets. Both at origin and destination the changing pattern of employment sets off a chain of events in imperfect labor markets as some workers move up (at the origin) and some move down (at the destination.) Transit users are unaware of these changes, and neither their willingness to pay nor the value of their time savings can possibly reflect these welfare effects. We are dealing with real externalities that should be included in the analysis. A chain model with its emphasis on labor opportunity costs provides a consistent theoretical base for calculating these externalities.

7.7 Main Findings for Base Year

The measures described in the previous section are presented in this section. The results are summarized for the base year based on three different scenarios for users, non-users and society.

Figure 7.2 shows that the average net change in user income (ie, Scenario I) for all subgroups is $3,542.86 whereas the average net change in user surplus (obtained by factoring in a proxy for leisure time foregone, ie, Scenarios I and II) is $2,757.51. On the whole, the results show that in the base year, the use of JARC services brings about a net gain in economic benefit to users. The gains might be attributed to a combination of low-cost connectivity to jobs and other destinations meaningful to users, compared to what was available to users previously, as well as improvements in the economic value of the activities that users can partake in the destinations (such as job destinations with higher paying jobs).
Figure 7.2: Average Incremental Net User, Non-User and Societal Benefits (2002 dollars)

Figure 7.2 shows that the non-user benefits generated by each JARC user are positive on the average for Scenarios I and II (i.e., when impacts are considered only on the general tax-paying public and the regional traveling public). These are estimated to be an average of $880 per JARC user for the base year. However, when local labor market impacts are taken into account in addition to the positive gains that accrue to the general tax-paying public and the regional traveling public (i.e., Scenario III), we find that the non-user benefits are negative (at about -$2,539). This means that by introducing increased low-wage labor into job sites, there are significant perturbations to existing workers in those sites in terms of displacement, deflation of wages and other impacts.

The resultant societal impacts are also shown in Figure 7.2. For Scenarios I and II, we estimate that the average net incremental benefit to society are about $4,423 and $3,637 respectively per JARC user. However, Scenario III, which accounts for the labor market impacts, indicates that the JARC program leads to an average societal benefit of $218 per user.

7.7.1 Ratio Measures for Base Year

We now examine the above results on the basis of program cost expended per user. Figure 7.3 shows the Average Per User Benefit to Cost ($APUBC_t$) or the average of the ratio of Incremental Net User Benefit to total JARC program cost ($PCOST_t$) expended annually on each service user, the Average Non-User Benefit to Program Cost ($ANoUBC_t$) and the Average Societal Benefit to Program Cost ($ASBC_t$).
Figure 7.3: Average User, Non-User and Societal Benefit to Program Cost Ratios*

![Graph showing benefit to cost ratios for different scenarios.]

* Due to the reasons given in Section 7.5.4, the Average of Societal Benefit to Cost Ratio or $ASBC_t$, will not be equal to the sum of Average of Per User Benefit to Program Cost Ratio ($APUBC_t$) and Average Non-User Benefit to Program Cost Ratio ($ANoUBC_t$). Appendix M presents the quantity Total Societal Benefit to Total Program Cost ($TSBC_t$) in Appendix M for this case.

Figure 7.3 shows that when the value of leisure time foregone in transitioning from a situation of unemployment to work is not accounted for, the $APUBC_t$ index is $1.99$, ie, there is a return of $1.99$ dollars in net income gains for every dollar expended on the JARC user. When the opportunity costs of time are taken into consideration, the user’s gain drops to about $1.61$ (as given by Scenarios II and III) in Figure 7.3. We can expect then, on the whole, that JARC users gain from about $1.6$ to $2$ times from every dollar expended by the JARC program on him or her in the base year.

The Average Non-User Benefit to Cost ($ANoUBC_t$) index is the average of the ratio of Incremental Net Non-User Benefit generated by each user to total JARC program cost ($PCOST$) for each service user. We find from Figure 7.3 that when benefits to the tax-paying public and commuters in the region alone are considered, for every dollar of JARC investment per user, there is a return of about $1.72$ to non-users. These gains accrue due to changes in income taxes generated by the users, alternative use of tax-payer funds on welfare and other public assistance payments as well as the external costs of non-transit modes of transportation that might have been previously used. When labor market impacts are taken into account and the definition of non-users are extended to include other low-wage labor in local labor markets, the return on a dollar of JARC investments on users bring a return of about $0.18$ on non-users.

The returns to society are the greatest under Scenario I, at close to $4$ for every dollar of JARC investment. Under Scenario II, the returns reduce to $3.63$. When both opportunity costs of user’s time (ie, monetized value of leisure time) and local labor markets impacts are
introduced in Scenario III, we find that the estimated returns to society from a dollar of JARC program investment reduces to $1.38.

### 7.7.2 Results by Subgroup: User Benefits

In this section, results are presented by subgroup. Figure 7.4 shows the \( APUBC_t \) index for the six subgroups. Because of the way in which Incremental Net User Benefit (\( \Delta NUB \))’s are defined, the \( APUBC_t \) index varies only for Subgroup 1 across the three scenarios. Among all three subgroups undertaking work trips, return to JARC program investments as given by the \( APUBC_t \) index is the highest for Subgroup 1 under Scenario I at close to 2.5. Once the value of leisure time is introduced, the rate of return to the user drops to only 0.71. In Scenarios II and III, Subgroup 3 riders, who are potentially incurring changes in travel times, out-of-pocket transportation costs and also wage rates by shifting to jobs in other start times which pay better, enjoy the greatest rate of return for a dollar of JARC investment – at 1.94. We have calculated that that this group saves over $2000 per year in out-of-pocket costs for their commuting trip, in addition to undergoing increases in earnings from about $15,500 per year on the average to close to $17,000 per year.

Figure 7.4: Average Per User Benefit to Program Cost Ratio (APUBCt) by Subgroup

The average of per user annual net benefits to program cost is highest for Subgroup 6 under all three scenarios. The reason for this is lower levels of trip frequency by Subgroup 6, which results in lower \( PCOST \) values for this group, while at the same time incurring higher values of \( \Delta NUB \) (at an average of $1,868 per year). The net benefits for this subgroup is the difference between the annual generalized user cost of travel to the same destination and/or purpose for the mode of transportation previously used and the annual generalized user cost due to use of the JARC service. Close to 48% of auto drivers who switched to the JARC service are from Subgroup 6. This accounts for the large gain in net benefit.

Subgroups 5 and 4 suffer from the lowest returns to JARC program investments on them in the base year. Subgroup 5 riders are unemployed and looking for jobs. These users are young
overall, with close to 50 percent at less than 25 years of age. Subgroup 5 makes infrequent use of the service, resulting in an average annual $PCOST$ value of about $900. However, their base year benefits are also very low (at about $140 per year). These facts deflate their overall $APUBC_i$ index. The situation is similar for the case of Subgroup 4 or those riders who are using the service for school, education and job training. These are young individuals with 40 percent less than 19 years of age and another 40 percent between 20 and 25 years of age. According to our longitudinal analysis, we expect both Subgroups 4 and 5 to reap the benefits of the boost in mobility given to them by the JARC services in these economically formative years of their lives over the rest of their worklives, beyond the base year.

### 7.7.3 Results by Subgroup: Non-User and Societal Benefits

Figure 7.5 shows the Average Non-User Benefit to Program Cost ($ANoUBC_i$) by subgroup. It may be recalled that under Scenarios I and II, only impacts on the tax-paying public and the transportation system in the region are taken into consideration. On the other hand, Scenario III also considers the impacts on local labor markets.

Under Scenarios I and II, the return to non-users due to JARC investments on all subgroups except 3 and 4, are positive. Under Scenario III, Subgroups 2 and 3 lead to a non-user benefit return of less than 0 for program dollars invested on JARC users. The tax-payer subsidy to the JARC program combined with the negative labor market impacts contribute to this negative rate of return to non-users. Table 7.5 breaks down base year non-user benefits into its component parts.

Figure 7.5: Average Non-User Benefit to Program Cost Ratio ($ANoUBC_t$) by Subgroup
### Table 7.5: Breakdown of Base Year Non-User Net Benefits

<table>
<thead>
<tr>
<th>User Subgroup</th>
<th>Average Impact Generated by User Category</th>
<th>Scenario I &amp; II</th>
<th>Scenario III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Tax Payments Generated</td>
<td>2,666.67</td>
<td>2,666.67</td>
</tr>
<tr>
<td>1</td>
<td>Average Transfer Payments Diverted</td>
<td>5,082.34</td>
<td>5,082.34</td>
</tr>
<tr>
<td></td>
<td>Average Societal Costs of Prior Mode Saved</td>
<td>1,083.30</td>
<td>1,083.30</td>
</tr>
<tr>
<td></td>
<td>Average Labor Market Impact</td>
<td>-</td>
<td>-5,680.19</td>
</tr>
<tr>
<td></td>
<td>Average (JARC Subsidy)</td>
<td>3,335.00</td>
<td>3,335.00</td>
</tr>
<tr>
<td></td>
<td>Average Non-User Gain at Base Year</td>
<td>4,414.02*</td>
<td>-1,955.24</td>
</tr>
<tr>
<td>2</td>
<td>Average Tax Payments Generated</td>
<td>4,092.81</td>
<td>4,092.81</td>
</tr>
<tr>
<td></td>
<td>Average Transfer Payments Diverted</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Societal Costs of Prior Mode Saved</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Labor Market Impact</td>
<td>-</td>
<td>-6,391.45</td>
</tr>
<tr>
<td></td>
<td>Average (JARC Subsidy)</td>
<td>1,770.47</td>
<td>1,770.47</td>
</tr>
<tr>
<td></td>
<td>Average Non-User Gain at Base Year</td>
<td>2,107.88</td>
<td>-6,196.00</td>
</tr>
<tr>
<td>3</td>
<td>Average Tax Payments Generated</td>
<td>4,065.72</td>
<td>4,065.72</td>
</tr>
<tr>
<td></td>
<td>Average Transfer Payments Diverted</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Societal Costs of Prior Mode Saved</td>
<td>921.10</td>
<td>921.10</td>
</tr>
<tr>
<td></td>
<td>Average Labor Market Impact</td>
<td>-</td>
<td>-689.00</td>
</tr>
<tr>
<td></td>
<td>Average (JARC Subsidy)</td>
<td>3,726.74</td>
<td>3,726.74</td>
</tr>
<tr>
<td></td>
<td>Average Non-User Gain at Base Year</td>
<td>1,042.03</td>
<td>-7,954.36</td>
</tr>
<tr>
<td>4</td>
<td>Average Tax Payments Generated</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Transfer Payments Diverted</td>
<td>5,876.67</td>
<td>5,876.67</td>
</tr>
<tr>
<td></td>
<td>Average Societal Costs of Prior Mode Saved</td>
<td>287.52</td>
<td>287.52</td>
</tr>
<tr>
<td></td>
<td>Average Labor Market Impact</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Average (JARC Subsidy)</td>
<td>3,659.13</td>
<td>3,659.13</td>
</tr>
<tr>
<td></td>
<td>Average Non-User Gain at Base Year</td>
<td>-3,596.10</td>
<td>-3,596.10</td>
</tr>
<tr>
<td>5</td>
<td>Average Tax Payments Generated</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Transfer Payments Diverted</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Societal Costs of Prior Mode Saved</td>
<td>237.41</td>
<td>237.41</td>
</tr>
<tr>
<td></td>
<td>Average Labor Market Impact</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Average (JARC Subsidy)</td>
<td>765.88</td>
<td>765.88</td>
</tr>
<tr>
<td></td>
<td>Average Non-User Gain at Base Year</td>
<td>-528.19</td>
<td>-528.19</td>
</tr>
<tr>
<td>6</td>
<td>Average Tax Payments Generated</td>
<td>169.59</td>
<td>169.59</td>
</tr>
<tr>
<td></td>
<td>Average Transfer Payments Diverted</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Average Societal Costs of Prior Mode Saved</td>
<td>341.34</td>
<td>341.34</td>
</tr>
<tr>
<td></td>
<td>Average Labor Market Impact</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Average (JARC Subsidy)</td>
<td>1,163.32</td>
<td>1,163.32</td>
</tr>
<tr>
<td></td>
<td>Average Non-User Gain at Base Year</td>
<td>-622.06</td>
<td>-622.06</td>
</tr>
</tbody>
</table>
7.7.4 Benefits and Costs by Type of Service

The Cost Effectiveness (CE) analysis presented in the previous chapter showed that the cost per ride of Demand Responsive (DR) services is much higher than Fixed-Route (FR) services. This begs the question of whether the return on investment to the users, non-users and society in general are higher from DR services compared to FR services. Table 7.6 summarizes the results of this analysis.

On the measures considered, FR services perform better overall than DR in the base year. The $APUBC_t$ is above 2 in the case of FR services for all three scenarios but less than 1 for DR services. These results can be understood by considering the summary statistics presented in Table 4.1. Although a greater share of DR service riders transitioned from a state of unemployment or public assistance to jobs (31.5% to 25.9% for FR riders) and reported earning more (54.1% versus 36.5% for FR service riders), the estimated net increase in earnings reported by FR riders is higher than DR riders.

Table 7.6: Base Year User, Non-User and Societal Net Benefits by Type of Service

<table>
<thead>
<tr>
<th>Measure</th>
<th>Type of Service</th>
<th>Scenario I</th>
<th>Scenario II</th>
<th>Scenario III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>Fixed Route</td>
<td>3,714.68</td>
<td>2,928.08</td>
<td>2,928.08</td>
</tr>
<tr>
<td>Average Incremental Net User Benefit ($\Delta NUB$)</td>
<td>Demand Responsive</td>
<td>3,132.70</td>
<td>2,350.34</td>
<td>2,350.34</td>
</tr>
<tr>
<td>Non-Users</td>
<td>Fixed Route</td>
<td>2.55</td>
<td>2.05</td>
<td>2.05</td>
</tr>
<tr>
<td>Average Net User Benefit to Program ($APUBC$)</td>
<td>Demand Responsive</td>
<td>0.71</td>
<td>0.58</td>
<td>0.58</td>
</tr>
<tr>
<td>Society</td>
<td>Fixed Route</td>
<td>5,725.25</td>
<td>4,913.04</td>
<td>-1,733.19</td>
</tr>
<tr>
<td>Average Incremental Net Societal Benefit ($\Delta NSB$)</td>
<td>Demand Responsive</td>
<td>1,701.73</td>
<td>919.37</td>
<td>-2,421.47</td>
</tr>
<tr>
<td>Non-Users</td>
<td>Fixed Route</td>
<td>0.52</td>
<td>0.52</td>
<td>0.10</td>
</tr>
<tr>
<td>Average Non-User Benefit to Program Cost Ratio ($ANoUBC$)</td>
<td>Demand Responsive</td>
<td>5.21</td>
<td>4.72</td>
<td>1.67</td>
</tr>
<tr>
<td>Non-Users</td>
<td>Fixed Route</td>
<td>1.24</td>
<td>1.12</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Further, a far greater share of DR service riders were likely to have used alternative bus or rail transit prior to use the JARC service. Hence the transportation cost differential of DR service riders (between the “before” and “after” situation) is likely to be small. We have calculated the difference between the dollar cost of prior and current modes of transportation to be close to $2,000 annually for FR riders whereas it is only about $1,200 annually for DR riders. These factors account for a smaller estimate of $\Delta NUB_t$ for DR compared to FR.
services, which together with the significantly larger program costs associated with DR services, leads to a smaller estimate of $APUBC_t$.

The lower non-user benefits of DR services compared to FR services can be primarily attributed to several factors. Although the transfer payments diverted to alternative uses are higher with DR and thus is a benefit to non-users, higher program costs, together with greater (negative) impacts on labor markets (a loss of $3,200 to non-users compared to a loss of $2,000 for FR services) leads to an overall negative $ANoUBC_t$ for all three scenarios.

### 7.7.5 Benefits and Costs by Public Assistance Received

Table 7.7 shows that, in general, the user, non-user and societal benefits are larger if the rider reported that they did not earn any public assistance in the last five years. Two factors contributed to this trend: first, those on public assistance have lower skill levels and incurred a smaller income differential after using the service. In addition, due to mode shifts from primarily alternative transit or non-motorized modes, the transportation cost differentials between the “before” and “after” situations is significantly smaller for those reporting receipt of public assistance.

#### Table 7.7: Base Year User, Non-User and Societal Net Benefits by Assistance Received

<table>
<thead>
<tr>
<th>Measure</th>
<th>Assistance</th>
<th>Scenario I</th>
<th>Scenario II</th>
<th>Scenario III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Users</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net User Benefit ($\Delta NUB_t$)</td>
<td>Assistance (=yes)</td>
<td>2,414.42</td>
<td>1,702.64</td>
<td>1,702.64</td>
</tr>
<tr>
<td></td>
<td>Assistance (=no)</td>
<td>4,008.40</td>
<td>3,192.70</td>
<td>3,192.70</td>
</tr>
<tr>
<td>Average Net User Benefit to Program ($APUBC_t$)</td>
<td>Assistance (=yes)</td>
<td>0.92</td>
<td>0.67</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Assistance (=no)</td>
<td>2.44</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Non-Users</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net Non-User Benefit ($\Delta NNoUB_t$)</td>
<td>Assistance (=yes)</td>
<td>-898.28</td>
<td>-2,611.99</td>
<td>-2,611.99</td>
</tr>
<tr>
<td></td>
<td>Assistance (=no)</td>
<td>1,598.44</td>
<td>1,598.44</td>
<td>-2,503.40</td>
</tr>
<tr>
<td>Average Non-User Benefit to Program Cost Ratio ($ANoUBC_t$)</td>
<td>Assistance (=yes)</td>
<td>1.01</td>
<td>1.01</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Assistance (=no)</td>
<td>2.09</td>
<td>2.09</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Society</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net Societal Benefit ($\Delta NSB_t$)</td>
<td>Assistance (=yes)</td>
<td>1,438.12</td>
<td>718.51</td>
<td>-2,588.63</td>
</tr>
<tr>
<td></td>
<td>Assistance (=no)</td>
<td>5,798.71</td>
<td>4,960.45</td>
<td>-1,624.27</td>
</tr>
<tr>
<td>Average Societal Benefit to Cost Ratio ($ASBC_t$)</td>
<td>Assistance (=yes)</td>
<td>1.99</td>
<td>1.73</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Assistance (=no)</td>
<td>4.86</td>
<td>4.42</td>
<td>1.81</td>
</tr>
</tbody>
</table>

As far as the non-user benefits are concerned, a greater share of those on public assistance tends to be DR service users, with greater associated program costs and labor market impacts.

### 7.7.6 Benefits, Costs and Gender Effects
The rate of return to program costs ($APUBC_t$) are higher for male riders compared to females. Previous analysis showed that female riders are more likely to have been previously on public assistance, to be in Subgroups 1, 4 and 5, use DR services and to have switched from transit or non-motorized modes to the JARC service. Although there was virtually no difference in the magnitude of income change “before” and “after” using the service between males and females, the estimate of $\Delta NUB$, is greater for males because of cost savings on transportation (Table 7.8). A much greater share of male riders switched from personal, motorized transportation to the JARC service than females, leading to improved cost savings.

Table 7.8: Base Year User, Non-User and Societal Benefits and Costs by Gender

<table>
<thead>
<tr>
<th>Measure</th>
<th>Gender</th>
<th>Scenario I</th>
<th>Scenario II</th>
<th>Scenario III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Users</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net User Benefit ($\Delta NUB_t$)</td>
<td>Male</td>
<td>3,877.42</td>
<td>3,017.53</td>
<td>3,017.53</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3,271.59</td>
<td>2,523.35</td>
<td>2,523.35</td>
</tr>
<tr>
<td>Average Net User Benefit to Program ($APUBC_t$)</td>
<td>Male</td>
<td>2.21</td>
<td>2.21</td>
<td>1.73</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1.64</td>
<td>1.33</td>
<td>1.33</td>
</tr>
<tr>
<td><strong>Non-Users</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net Non-User Benefit ($\Delta NNoUB_t$)</td>
<td>Male</td>
<td>1,531.41</td>
<td>1,531.41</td>
<td>-2,489.19</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>369.17</td>
<td>369.17</td>
<td>-2,721.35</td>
</tr>
<tr>
<td>Average Non-User Benefit to Program Cost Ratio ($ANoUBC_t$)</td>
<td>Male</td>
<td>2.13</td>
<td>2.13</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1.52</td>
<td>1.52</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Society</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net Societal Benefit ($\Delta NSB_t$)</td>
<td>Male</td>
<td>5,613.54</td>
<td>4,737.72</td>
<td>-1,756.41</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3,551.54</td>
<td>2,781.45</td>
<td>-2,226.49</td>
</tr>
<tr>
<td>Average Societal Benefit to Cost Ratio ($ASBC_t$)</td>
<td>Male</td>
<td>4.61</td>
<td>4.14</td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.30</td>
<td>2.99</td>
<td>0.99</td>
</tr>
</tbody>
</table>

7.7.7 Area of Operations

While the large urban and rural areas exhibited significantly large benefits, those in small urban areas benefited to a lesser degree according to the measures estimated, especially in the non-user category. A greater share of riders in small urban areas uses DR services (38%, compared to 31% of riders in large areas and 26% in rural areas). Income differentials in the “before” compared to the “after” situation is the lowest for small urban area riders.

Tax revenues diverted are the smallest in small urban areas ($2,220, compared to $2,950 in large urban areas and about $2,600 for rural areas). Further, JARC program costs are the highest in small urban area (at $3,780 per rider annually compared to $2,800 per rider in large urban areas and about $3,000 in rural areas) – these are an outcome of higher DR services sampled in small urban areas. However, the net loss to local labor market impacts is the greatest in large urban areas (at -$3,746) compared to $1,654 in rural areas and $1,813 in small urban areas (Table 7.9).
Table 7.9: Base Year User, Non-User and Societal Net Benefits by Type of Area

<table>
<thead>
<tr>
<th>Measure</th>
<th>Area</th>
<th>Scenario I</th>
<th>Scenario II</th>
<th>Scenario III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Users</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net User Benefit ($ΔNUB_t$)</td>
<td>Large Urban</td>
<td>3,780.30</td>
<td>3,184.99</td>
<td>3,184.99</td>
</tr>
<tr>
<td></td>
<td>Small Urban</td>
<td>2,990.43</td>
<td>2,051.59</td>
<td>2,051.59</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>3,324.64</td>
<td>2,423.80</td>
<td>2,423.80</td>
</tr>
<tr>
<td>Average Net User Benefit to Program ($APUBC_t$)</td>
<td>Large Urban</td>
<td>2.27</td>
<td>1.94</td>
<td>1.94</td>
</tr>
<tr>
<td></td>
<td>Small Urban</td>
<td>1.07</td>
<td>0.79</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>2.52</td>
<td>1.98</td>
<td>1.98</td>
</tr>
<tr>
<td><strong>Non-Users</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net Non-User Benefit ($ΔNNoUB_t$)</td>
<td>Large Urban</td>
<td>989.68</td>
<td>989.68</td>
<td>-3,745.52</td>
</tr>
<tr>
<td></td>
<td>Small Urban</td>
<td>47.36</td>
<td>47.36</td>
<td>-1,812.67</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>1,538.46</td>
<td>1,538.46</td>
<td>-1,651.62</td>
</tr>
<tr>
<td>Average Non-User Benefit to Program Cost Ratio ($ANoUBC_t$)</td>
<td>Large Urban</td>
<td>1.74</td>
<td>1.74</td>
<td>-0.46</td>
</tr>
<tr>
<td></td>
<td>Small Urban</td>
<td>1.08</td>
<td>1.08</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>2.49</td>
<td>2.49</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>Society</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Incremental Net Societal Benefit ($ΔNSB_t$)</td>
<td>Large Urban</td>
<td>4,932.41</td>
<td>4,337.10</td>
<td>-2,928.81</td>
</tr>
<tr>
<td></td>
<td>Small Urban</td>
<td>3,002.53</td>
<td>2,063.70</td>
<td>-1,236.20</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>5,403.70</td>
<td>4,502.86</td>
<td>-1,384.02</td>
</tr>
<tr>
<td>Average Societal Benefit to Cost Ratio ($ASBC_t$)</td>
<td>Large Urban</td>
<td>4.14</td>
<td>3.82</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Small Urban</td>
<td>2.22</td>
<td>1.95</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>5.46</td>
<td>4.97</td>
<td>2.98</td>
</tr>
</tbody>
</table>

7.7.8 Additional Base year CBA Results

In the two previous chapters, a number of trip-level labor market outcomes were considered, including:

1) Trips to higher wage destinations:
2) Trips by non-high school graduates:
3) Trips to destinations perceived to be inaccessible without the service:

Program costs and level of subsidies for each of the above trip-types were presented in those chapters. The results of the net user, non-user and societal benefits relating to these trip-types are given in Appendix E.

7.8 Longitudinal Estimates of Benefits and Costs

The longitudinal estimation of JARC user impacts is important because many of the benefits that accrue might not be evident during the base year. However, many contextual and personal factors pertaining to JARC service users might change fundamentally over the years, rendering forecasts useless. For example, the entire labor market dynamics in local areas might change resulting in changes in employment opportunities and ability to change income levels by moving to jobs in other locations of shifts. This, in turn, can change the way transportation can facilitate improvements in economic outcomes. Therefore, longitudinal
estimates must necessarily be scenario-based and the assumptions under which longitudinal estimates might be expected to hold with reasonable certainty should be duly noted.

In this section, we describe the process by means of which longitudinal impacts of JARC service were estimated. In Section 7.11.1, we provide an overall description of the process. Appendix A provides a brief literature review on how longitudinal estimates were obtained in other human services, job training or workforce development studies. The implications of these studies are drawn for the current case. Finally, we present the results of the analysis in Section 7.16.

7.8.1 Description of the Longitudinal Estimation Process

Figure 7.6 describes the process by means of which the longitudinal estimates of JARC impacts were obtained. We start by taking the base year estimates of net benefits, benefits and costs that were presented in Section 7.8. The entire longitudinal analysis is restricted to Subgroups 1 through 5, who are JARC service users either using the service for commuting purposes or for trips to destinations such as job training centers that are somehow linked to future employment. Subgroup 6, JARC service users who use the service for discretionary trips, are excluded from this analysis since we are primarily interested in the role of the services towards enhancing peoples’ economic opportunities.

Section 7.8 presents base year estimates of net benefits, benefits and costs under different scenarios. For the purpose of simplicity, we present here only the results of Scenario II, the scenario with the leisure time estimates, for the current exercise. Longitudinal estimates based on the other base year scenarios can be obtained from the authors of the report.

The next step in the analysis is to obtain estimates of expected worklife of JARC service riders in Subgroups 1 through 5. These estimates were taken from a study published by the Bureau of Labor Statistics (1986)\textsuperscript{26}. Table 7.10 summarizes the expected worklife (in years) for age cohorts in 5-year increments, by gender. For example, males who are in the 15 to 19 year age group are expected to work an average of 39 years whereas females in this age group are expected to work 29 years. The table also gives the distribution of all JARC survey respondents as well as respondent by subgroup in these age categories. The highest proportion of JARC survey respondents are in the 20-24 year category. This is true for all the subgroups except Subgroup 4, which is composed of non-workers in school or job training programs. About 40 percent of Subgroup 4 respondents are in the youngest age category suggesting that they might be using the service to go to school. Most of the subgroups except Subgroup 6 have a negligible proportion of riders in the 60 and above years of age categories indicating that seniors are using the services to go shopping, health care centers or shopping.

Figure 7.6: Flowchart of steps involved in estimating worklife net benefit estimates

1. Assign expected worklife estimates (in years) to JARC sample
2. NLSY analysis
3. Estimate (using Model I) expected wage trajectories
4. Forecast wages (using Model II) to extrapolate wage trajectories to work-years beyond that covered by NLSY
5. Estimate annual growth rates in JARC user wages over expected worklife starting with base year earnings at year 0
6. Estimate wages for each year of expected worklife
7. Obtain Present Value of impact streams by using 5 different discount rates (2, 4, 6, 8 and 10 percent)
8. Estimate Present Value of Worklife Benefits, Costs and Net Benefits (difference between differences of worklife benefits and costs of JARC users and their counterfactual)
9. Scenario I: Transportation cost remains the same fraction of income as base year
10. Scenario II: JARC users remain in transit system for the remainder of worklife
11. Scenario III: JARC users become car-owners at empirically observed rates and times
12. Estimate expected cost trajectories for Groups 1 & 2
13. Estimate expected cost trajectories for JARC users and their counterfactual
14. Estimate change in generalized cost of travel over time
15. Determine transportation costs over time for JARC users and their counterfactual
16. Estimate time expected time of car purchase and time when JARC user becomes regular car user using Model III
17. Prorate fixed cost of car purchase over expected duration of 60 months
18. Determine transportation costs over time for JARC users and their counterfactual
19. Estimate annual growth in car ownership costs over expected worklife
Table 7.10: Expected Worklife and Survey

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Expected Worklife for Males (years)</th>
<th>Expected Worklife for Females (years)</th>
<th>Percent of Survey Respondents</th>
<th>Percent of Subgroup 1 Survey Riders</th>
<th>Percent of Subgroup 2 Survey Riders</th>
<th>Percent of Subgroup 3 Survey Riders</th>
<th>Percent of Subgroup 4 Survey Riders</th>
<th>Percent of Subgroup 5 Survey Riders</th>
<th>Percent of Subgroup 6 Survey Riders</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-19</td>
<td>39</td>
<td>29</td>
<td>15.25</td>
<td>16.18</td>
<td>11.76</td>
<td>8.54</td>
<td>40.00</td>
<td>21.43</td>
<td>21.69</td>
</tr>
<tr>
<td>20-24</td>
<td>37</td>
<td>27</td>
<td>19.75</td>
<td>25.00</td>
<td>32.35</td>
<td>15.24</td>
<td>40.00</td>
<td>28.57</td>
<td>12.05</td>
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<tr>
<td>25-29</td>
<td>33</td>
<td>24</td>
<td>13.75</td>
<td>13.24</td>
<td>14.71</td>
<td>9.76</td>
<td>15.00</td>
<td>35.71</td>
<td>13.25</td>
</tr>
<tr>
<td>30-34</td>
<td>29</td>
<td>21</td>
<td>9.25</td>
<td>5.88</td>
<td>17.65</td>
<td>14.63</td>
<td>0.00</td>
<td>0.00</td>
<td>3.61</td>
</tr>
<tr>
<td>35-39</td>
<td>25</td>
<td>18</td>
<td>9.00</td>
<td>14.71</td>
<td>5.88</td>
<td>10.37</td>
<td>5.00</td>
<td>0.00</td>
<td>7.23</td>
</tr>
<tr>
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<td>20</td>
<td>14</td>
<td>9.00</td>
<td>10.29</td>
<td>2.94</td>
<td>11.59</td>
<td>0.00</td>
<td>0.00</td>
<td>10.84</td>
</tr>
<tr>
<td>45-49</td>
<td>16</td>
<td>11</td>
<td>9.00</td>
<td>8.82</td>
<td>2.94</td>
<td>11.59</td>
<td>0.00</td>
<td>7.14</td>
<td>9.64</td>
</tr>
<tr>
<td>50-54</td>
<td>12</td>
<td>8</td>
<td>7.25</td>
<td>4.41</td>
<td>8.82</td>
<td>8.54</td>
<td>0.00</td>
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<td>8.43</td>
</tr>
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<td>5</td>
<td>4.00</td>
<td>1.47</td>
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<td>5.49</td>
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<td>3</td>
<td>2.50</td>
<td>0.00</td>
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<td>3.66</td>
<td>0.00</td>
<td>0.00</td>
<td>4.82</td>
</tr>
<tr>
<td>65-69</td>
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<td>2</td>
<td>0.50</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.20</td>
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<td>70-74</td>
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<td>0.00</td>
<td>0.61</td>
<td>0.00</td>
<td>0.00</td>
<td>1.20</td>
</tr>
<tr>
<td>75+</td>
<td>0</td>
<td>0</td>
<td>0.50</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Samples by Age Category

We then utilize the National Longitudinal Survey of Youth 1979 (NLSY79) data to estimate expected wage growth as well as transportation use growth trajectories over time. As described in greater detail in Section 7.13, the NLSY79 is an ongoing data program of the Bureau of Labor Statistics. It is comprised of a nationally representative sample of more than 12,000 young adults aged from 14 to 22 in 1979 when they were first surveyed. The survey then followed these respondents each year between 1979 and 1994 and biennially since 1994. We have used data from the period 1979 till 2002.

We have developed a dynamic microsimulation model\textsuperscript{27}, which uses the NLSY79, the Current Population Survey (CPS) of the Bureau of Census and the JARC User Survey, to “age” the JARC sample over time in order to observe net benefits of the program over the expected worklife of the respondents. The dynamic microsimulation model first smoothes the bottom and top-coded wage data using the Wage Smoothing Process described in Appendix G. Using a series of econometric models and Monte Carlo simulations, it generates wage growth and cost growth trajectories over the expected worklife of the JARC survey respondents. These time series data are then discounted to their present values to arrive at net benefits over the course of the expected worklife of JARC service users. Final results from

\textsuperscript{27} Well known in the field of transportation modeling to simulate traffic operations and travel behavior, dynamic microsimulations are also extensively used in policy analysis. Specifically in policy analysis, “microsimulations model use micro-data on persons (or households or firms or other micro-units) and simulate the effect of policy changes (or other changes) on these units. Differences before and after the change can be analyzed at the micro-level or aggregated to show the overall effect of the change” (Mitton, Sutherland and Weeks, 2000).
this process are scenario-based (with three different cost scenarios) and yield insights into the lifecycle return on investment of JARC funding.

7.9 Baseline Condition for Longitudinal Estimates Versus Base Year Estimates

There is an important point of difference between the evaluation framework used in the base year estimates and the longitudinal estimates. As described earlier, in the case of the base year estimates, we constructed, using the survey data, a before-and-after scenario for the JARC sample, where the net benefits are the differences in benefits and costs in the “after using the JARC service” period and the “before using the JARC service” period. The baseline or counterfactual, in that case, to the JARC riders, was their situation before they started to use the service.

In contrast, in the case of the longitudinal analysis, the counterfactual, as the JARC sample is aged, is what their economic situation would have been like, if they did not have access to the service. This is possible in the longitudinal case, because the NLSY79 sample can be partitioned into two groups of respondents – those with transportation problems (to be defined later in Section 7.14) and those without transportation problems. Under the assumption that the JARC service addresses the transportation problem of the riders, we are able to allocate to them wage and cost growth trajectories that pertain to similar NLSY79 respondents without transportation problems. Similarly, in the case of the baseline, ie, what would have happened over time, had the JARC riders not been able to access the service and thus continue to face transportation problems, we are able to assign wage and cost growth trajectories of those NLSY79 respondents facing transportation problems. Thus, in the case of the base year estimates, the baseline condition is the constructed “before” period of the JARC riders whereas in the case of the longitudinal estimates, the baseline is what the JARC rider would have faced, had he or she not have access to the service.

Extending the NLSY79 Data For Future Years

The NLSY79 data is cohort-based and the oldest NLSY79 respondent was only 45 years of age in 2002, the last survey year we used. Using a statistical model, we forecast wage growth for the NLSY79 respondents to what they would earn, in inflation-adjusted wages, when they reach the age of 75, the age of the oldest JARC User Survey respondent.

Using gender, educational level, enrollment in training programs and perceived transportation difficulty to link low-income NLSY79 respondents to the JARC respondents, we are able to assign NLSY79 wage growth curves to the latter, over their expected worklife. The base year income estimates are then aged using these wage growth curves. Assumptions that are made with this process are described in detail in Section 7.14.

Cost Aspects of the Longitudinal Analysis

There are also numerous uncertainties on the cost side. For example, how do transportation costs incurred by JARC riders change over time? The value of time itself, being dependent on the wage rate, will change over time. Transit fares will change and so will the possibility
that the JARC respondent will “drop out of the program”, i.e., stop using the service because, for instance, they purchased a car. We find from the NLSY79 data that the average duration between the first job of carless, economically disadvantaged NLSY79 respondents and purchase of a car is approximately 5 years. Various approaches are taken in the dynamic microsimulation model to account for these cost uncertainties. For instance, in one cost scenario, we assume that all JARC respondents continue to use transit throughout their worklife. In another cost scenario, we use a duration model to assign the probability that JARC respondent will purchase a vehicle by a certain time and from there on, incur costs of auto-based commuting, in contrast to transit-based commuting. This necessitates the development of yet another model to forecast growth in costs of car use. The differences in the longitudinal estimates from the different scenarios are described in Section 7.15.

Discount Rate

Another point of discussion is the discount rate to be used in the longitudinal analysis, in order to discount future costs and benefits to their present values. A discount rate of around 4 percent has been used for several studies where human capital outcomes were discounted over time and where the benefits are likely to occur in the future.

For example, McConnell and Glazerman (2001) used a 4 percent discount rate in valuating the benefits and costs of the National Job Corps program. This program is administered by the U.S. Department of Labor and offers residential and career training program for eligible youth ages 16 through 24 offers career training in more than 100 occupational areas, including business technology, health occupations, hospitality, culinary arts, construction, and auto mechanics. Rice et al. (1990) estimated the lifetime productivity costs of drug and alcohol abuse at 2, 4 and 6 percent. Another program that is useful to consider in this context is the Head Start program, which is a national program administered by the Administration of Children and Families of the U.S. Department of Health and Human Services. The Head Start program promotes school readiness by enhancing the social and cognitive development of children through the provision of educational, health, nutritional, social and other services to enrolled children and families. Ludwig and Phillips (2007) conservatively assumed that an extra $400 in Head Start funding raises lifetime earnings by 2 percent per child, which Krueger (2003) shows is worth at least $15,000 in present value using a 3 present discount rate (even assuming no productivity growth over time). Another noteworthy study is that of the High/Scope Perry Preschool which was initiated in 1962. This is a high quality one-to-two-year-long program with a home-visiting component designed to promote social and


cognitive development in at-risk children. The dollar value of Perry Preschool’s long-term benefits (in present dollars) range from nearly $100,000 calculated using a 7 percent discount rate to nearly $270,000 using a 3 percent discount rate (Belfield et al., 2006\(^{32}\)).

McConnell and Glazerman also noted that many researchers have recommended using the U.S. Treasury borrowing rate when the theoretically correct approach using the shadow-price method cannot be used. The approximate real rate of return on 30-year Treasury Bonds is 4 percent (3.9 percent between 1990 and 2000 and 4.2 percent in 2000 – the authors obtained these rates from OMB), signifying the importance of evaluating JARC investments at this discount rate to reflect the opportunity cost of government borrowing to fund projects.

The discount rates used for CBA of transportation projects are typically in the range of 4 to 8 percent (Weisbrod and Weisbrod, 1997\(^{33}\)). The Office of Management and Budget (OMB) recommends a 7 percent discount rate, as representing the private sector rate of return on capital investments (OMB, 1992\(^{34}\)).

The literature indicated that a variety of reasons exist for why different rates should be used. We have taken the approach of estimating all results for a range of discount rates (in increments of 2 percent between 2 and 10). However, to make the results concise, we will present final results using discount rates of 4 percent and 8 percent.

### 7.10 National Longitudinal Survey of Youth 1979 (NLSY79) Analysis

We have used the National Longitudinal Survey of Youth (NLSY), which is a panel dataset collected on individual respondents since 1979 and continuing till 2005, in order to estimate wage growth, costs and other parameters needed in the longitudinal analysis of the JARC sample. The main reason we have used this survey is that the other longitudinal survey data that have personal earning records, such as Survey of Income and Program Participation (SIPP), does not provide the information about transportation situations of individuals. The NLSY provides information on transition of those young people from school to work, and from their parents' homes to being parents and homeowners. It also has information about vehicle ownership, perceived transportation problems and transportation services provided by the governmental job or training programs to those surveyed youth.

The NLSY79, conducted by Bureau of Labor Statistics (BLS), is a nationally representative sample of 12,686 young men and women who were 14-22 years old when they were first surveyed in 1979. The NLSY79 study was initiated to assist in the evaluation of the expanded employment and training programs for youth legislated by the 1977 amendments to


the Comprehensive Employment and Training Act (CETA). To these ends, in 1978 a national probability sample was drawn of young women and young men living in the United States and born between January 1, 1957 and December 31, 1964. This sample included an overrepresentation of blacks, Hispanics, and economically disadvantaged non-black/non-Hispanics. With funding from the Department of Defense and the Armed Services, an additional group of young persons serving in the military was selected for interviewing. The NLSY79 sampling design therefore enables researchers to analyze the experiences of groups such as women, Hispanics, blacks, and the economically disadvantaged. The following three sub-samples comprise the NLSY79:

1) a cross-sectional sample of 6,111 respondents designed to be representative of the non-institutionalized civilian segment of young people living in the United States in 1979 and born between January 1, 1957, and December 31, 1964 (ages 14–21 as of December 31, 1978)

2) a supplemental sample of 5,295 respondents designed to over-sample civilian Hispanic, black, and economically disadvantaged non-black/non-Hispanic youth living in the United States during 1979 and born between January 1, 1957, and December 31, 1964

3) a sample of 1,280 respondents designed to represent the population born between January 1, 1957, and December 31, 1961 (ages 17–21 as of December 31, 1978), and who were enlisted in one of the four branches of the military as of September 30, 1978

These individuals were interviewed annually through 1994 and are currently interviewed on a biennial basis. The 2002 round has been published, with a sample size of 7,724; the retention rate is quite high—77.5%. Besides, there are 6,004 individuals who complete all the 20 rounds of this survey.

The primary purpose of the NLSY79 is the collection of data on each respondent’s labor force experiences, labor market attachment, and investments in education and training. However, the actual content of the NLSY79 is much broader due to the interests of governmental agencies besides the Department of Labor. At several points throughout the survey, various agencies have funded special sets of questions. In addition to major funding, supportive funding has been provided by the U.S. Department of Health and Human Services, the National Institute on Aging, the National Institute on Alcohol Abuse and Alcoholism, the U.S. Department of Defense and the Armed Services and the National Institute of Education.

The NLSY79 are a composite of several different data collection efforts including respondent interviews about their work, family and other life experiences and a series of separately fielded administrative data collections. It is a very large database with over two thousands questions asked each survey year. Besides the aforementioned information, it also provides the family background, personal or household characteristics, working history, substance use, and criminal behavior, which can help researchers, build a detailed profile of those individuals.
7.11 NLSY79 Variables and Research Design for JARC Longitudinal Analysis

As indicated earlier, by mining the NLSY79 dataset, we attempt to allocate to the JARC survey respondents, wage growth levels and other factors that will determine their economic outcomes over their worklife. The NLSY 79 variables that are of specific interest to us include whether or not respondents had access to a vehicle, whether they perceived difficulties with their transportation, whether the respondents were from economically disadvantaged families, whether respondents were enrolled in a governmental job training program and whether those enrolled in such programs received transportation assistance of any kind. Table 7.11 gives the subset of variables used from the NLSY79 in this analysis.

As discussed earlier, the research design used in analyzing the NLSY79 dataset leads to the designation of certain individuals in the NLSY as the experimental group and others as the control group. The NLSY experimental group consists of individuals defined to be facing transportation problems during the time window of 1983 through 2002, with economic outcomes projected till the year when the oldest NLSY79 respondent becomes 75 years of age. In the JARC longitudinal analysis, the growth trajectories of the NLSY79 experimental group forms the baseline or counterfactual, i.e., what the JARC survey respondents would have encountered, if they continued to face transportation problems. On the other hand, the NLSY control group consists of respondents who do not face transportation problems. Under the assumption that the JARC service addresses the transportation problems of its riders, the growth trajectories of the NLSY79 control group gives the appropriate trends by which the JARC users can be aged over time.

The NLSY79 experimental group is composed of those respondents who faced transportation problems during the 1979-1982 time window, defined as those who either did not own a vehicle or otherwise perceived transportation difficulty in some way. In contrast, the control group respondents owned a vehicle and did not perceive transportation difficulties. The “intervention” (that is, vehicle ownership and perceived transportation difficulty) considered in this research is multiple-period and time variant. It is possible for a respondent to enjoy the benefit of owning vehicles in one year and to lose this asset (the vehicle or vehicles) in another year. In order to clearly define the experimental and control group, if at any time a respondent answered “no” to the vehicle ownership questions and “yes” to the perceived transportation difficulty questions during the intervention period of 1979 through 1982, that respondent is allocated the experimental group. The control group includes respondents who always owned a vehicle(s) but also did not perceive any transportation difficulties during this time window.

Ideally, an experimental group differs from the control group only by the intervention under study. However, this requirement is always violated in reality due to lack of random assignment. As a result, we need to introduce control variables to correct this non-random
assignment with the assumption of sufficient information in the data to correct for systematic differences between the intervention and control group\textsuperscript{35}.

For the outcome measure, we have used salaries and wages reported every year. There are different ways to measure people’s economic performance or earning ability. In many labor market studies, earning ability has been examined not only using salaries and wages but also a dichotomous employment status (employed or not; part time or full time). Researchers also have other suggestions for supplementary measurement, such as whether an individual is on welfare, their health condition or status, substance usage, depending on their research context.

The nominal salaries and wages were adjusted to 2002 dollars by using the Consumer Price Index (CPI) to account for inflation at consumer levels. Figure 7.7 shows the mean adjusted wages of individuals who were 14 to 22 years of age in 1979, for the time period 1983 through 2002. Since 1983, real salaries, adjusted for inflation using the CPI, have risen nearly steadily. There is a rapid growth in the initial years (up until about 1987), followed by a much more deflated rate of growth. We expect that wages and salaries of young adults would rise rapidly in the initial stages of their careers and then settle down to a less rapid growth rate.

However, the CPI itself might have added a caveat. The CPI underwent a major revision in 1983 (Jackman, 1990). However, this is immediately prior to our 20-year observation window and does not affect our analysis. Real pay in general fell between 1971-72 and 1981-82. The substantial drop in real salaries was produced by an oil shock that generated a severe recession. As the economy rebounded in the early 1980’s, there was strong growth in real terms, with the growth leveling off in the later part of the decade.

The initial (1983) values of the mean salaries and wages of the control group is about $7000 dollars higher than the experimental group. However, the growth trajectory over time of the mean series appears to be quite similar. In fact the first-differences of the mean series (ie, the annual wage growth rates) for these two broad groups appear to be remarkably similar. But once we partition these groups into smaller sub-groups, these differences disappear. Our next step is to examine if this difference in the outcome levels between the two groups diminish once appropriate controls are applied.

\textsuperscript{35} But there is always the possibility of unobservable factors to influence systematic differences, which need the special treatment (e.g. instrumental variables methods).
Figure 7.7: CPI-adjusted (to 2002) Wages over Time of Different Age-Cohorts (NLSY, 1979)
Sub-grouping by Level of Economic Disadvantage of Families

Since the program targeting analysis presented in an earlier chapter showed that JARC respondents are mainly from the lower-income strata of society, those NLSY79 respondents who are from economically disadvantaged families are assumed to be similar to the JARC respondents compared to all NLSY79 respondents.

The problem is how to define economically disadvantaged families. We refer to the literature for this purpose. We define economic disadvantaged families as those in which neither parents has received a high school education or higher. It is ideal to use family income to measure economic disadvantage, however, NLSY79 doesn’t provide parental income measures, thus we use their parents’ education as a proxy for family income as previous studies have shown “strong positive correlation between education and earnings” (14).

Further Disaggregation by Involvement in Job Training Programs

Subgroup 4 of the JARC survey respondents consists of individuals who are currently not employed and are involved in job-training programs. As seen in the analysis presented in Section 7.6, the base years net benefits of this subgroup is lower compared to the other groups. This is because these JARC riders have deferred earning at a higher rate in return for acquiring greater job skills.

In order to conduct longitudinal analysis for this subgroup over their expected worklife, we need two critical estimates: the length of the period of time after which individuals in job training enter the workforce and their wage growth rates in contrast to similar individuals who do not go through job training, once they are employed. The NLSY79 is used to estimate the input values for the longitudinal analysis of Subgroup 4 JARC riders.

During the NLSY79 intervention window of 1979 through 1982, many of the respondents were simultaneously participants in governmental employment and job training programs. The intent of these programs is to give participants a boost in obtaining and retaining employment. A fundamental concern of the Employment and Training Administration of the U.S. Department of Labor, which funded the 1979–86 rounds of the NLSY79, was the efficacy of various federally funded employment and training programs in helping youths to acquire skills and secure employment. The 1979–86 “Other Training” sections of the questionnaire supplemented data collected in three other core question series: (1) “On Jobs,” which gathered detailed information on government jobs and associated training; (2) “Government Training,” which highlights other opportunities in which respondents participated over and above those reported in the “On Jobs” section; and (3) “Military,” in which data on formal and on-the-job training for military jobs were collected. Data collection during the 1979–86 interviews was limited to only those training programs in which the respondent had been enrolled for one month or more. It needs to be noted that there are year-to-year variations on the way the data were collected on this program.

We have attempted to create a composite picture of respondents’ job-training participation using the variables given in NLSY79. The \textit{govt} variable indicates whether respondents were
enrolled in one or more such program, irrespective of the quality of the program(s) or duration of time for which respondents were enrolled.

Table 7.11: Summary statistics of Group 1 (experimental) and Group 2 (control) of economically disadvantaged NLSY79 respondents

<table>
<thead>
<tr>
<th>Group</th>
<th>Percent</th>
<th>Mean Inflation-Adjusted Wages in 1983 (average age=21.67 yrs)</th>
<th>Percent of group who reported using Public Assistance in 1983</th>
<th>Percent of group involved in Job-Training Programs</th>
<th>Average Duration of Being Carless after First Job (years)</th>
<th>Average Age at First Job (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53.64</td>
<td>$7,457.53</td>
<td>15.16</td>
<td>25.67</td>
<td>5.62</td>
<td>24.45</td>
</tr>
<tr>
<td>2</td>
<td>46.36</td>
<td>$8,508.08</td>
<td>10.21</td>
<td>26.60</td>
<td>5.49</td>
<td>22.84</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>$7,982.81</td>
<td>12.65</td>
<td>26.14</td>
<td>5.56</td>
<td>23.75</td>
</tr>
</tbody>
</table>

Model Results in Summary

Two sets of models were estimated for the entire NLSY79 sample and for the sample of economically disadvantaged NLSY79 respondents:

- Models I: Models that estimate changes in adjusted wages and wage growth rates for the 1983 through 2002 period;
- Models II: Models that extrapolate adjusted wages and wage growth rates to time periods beyond 2002 (until the oldest NLSY79 respondent is estimated to reach age 75).

Models I: Estimation of Changes in Adjusted Wages and Wage Growth: The estimated models and results are given in Appendix F. Our main conclusions in the case of the models for all NLSY79 respondents are that for those who participated in governmental employment-training programs, having transportation problems in their early adulthood leads to an estimated $2982.49 less on the average compared to those who do not face transportation problems, an effect which is significant at the .05 level. For the group which was not enrolled in governmental training programs, the model predicts that facing transportation problems leads to $3309.70 less on the average in adjusted wages compared to those who did not face such problems.

As for the models estimated on the subset of NLSY79 respondents who were defined to be economically disadvantaged, having transportation problems lead to an estimated $2,428 or $2,534 less on the average compared to those who don’t have such problems for those who participated in governmental employment-training programs and those did not, respectively. This effect is significant at the .01 level. Enrollment in employment training programs is estimated to reduce the gap between car-owners and non-owners by $106.
Models II: Model to Extrapolate Outputs of the NLSY79 analysis for JARC Longitudinal Analysis

Using the statistical models described above for NLSY79 respondents from economically disadvantaged families, separate curves for wage growth rates and adjusted wages were estimated for four different factors (gender, education level, transportation difficulty and enrollment in training programs): gender (2 levels), education level (5 levels), transportation difficulty (2 levels; yes for those who had transportation problem and no for those who did not) and governmental training (yes for those who were enrolled and no for those who were not).

Figure 7.8: Hypothetical Example for Allocating Adjusted Wages

Figure 7.8 gives hypothetical example illustrating the process of allocating adjusted wages of NLSY79 respondents to JARC survey respondents. The illustrative wage growth curves here depict the situation for female NLSY79 respondents from economically deprived families, who completed high school. Two curves are shown here: the upper one is for respondents who did not experience transportation difficulties during the 1979-1982 period (ie, the “control” group) whereas the lower curve is for identical respondents who experienced transportation difficulty during that period (the “experimental” group). This particular example shows that around the age of 20 years, annual wage growth declines, to undergo an increase in the late 20’s for both the experimental and control group, but at a much greater rate of increase for the former than the latter. After a peak in the early 30’s, increases in wages decline over time but at a more rapid rate for the experimental group than the control.
group, up until the age of 45 years or after which annual changes in adjusted wages hover around 0 for both groups. The estimated wage growth trajectories for all groups considered show a typical pattern of a peak in the mid-20’s and a steady decline thereafter, although the actual wage rate changes are quite different for the different groups.

In this example, we relate the 34-year old female JARC survey respondent who completed high school to the average wage and wage growth rates of the 30-35 year old age category (called reference age) NLSY79 control group respondents (the upper curve) who did not face transportation difficulties, at the same educational level. For this particular JARC rider then, the baseline becomes the lower curve, which gives changes in annual wages that she might have incurred had she continued to face transportation problems.

7.12 Growth in Costs Over Time

Just as income levels rise over time, so do costs of commuting to jobs. In the longitudinal analysis, we consider three different cost scenarios that are described next.

Cost Scenario I

In this Cost Scenario, transportation costs remain the same fraction of income as in the base year. Since transportation costs in the base year are a function of transit fares and frequency of use, these are implicitly assumed to remain the same over time. This scenario is not realistic but serves as a baseline against which to compare the results of the other scenarios.

Cost Scenario II

In this scenario, JARC respondents are assumed to use transit for the remainder of their worklife but where growth rates are applied to transit costs (based on data published by the Bureau of Transportation Statistics, BTS), and value of time which is based on the respondent’s current year income levels obtained after applying the growth rates (ie, transportation costs change differentially over time).

In constructing Cost Scenario II, information from the Bureau of Transportation Statistics (BTS) was used. Transit fares remained relatively stable between 1992 and 2002. Nationally, increases in fares per passenger-mile for some types of transit service were offset by lower fares per passenger-mile for other types. Local transit bus service, which accounted for 58 percent of public transportation ridership (by number of unlinked passenger trips) in 2002, cost the same (18¢ per passenger-mile) in 2002 as it did in 1992 (in chained 2000 dollars), although it rose to 21¢ in 2000. Demand-responsive transit fares rose the most between 1992 and 2002: from 18¢ to 22¢ per passenger-mile or 20 percent. These fares were at their highest point (27¢) however, in 1995. All fares were extrapolated from these numbers for the purpose of the current analysis. In this scenario, the value of time changed with wages, although we restricted the percentage to 40, irrespective of increases in wage levels.
**Cost Scenario III**

In Cost Scenario III, the JARC riders “drop out of the transit program” based on a probability of car ownership estimated using the NLSY79 data: these probabilities are estimated by means of a duration model of the NLSY79 respondents which predicts the time after start of employment when a car is purchased; these duration times are assigned to the JARC respondents using the same rationale as above. Costs of car ownership are aged based on estimates published in the literature on per mile costs.

Constructing Cost Scenario III involved considerably greater number of data sources and methods. Two major issues have to be addressed in this scenario: when are the JARC respondents estimated to become car owners and regular car users and what would be the cost of operating the car over time for the commuting trip.

To address the first issue, we once again turn to the NLSY79 data. Appendix H provides the results of a model of duration of carlessness after NLSY79 respondents are employed for the first time. The predictions from this model are allocated to the JARC respondents using age, gender and educational levels, as before. The longitudinal analysis assumes that once JARC respondents acquire the car, they will use it regularly and drop out of the transit system. Hence, their costs take on a different trend compared to those who continue to stay in the system, in which case they are allocated the same transit fare growth as in Scenario II.

An issue that has received considerable coverage in the recent popular literature is the high costs of transportation. Transportation expenditures are second only to housing expenses incurred by households (Thakuriah and Liao, 2007). Historically, (from the 1910’s through the 1990’s) the share of household expenditure allocated to housing and transportation (in constant dollars) has increased relative to other expenditure categories such as food and apparel (Jacobs and Shipp, 2005); of this allocation, from 1984 to 1998, among aggregate expenditure categories, housing faced the largest change in budget allocation, increasing from 32.3 % in 1984 to 35.3% in 1998 (Johnson et al. 2001).

The monetary cost of purchasing and operating a vehicle dominates transportation-related costs to households. Vehicle ownership costs include fixed and variable costs. In particular, the cost of owning and operating a vehicle includes net outlays on vehicle purchases, vehicle finance charges including the dollar amount of interest paid for a loan contracted for the purchase of vehicles, gasoline and motor oil purchases, maintenance and repairs and vehicle insurance which includes the premium paid for insuring vehicles. Table 7.12 gives the average expenditures made by households on vehicles in 1999 dollars (Thakuriah and Liao, 2006), based on data from the Consumer Expenditure Survey (CEX, 1999).
Table 7.12: Details of Expenditures Made by Households on Vehicles (in 1999 US Dollars)

<table>
<thead>
<tr>
<th>Spending Category</th>
<th>Nationwide</th>
<th>Northeast</th>
<th>Midwest</th>
<th>South</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle expenses per household</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vehicle related cost</td>
<td>7,906</td>
<td>8,027</td>
<td>7,627</td>
<td>7,790</td>
<td>8,309</td>
</tr>
<tr>
<td>Net outlay</td>
<td>4,051</td>
<td>3,911</td>
<td>3,956</td>
<td>4,190</td>
<td>4,046</td>
</tr>
<tr>
<td>Finance charges</td>
<td>409</td>
<td>374</td>
<td>415</td>
<td>439</td>
<td>380</td>
</tr>
<tr>
<td>Gasoline and oil</td>
<td>1,222</td>
<td>1,183</td>
<td>1,130</td>
<td>1,238</td>
<td>1,327</td>
</tr>
<tr>
<td>Maintenance and repairs</td>
<td>717</td>
<td>705</td>
<td>603</td>
<td>655</td>
<td>937</td>
</tr>
<tr>
<td>Insurance</td>
<td>910</td>
<td>1,111</td>
<td>848</td>
<td>847</td>
<td>950</td>
</tr>
<tr>
<td>Other charges</td>
<td>597</td>
<td>744</td>
<td>675</td>
<td>421</td>
<td>669</td>
</tr>
<tr>
<td><strong>Vehicle expenses per vehicle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vehicle related cost</td>
<td>2,888</td>
<td>2,876</td>
<td>2,668</td>
<td>2,893</td>
<td>3,136</td>
</tr>
<tr>
<td>Net outlay</td>
<td>1,237</td>
<td>1,141</td>
<td>1,175</td>
<td>1,308</td>
<td>1,265</td>
</tr>
<tr>
<td>Finance charges</td>
<td>160</td>
<td>143</td>
<td>162</td>
<td>172</td>
<td>150</td>
</tr>
<tr>
<td>Gasoline and oil</td>
<td>533</td>
<td>525</td>
<td>469</td>
<td>556</td>
<td>580</td>
</tr>
<tr>
<td>Maintenance and repairs</td>
<td>313</td>
<td>313</td>
<td>260</td>
<td>289</td>
<td>406</td>
</tr>
<tr>
<td>Insurance</td>
<td>395</td>
<td>470</td>
<td>344</td>
<td>383</td>
<td>424</td>
</tr>
<tr>
<td>Other charges</td>
<td>250</td>
<td>285</td>
<td>258</td>
<td>185</td>
<td>311</td>
</tr>
</tbody>
</table>

[Source: Thakuriah and Liao, 2006]

For low-income households in particular, the availability of good credit is critical to financing a vehicle. Although income determines vehicle ownership to a large extent, the availability of credit and financing mechanisms play an important role as well. Good credit rating is critical for vehicle financing as few households purchase vehicles in cash. Credit bureaus use numerous methods for scoring household regarding their credit worthiness, which vehicle dealers and banks use liberally to assess the amount and type of vehicle loan that will be financed. While we do not have access to the detailed data required for this type of credit scoring, the CEX data still allows us to develop a profile of the general credit worthiness. One key measure that we will use is the ratio of median expenditure to before tax income of households (debt ratio). These estimates are given in Table 7.13. The median debt ratio is the lowest for high-income households; low-income household, on the average, spend 1.42 times more than their before-tax income. Households residing in public housing projects have the lowest median debt ratio. Since the median for all low-income households is much higher than any of the four assisted groups reported here, it must be that low-income households that do not receive these types of subsidies are overspending relative to their incomes.
Table 7.13: Vehicle Ownership Credit Related Factors

<table>
<thead>
<tr>
<th>Household Category</th>
<th>Median debt ratio&lt;sup&gt;a&lt;/sup&gt;</th>
<th>% vehicle ownership costs on finance Charges&lt;sup&gt;b&lt;/sup&gt;</th>
<th>% With zero insurance payments&lt;sup&gt;c&lt;/sup&gt;</th>
<th>% Older Vehicles (pre-'90)&lt;sup&gt;d&lt;/sup&gt;</th>
<th>% Leasing Vehicles&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>All low-income</td>
<td>1.42</td>
<td>20.42</td>
<td>22.95</td>
<td>46.2</td>
<td>4.17</td>
</tr>
<tr>
<td>With housing subsidy</td>
<td>1.02</td>
<td>19.30</td>
<td>34.38</td>
<td>57.65</td>
<td>2.78</td>
</tr>
<tr>
<td>Public housing resident</td>
<td>0.91</td>
<td>21.59</td>
<td>40.00</td>
<td>38.46</td>
<td>2.78</td>
</tr>
<tr>
<td>Private rental subsidy</td>
<td>1.06</td>
<td>18.68</td>
<td>31.82</td>
<td>66.10</td>
<td>2.78</td>
</tr>
<tr>
<td>Public assistance recipients</td>
<td>1.13</td>
<td>17.07</td>
<td>29.08</td>
<td>68.49</td>
<td>1.48</td>
</tr>
<tr>
<td>All high-income</td>
<td>0.70</td>
<td>15.15</td>
<td>9.59</td>
<td>37.05</td>
<td>8.10</td>
</tr>
</tbody>
</table>

<sup>a</sup> Debt Ratio = Total Annual Expenditure/Total Before Tax Income

<sup>b</sup> Percent of vehicle ownership cost that is expended for vehicle financing (that is, the net outlay for a vehicle, gasoline and oil purchase, maintenance and repairs, vehicle insurance and finance charges). For each category of households, only those households are included in the estimate that is currently making vehicle loan payments.

<sup>c</sup> Percent of vehicle-owning households that paid $0.00 in insurance over the year.

<sup>d</sup> Percent of pre-1990 vehicles of all vehicles in each household category for a representative quarter.

<sup>e</sup> Most households that lease vehicles also own one or more vehicles.

Irrespective of the mechanisms by means of which the vehicle is financed, Table 7.13 shows the average duration of being carless, after the first job, is only 5.56 years. There is undoubtedly some simultaneity between levels of mobility investments (which would undoubtedly increase in switching from transit use to car use) and the monetary well being of households. It seems that greater investment in transportation would bring about mobility benefits with economic and social returns as it expands the area in which people can search for and access jobs and job-supportive destinations, which, in turn, leads to an improvement in people’s economic outcomes in the labor market, better and more productive integration of social and household activities into one’s work life, flexibility in job search and ability to change employers to obtain employment with higher wages and benefits, without having to make residential location changes.

Such benefits of transportation are well acknowledged by planners and policy makers and attempts have been made by many researchers using data at many different aggregation levels to quantify the return on transportation investment. Recent studies (Thakuriah and Liao, 2007, which examines the case of transportation expenditures and Ong, 2000 and Raphael and Rice, 2000 which focus on low-income workers, by using a binary vehicle ownership variable as an indicator of transportation investment) sought to isolate this endogenous effect. In particular, Thakuriah (2006) found that households at the cusp of transitioning from low-income and states of welfare dependency to higher-income, higher mobility lifestyle appear to experience the greatest rate of return on their investments in personal mobility. The rate flattens out for higher-spending, higher-income households. These findings have the implication that one of the major benefits of the JARC program could be to give a preliminary boost to low-income workers’ mobility needs in the preliminary stages of their self-sufficient careers, which leads to eventual acquisition of
private transportation ownership, which speeds up the economic benefit rates. Therefore, it is important to include car ownership in the longitudinal scenarios for JARC riders.

Yet, virtually no longitudinal data exists on car operating expenses (either on an annual or a per mile basis), which might enable us to extrapolate future costs. Most car ownership and use models use incomes and not costs as determinants of future trends. Where costs are used, purchase prices are considered and not the operational costs of owning and operating vehicles.

We have used the following strategy for this analysis: normalize car purchase prices (of small sedan) over the first few years (60 months) after vehicle acquisition per JARC respondent, assume that commuting distance does not change over time and construct growth in annual operating costs that is tied to price of fuel. Historically, the real price of fuel reduced by 50% between 1985 and 1999 (Becca Carter Hollings and Ferner, 2003). While these are strong assumptions, we believe that they are reasonable enough to allow an exploration of preliminary effects, in the absence of other data. This approach was used to yield annual user costs of transportation allocated to the commuting trip.

7.13 Projected Worklife Effects of JARC Program - Potential User Worklife Benefit Index

In this section, we project ways in which use of the JARC program in the base year might jump-start improved worklife trajectories in the future, compared to trajectories they might otherwise incur. There is no substitute for good-quality longitudinal data collection on outcomes of employment transportation users over time; in the absence of such data, our analysis here is restricted to drawing inferences from the dynamic microsimulation which uses existing data and which projects worklife income growth and cost trajectories.

We therefore caution against the use of the term “impact” for this part of the analysis. Rather, we will refer to Potential User Worklife Benefit Index that is facilitated by JARC program costs. As per the research design established earlier, we do not have a way to attribute the share of net benefits over time to good transportation because, over time, other factors might contribute much more significantly to the net benefits than improved mobility alone.

The difference between the worklife trajectory jump-started by use of the service, in comparison to the worklife trajectory that users would have experienced, if users did not have access to the service, is the estimate of the Potential User Worklife Benefit Index. The ratio measures considered here is the ratio of this Index to base year program costs.

Estimated Potential User Worklife Benefit Index by Age Cohorts

Figure 7.9 shows the worklife benefits that are estimated to accrue to JARC riders, by age cohort, for the three cost scenarios, discounted using a 4 percent rate. Worklife benefits of an individual JARC rider are defined as the sum of the annual difference between the JARC users (the “experimental” group) and his or her counterfactual (from the “control” group)
over the estimated worklife of the rider. This is a measure of the estimated “premium” in net income (difference between earnings and transportation costs) that will be experienced by the JARC rider compared to what they would have experienced, had they not had access to the service.

Not surprisingly, the figure indicates that worklife benefits will be the greatest, irrespective of the cost scenario used, for younger JARC riders. This is due to the fact that these workers will be in the labor-force for longer periods of time, post JARC-use, compared to older workers. For all cost scenarios, worklife benefits decline at every age increment past the 20-year cohort, but rapidly so after the age of 50-54 years of age, when males will have an estimated 12 years left in the labor force and females, 8 years.

The figure also shows that estimated worklife benefits are greatest under Cost Scenario 1. The sum of the annual difference between JARC users in the 20-year old cohort and his or her counterfactual over the estimated worklife of the rider is estimated to be over $60,000 under this scenario. This large premium can be attributed to the unrealistic assumption behind this cost scenario – that transportation costs will remain a constant fraction of incomes over time. In fact, as Cost Scenarios 2 and 3 show, transportation costs will change differentially, whether it is due to changing real costs of transit use or due to the real costs of purchasing and operating a vehicle, which, as our empirical analysis shows, a large proportion of JARC users are expected to, unless there are significant changes in governmental policies which make car-ownership greatly expensive.

Figure 7.9: Estimated Potential Worklife Benefit Index by Age Cohort under Three Different Cost Scenarios Discounted at 4 Percent

Figure 7.10 shows worklife benefits for Cost Scenario 3. We would expect that the less-than-20 year cohort would have greater expected worklife benefits; yet the benefits of JARC riders
in these categories are lower than those in the 25-30 and 30-35 year cohorts. Subgroup 4 users tend to be in the less-than 20-year cohort at a greater rate than other subgroups. Many of these users are in school or more importantly, in job-training programs, which indicates the possibility of a “self-selection” issue – ie, those individuals who enroll in certain job-training programs are more likely than other riders to come from especially disadvantaged environments with resultant lower estimated worklife benefits. However, these individuals still do better than others in job-training programs who do not have access to good transportation as evidenced by their positive worklife benefits.

Figure 7.10: Estimated Potential Worklife Benefit Index Age Cohort under Cost Scenario 3

Figure 7.11 shows the ratio of Average Per User Worklife Benefit to Base Year Program Cost as a function of age cohorts. The average ratio is 15.87, ie, we estimate that every dollar spent in JARC program costs facilitates a return on $15.87 in the future.
Figure 7.11: Ratio of Average Per User Worklife Benefit to Base Year Program Cost by Age Cohort

Estimated Potential Worklife Benefit Index by Subgroup

Figure 7.12 shows the three cost scenarios, at 4 percent discount rate, for the 5 subgroups. Irrespective of the cost scenario, the gains are expected to be largest for Subgroup 1 users. Individuals in Subgroup 1’s situation, who do not have access to adequate transportation, are likely to suffer from deflated net incomes over their expected work lives. Mobility-boosters to this subgroup are likely to bring about the greatest returns to users over their worklife, a part of the analysis, which we will explore in greater detail later in this Section.

Another fact to notice is that the cost scenarios impact the worklife benefits of different subgroups differentially. Further, Cost Scenario 1 is the most “volatile” with the greater subgroup-to-subgroup variability in the estimate of worklife benefits. Given our earlier discussion regarding the three cost scenarios, we will restrict the discussion to Cost Scenario 3 only.
Figure 7.12: Estimated Worklife Benefits for all Cost Scenarios and 5 Subgroups

![Graph showing estimated worklife benefits for different cost scenarios and subgroups.](image)

Figure 7.13: Estimated Worklife Benefits for Subgroup 1 under Cost Scenario 3

![Graph showing expected worklife benefits for Subgroup 1 under Cost Scenario 3.](image)

Figure 7.13 shows the Subgroup 1’s expected worklife benefits under Cost Scenario 3 over the 5 different discount rates considered. As speculated earlier, the choice of the discount rates can have very significant implications on the magnitude of the benefits. At 4 percent, the estimated benefits are about $13,000 over the counterfactual group in contrast to only
about $3,000 at 8 percent. We recommend using a 4 percent rate for this study and will henceforth present all worklife estimates at this rate.

At 4 percent, the magnitude of worklife benefits are estimated to be highest for Subgroup 1, followed by 2, 5, 3 and finally Subgroup 4. Figure 7.14 shows the ratio of Average Per User Worklife Benefit to Base Year Program Cost as a function of subgroups 1 through 5, at 4 percent discount rate. For Subgroup 2, the return is about 16, followed by Subgroup 3 at 8.95 and 6.46 for Subgroup 5 and finally, 4.85 for Subgroup 4.

Figure 7.14: Ratio of Average Per User Worklife Benefit to Base Year Program Cost by Subgroup

### Estimated Potential Worklife Benefit Index by Gender, Public Assistance Receipt, Type of Service and Area

The worklife estimates are broken down in this section by several factors considered in the case of the base year estimates. Table 7.14 gives the Average Per User Worklife Benefit to Base Program Cost by gender, public assistance receipt, type of Service and type of area.

The ratio is higher for males than for females due to a combination of the fact that females have lower net benefits in the base year and also that their worklives are shorter than males. Those who reported earning some form of public assistance in the five years prior to the base year have a greater return over their worklife (at 18.58) compared to those JARC riders who reported not receiving public assistance.

Fixed-route service riders have a higher rate of return (at 22.35) than demand-response service users (12.82). This is most likely due to lower net benefits in the base year coupled with higher cost per ride measures for DR services. Finally, JARC users in smaller urban...
areas and rural areas are predicted to enjoy a much greater rate of return than riders in large urban areas (at 19.77 versus 9.28).

Table 7.14: Estimated Potential Worklife Benefit Index to Base Year Program Cost by Gender, Public Assistance Receipt, Type of Service and Area

<table>
<thead>
<tr>
<th>Factor</th>
<th>Level</th>
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</tr>
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<tr>
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<td>Male</td>
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<tr>
<td></td>
<td>Yes</td>
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</tr>
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<td>Type of Service</td>
<td>Demand-Responsive</td>
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</tr>
<tr>
<td></td>
<td>Fixed-Route</td>
<td>22.35</td>
</tr>
<tr>
<td>Area</td>
<td>Small Urban &amp; Rural</td>
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</tr>
<tr>
<td></td>
<td>Large Urban</td>
<td>9.28</td>
</tr>
</tbody>
</table>