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# 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

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#### ECONOMIC BENEFITS AND USER OUTCOMES

**T**his 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

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**T**he 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

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- 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 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

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*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 policies 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.



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## 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<sup>1</sup> 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

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<sup>1</sup> 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>)

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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).

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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 (Thakuria, 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

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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 (Deweese, 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-

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term activity changing effects. 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 21<sup>st</sup> 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

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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<sup>2</sup> 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.

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<sup>2</sup> User Survey and Planning Partnership Survey – Chapter 3.

Figure 1.1: JARC Grants By State



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Figure 1.2: Types of Job Access and Reverse Commute programs funded to date

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.

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### 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.

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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

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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

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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

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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<sup>3</sup>). 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

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<sup>3</sup> 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).

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programs. 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

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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” (ie, 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?

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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).

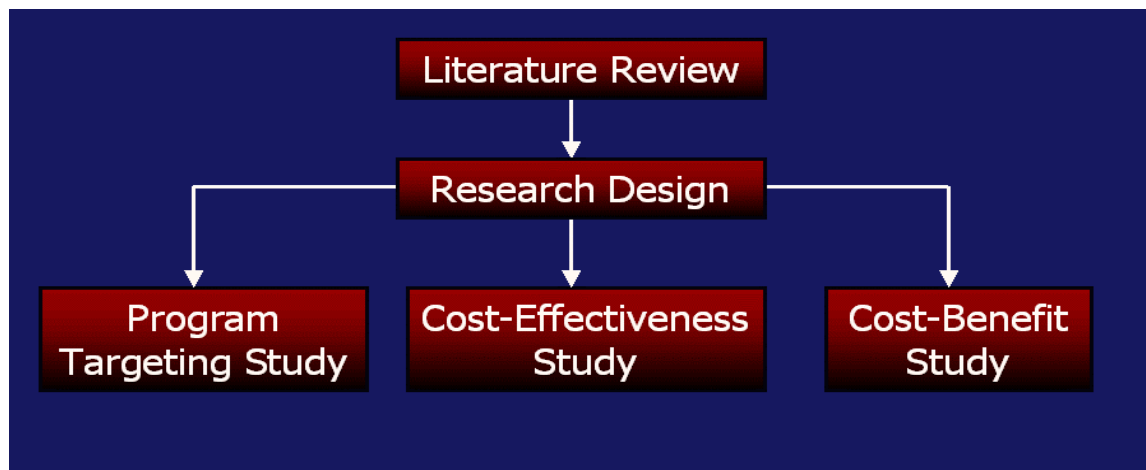
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## CHAPTER 2: Scope of Employment Transportation Economic Benefits Assessment

### 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**

| <b>Research Objective</b>  | <b>Research Task</b>  | <b>Chapter</b>                        |
|--|---|---------------------------------------|
| 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.                           | <b>Problem 1:</b> Undertake a literature review.  | <b>Incorporated into each chapter</b> |
|  | <b>Problem 1A:</b> Review methodologies and research designs utilized for outcome and impact evaluation                                     | <b>Appendix A.3</b>                   |
|  | <b>Problem 1B:</b> Develop a list of the non-transportation literature that cite lack of adequate transportation as a major barrier to work | <b>Appendix A.2</b>                   |
| 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.                      | <b>Problem 2:</b> Determine if JARC services are serving the target population.   | <b>Chapter 4</b>                      |
|  | <b>Problem 2A:</b> Compare socio-demographics of JARC service users with non-users in selected areas  | <b>Chapter 4; Section 4.2</b>         |
|  | <b>Problem 2B:</b> Behavioral Changes and Economic Indicators of JARC service users in selected areas                                       | <b>Chapter 4; Section 4.3</b>         |
| 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.   | <b>Problem 3:</b> Identify outcomes that are relevant to study.   | <b>Chapter 5; Section 5.3</b>         |
|  | <b>Problem 3A:</b> Identify relevant labor market outcomes from review of literature  | <b>Chapter 5; Section 5.4</b>         |
|  | <b>Problem 3B:</b> Assess the extent of site-to-site variations in labor market outcomes achieved by JARC users.                            | <b>Chapter 5; Section 5.4</b>         |
| 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. | <b>Problem 4:</b> Conduct a Cost-Effectiveness Analysis of JARC services.   |                                       |
|  | <b>Problem 4A:</b> Estimate cost-per-ride of JARC services and compare to that of peer services.  | <b>Chapter 6; Section 6.3</b>         |
|  | <b>Problem 4B:</b> Estimate JARC Annual Program Cost Per Rider for different trip types, labor market outcomes and user subgroups.          | <b>Chapter 6; Section 6.4</b>         |
|  | <b>Problem 4B:</b> Compare JARC cost-effectiveness estimates to that of other social, economic and human services programs.                 | <b>Chapter 6; Section 6.5</b>         |
| 5. To quantify the economic benefits to individual users, non-users and to society that result from these services.  | <b>Problem 5:</b> Conduct a Cost Benefit Analysis of JARC Services.   |                                       |
|  | <b>Problem 5A:</b> Estimate base year benefits and costs for JARC Service Riders  | <b>Chapter 7; Section 7.3</b>         |
|  | <b>Problem 5B:</b> Estimate longitudinal benefits and costs for JARC service riders.  | <b>Chapter 7; Section 7.5</b>         |
|  | <b>Problem 5C:</b> Estimate the societal benefits of the JARC program.  | <b>Chapter 7; Section 7.5</b>         |

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<sup>4</sup> who may live in the city core and work in suburban locations<sup>5</sup> (PL 105-178,

<sup>4</sup> 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).

<sup>5</sup> Section 3067 of the Transportation Equity Act for the 21<sup>st</sup> 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

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1998). 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 2 B:** 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).

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**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

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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.

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**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.

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## 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<sup>6</sup>). 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)

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<sup>6</sup> The report titled “Job Access and Reverse Commute Program: Report to Congress” is available from the FTA website at [http://www.fta.dot.gov/funding/grants/grants\\_financing\\_7175.html](http://www.fta.dot.gov/funding/grants/grants_financing_7175.html).

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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 3.1: Areas and Types of Services Surveyed**

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

\* 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](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 ridesharing, 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 3.2 Comparison of Type of Services in the User Survey and JARC 2006.**

| Type              | From User Survey<br>Percent | From FTA Evaluation 2006<br>Percent |
|-------------------|-----------------------------|-------------------------------------|
| Fixed-route       | 52%                         | 44%                                 |
| Demand-response   | 39%                         | 39%                                 |
| Information-based | 9%                          | 8%                                  |

### 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

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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**

| Program Targeting Study (Chapter 4)     |  |
|---|--|
| 1)                                      | JARC User Survey   |
| 2)                                      | Census 2000 PUMS data on the 23 locations                            |
| 3)                                      | Census Transportation Planning Package 2000                          |
| Cost-Effectiveness Analysis (Chapter 6) |  |
| 1)                                      | JARC User Survey   |
| 2)                                      | Census 2000 PUMS data on the 23 locations                            |
| 3)                                      | Census Transportation Planning Package 2000                          |
| 4)                                      | National Transit Database 2002                                       |
| 5)                                      | Cost and Operations Questionnaire                                    |
| 6)                                      | FTA JARC Quarterly Reporting Database 2002                           |
| Cost-Benefit Analysis (Chapter 7)       |  |
| 1)                                      | Consumer Expenditure Survey (CEX) 2002                               |
| 2)                                      | National Longitudinal Survey of Youth (NLSY) 1979                    |
| 3)                                      | JARC User Survey 2002  |
| 4)                                      | Cost and Operations Questionnaire                                    |
| 5)                                      | FTA JARC Quarterly Reporting Database 2002                           |
| 6)                                      | Census 2000 PUMS data on the 23 locations                            |
| 7)                                      | Census Transportation Planning Package 2000                          |
| 8)                                      | Panel Study of Income Dynamics                                       |
| 9)                                      | Site-specific public assistance, unemployment benefit and other data |

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## CHAPTER 4: An Analysis of Program Targeting and Travel Behavior impacts

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

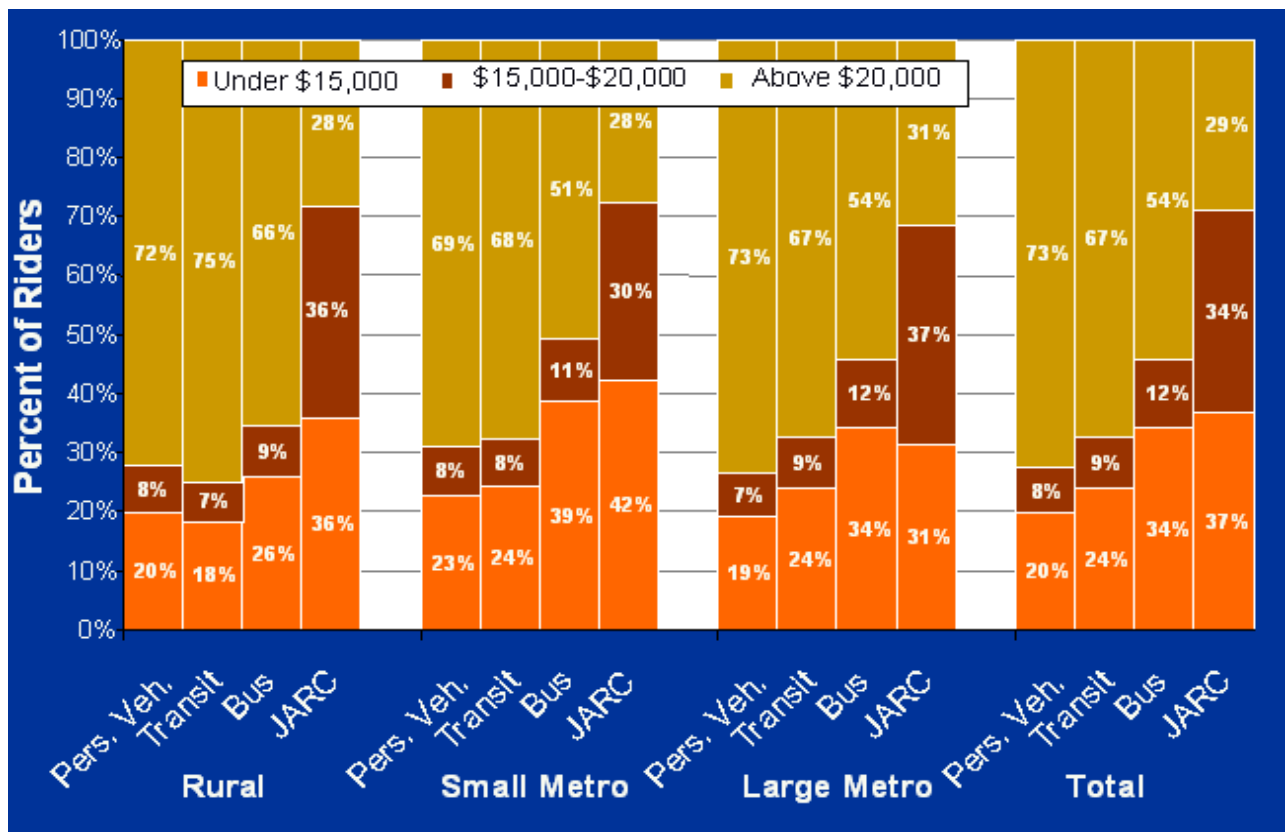
The JARC program was established to provide funds for transit services and information services and mobility managers in support of low-income workers and former public assistance clients' access to jobs. In order to ensure that program funds reached the target population, the FTA started by following 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 indicators 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.

Figure 4.1: Annual incomes of JARC service riders and general commuters in the same service area



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

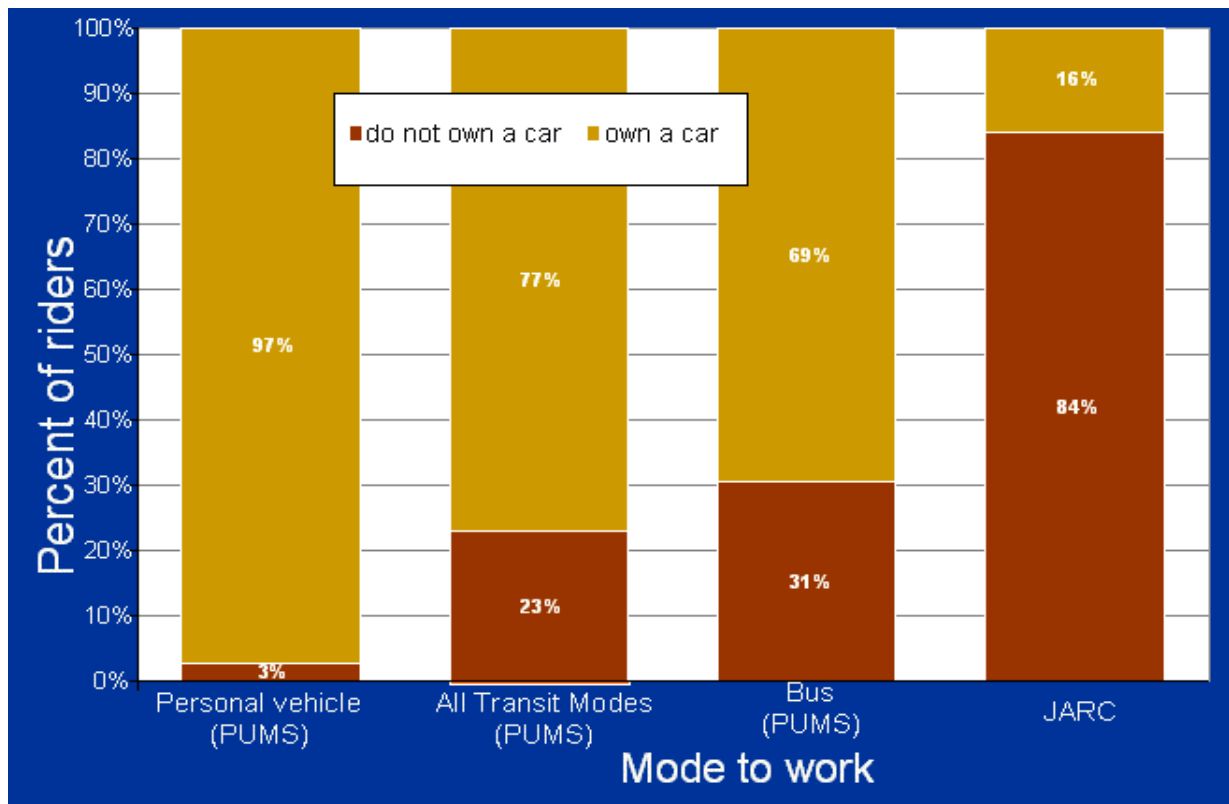
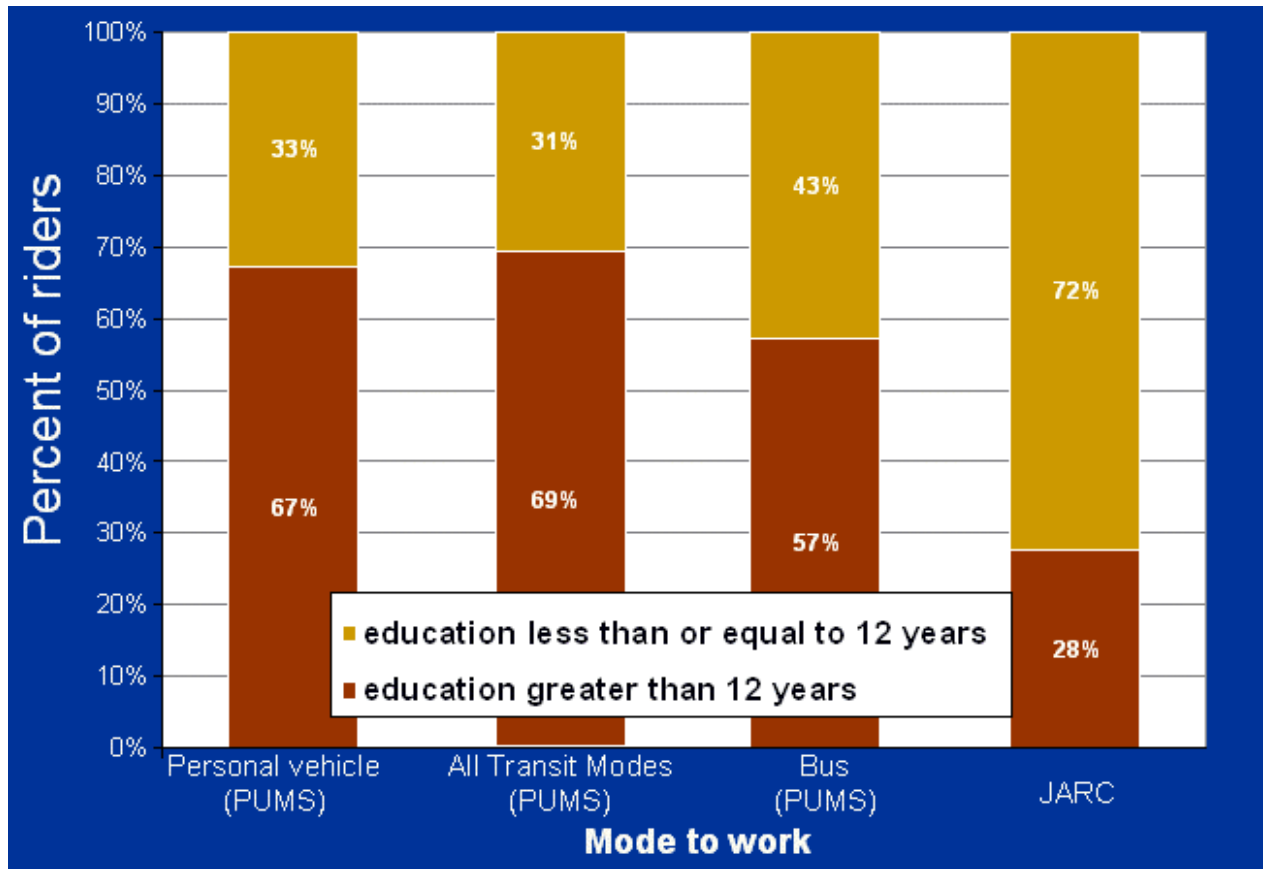


Figure 4.3: Educational attainment of JARC riders versus general commuters in the same service area



**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.

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**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**

| Variable  | Total | Fixed Route Services | Demand-responsive Services | Large Metro | Small Metro | Rural |
|---|-------|----------------------|----------------------------|-------------|-------------|-------|
| New workers in the labor force (did not work before)                              | 27.3% | 25.9%                | 31.5%                      | 21.9%       | 24.4%       | 35.7% |
| Existing workers earning more after using service                                 | 40.8% | 36.5%                | 54.1%                      | 47.6%       | 39.6%       | 34.7% |
| Workers accessing new destinations (new job locations after having switched jobs) | 12.0% | 14.9%                | 7.6%                       | 17.3%       | 7.3%        | 15.2% |
| Workers switching from other modes:   |       |                      |                            |             |             |       |
| From auto   | 14.2% | 12.6%                | 17.9%                      | 10.5%       | 12.4%       | 20.2% |
| From bus or train   | 23.6% | 18.9%                | 34.3%                      | 44.4%       | 18.0%       | 11.9% |
| From walking  | 17.0% | 22.2%                | 5.2%                       | 4.8%        | 28.1%       | 13.9% |
| From taxi   | 22.3% | 23.5%                | 19.4%                      | 30.7%       | 16.9%       | 21.6% |
| From rideshare  | 22.3% | 22.2%                | 22.2%                      | 9.9%        | 24.2%       | 31.3% |
| “Employment-supportive” trips   | 71.2% | 65.9%                | 84.0%                      | 91.2%       | 63.4%       | 61.7% |
| Work trips  | 62.6% | 61.9%                | 64.1%                      | 73.6%       | 73.6%       | 56.8% |

**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).

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**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).

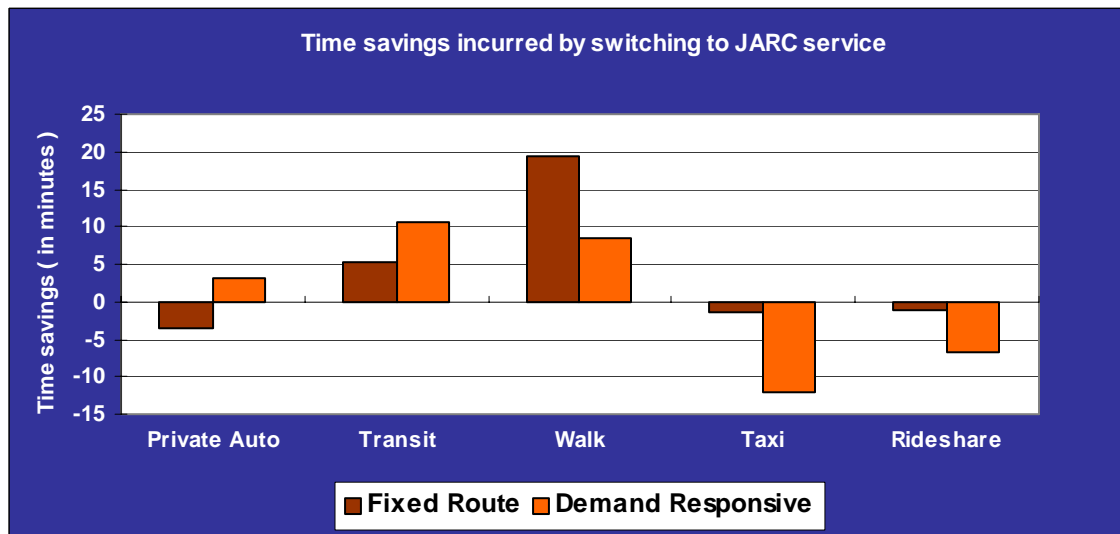
Riders also reported that JARC services were being used to satisfy a variety of social and economic trip purposes. Work trips, trips to educational centers, child-care centers, trips for job-seeking, interviewing or job-training activities may be defined as “employment-supportive” trips. We find that 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)



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

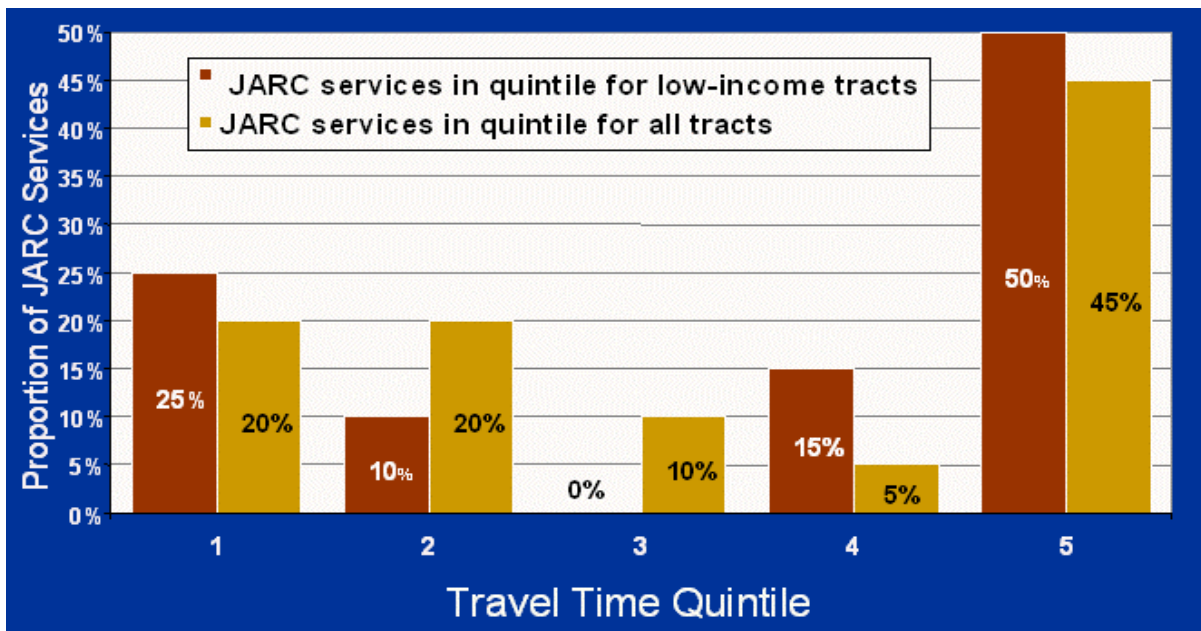
Our purpose in this section is to show how the travel times of JARC service riders compare with the travel times incurred by general commuters in the same region.

**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

proportion of sites fall in the last quintile of the distribution of travel times obtained from the Census. In fact, 50% of the JARC services have median travel times in the last two quintiles within their region (gray bars on the right). This means that a substantial number of services provide travel times that are indicative of longer trips. This fact underscores the importance of such services in light of the fact that many of the respondents indicated that the JARC service was very important for them to get to their destination, i.e. work.

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**

| Travel Time<br>(in minutes) | Work trips |                       | Work-Supportive Trips |                       | Non-Work Trips |                       |
|-----------------------------|------------|-----------------------|-----------------------|-----------------------|----------------|-----------------------|
|                             | Percent    | Cumulative<br>Percent | Percent               | Cumulative<br>Percent | Percent        | Cumulative<br>Percent |
| 0 to 5                      | 2.46       | 2.46                  | 3.69                  | 3.69                  | 9.84           | 9.84                  |
| 6 to 15                     | 25.12      | 27.59                 | 26.64                 | 30.33                 | 32.79          | 42.62                 |
| 16 to 30                    | 50.25      | 77.83                 | 48.77                 | 79.10                 | 40.98          | 83.61                 |
| 31 to 45                    | 15.27      | 93.10                 | 14.34                 | 93.44                 | 8.20           | 91.80                 |
| 46 to 60                    | 2.96       | 96.06                 | 2.87                  | 96.31                 | 6.56           | 98.36                 |
| > 60                        | 3.94       | 100.00                | 3.69                  | 100.00                | 1.64           | 100.00                |

**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**

| Difference from service area mean travel time (minutes) | (I)<br>Before Service |                    | (II)<br>After Service for Users who Previously Accessed the Same Destination |                    | (III)<br>After service for all Service Users |                    |
|---|-----------------------|--------------------|--|--------------------|--|--------------------|
|   | Percent               | Cumulative Percent | Percent  | Cumulative Percent | Percent                                      | Cumulative Percent |
| < regional mean by 16 or more                           | 13.64                 | 13.64              | 16.67  | 16.67              | 15.38  | 15.38              |
| 15 to 0 less than mean                                  | 30.11                 | 43.75              | 43.40  | 60.06              | 40.79  | 56.18              |
| 0 to 5 more than mean                                   | 10.80                 | 54.55              | 11.64  | 71.70              | 10.49  | 66.67              |
| 6 to 15 more than mean                                  | 15.91                 | 70.45              | 16.67  | 88.36              | 19.35  | 86.01              |
| 16 to 30 more than mean                                 | 10.23                 | 80.68              | 6.92   | 95.28              | 8.39   | 94.41              |
| 31 to 45 more than mean                                 | 12.78                 | 93.47              | 2.52   | 97.80              | 2.80   | 97.20              |
| 46 to 60 more than mean                                 | 2.27                  | 95.74              | 0.94   | 98.74              | 1.17   | 98.37              |
| > regional mean by 61 or more                           | 4.26                  | 100.00             | 1.26   | 100.00             | 1.63   | 100.00             |

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 (ie, 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

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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

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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 (Thakuria, 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.

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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 is 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

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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

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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

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## 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<sup>7</sup>. 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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<sup>7</sup> 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.

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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<sup>8</sup>).

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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<sup>8</sup> 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).

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much better in one county in California (Riverside County) than in another (Los Angeles County); the National Evaluation of Welfare-to-Work Strategies (NEWS) 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

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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 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 Michalopoulos, 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

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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 (Deweese, 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.

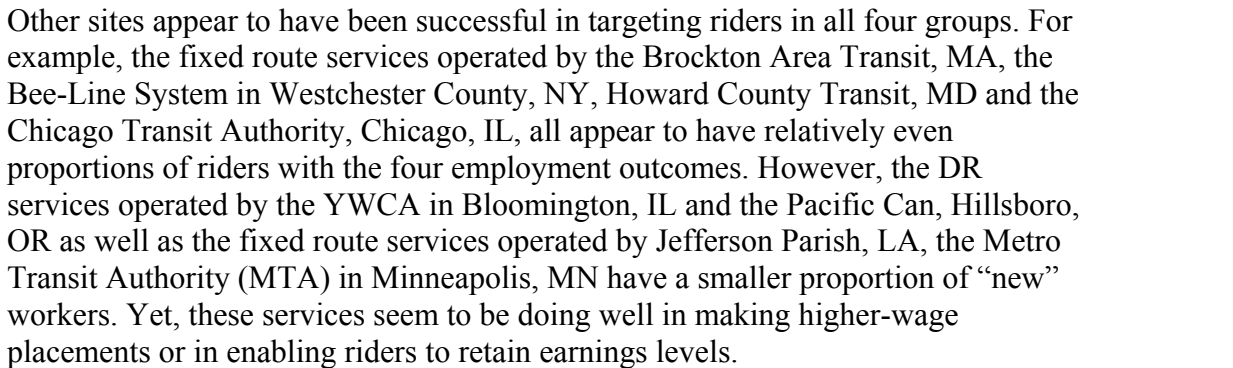
In contrast to this service are two fixed-route services operated by Change Inc., which provides two main adaptable fixed routes, a local route which operates 7am

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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<sup>9</sup> 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.

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<sup>9</sup> 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: [www.bls.gov/LAU](http://www.bls.gov/LAU)



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## 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).

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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).

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**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 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 (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.

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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.

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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.

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## 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:

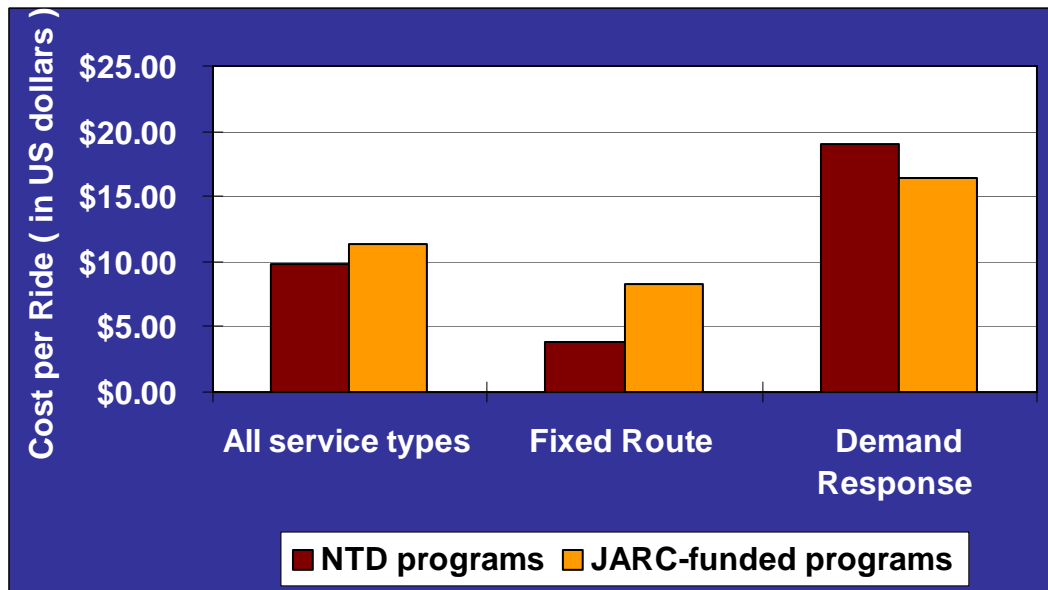
**Cost and Operations Survey:** Service costs were obtained during the site visits as well as from a Cost and Operations Survey, that was described in Chapter 3. This survey was administered by email and followed up with telephone reminders. The objective of the survey was to elicit information pertaining 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<sup>10</sup>.

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

<sup>10</sup> 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 (Thakuria *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

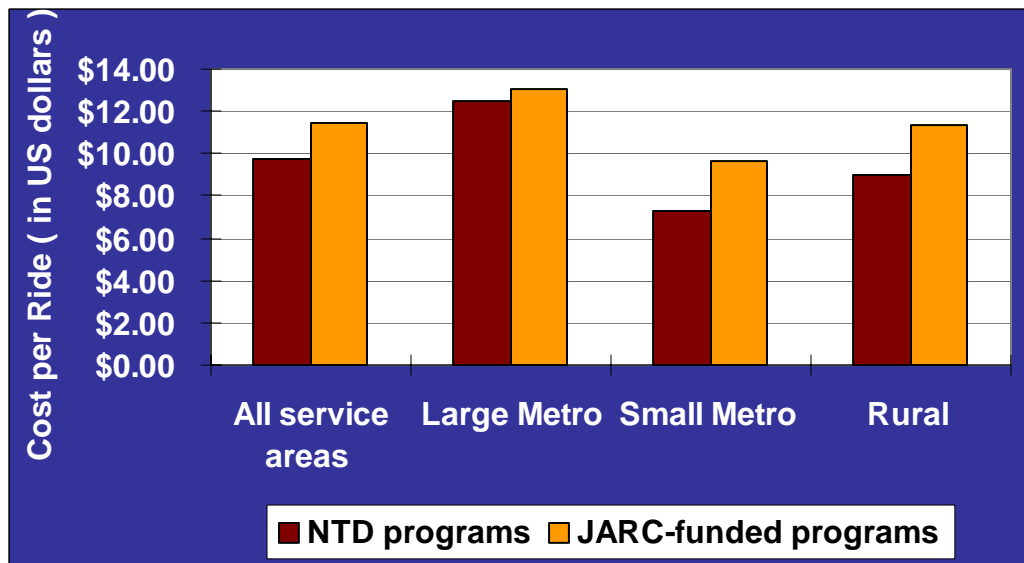


Figure 6.2 also shows the contrast between the JARC programs and the NTD programs in terms of the area of operation. The trends are similar. For the sites selected, both types of services are highest on a CPR basis for large urban areas, followed by rural areas and then by smaller urban areas. DR services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

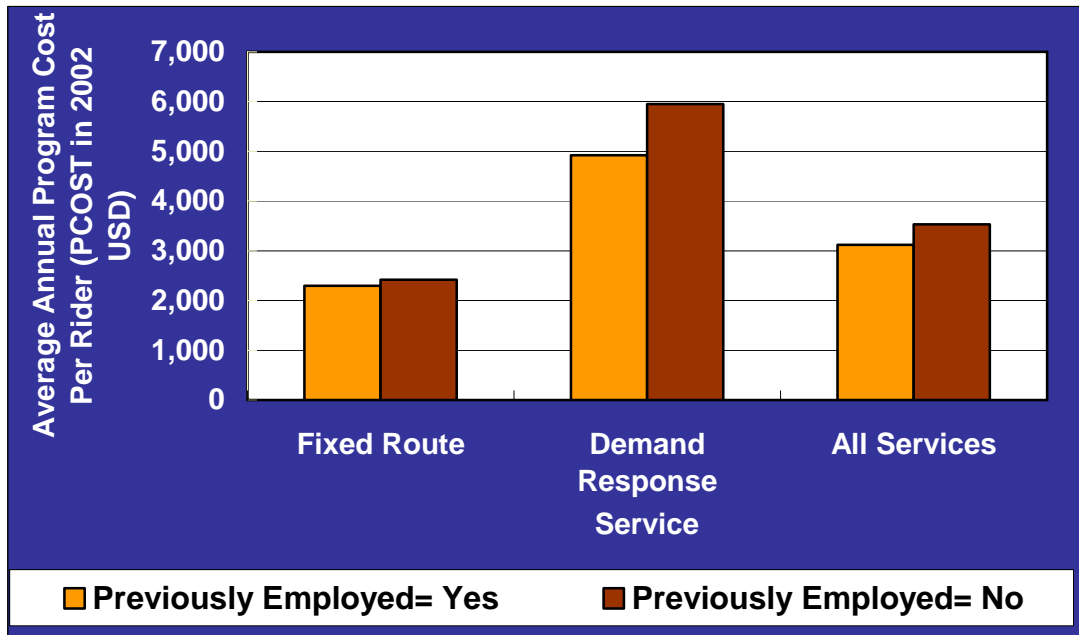


Figure 6.4: Mean Annual Program Cost Per Rider (PCOST) by Education Status of Rider and Service Type

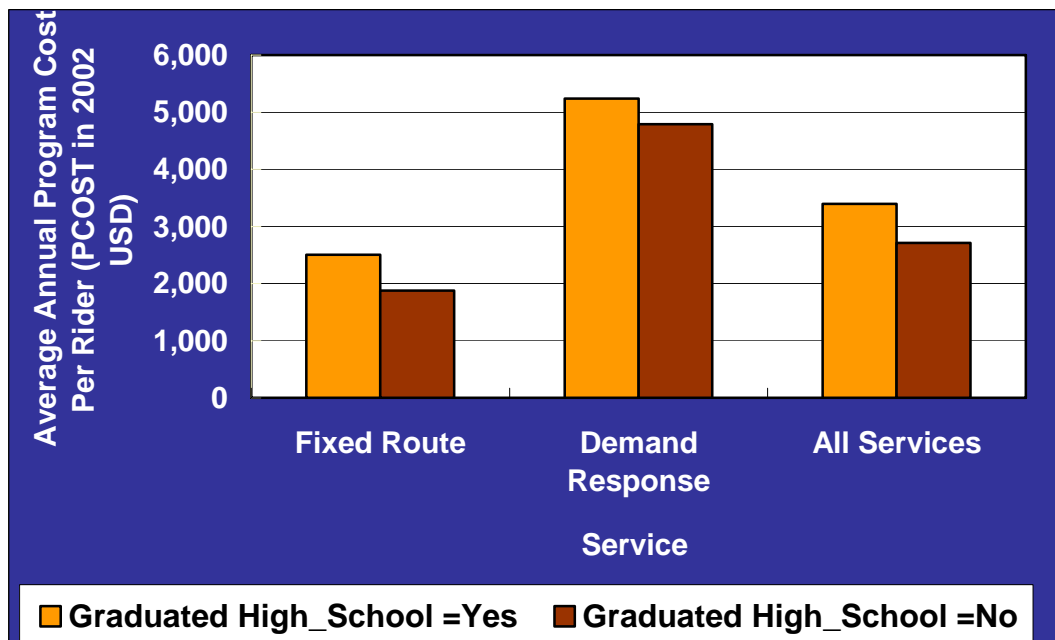


Figure 6.4 gives the Annual Program Cost Per Rider by educational status. According to the survey data, only 28% of the JARC respondents indicated that they had at least completed high school. By contrast, the PUMS data for these same regions indicates that

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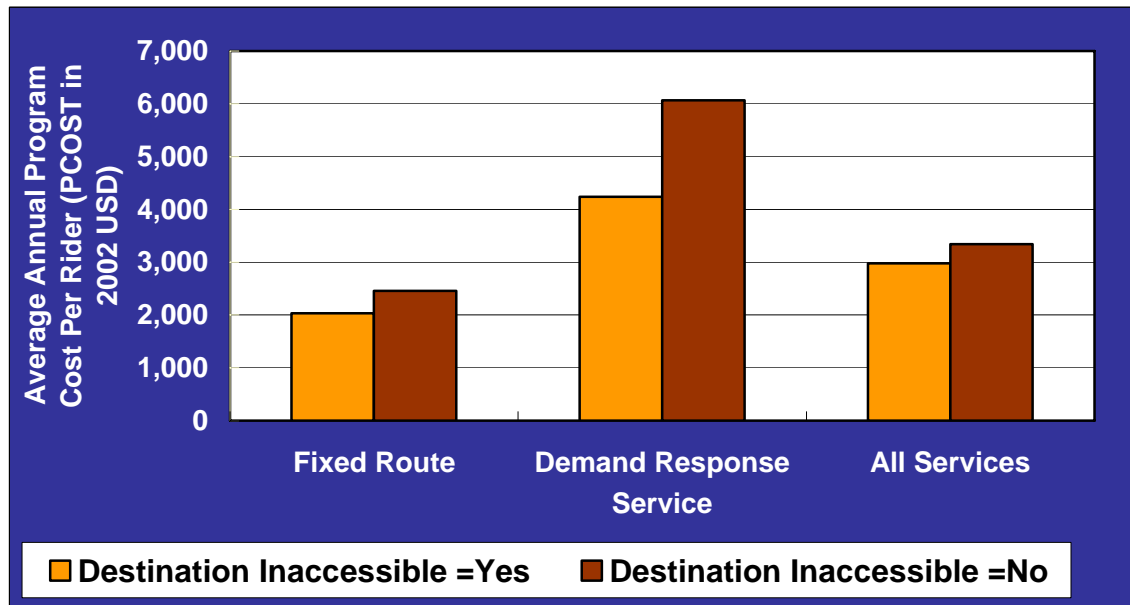
almost half of the bus riders and two-thirds of those using traditional transit (57% and 69% respectively) had completed at least 12 years of school. Many of the JARC services provide access to not just employment locations, but also to job training centers and other skill-enhancing centers.

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 (Thakuriah, *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).

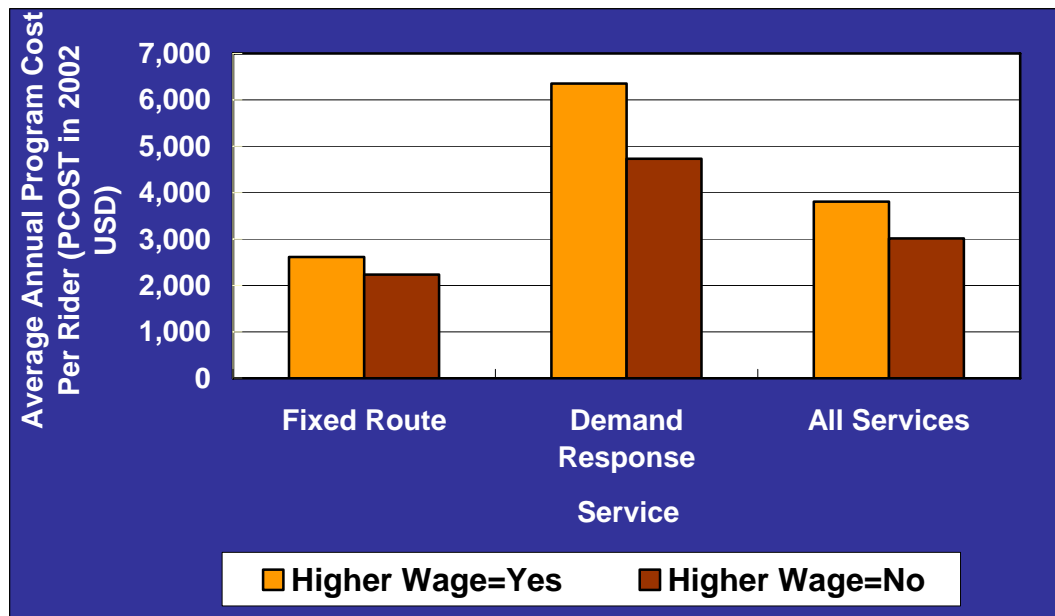
Figure 6.5: Mean Annual Program Cost Per Rider (PCOST) by Perceived Inaccessibility of Destination and Service Type



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.

Figure 6.6: Mean Annual Program Cost Per Rider (PCOST) by Wage Level at Job Destination and Service Type



#### 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**

| Nature of Trip                        |   | Potential Impacts   | JARC User Survey Data  |
|---------------------------------------|---|---|--|
| <b>Work Trips</b>                     |   |   |  |
| Subgroup 1                            | <b>New Workers in Labor Force:</b> Subgroup taking work trip to location to which rider did not go before because rider did not work before   | 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 | Duration of job; whether part-time or full-time, hours worked at job, categorical data on wages; travel time   |
| Subgroup 2                            | <b>Existing Workers Working in Jobs in New Locations:</b> Subgroup using JARC service for work trip to location to which rider did not go before because rider changed job location | A trip diverted from another work location; possibly changes in travel time, out-of-pocket transportation costs and annual wages earned   | 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  |
| Subgroup 3                            | <b>Existing Workers Working in Same Locations as Prior to using JARC Service:</b> Subgroup using JARC service for work trips to existing work location                              | Possibly changes in travel time and out-of-pocket transportation costs and also wages earned by shifting to another job start time  | 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 |
| <b>Employment-Related Trips</b>       |   |   |  |
| Subgroup 4                            | <b>Non-Workers in School or Job Training:</b> Subgroup using service for trips to school, education and employment training   | Deferred earnings and possibly new trips or changes in time or mode for existing trip   | Unemployed and looking for work, unemployed and not looking for work, prior mode if trip is to same location, travel time  |
| Subgroup 5                            | <b>Non-Workers Looking for Jobs:</b> Subgroup using JARC service for employment-seeking trips   | Deferred earnings and possibly new trips or changes in time or mode for existing trip   | Unemployed and looking for work, unemployed and not looking for work, prior mode if trip is to same location, travel time  |
| <b>Non-Work (Discretionary) Trips</b> |   |   |  |
| Subgroup 6                            | <b>Discretionary Users:</b> Subgroup using JARC service for trips to health care centers, social visits, shopping   | 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                               | Employed or unemployed individuals, prior mode if trip is to same location, travel time  |

**Table 6.2: Sociodemographic Information on Six Different Subgroups**

| Sub-group | Previous Employment Condition |                        |                            |                        | Percent car-owners | Gender |       | Previously on public assistance | Percent High School Graduate & Higher | Percent who rated service as very important | Percent unable to reach destination without service | Percent without license |
|-----------|-------------------------------|------------------------|----------------------------|------------------------|--------------------|--------|-------|---------------------------------|---------------------------------------|---|---|-------------------------|
|           | Did not work before           | Worked but earned less | Worked and earned the same | Worked and earned more |                    | Female | Male  |                                 |                                       |   |   |                         |
| 1         | 100.00                        | 0.00                   | 0.00                       | 0.00                   | 8.33               | 41.67  | 58.33 | 25.00                           | 75.0                                  | 84.00                                       | 82.00   | 70.42                   |
| 2         | 0.00                          | 45.71                  | 42.86                      | 11.43                  | 14.29              | 45.71  | 54.29 | 22.86                           | 74.0                                  | 85.29                                       | 67.24   | 60.00                   |
| 3         | 0.00                          | 41.62                  | 43.15                      | 15.23                  | 16.24              | 45.13  | 54.87 | 23.35                           | 78.86                                 | 81.63                                       | 68.93   | 64.40                   |
| 4         | 60.00                         | 0.00                   | 40.00*                     | 0.00                   | 11.11              | 31.58  | 68.42 | 44.44                           | 51.85                                 | 55.56                                       | 46.15   | 77.27                   |
| 5         | 33.33                         | 33.33*                 | 33.33*                     | 0.00                   | 29.41              | 40.00  | 60.00 | 58.82                           | 64.71                                 | 52.94                                       | 58.82   | 60.00                   |
| 6         | 27.27                         | 21.00                  | 29.09                      | 3.00                   | 20.49              | 45.54  | 54.46 | 28.69                           | 65.57                                 | 70.49                                       | 60.68   | 58.12                   |

\* Income from public assistance, job training stipends or unemployment benefits programs.

**Table 6.3: Travel and Program Characteristics of Subgroups**

| Subgroup | Average Cost Per Ride (\$) | Subsidy Per Trip | Travel Time (in Minutes) |
|----------|----------------------------|------------------|--------------------------|
| 1        | 8.44                       | 6.94             | 28.46                    |
| 2        | 5.19                       | 3.68             | 24.73                    |
| 3        | 9.26                       | 7.76             | 29.70                    |
| 4        | 13.38                      | 11.88            | 23.42                    |
| 5        | 14.23                      | 12.74            | 27.64                    |
| 6        | 8.62                       | 7.12             | 22.20                    |

**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.

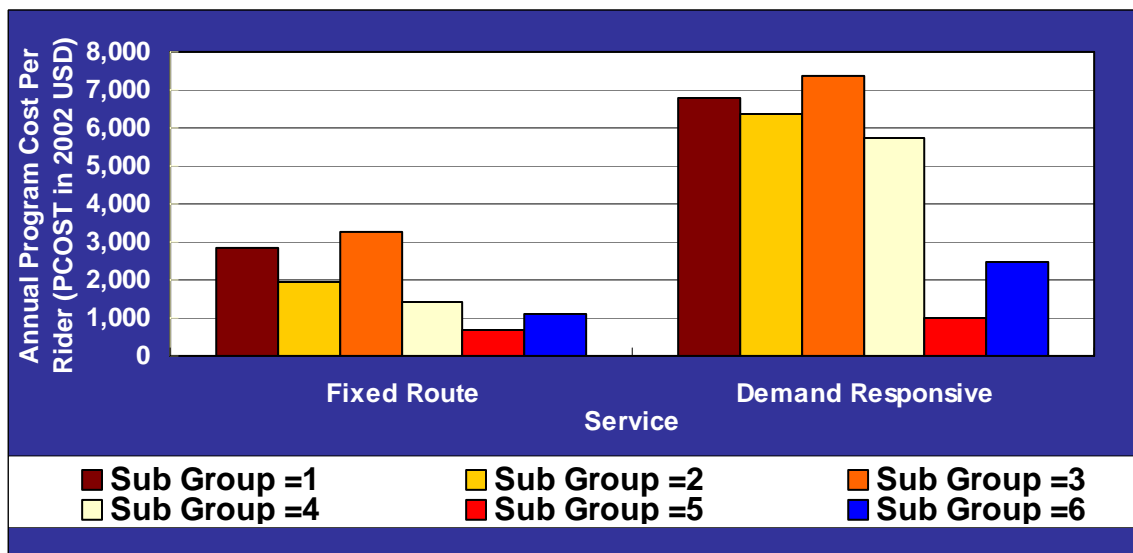
**User Subgroup 4:** Subgroup 4 users are non-workers who are currently enrolled in school or job-training programs. As Table 6.2 shows, 40 percent did not work before and reported no current wages while 60 percent of these non-workers reported that they are earning about the same as they were before 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.

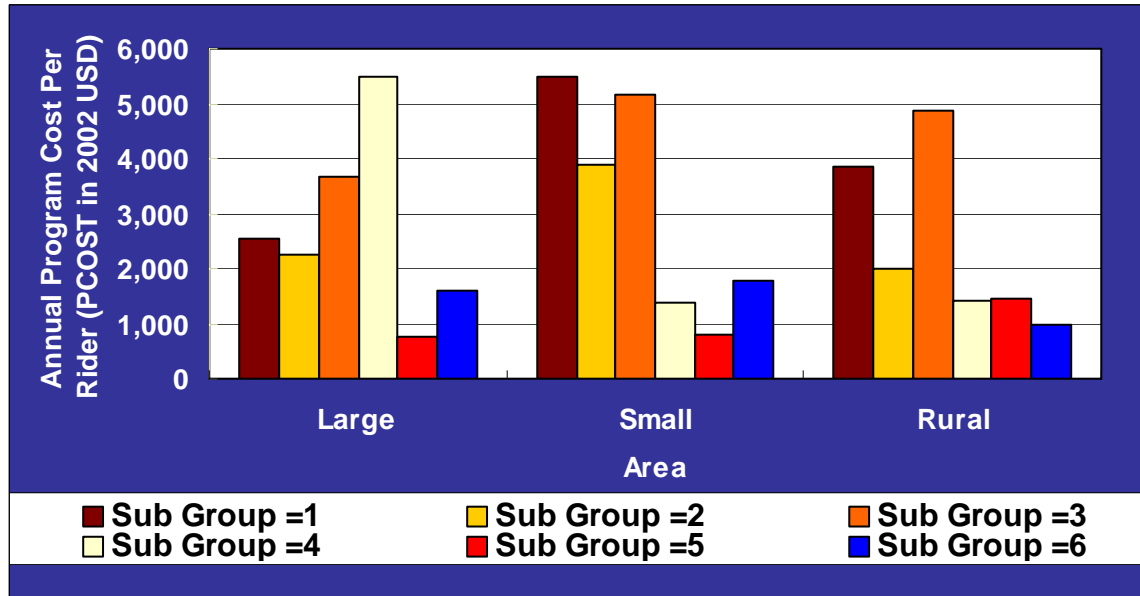
Figure 6.7: Mean Annual Program Cost Per Rider by Subgroup and Type of Service



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

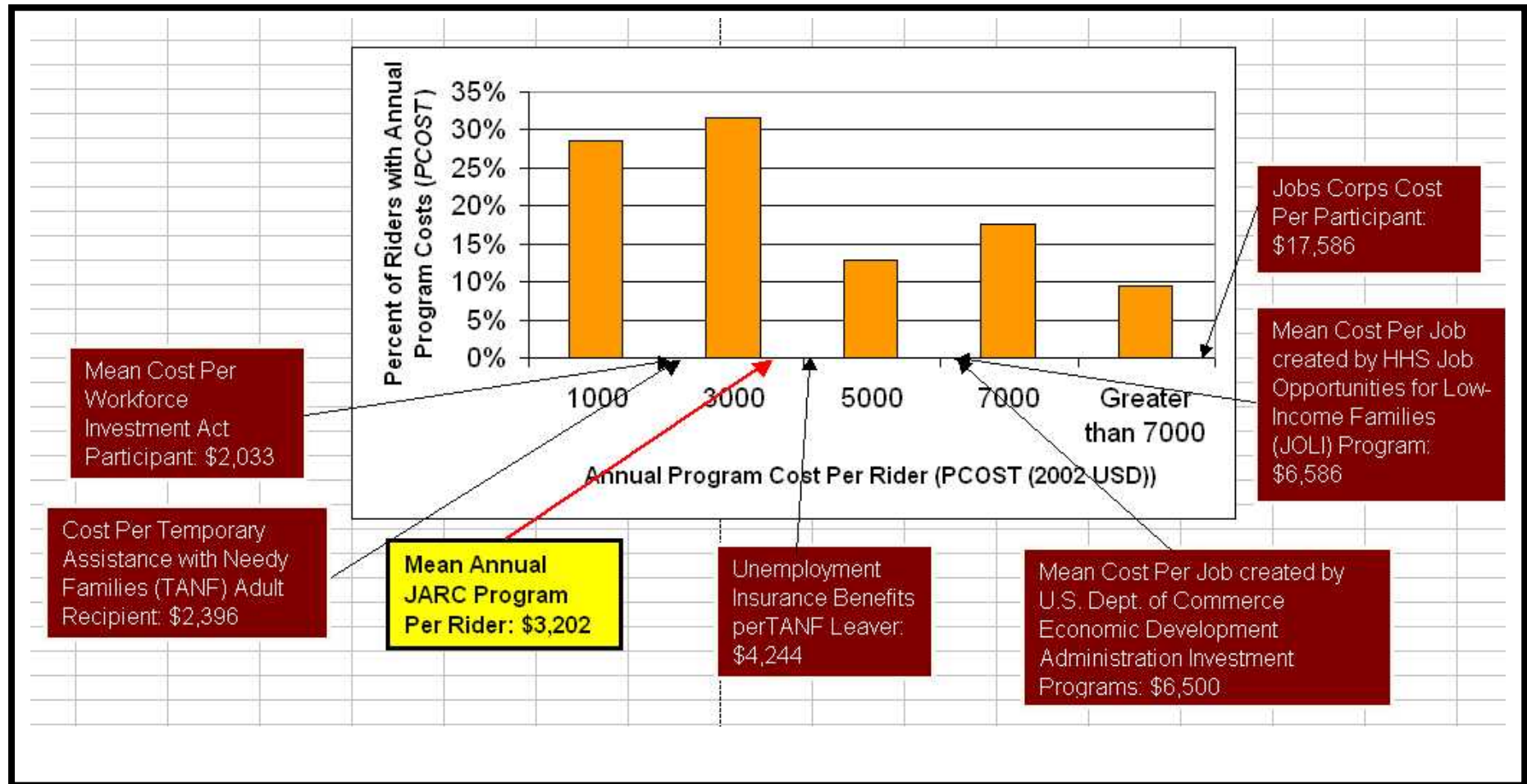


### 6.5 Comparison of JARC Program Costs with Costs of Non-Transportation Programs

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



**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)<sup>11</sup> 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<sup>12</sup> 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

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<sup>11</sup> Glasmeier, A. K. (2002). *Cost Per Job Associated with EDA Investments in Urban and Rural Areas*. Economic Development Administration, U.S. Department of Commerce.  
<http://www.eda.gov/Research/ResearchReports.xml>

<sup>12</sup> <http://www.acf.hhs.gov/programs/ocs/joli/index.html>

increases<sup>13</sup>. 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<sup>14</sup>. 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)<sup>15</sup>. 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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<sup>13</sup> Detailed information on the WIA Adult Employment and Training Program assessments can be found in <http://www.whitehouse.gov/omb/expectmore/detail/10003900.2005.html>

<sup>14</sup> Detailed information on the TANF program performance measures can be found in <http://www.whitehouse.gov/omb/expectmore/detail/10003502.2005.html>

<sup>15</sup> Rangarajan, A. and C. Razafindrakoto. (2004). *Unemployment Insurance as a Potential Safety Net for TANF Leavers: Evidence From Five States*. Submitted to U.S. Department of Health and Human Services a Office of the Assistant Secretary for Planning and Evaluation. Mathematica Policy Research, Inc. <http://aspe.hhs.gov/HSP/wtw-grants-eval98/ui04/index.htm>

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<sup>16</sup>.

**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 *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.

<sup>16</sup> 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.

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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.

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## 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 Job Corps<sup>17</sup> (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:

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<sup>17</sup> 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**

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

### 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

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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

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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

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after benefits and before and after costs is an illustrative measure of benefits that is estimated. Other summary measures are described in Section -.

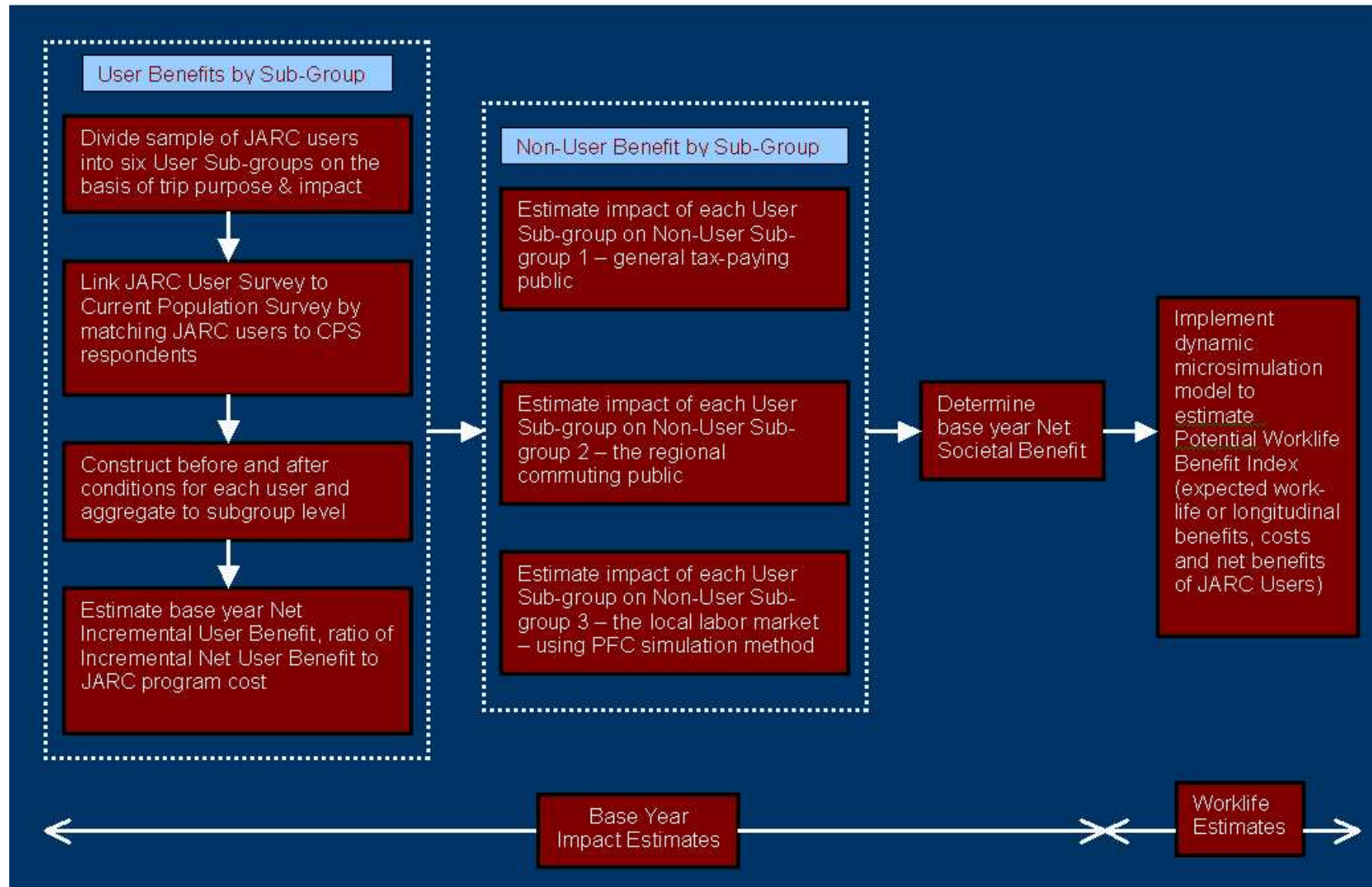
The JARC User Survey was a 2-page survey that could be completed in 10 minutes. Needless to say, this is not enough to capture a wide-variety of data that are necessary to fully estimate impacts. For this reason, we use data matching as a solution to incorporating a wide variety of information into the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



**Table 7.2: Evaluation Designs and Construction of “Base” Cases**

| Estimate               | Evaluation Design  | Description   | Illustrative Measure of User Net Benefit   | Data Source   |
|------------------------|--|---|--|---|
| Base year estimates    | Before and after comparison                                | Base case or counterfactual is the condition of the rider before they used the transit service  | <ul style="list-style-type: none"> <li>- 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)</li> <li>- Net user benefit at base year</li> <li>- Incremental net user benefit to JARC annual investment per user</li> </ul> | 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 | <ul style="list-style-type: none"> <li>- Incremental Net Benefit: (Difference in benefit between treatment and control group) – (Difference in costs between treatment and control group)</li> </ul>   | 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 ( $PCOST$ ) expended annually on each service user:

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

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, ie, “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”<sup>18</sup>. 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 ( $NoUB_{T,i}$ ) and User Costs ( $NoUC_{T,i}$ ) for times periods  $T = t, t-\delta$  and for impact

<sup>18</sup> The concept of leisure time and the details of estimation in the context of the valuation of user benefits of JARC services are given in Appendix -.

categories  $I=1,2,3\dots$  to estimate  $\Delta NNoUB_t$ , or Incremental Net Non-User benefit as follows:

$$\Delta NNoUB_t = \left( \sum_{i=1}^I NoUB_{t,i} - \sum_{i=1}^I NoUB_{t-\delta,i} \right) - \left( \sum_{i=1}^I NoUC_{t,i} - \sum_{i=1}^I NoUC_{t-\delta,i} \right)$$

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

Average Non-User Benefit to Program Cost Ratio ( $ANoUBC_t$ ): 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:

$$ANoUBC_t = \frac{\left( \sum_{m=1}^M \Delta NNoUB_{t,m} / PCOST_{t,m} \right)}{M}$$

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 benefits that he or she generates to others in society, related to program investments, ie, “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 ( $\Delta NSB_t$ ): The  $\Delta NSB_t$  is simply the sum of Incremental Net User Benefits and Incremental Net Non-user Benefits:

$$\Delta NSB_t = \Delta NUB_t + \Delta NNoUB_t$$

Average of Societal Benefit to Cost Ratio ( $ASBC_t$ ): 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:

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

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 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

| Subgroup 1 |  |   |   |
|------------|--|---|---|
| Scenario   | User   | Non-User  | Society   |
| I          | <i>Change in Net User Incomes:</i><br>Scenario I Incremental Net User Benefits ( $\Delta NUB_i$ )<br>= {Net Annual Income – Annualized Generalized cost of trip} – {Annual Welfare or Unemployment Benefits Earnings <sup>19</sup> }<br>= {(Gross Annual Income – Tax Payments + Fringe Benefits) <sup>20</sup> – Monetized Value of Travel Time <sup>21</sup> } – {Annual Welfare or Unemployment Benefits Earnings}                      | <i>Change in net benefits to general and regional non-users:</i><br>Scenario I Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ )<br>= {Tax Revenues from User + Transfer Payments Diverted from user + Monetized Value of Societal Cost of Prior Transportation Saved}  | <i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users:</i><br>Scenario I Incremental Net Societal Benefit ( $\Delta NSB_i$ )<br>= Scenario I Incremental Net User Benefits ( $\Delta NUB_i$ ) + Scenario I Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ )                               |
| II         | <i>Change in Net User Surplus:</i><br>Scenario II Incremental Net User Benefits ( $\Delta NUB_i$ )<br>= {Net Annual Income – Annualized Generalized cost of trip} – {Annual Welfare or Unemployment Benefits Earnings + Monetized Value of Leisure Time}<br>= {(Gross Annual Income – Tax Payments + Fringe Benefits) – (+ Monetized Value of Travel Time)} – {(Annual Welfare Earnings + Monetized Value of Leisure Time) <sup>22</sup> } | <i>Change in net benefits to general and regional non-users:</i><br>Scenario II Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ )<br>= {Tax Revenues from User + Transfer Payments Diverted from user + Monetized Value of Societal Cost of Prior Transportation Saved}   | <i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users:</i><br>Scenario II Incremental Net Societal Benefit ( $\Delta NSB_i$ )<br>= Scenario II Incremental Net User Benefits ( $\Delta NUB_i$ ) + Scenario II Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ )                            |
| III        | <i>Change in Net User Surplus:</i><br>Scenario III Incremental Net User Benefits ( $\Delta NUB_i$ )<br>= {Net Annual Income – Annualized Generalized cost of current trip} – {Annual Welfare or Unemployment Benefits Earnings + Monetized Value of Leisure Time}<br>= {(Gross Annual Income – Tax Payments + Fringe Benefits) – (+ Monetized Value of Travel Time)} – {(Annual Welfare Earnings + Monetized Value of Leisure Time)}       | <i>Change in net benefits to general and regional non-users as well as to local labor markets:</i><br>Scenario III Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ )<br>= {Tax Revenues from User + Transfer Payments Diverted from user + Monetized Value of Societal Cost of Prior Transportation Saved} + {Labor Market Impact due to User <sup>23</sup> } | <i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users and Local Labor Markets:</i><br>Scenario III Incremental Net Societal Benefit ( $\Delta NSB_i$ )<br>= Scenario III Incremental Net User Benefits ( $\Delta NUB_i$ ) + Scenario III Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ ) |

<sup>19</sup> 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.

<sup>20</sup> 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”

<sup>21</sup> Taken to be 60% of wage rate.

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

<sup>23</sup> Details on the calculation of the labor market impacts due to the user is given in Appendix -.

| Subgroups 2 and 3 |   |   |  |
|-------------------|---|---|--|
| Scenario          | User  | Non-User  | Society  |
| I & II            | <p><i>Change in Net User Incomes:</i></p> <p>Scenario I Incremental Net User Benefits (<math>\Delta NUB_t</math>)</p> <p>= {Net Annual Income – Annualized Generalized cost of current trip} - {Prior Annual Income -Annualized Generalized cost of prior trip} = {(Gross Annual Income – Tax Payments + Fringe Benefits) – (+ Monetized Value of Travel Time)} - {(Prior Gross Annual Income – Tax + Fringe) - (Annual Expenditures on Previous Mode of Transportation<sup>24</sup> + Monetized Value of Travel Time)}</p> | <p><i>Change in net benefits to general and regional non-users:</i></p> <p>Scenario I Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p> <p>= {Tax Revenues from User + Monetized Value of Societal Cost of Prior Transportation Mode<sup>25</sup>}</p>   | <p><i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users:</i></p> <p>Scenario I Incremental Net Societal Benefit (<math>\Delta NSB_t</math>)</p> <p>= Scenario I Incremental Net User Benefits (<math>\Delta NUB_t</math>) + Scenario I Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p>                        |
| III               | <p><i>Change in Net User Surplus:</i></p> <p>Scenario III Incremental Net User Benefits (<math>\Delta NUB_t</math>)</p> <p>= {Net Annual Income} - {Prior Annual Income -Annualized Generalized cost of prior trip}</p>   | <p><i>Change in net benefits to general and regional non-users as well as to local labor markets:</i></p> <p>Scenario III Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>) = {Tax Revenues from User + Monetized Value of Societal Cost of Prior Transportation Mode} - {Labor Market Impact due to User}</p> | <p><i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users and Local Labor Markets:</i></p> <p>Scenario III Incremental Net Societal Benefit (<math>\Delta NSB_t</math>) = Scenario III Incremental Net User Benefits (<math>\Delta NUB_t</math>) + Scenario III Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p> |

<sup>24</sup> Annual expenditures on modes of transportation previously used:

- 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;
- For transit, [*site-specific fares X estimated annual number of round trips*] where the site-specific fare data were collected during the site visits;
- 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/controller/reports/Taxi\\_0806.pdf](http://www.sfgov.org/site/uploadedfiles/controller/reports/Taxi_0806.pdf)
- For non-motorized modes, the out-of-pocket costs are assumed to be \$0.

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

- 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> which summarizes these costs); these costs are assumed to be \$0.329 per mile.
- 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).
- For non-motorized modes and public transit previously used, the societal cost is set at \$0.

| Subgroups 4 and 5    |   |  |  |
|----------------------|---|--|--|
| Scenario             | User  | Non-User   | Society  |
| I,<br>II<br>&<br>III | <p><i>Change in Net User Incomes:</i></p> <p>Scenario I Incremental Net User Benefits (<math>\Delta NUB_t</math>)</p> <p>= {Annualized Generalized cost of current trip}</p> <p>- {Annualized Generalized cost of prior trip to same destination or trip purpose}</p> <p>= {( Monetized Value of Travel Time)} - { (Annual Expenditures on Previous Mode of Transportation + Monetized Value of Travel Time)}</p> | <p><i>Change in net benefits to general and regional non-users:</i></p> <p>Scenario I Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p> <p>= {Monetized Value of Societal Cost of Prior Transportation Mode}</p>  | <p><i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users:</i></p> <p>Scenario I Incremental Net Societal Benefit (<math>\Delta NSB_t</math>)</p> <p>= Scenario I Incremental Net User Benefits (<math>\Delta NUB_t</math>)</p> <p>+ Scenario I Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p> |
| Subgroups 6          |   |  |  |
| I,<br>II<br>&<br>III | <p><i>Change in Net User Incomes:</i></p> <p>Scenario I Incremental Net User Benefits (<math>\Delta NUB_t</math>)</p> <p>= {Annualized Generalized cost of current trip}</p> <p>- {Annualized Generalized cost of prior trip to same destination or trip purpose}</p> <p>= {( Monetized Value of Travel Time)} - { (Annual Expenditures on Previous Mode of Transportation + Monetized Value of Travel Time)}</p> | <p><i>Change in net benefits to general and regional non-users:</i></p> <p>Scenario I Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p> <p>= {Monetized Value of Societal Cost of Prior Transportation Mode + Sales Tax Generated for Shopping Trips at New Destinations}</p> | <p><i>Change in Net User Incomes and Net Benefits to General and Regional Non-Users:</i></p> <p>Scenario I Incremental Net Societal Benefit (<math>\Delta NSB_t</math>)</p> <p>= Scenario I Incremental Net User Benefits (<math>\Delta NUB_t</math>)</p> <p>+ Scenario I Incremental Net Non-User Benefit (<math>\Delta NNoUB_t</math>)</p> |

## 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**

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

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)

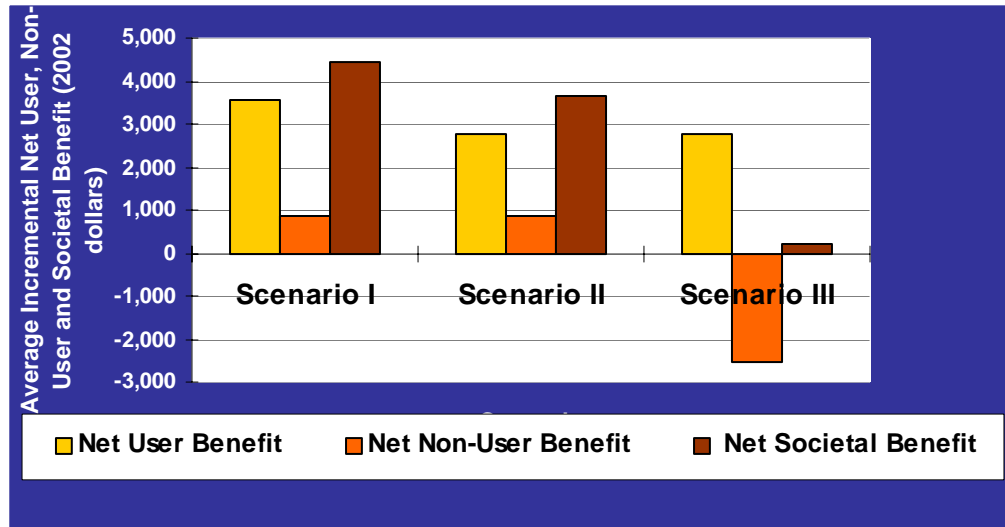


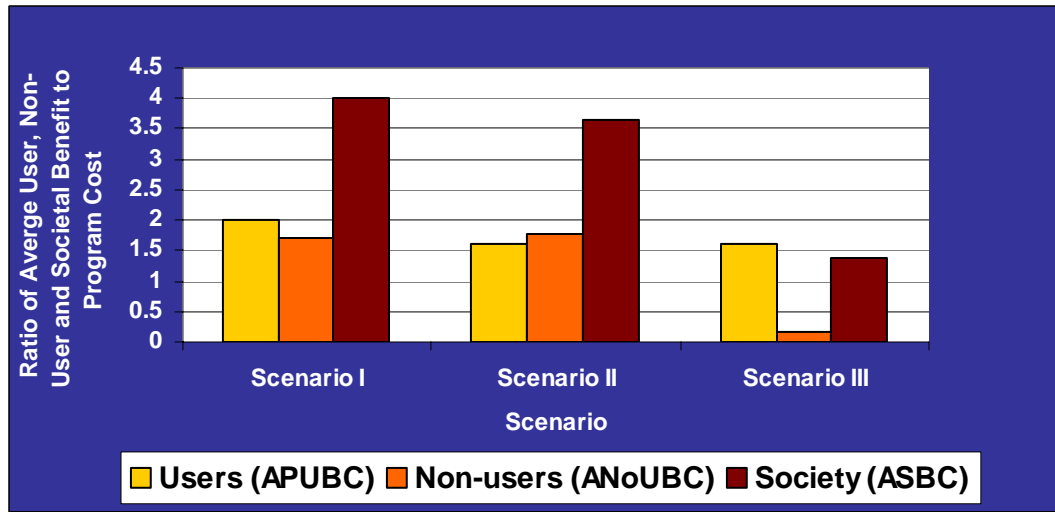
Figure 7.2 shows that the non-user benefits generated by each JARC user are positive on the average for Scenarios I and II (ie, when impacts are considered only on the general tax-paying public and the regional traveling public). These are estimated to be an average of \$880 per JARC user for the base 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 (ie, 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\*



\* 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 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.

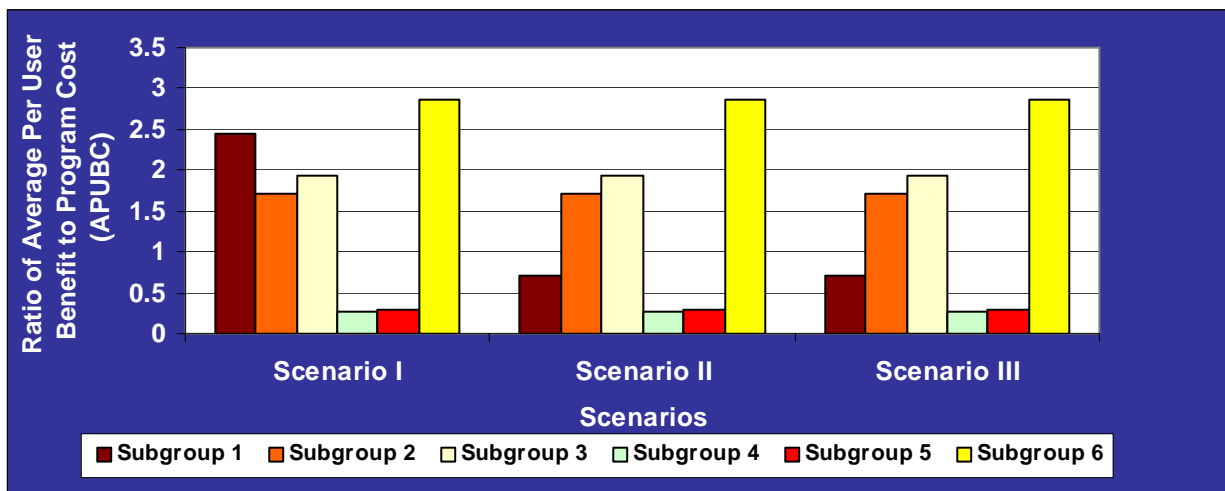
The returns to society are the greatest under Scenario I, at close to \$4 for every dollar of JARC investment. Under Scenario II, the returns reduce to \$3.63. When both opportunity costs of user's time (ie, monetized value of leisure time) and local labor markets impacts are

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  $APUBC_i$  index for the six subgroups. Because of the way in which Incremental Net User Benefit ( $\Delta NUB$ )'s are defined, the  $APUBC_i$  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  $APUBC_i$  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

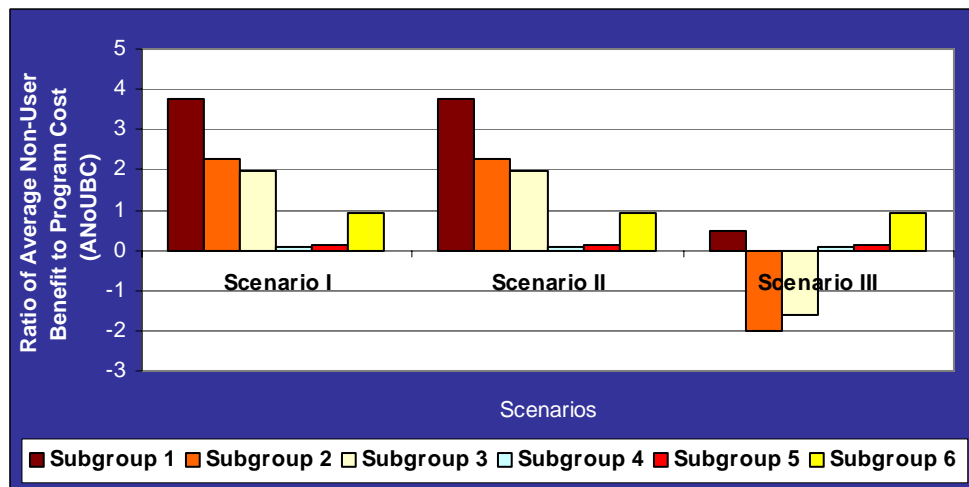
overall, with close to 50 percent at less than 25 years of age. Subgroup 5 makes infrequent use of the service, resulting in an average annual *PCOST* value of about \$900. However, their base year benefits are also very low (at about \$140 per year). These facts deflate their overall *APUBC<sub>i</sub>* 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<sub>i</sub>*) 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<sub>i</sub>*) by Subgroup



**Table 7.5: Breakdown of Base Year Non-User Net Benefits**

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

### 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**

| Measure   | Type of Service   | Scenario I | Scenario II | Scenario III |
|---|-------------------|------------|-------------|--------------|
| Users   |                   |            |             |              |
| Average Incremental Net User Benefit ( $\Delta NUB_t$ )       | Fixed Route       | 3,714.68   | 2,928.08    | 2,928.08     |
|   | Demand Responsive | 3,132.70   | 2,350.34    | 2,350.34     |
| Average Net User Benefit to Program ( $APUBC_t$ )             | Fixed Route       | 2.55       | 2.05        | 2.05         |
|   | Demand Responsive | 0.71       | 0.58        | 0.58         |
| Non-Users   |                   |            |             |              |
| Average Incremental Net Non-User Benefit ( $\Delta NNoUB_t$ ) | Fixed Route       | 2,003.51   | 2,003.51    | -2,294.62    |
|   | Demand Responsive | -1,510.83  | -1,510.83   | -3,104.16    |
| Average Non-User Benefit to Program Cost Ratio ( $ANoUBC_t$ ) | Fixed Route       | 2.38       | 2.38        | 0.21         |
|   | Demand Responsive | 0.52       | 0.52        | 0.10         |
| Society   |                   |            |             |              |
| Average Incremental Net Societal Benefit ( $\Delta NSB_t$ )   | Fixed Route       | 5,725.25   | 4,913.04    | -1,733.19    |
|   | Demand Responsive | 1,701.73   | 919.37      | -2,421.47    |
| Average Societal Benefit to Cost Ratio ( $ASBC_t$ )           | Fixed Route       | 5.21       | 4.72        | 1.67         |
|   | Demand Responsive | 1.24       | 1.12        | 0.69         |

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**

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

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 ( $APUBC_i$ ) 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  $\Delta NUB_i$  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**

| Measure   | Gender | Scenario I | Scenario II | Scenario III |
|---|--------|------------|-------------|--------------|
| <b>Users</b>  |        |            |             |              |
| Average Incremental Net User Benefit ( $\Delta NUB_i$ )       | Male   | 3,877.42   | 3,017.53    | 3,017.53     |
|   | Female | 3,271.59   | 2,523.35    | 2,523.35     |
| Average Net User Benefit to Program ( $APUBC_i$ )             | Male   | 2.21       | 2.21        | 1.73         |
|   | Female | 1.64       | 1.33        | 1.33         |
| <b>Non-Users</b>  |        |            |             |              |
| Average Incremental Net Non-User Benefit ( $\Delta NNoUB_i$ ) | Male   | 1,531.41   | 1,531.41    | -2,489.19    |
|   | Female | 369.17     | 369.17      | -2,721.35    |
| Average Non-User Benefit to Program Cost Ratio ( $ANoUBC_i$ ) | Male   | 2.13       | 2.13        | 0.21         |
|   | Female | 1.52       | 1.52        | 0.11         |
| <b>Society</b>  |        |            |             |              |
| Average Incremental Net Societal Benefit ( $\Delta NSB_i$ )   | Male   | 5,613.54   | 4,737.72    | -1,756.41    |
|   | Female | 3,551.54   | 2,781.45    | -2,226.49    |
| Average Societal Benefit to Cost Ratio ( $ASBC_i$ )           | Male   | 4.61       | 4.14        | 1.46         |
|   | Female | 3.30       | 2.99        | 0.99         |

### 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**

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

### 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 or shifts. This, in turn, can change the way transportation can facilitate improvements in economic outcomes. Therefore, longitudinal

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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.

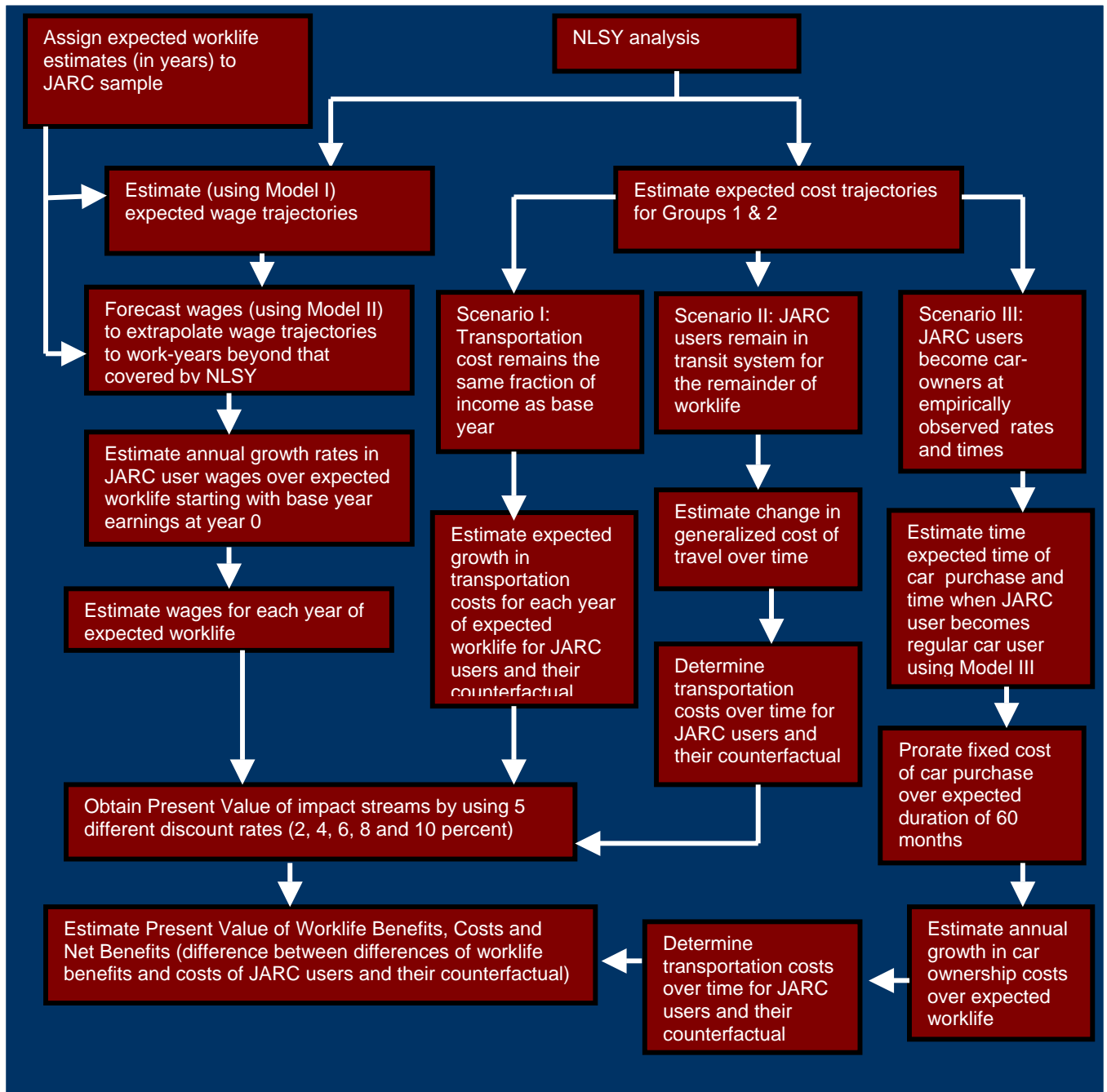
Section 7.8 presents base year estimates of net benefits, benefits and costs under different scenarios. For the purpose of simplicity, we present here only the results of Scenario II, the scenario with the leisure time estimates, for the current exercise. Longitudinal estimates based on the other base 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)<sup>26</sup>. 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.

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<sup>26</sup> Bureau of Labor Statistics (1986). *Worklife Estimates: Effects of Race and Education*. Bulletin 2254.

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



**Table 7.10: Expected Worklife and Survey**

| Age Category | Expted Worklife for Males (years) | Expted Worklife for Females (years) | Percent of Survey Respondents | Percent of Subgroup 1 Survey Riders | Percent of Subgroup 2 Survey Riders | Percent of Subgroup 3 Survey Riders | Percent of Subgroup 4 Survey Riders | Percent of Subgroup 5 Survey Riders | Percent of Subgroup 6 Survey Riders |
|--------------|-----------------------------------|-------------------------------------|-------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 16-19        | 39                                | 29                                  | 15.25                         | 16.18                               | 11.76                               | 8.54                                | 40.00                               | 21.43                               | 21.69                               |
| 20-24        | 37                                | 27                                  | 19.75                         | 25.00                               | 32.35                               | 15.24                               | 40.00                               | 28.57                               | 12.05                               |
| 25-29        | 33                                | 24                                  | 13.75                         | 13.24                               | 14.71                               | 9.76                                | 15.00                               | 35.71                               | 13.25                               |
| 30-34        | 29                                | 21                                  | 9.25                          | 5.88                                | 17.65                               | 14.63                               | 0.00                                | 0.00                                | 3.61                                |
| 35-39        | 25                                | 18                                  | 9.00                          | 14.71                               | 5.88                                | 10.37                               | 5.00                                | 0.00                                | 7.23                                |
| 40-44        | 20                                | 14                                  | 9.00                          | 10.29                               | 2.94                                | 11.59                               | 0.00                                | 0.00                                | 10.84                               |
| 45-49        | 16                                | 11                                  | 9.00                          | 8.82                                | 2.94                                | 11.59                               | 0.00                                | 7.14                                | 9.64                                |
| 50-54        | 12                                | 8                                   | 7.25                          | 4.41                                | 8.82                                | 8.54                                | 0.00                                | 7.14                                | 8.43                                |
| 55-59        | 8                                 | 5                                   | 4.00                          | 1.47                                | 2.94                                | 5.49                                | 0.00                                | 0.00                                | 6.02                                |
| 60-64        | 4                                 | 3                                   | 2.50                          | 0.00                                | 0.00                                | 3.66                                | 0.00                                | 0.00                                | 4.82                                |
| 65-69        | 2                                 | 2                                   | 0.50                          | 0.00                                | 0.00                                | 0.00                                | 0.00                                | 0.00                                | 1.20                                |
| 70-74        | 1                                 | 1                                   | 0.50                          | 0.00                                | 0.00                                | 0.61                                | 0.00                                | 0.00                                | 1.20                                |
| 75+          | 0                                 | 0                                   | 0.50                          | 0.00                                | 0.00                                | 0.00                                | 0.00                                | 0.00                                | 0.00                                |

### 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<sup>27</sup>, 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

<sup>27</sup> 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).

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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”, ie 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)<sup>28</sup> 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)<sup>29</sup> 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)<sup>30</sup> conservatively assumed that an extra \$400 in Head Start funding raises lifetime earnings by 2 percent per child, which Krueger (2003)<sup>31</sup> shows is worth at least \$15,000 in present value using a 3 percent 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

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<sup>28</sup> McConnell, S. and S. Glazerman (2001). *National Job Corps Study: the Benefits and Costs of Job Corps*. For Employment and Training Administration (DOL), Washington, D.C. Office of Policy and Research. Available from <http://wdr.doleta.gov/opr/fulltext/01-jcbenefit.pdf>

<sup>29</sup> Rice, D.P., Kelman, S., Miller, L.S.; and S.Dunmeyer (1990). *The Economic Costs of Alcohol and Drug Abuse and Mental Illness: 1985*. Report submitted to the Alcohol, Drug Abuse, and Mental Health Administration, U.S. Department of Health and Human Services. DHHS Publication No. (ADM) 90-1694. San Francisco, CA: Institute for Health & Aging, University of California.

<sup>30</sup> Ludwig, J. and D. Phillips (2007). The Benefits and Costs of Head Start. In *Social Policy Report*, Vol. XXI, No. 3.

<sup>31</sup> Krueger, R. (2003). Economic considerations and Class Size. In *Economic Journal*, 113, 34-63.

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<sup>32</sup>).

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<sup>33</sup>). 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<sup>34</sup>).

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

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<sup>32</sup> Belfield, C. R., Nores, M., Barnett, S. W. and L. J. Schweinhart (2006). The High/Scope Perry Preschool Program: Cost-benefit analysis using data from the age-40 followup. In *Journal of Human Resources*, 41(1), 162-190.

<sup>33</sup> Weisbrod, G. and B. Weisbrod (1997). *Assessing the Economic Impact of Transportation Projects*. Transportation Research Circular, Transportation Research Board, No. 477, October.

<sup>34</sup> Office of Management and Budget (1992). *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*. Circular No. A-94 Revised. <http://www.whitehouse.gov/omb/circulars/a094/a094.html#8>

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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.

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### 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, ie, 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

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assignment with the assumption of sufficient information in the data to correct for systematic differences between the intervention and control group<sup>35</sup>.

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.

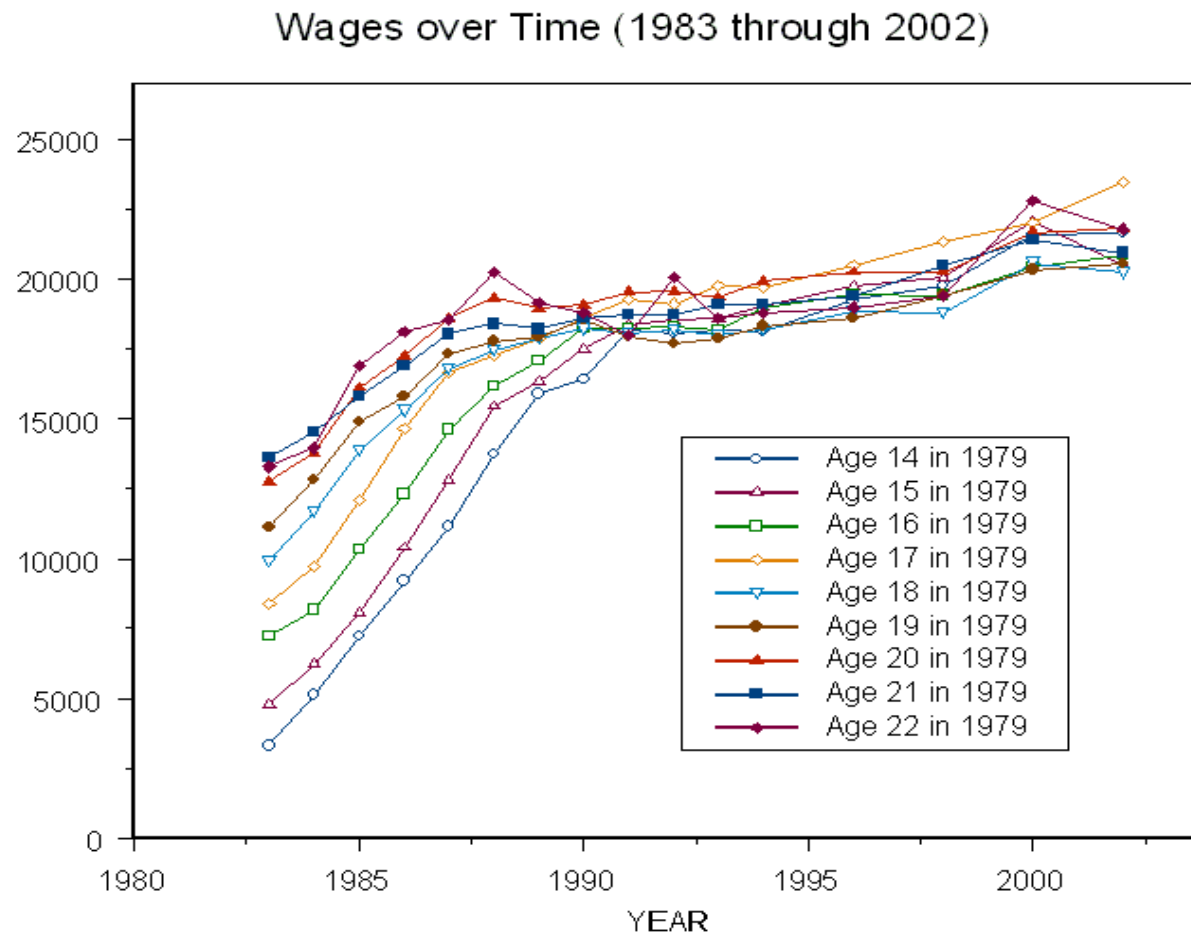
However, the CPI itself might have added a caveat. The CPI underwent a major revision in 1983 (Jackman, 1990). However, this is immediately prior to our 20-year observation window and does not affect our analysis. Real pay in general fell between 1971-72 and 1981-82. The substantial drop in real salaries 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.

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<sup>35</sup> 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)



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### 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 *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**

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

### 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

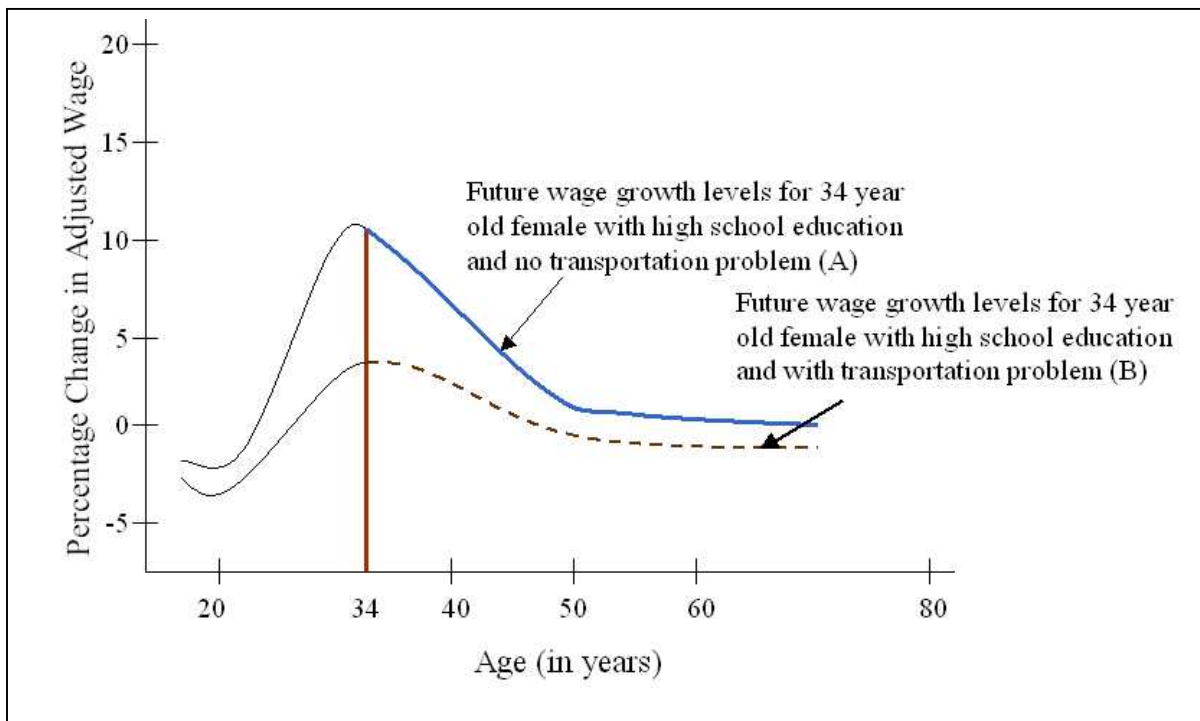


Figure 7.8 gives hypothetical example illustrating the process of allocating adjusted wages of NLSY79 respondents to JARC survey respondents. The illustrative wage growth curves here depict the situation for female NLSY79 respondents from economically deprived families, who completed high school. Two 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<sup>1</sup>) 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.

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### 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)**

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

[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**

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

<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

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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 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

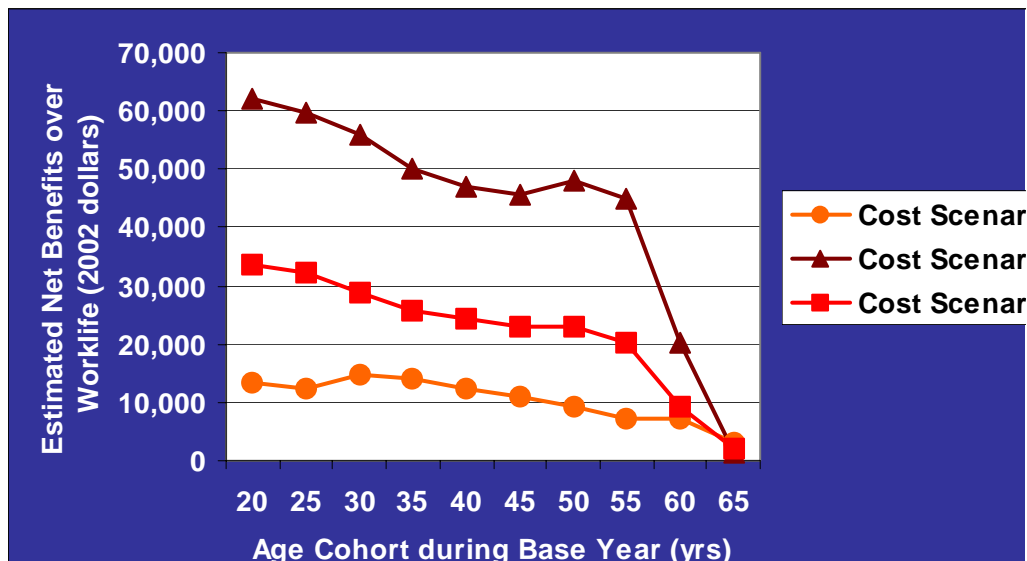


Figure 7.10 shows worklife benefits for Cost Scenario 3. We would expect that the less-than-20 year cohort would have greater expected worklife benefits; yet the benefits of JARC riders

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

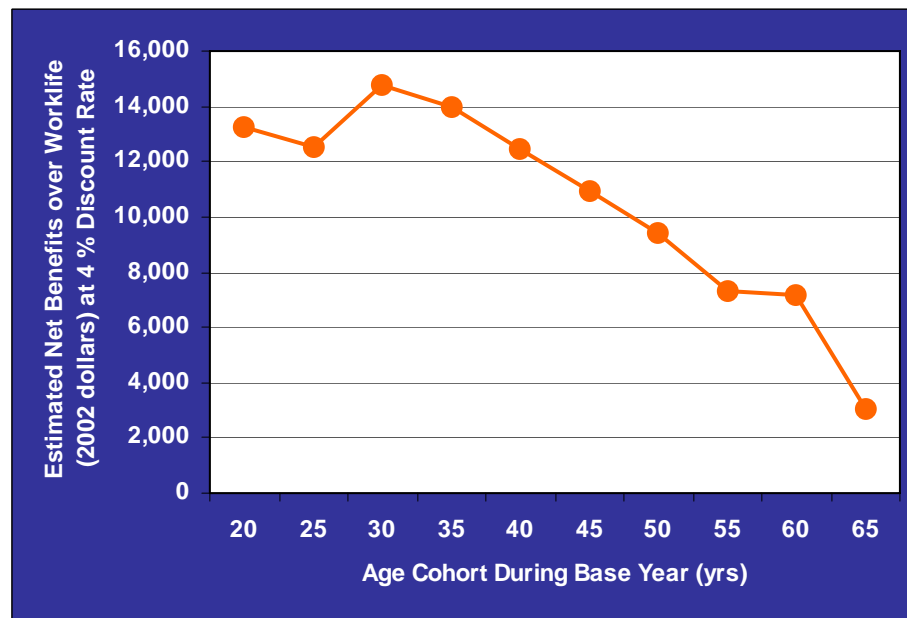
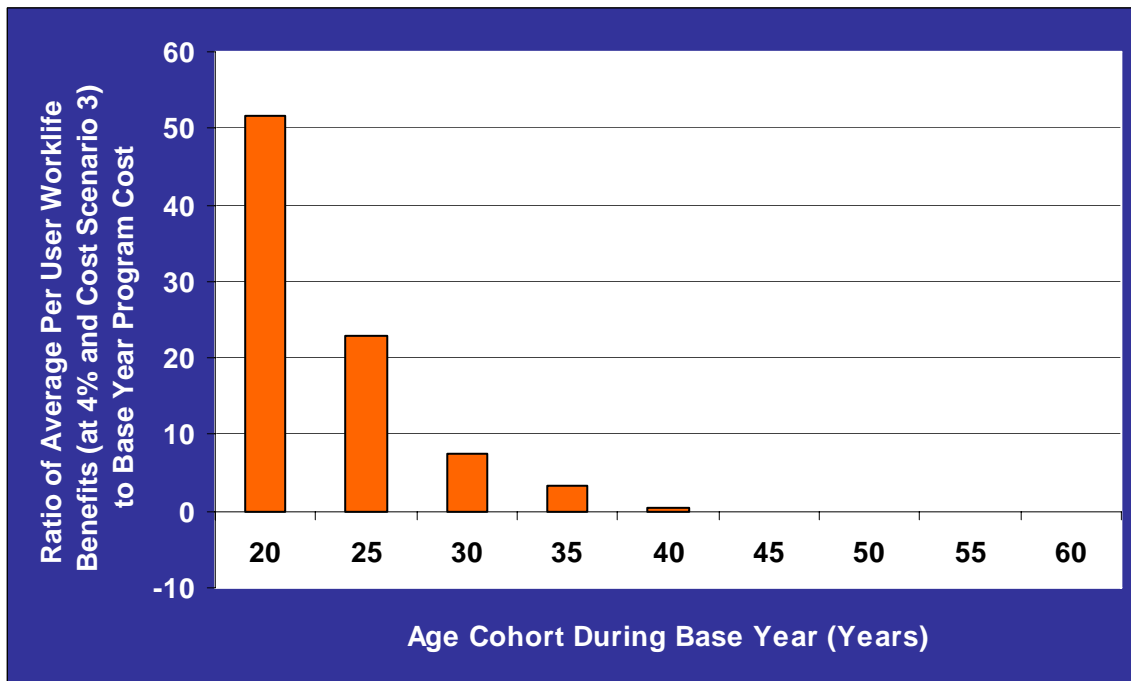


Figure 7.11 shows the ratio of Average Per User Worklife Benefit to Base Year Program Cost as a function of age cohorts. The average ratio is 15.87, ie, we estimate that every dollar spent in JARC program costs facilitates a return on \$15.87 in the future.

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

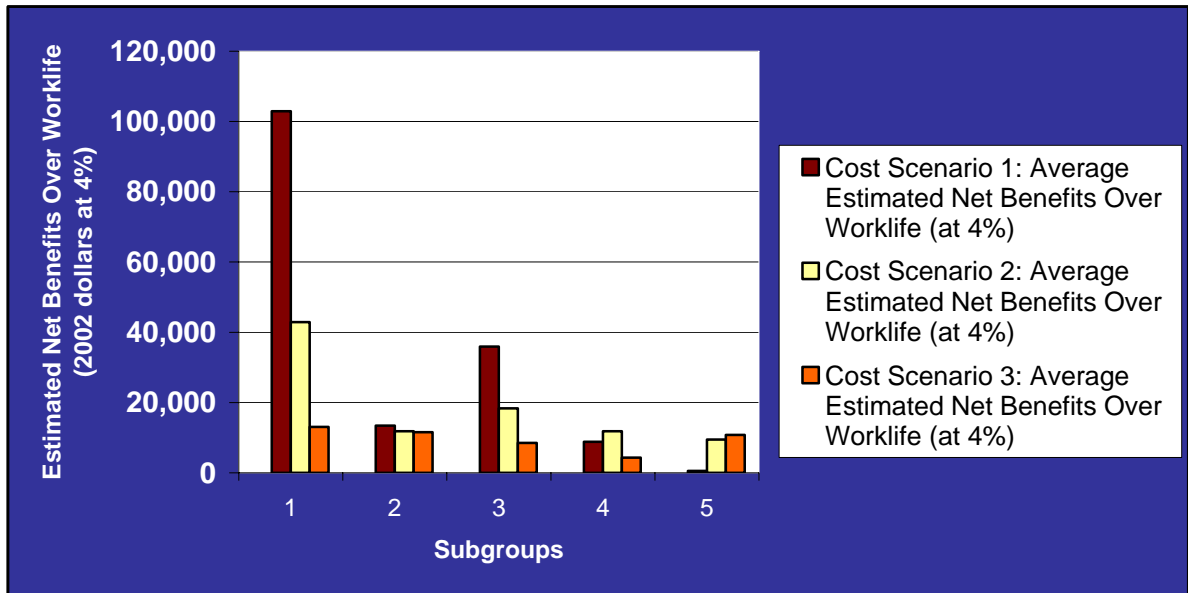


Figure 7.13: Estimated Worklife Benefits for Subgroup 1 under Cost Scenario 3

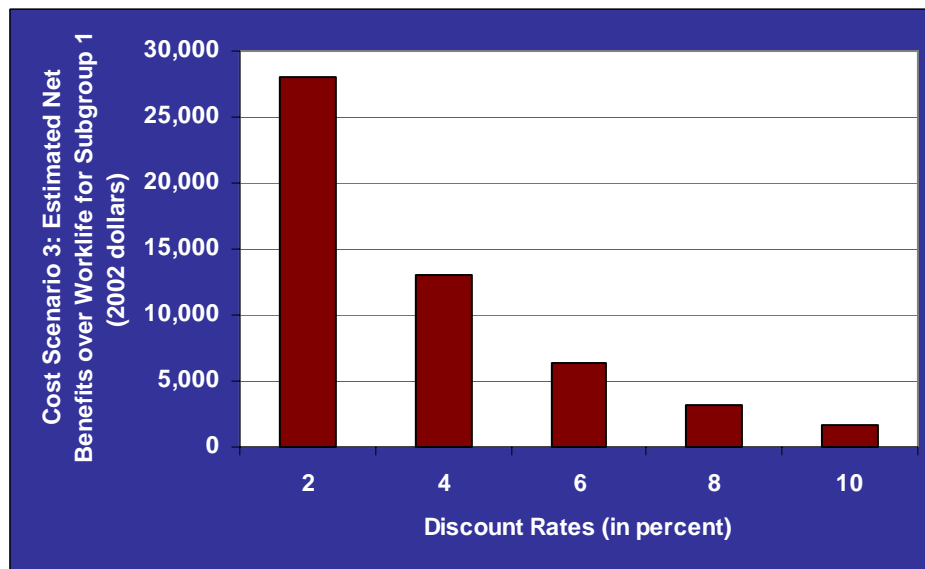
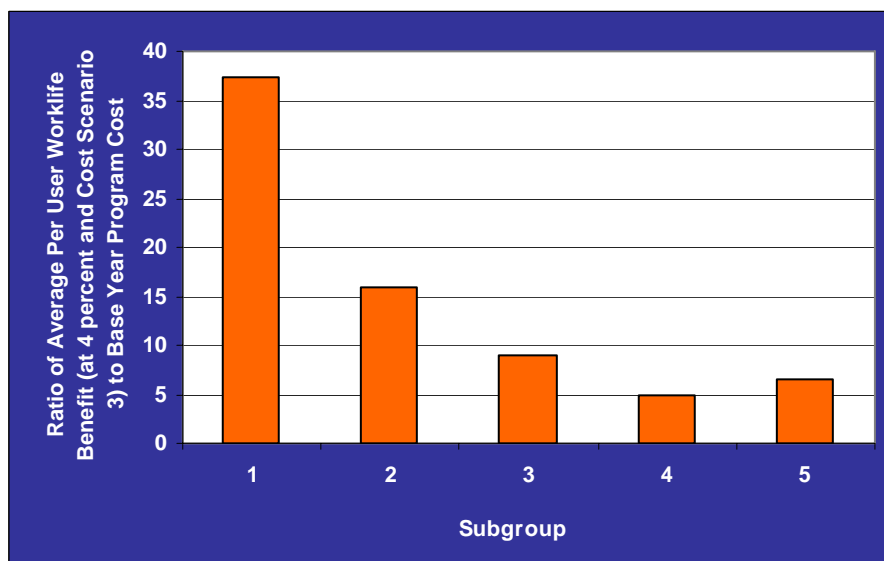


Figure 7.13 shows the Subgroup 1's expected worklife benefits under Cost Scenario 3 over the 5 different discount rates considered. As speculated earlier, the choice of the discount rates can have very significant implications on the magnitude of the benefits. At 4 percent, the estimated benefits are 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**

| <b>Factor</b>              | <b>Level</b>        | <b>Ratio of Per User Worklife Benefits to Base Year Program Cost</b> |
|----------------------------|---------------------|--|
|                            |                     |  |
| Gender                     | Female              | 11.57  |
|                            | Male                | 19.11  |
| Public Assistance Received | No                  | 15.00  |
|                            | Yes                 | 18.58  |
| Type of Service            | Demand-Responsive   | 12.82  |
|                            | Fixed-Route         | 22.35  |
| Area                       | Small Urban & Rural | 19.77  |
|                            | Large Urban         | 9.28   |

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## CHAPTER 8: Conclusions and Recommendations

### 8.1 Summary of Findings

Employment transportation services are providing 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 users will stay in the transit system over the long haul. However, the transient boost that these services provide are likely to make a significant difference in their worklife outcomes.

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 dynamics of local labor market perturbations are likely to cancel out some of these benefits. However, since these negative dynamics are dependent on local unemployment rates, the non-user benefits from these services are ultimately likely to depend on economic cycles.

The major findings of the study are summarized as follows:

- 1) Employment transportation services funded by the JARC program are reaching the target population as stipulated by TEA-21.
- 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.
- 3) Users have undergone a variety of travel behavior and work-related changes, which have an economic benefit to them.
- 4) These services have helped many users overcome the psychological barrier imposed by the lack of means to travel to locations that are job-rich.
- 5) 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 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 CBA analysis, 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) these societal returns drops 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 users in this subgroup 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 estimated that average worklife benefit to base year program cost is \$15.87 ie, we estimate that every dollar spent in JARC program costs facilitates a return of about \$15 in the future, over the remainder of the users’ worklife.

## 8.2 Recommendations of the Study

The JARC program has provided an explicit identity to the equity dimension of transportation policy and has jump-started the types of partnerships needed for the long-term sustainability of employment transportation. However, given the size of the problem under consideration, these activities are still limited in scope and mechanisms need to be in place to leverage other resources in order to address both the long-term and short-term changes that would be needed for beneficial user outcomes. *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 policies and, at the same time, leverages local land-use, affordable housing and economic development strategies.* Such policies should be targeted to “users” in contrast to “trips” and should adapt to their changing needs, involve the participation of the private sector and have dedicated funds in the form of special programs

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to address and adequately coordinate the complexity caused by a wide range of services and resources needed to address the problem.

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.**

High costs of car-ownership, long commute distances and lack of travel alternatives pose a formidable challenge to low-income workers. These barriers are the result of a history of structural inequities built into the land-use, affordable housing and economic development patterns as well as into our transportation system. The governmental programs and pool of resources currently available to address these structural inequities are a step in the right direction. But given the size of the problem under consideration, these activities are still limited in scope. Addressing structural inequities should be a critical focus of a multitude of transportation programs and planning processes.

The policy and programs relating to the environment set an illustrative precedent in this regard. Currently, one of the most visible environmental programs in the U.S. is the Congestion Mitigation and Air Quality (CMAQ) program instituted by the Intermodal Surface Transportation Efficiency Act (1991). Following closely on the heels of the Clean Air Act Amendments of 1990, the intent of the CMAQ program was to fund programs to improve air quality in non-attainment and maintenance areas. By one estimate (Surface Transportation Policy Project, 2003)<sup>36</sup>, a total of \$11.7 billion was apportioned between 1992 and 2001 on the CMAQ program (of which about \$2 billion remained unobligated). CMAQ funds are largely spent on Transportation Control Measures (TCMs) such as improving public transit service, traffic signalization and other traffic flow improvements, trip reduction and ride-sharing initiatives, and bicycle facilities.

However, a variety of other programs supplemented the intent of this program by focusing on non-motorized transportation and land-use factors that have the potential of addressing air quality. Notable is the Transportation Enhancement (TE) program, which set aside 10 percent of all highway funding through the Surface Transportation Program plus funds from the Equity Bonus Program and the Revenue Aligned Budget Authority (RABA) that are distributed to the STP. The objective of the TE program is to set the broader stage for communities to have alternatives to road transportation by providing context-sensitive solutions to transportation problems and to foster safety, accessibility and environmental preservation. Funds are eligible for 12 activities including pedestrian and bicycle facilities and environmental mitigation of runoff pollution. The cumulative spending on TE activities for FY1992 through FY2006 is at least \$7.82 billion (two states are not included in these numbers) with FY 2006 apportionments being \$804 million. Overall, bicycle and pedestrian

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<sup>36</sup> Surface Transportation Policy Project (2003). *The CMAQ Program: Funding Cleaner Air*. Decoding Transportation Policy and Practice #7.

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facilities, combined with rail-trails and bike/pedestrian safety comprise 55.5 percent of programmed funds between FY 1992 and fiscal year 2003.

States are also permitted to transfer TE funds to the Federal Transit Administration (FTA) under the requirements of Chapter 53 of title 49, U.S.C. In FY 2006, five states transferred a total of \$35.3 million out of TE for TE-eligible activities. The amount transferred to date, \$98.8 million is about one percent (1.2 percent) of cumulative available funds.

One strategy would be to address transportation for low-income individuals and those without transportation options by means of an equity set-aside from major highway and transit programs, including programs such as the Surface Transportation Program (STP), Section 5307 (Urbanized Area Formula Program), 5309 (Capital Program including Fixed Guideway Modernization, New Starts and Small Starts Program, and Bus and Bus Facilities) and 5311 (Non-Urbanized Area Formula Program). *For purposes of program sustainability, the strategy for designing the set-aside should be one that strongly couples with the existing infrastructure development, demand management, environmental and safety goals of these programs.* Further, they should be designed keeping in mind the needs not only of low-income users but also of temporarily poor families who might not reside in typical disadvantaged neighborhoods, seniors, the disabled and other members of America's disadvantaged populations. At the same time, it is highly likely that the proposed set-aside, if targeted to the activities below, will have spill-off benefits, which will affect a larger population.

The set of activities for which the equity set-aside can be jointly targeted to include:

#### Land Use Planning

- 1) Block grants to communities to develop affordable and accessible housing near transit, mobility hubs and job locations;
- 2) Safety enhancing transit stops and pedestrian and bike paths in low-income neighborhoods as well as funds for regulation and enforcement;
- 3) Innovative alternative transportation solutions for low-income neighborhoods that are affordable and sustainable to the user but which also address demand management issues;
- 4) Land-use and environmental enhancement projects including infill development and brownfield redevelopment to create economic opportunities in or near low-income neighborhoods;
- 5) Planning and administering the dedication of a portion of revenues raised from value pricing programs for redistribution towards projects that support low-income mobility.

#### Employment Options

- 1) Supplemental funds for economic development and job creation programs in low-income areas;

- 2) Tax benefits to employers for providing employment transportation, assistance to workers with availing of Earned Income Tax Credit (EITC, which can be used to recoup transportation costs), transit pre-tax benefits or otherwise contributing to employment transportation.

#### Information Technology

- 1) Support for informational campaigns on EITC, Individual Development Accounts, pre-tax benefits and other credits that can be used to boost mobility of low-income workers;
- 2) Mobility managers and information technology projects towards support of planning and implementing employment transportation.

#### **Recommendation #2: Special program emphasis to employment transportation should continue.**

The current policy network to connect low-skilled workers to jobs should continue in its funding and coordination role but should be greatly supplemented by policy shifts given under Recommendation #1. As the results of this report show, the user outcomes of employment transportation services such as JARC have been substantial and are likely to be even greater when the potential longitudinal impacts are taken into account.

In many urban and rural areas across the U.S., there will always be gaps in the transportation system with respect to the mobility of low-income workers and hence there will always be the need for specialized services for this purpose. The safety net offered by these specialized services is key in the face of such gaps - the earlier discussion showed that the estimated benefits for these programs provide a much-needed safety net to low-income workers - but the size of the safety net needed might be larger than what is connoted in SAFETEA-LU in the context of JARC. A 2002 White House Report<sup>37</sup> stated that: “...more than 100 million low-income, older Americans and people with disabilities are at risk of being unable to provide or afford their own transportation - they are also more likely to be dependent upon others for their mobility. Employment remains one of the greatest barriers for people with disabilities. Of the 7.5 million people with disabilities on the Social Security rolls, fewer than 1 percent ever leave those rolls to return to work. People with disabilities deserve the chance to engage in meaningful work and to contribute to America’s economy”. *The specialized services should have the alleviation of immediate, short-term gaps in the mobility of disadvantaged populations as a goal.* It might not be possible to address long-term structural inequities with this type of services – such activities should be the purpose of the equity set-aside proposed earlier and by means of strategies discussed below.

- 1) A generic special program for disadvantaged populations, that addresses the travel needs of low-income workers, disabled individuals and senior citizens, might be considered. At the time of writing this report, there are three FTA programs that address needs of such populations, including Section 5310 (Elderly and Persons with

<sup>37</sup> White House (2002). *New Freedom Initiative: A Progress Report*. May.

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- Disabilities Program), Section 5316 (JARC) and Section 5317 (New Freedom that addresses the needs of the disabled community). JARC has already funded programs for individuals with disabilities to access jobs; since the unemployment rate among individuals with disabilities is over 70 percent, access to jobs by this group is a critical need. However, these trends could become a matter of policy rather than isolated projects. Pooling together resources from multiple programs might address one of the difficulties faced by current employment transportation users, e.g., sustainability of services after federal funds are no longer available for JARC. This approach might also help the services become more adaptable to current needs, if the demand changes over time.
- 2) Such programs would not only require significant amount of resources for coordination and planning but also in matters of guidance to agencies and in training of administrators, program managers and vehicle operators. Coordination efforts and matching programs with health and human services agencies, workforce investment boards, labor and social services agencies, that were planning or financial partners to JARC services should be expanded to stakeholder agencies associated with aging and disabilities.
  - 3) SAFETEA-LU requires a match of 20 percent for capital projects and 50 percent for operating projects under JARC and New Freedom. Finding sustainable match for these programs has been very difficult for many grantees. The study recommends that match requirements for the consolidated program be no more than 20 percent for both capital as well as operating projects. Since the implication of this is that a larger share of the project cost will fall on the federal funding sources, incentives should be built into the program for local organizations to pool together resources from sources typically used for transportation of disabled and senior citizens, which will have the net result of avoiding duplication of efforts.

### **Recommendation #3: Focus on individual user and lifecycle transportation.**

A combination of infrastructure, service and financial instruments that facilitate a low-income person's seamless access to a productive worklife are necessary. This includes not only the trip to work, but also to schools or job-training centers when they are younger or trips to employment counseling centers and job search after graduation. At other periods of their lives when they are out of work, they might need to access such destinations again. During times when they are working parents, they will need to undertake commuting trips that are linked seamlessly to shopping trips or trips to child-care centers and health care facilities. Senior citizens need to access medical facilities and community centers. Older workers are also increasingly a part of the workforce. From a lifecycle perspective, changes in the employment location of principal breadwinners and housing relocation are also important factors in their relationship to transportation options.

While the right infrastructure is critical to address the problem in general, the mobility solutions for a user can only be right if these are flexible enough to adapt to the changing circumstances over the individual's worklife. Cross-sectional data such as the National

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Household Travel Survey indicates that, nationwide, public transportation is the usual mode for 5.05 percent of work trips and only 1.56 percent of all trips. Public transit is not available as a travel option for individuals in many localities including metro areas with extensive transit systems. But with changes in employment or residential location over time, it is possible that travel alternatives including transit, paratransit, ridesharing or non-motorized modes might be a more feasible travel option for some part of their worklife. Since these alternative modes have the potential of greatly subsidizing transportation costs to the household, strategies should be in place to assist individuals to capitalize on this availability, when and where possible.

- 1) One approach to dealing with changing lifecycle mobility needs is to create a credit-based incentive system around it, which could be termed “Lifecycle Mobility Credit Program”. The system would give credit for participating in non-private modes of transportation such transit, car-sharing, ride-sharing or employer-supported transportation, which can have the joint effects of keeping household transportation costs down, building savings and contributing to travel demand management. The individuals could then use the credits accrued on private automobile transportation costs at some other time, when the availability of a car becomes indispensable. For example, a low-income working mother with two young children might find it extraordinarily difficult to meet her daily activity patterns using transit, car-sharing, ride-sharing or employer-supported transportation, even if these are of high quality and find a private car to be indispensable at that stage of her life. In the case of this woman, mobility credits can be accumulated over time when she is able to car-share, ride-share or use transit due to lower family responsibilities and used at another stage of her life towards the purchase/and or use of a car. Individuals can “opt-out” of the program when their life circumstances change to no longer having an indispensable need for a private car and pay market prices for future purchases and use of the private car – however, they could be given the choice of “partial opt-out” by limiting their driving (by participating in a mileage-based insurance program which would reduce their insurance costs) or by driving only upto pre-determined annual mileage limits and traveling by alternative modes, in return for a guarantee against vehicle repossession during financially difficult times or by reduced costs of participating in a car-sharing program. They could also be given the choice of “cashing-out” by voluntarily surrendering the vehicle at that stage, augmented by subsidized transit passes, subsidized participation in car-sharing programs and access to other alternative modes of transportation.

A smart card that tracks transit or alternative transportation use could be linked to individualized Lifecycle Mobility Credit Accounts that accumulates or deducts credit according to use. This concept connotes the creation of a network of participating organizations including private industry with vehicles equipped for smart card use or portable smart card readers. This opens the door for potential private sector participation; private industry could be involved in creating and operating the smart cards, in the operation of mobility hubs integrating car-sharing with transit, employment transportation offering door-to-door or feeder services, non-motorized transportation including bike rentals, taxi service and travel information services.

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These technologies will very likely evolve quickly over time and details regarding implementation would need to be investigated. Further analysis will also be needed to find out if the best strategy would be to have a time-limited mobility credit program.

- 2) A combination of pre-tax transit benefits, Earned Income Tax Credit (EITC), loan programs for auto ownership and use and commuter vouchers might be available towards the transportation benefit of a low-income person. However, having access to information regarding these options is key to their effective use, and information is often not accessible to those most in need. By some estimates, up to 25 percent of eligible families fail to claim the EITC they have earned. Moreover, federal and state social policies that address the needs of the individual at varying stages of their lives are often different and not available from one single source. The mobility managers that have been funded by JARC and other programs or the United We Ride Ambassador program could play a critical role in this matter and these programs should be expanded. Public outreach programs and inclusion of these options in the public participation process in transportation planning should be funded.
- 3) Other, more drastic relief measures such as sales tax relief programs for gas purchase for low-income workers during periods of high gas prices can also address the problems of extreme burden imposed on low-income working families.

**Recommendation #4: Invest in transportation for low-income children and young adults in their economically formative years.**

Federal transportation policy has not explicitly addressed transportation needs of children or young adults leaving the care of families to enter the workforce. Transportation can be a major barrier for youth who are pursuing job skills education and training programs because most of programs are given in technical colleges, community colleges, or other type of accredited trade school, which can be located far away from the home locations of needy youth. Many young adults also work part-time, requiring them to make complex trip chains.

A variety of governmental programs fund transportation expenses to job training programs including driver's education and licensing fees for youth, car insurance, maintenance and repairs costs, reimbursing volunteer youth drivers for gas or mileage and purchasing transit passes for youth. While funding levels for these programs should increase, the larger challenge is lack of availability of adequate infrastructure and transportation options. The JARC program has funded transit services to job training centers, which has the likelihood of improving the worklife outcomes of these individuals. Their higher cost per ride indicates that they are mostly DR users, requiring greater subsidy per ride. However, we have estimated that there is a return of \$5 for a dollar of employment transportation investment, over their worklife. These returns indicate that, from a societal point of view, it would be effective policy to continue to provide these services, especially since many individuals accessing these destinations are young enough not to have a driver's license.

Recently, SAFETEA-LU passed the Safe Routes to School program as a part of Title I, Subtitle D on Highway Safety, to promote safe, non-motorized transportation for the benefit

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of children in primary and middle schools. Section 4(f) of the DOT Act of 1966 has protected publicly owned school playgrounds. A variety of school bus programs that target school bus driver qualifications and clean buses exist in the current regulations. However, FTA does not fund school bus programs and school transportation is always funded through state or local sources. An emerging policy discussion is linking children's health and high rates of obesity to the built environment and low-density land-use patterns and lack of safe walking and biking opportunities. While these programs have the potential to greatly enhanced the safety and quality of life for children, it is not their intention to explicitly address the fundamental mobility links that are necessary to place children and young adults from low-income families in the right "economic ladder".

Comprehensive federal transportation policy is needed for the children and youth in general that addresses, not only bicycle and pedestrian programs and the health, safety, preservation and environmental aspects of their lives, but also their opportunities for career exploration, community service, mentoring, support services, internships and job training. A special program that supports the combination of school bus use, transit services and safe non-motorized options would greatly enhance their future economic and health prospects. Transit usage, walking and biking among youth can build healthy habits that might persist in their adult years. Further, it is well known that adults, particularly women in households with children, create complex trip chains substantially more than women in households without children. Analysis of NHTS data indicates that single mothers, especially of small children, are far more likely to create trip chains than either single fathers or mothers in households with two adults. The time and dollar costs associated with these linked trips are high and leads to the critical need for a personal car. Aside from the Lifecycle Mobility Credit program described earlier, other strategies should be in place to assist low-income households in transporting their children to career-enhancing opportunities, reducing some of these costs but most importantly, reducing the stress that is imposed on many working parents who have no option but to drive their children to various places.

- 1) One strategy for deflecting some of these trip complexities and associated personal costs would be to explore the potential of school buses for non-school activity by students. While Title 49 U.S.C. 5323(f) prohibits the use of FTA funds for exclusive school bus transportation for school students and school personnel, the use of school bus service for non-school trips is an area that has received increasing attention. Transportation of school children to non-school activities on a regular basis (as opposed to trips to off-campus school functions and the like) are typically governed by local regulations but the costs might be prohibitive. One possibility to offset costs is to coordinate trips between school transportation and those that would have been taken by public transportation by the general public. In rural areas where regular transit can be virtually non-existent, such uses of school buses might greatly increase transit availability for general commuters, since school buses are idle much of the time.
- 2) However, there are significant institutional barriers to such coordinated services. Some coordinated school bus services provide children and youth exclusively to non-school destinations whereas others co-mingle these riders with general transit users.

Although the latter types of services can provide cost-efficiencies when there is excess capacity in the vehicles, insurance can be prohibitively expensive if non-pupil transportation were to be allowed, thus exposing the school or parents to increased liability. Further, parents and the community might have negative attitudes towards the idea. Many state laws expressly prohibit such co-mingling and vehicle design can also prohibit ADA transportation. Nevertheless, school transportation has been used as an option for providing non-school trips in some areas and these trends should be explored further.

- 3) A network of informal services can be developed to enhance the mobility of children and young adults to career-enhancing destinations. When distances to such destinations are short, non-motorized transportation can be useful in achieving the dual objectives of accessibility and health. For example, “Walking School Bus” programs, where a group of children walk to school with one or more adults, have been implemented in some areas. These programs can be as informal as two families taking turns walking their children to school, to as structured as a route with meeting points, a timetable and a regularly rotated schedule of trained volunteers. “Biking trains” in which children bike to school under adult supervision is another program. There has been a great deal of interest recently in volunteer driver programs although many such programs target the mobility of seniors. Communities can be given assistance to gain better information on safety, reliability, compensation and insurance/liability aspects of these programs.

**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).**

A series of processes have been established to address the mobility needs of disadvantaged populations in transportation planning and to improve coordination among transportation agencies and other public, non-profit and private organizations. As a way to ensure that JARC project planning is part of a coordinated regional transportation planning process and not an isolated event that includes the project alone, an impetus was given to create Area-Wide Job Access and Reverse Commute Transportation Plans (JARCTP) and to update this plan by means of continuous monitoring of regional and state-level needs.

SAFETEA-LU 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 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.

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FTA Circular 9045.1 (2007) on the New Freedom program and Circular 9050.1 (2007) on the JARC program require that the coordinated plan can either be developed separately from the metropolitan and statewide transportation planning processes and then incorporated into the broader plans, or be developed as a part of the metropolitan and statewide transportation planning processes. Projects identified in the coordinated planning process, and selected for FTA funding through the competitive selection process, must be incorporated into both the Transportation Improvement Program (TIP) and Statewide Transportation Improvement Program (STIP) in urbanized areas with populations of 50,000 or more; and incorporated into the STIP for non-urbanized areas under 50,000 in population.

Finally, FTA's Title VI Circular 4702.1A (April 2007) offers guidance to MPOs on complying with Title VI and Environmental Justice, by requiring MPOs to have an analytic basis in place for identifying the locations and needs of low-income and minority populations, the benefits and burdens of metropolitan transportation system investments on different socioeconomic groups and for identifying imbalances and responding to the analyses produced.

Federal law also requires an outreach and Public Participation Program (PPP) for all transportation agencies that receive federal funding, especially to low-income communities and people of color. Due to similarities in the activities required for the HSTP and the EJ activities, there should be a way to avoid duplication of efforts relating to the two processes. Improved guidance is necessary to enable MPO's to establish effective ways of integrating these activities.

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

Many companies in the U.S. have historically subsidized transportation costs of its employees by providing free or low-cost parking. JARC funds can be used for matching employer-provided transportation such as employee shuttles, ridesharing and carpooling. Although there is no hard data, by some estimates, the program has not been able to attract the participation of many employers. Focus groups of partnerships by the research team indicated that the requirements for drug and alcohol testing and not having the know-how or enough personnel or funds for the reporting system required by FTA were some of the barriers to lower participation rates by employers as well as taxi services, social service organizations, and faith-based groups.

- 1) In contrast to employers, Transportation Management Associations (TMAs), which are non-profit, member-controlled organizations that provide transportation services in a particular area, such as a commercial district, mall, medical center or industrial park, might be better suited to participate in JARC services. They are generally public-private partnerships, consisting primarily of area businesses with local government support. This approach should be better investigated, as TMA's have the know-how to address transportation needs of their member organizations.

- 2) In metro areas where transit can be an option, current commuter choice options can play a role in subsidizing commuting costs for low-income workers (and all employees) but more employers need to be informed about such options. Current law allows businesses, governments, non-profits and other employers to provide employees with a tax-free or pre-tax transit benefit of up to \$115 per month and a parking benefit up to \$220 per month with savings in payroll taxes for employers.
- 3) The goal is not only to reduce employee transportation costs but also to increase employer participation in supporting alternative travel options. However, except in specific cases, there is no tax incentive for employers to directly subsidize their workers' transportation costs. The successful Wheels to Work program (W2W) program in New Hampshire is a statewide program operated by Rockingham Community Action, a private, non-profit organization. New Hampshire has the unique advantage of offering tax credits to companies that support Wheels to Work. The tax credits, which are authorized by the New Hampshire Community Development Finance Authority, may be applied against one or more of the following state business taxes: Business Enterprise Tax, Business Profits Tax, and Insurance Premium Tax. With Wheels to Work, the tax credits apply in two ways: car dealers donating cars to the program receive state business tax credits equal to 75 percent of the trade-in value of the vehicle or companies providing financial support receive state business tax credits equal to 75 percent of the contribution. As a response to high gas prices at the time of writing this report, legislation is being proposed in the Chicago metro area (Creating Opportunities to Motivate Mass-transit Utilization To Encourage Ridership (COMMUTER) Act) which will offer tax incentives for companies to boost employee participation in public transportation. The act proposes to give tax breaks for companies that offer their employees no-cost public transportation vouchers.
- 4) Such initiatives are likely to provide the financial incentives needed to encourage employers to support transportation that cater to low-income workers. However, in addition to transit, the use of tax incentives for companies should be explored for a variety of alternative transportation, which would be key for the successful participation of companies to which there is no transit available. This includes contribution towards car-sharing programs, shuttle service or feeder transportation from transit stops and stations, guaranteed ride home programs, rideshare and carpooling activities and contributing towards costs of shared rides. Some of these activities can also be supplemented by the equity set-aside proposed earlier.

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

A comprehensive evaluation is defined in the literature as an evaluation that includes monitoring, process evaluation, cost-benefit evaluation, and impact evaluation (Baker, 2000<sup>38</sup>). 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

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<sup>38</sup> Baker, J. L. (2000). *Evaluating the Impacts of Development Projects on Poverty. A Handbook for Practitioners*. The World Bank, Washington, D.C.

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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.

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 and area of operation. However, the measure of “number of jobs reached” needs to be evaluated further in the light of the results presented in this study – that transit services to areas of employment might have unintended effects in terms of deflation of wages or displacement of existing workers in those locations, although the impacts on service users have been estimated to be positive and high. Individual program management has administered user surveys that attempt to measure outcomes and evaluate coordination and partnerships on process. This research team has taken a multi-site study of JARC partnerships that provides qualitative evidence on the effectiveness, barriers and outcomes of such partnerships.

- 1) The varied nature of employment transportation projects and their important, but ultimately small and localized effects make it difficult to develop a uniform, nationwide data collection program, that enables one to draw inferences about program effectiveness on a continual, nationwide basis. The uniqueness of many of the programs also makes it difficult to be evaluated at the national level. As the results of this study showed, factors including local unemployment levels, welfare-to-work or unemployment benefits policies as well as spatial factors relating to local travel and transportation conditions all affect the outcomes of the employment transportation users and lead to significant site-to-site variations in outcomes. A similar conclusion was reached regarding the program evaluation, at a national level, of the CMAQ projects<sup>39</sup>. Whereas there have been numerous evaluations of federal programs based on multi-site studies, difficulties in controlling for these local variations do not lend to generalization of the results. Employment transportation services have also greatly evolved over time with the inclusion of a variety of transit services, auto ownership programs, mobility management, car-sharing programs, information technology programs and others. One strategy would be to administer periodic nationwide surveys as was done in the case of this study, but not expect similar outcome measures to be pertinent in all cases.
- 2) In order to find out corroborating information on non-user and societal effects, data could be collected from employers on impacts on existing workers. Administrative data on public assistance payments and data from local labor market organizations on

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<sup>39</sup> 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).

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unemployment benefits could be analyzed to empirically determine the extent of non-user benefits.

- 3) Coordination with data programs such as the National Longitudinal Survey of Youth of the Bureau of Labor Statistics, in the form of “add-ons” for participants of special transportation services, would enable a truly rich dataset for measuring outcomes over time and the persistence of these outcomes. Finally, the use of the Longitudinal Employment Household Dynamics (LEHD) data program of the Bureau of Census for program monitoring is a step in the right direction – the FTA has worked with the Census for their program monitoring effects - and should continue. This is important to do because the time intervals between two decennial census datasets or household travel surveys conducted by MPO’s or state agencies are simply too long to be useful for rapidly changing metropolitan and rural areas.

**Recommendation #8: Information networks on employment transportation should be strengthened and more easily accessible.**

The backbone of employment transportation is the partnerships that formed between transportation professionals and professionals in the human services, workforce development, labor, job training, economic development and other organizations including the non-profit and private sectors. The inclusion of non-traditional stakeholders in the employment transportation planning process required formal and informal exchange of information among transportation and non-transportation professionals. Knowledge of program requirements and plans in non-transportation organizations and what has worked and what has not has been acquired through “on-the-job” learning experience regarding employment transportation.

However, as partnerships evolved over time, our partnership studies showed that professionals faced several problems. High levels of time commitment, constant need to maintain project momentum, learning the terminologies and technicalities of each others programs, staff changes in partner organizations, program and mission changes in key organizations and changes in organizational assignment and priorities were only some of the factors that hindered seamless collaboration and sustainable partnerships over time.

Technical assistance programs in coordinating human services by the FTA and partners at the U.S. Departments of Health and Human Services, Labor, and Education are currently available. United We Ride has held web conferences to increase participants’ knowledge of employment transportation and coordination of human service transportation. The Community Transportation Association of America's Peer-to-Peer Network is a nationwide network of mobility experts who respond to the needs of communities seeking to strengthen transportation options.

- 1) A nationwide clearinghouse is needed on transportation for disadvantaged populations. This clearinghouse would be populated not only by the various service options, sources of funding, technical advice and guidance on pertinent rules and regulations and program implementation, but also case studies of specific programs,

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- their evaluations and lessons learned. Training programs would be a part of the clearinghouse along with indicators on current performance of projects. The goal of the clearinghouse would be to provide continuity in information dissemination to this subset of transportation professionals as well as professionals in relevant sectors.
- 2) An operations cost and benefits database, similar to the one developed by the Intelligent Transportation System (ITS) Joint Program Office<sup>40</sup>, would be very useful to employment transportation stakeholders. Outreach campaigns to employers, particularly regarding pretax transportation benefits, Earned Income Tax Credit and state or local credits due to transportation provision is critical to leverage their participation in employment transportation. Private providers of passenger transportation, car-sharing programs, school bus and charter bus service providers, Transportation Management Associations and non-profit that might initiate volunteer driver programs, auto ownership programs and other organizations can be better leveraged if provided more information about the alternative transportation they might be able to provide or facilitate in this context. Although the current JARC funding levels include 8 percent on information services and 7 percent on capital investment including car ownership programs, the vast majority (85 percent) was allocated (in FY 2006) to trip-based transit systems. Overall, a broader set of service providers should be included in the discussion and the development of an information network is critical towards that goal.

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<sup>40</sup> U.S. Department of Transportation, Research and Innovative Technology Administration.  
[http://www.its.dot.gov/tech\\_assistance.htm](http://www.its.dot.gov/tech_assistance.htm)

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**APPENDICES A - N**

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## Appendix A: Literature Review

### A.1 Introduction to the Review

The literature review is in two parts: in Section A.2 presents the review on the non-transportation literature on mobility needs of welfare recipients and low-income workers and Section A.3 summarized the studies that are relevant to the CBA.

### A.2 Literature Review of Transportation Impact on Welfare and Employment

Much of the research on the impact of transportation is conducted by and for transportation analysts and agencies. It is thus, not entirely surprising, that most such studies show that large benefits will accrue from transportation projects and that lack of transportation can severely impair economic development and social welfare.

It is thus instructive to see if similar conclusions can be derived from research by welfare analysts who are most concerned with employment rather than transportation.

The following is a review of about 140 studies of “welfare reform”, most produced by the “Manpower Development Research Corporation”, from 1993 to 2005. Every one of the studies that investigates the affect of transportation on “welfare to work” and related jobs programs, finds that it is a major obstacle to employment and economic welfare for low-income workers.

Some of the highlights of the 31 studies that included quantitative survey, or interview, data on transportation barriers and their affect on “welfare to work” programs are:

- In six of the reports transportation is found to be *the second, or first*, most cited barrier to employment after, or before, child care (see 2, 7, 12, 17, 19, and 27).
- Nine of the reports, including a large review of multiple studies of different state and national programs (see 7 from 2002 covering four states and a national program with sample size of over 26,000) find that transportation problems are among the *three most common*: barriers to employment, reasons for staying on welfare, or reasons for quitting latest job (see 2, 7, 12, 16, 17, 19, 27, 30, and 31). Other important barriers are: childcare, education, and health and emotional problems.
- In eight studies “transportation problems” were cited as a significant barrier to employment by roughly 26% to 49% of recipients (see 7, 15 – 18, 21, 24, 28).
- Another large study from 1986 to 1996 of employment outcomes of former welfare recipients in six cities in California, Atlanta GA, Grand Rapids MI, Columbus OH, Detroit MI, Oklahoma City OK, Portland OR, seven rural and urban counties in MN, and Escambia County FL, (of 20,400) found that families with transportation problems earned about half the income of families without transportation problems (15).

- There was a strong correlation between employment stability and access to transportation for never-employed inner city single mothers in 1998-1999 in Cleveland, Los Angeles, Miami-Dade, and Philadelphia (11). 47% of “high stability” single mothers drove a car to work whereas only 26% of “low stability” mothers did. Only 28% of high stability mothers used public transportation to get to work, whereas 44% of low stability mothers did.
- One fourth of welfare recipients who were sanctioned in a “welfare to work” program in Florida in 1994-1995, and agreed that they had violated a rule, said that transportation problems caused them to be non-compliant (16).
- In Cleveland in 2000, a 30 minute commute from the inner city would allow access to 41.7 percent of job openings, 30 minutes on public transit supplies access to only 7.1% of openings (8).

### **Transportation Impact on Low Income Employment as Described in Welfare to Work Literature**

#### **1) “Welfare Reform in Los Angeles,” Polit, Nelson, Richburg-Hayes, Seith, MDRC, August 2005.**

A survey was conducted of 697 Los Angeles women “who had a history of welfare receipt and lived in high-poverty neighborhoods prior to welfare reform” interviewed in 2001 (p. Sum-6, Table 4.5 p. 134).

“Nearly half the women in the survey sample in Los Angeles lacked a driver’s license or did not have regular access to a vehicle, and these women were significantly less likely to be employed than those who could drive (44 percent versus 69 percent, respectively). However, it is not clear whether not having a car created a barrier to employment or whether lacking a job made it difficult to afford an automobile. Only a handful of nonworking women (2 percent) cited transportation problems as the *main* reason for not having a job. Nevertheless, a much smaller percentage of employed women than non-employed women agreed with the statement “It is so inconvenient to travel to and from a job that it is difficult for me to work” (23 percent versus 44% percent, respectively).<sup>40</sup>” (p. 137)

<sup>40</sup>“About half the working women in Los Angeles reported that they drove their own car to work, and another 12 percent said that they got a ride. Only one out of five relied on public transportation. The average commuting time (one way) was 27 minutes, but this average masks a great deal of variability, with some respondents reporting no commuting time (for example those who worked out of their homes, babysitting or doing hair) and others reporting commutes of an hour or more each way (11 percent). When asked specifically whether they had transportation problems, nearly three-fourths of the working women said that they never had trouble getting to work – and this was true regardless of their method of commuting.” (footnote 40, p. 137)

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## 2) “Mobilizing Resident Networks in Public Housing” Kato, MDRC, June 2004.

Drawing on “intensive interviews and observations of program activities that were conducted by field researchers and the author over a period of three years, from summer 2000 through summer 2003” at public housing developments in Baltimore MD, Chattanooga TN, Dayton OH, Los Angeles CA, St. Paul MN, Seattle WA. (p. 2-3), the author states:

“Even so, the residents at the Jobs-Plus sites continued to site barriers to employment and job retention that required institutional attention, including the lack of early morning or evening public transportation, and the need for after-school programs to keep the children and youth occupied and safe until their parents come home from work.” (p. 9)

“A member of Dayton’s collaborative who runs an agency that places residents into temporary jobs observed:

Transportation and child care are two of the biggest barriers once we get [the residents] employed....Especially for the second and third shift.... I have companies along bus lines. The Regional transit authority here in town is wonderful to work with. We’ve had a lot of success over the years getting routes extended, routes changed. One of my oldest clients, one that I’ve worked with for 18 years... the workers had to walk to get there, a mile and a half to the bus stop. The route was extended so that they could get the route to the company... We showed [the transit authority] we had the number of people to make the change. It took months to do it. But if this is going to help people to get to work, this should help reduce welfare.... If you make that walk several days a week and its 30 degrees and you’re up to hour knees in snow, that makes a big difference.” (p. 9)

## 3) “Welfare Reform in Philadelphia: Implementation, Effects, and Experiences of Poor Families and Neighborhoods” Michalopoulos, Edin, Fink, Polit, Polyne, Richburg-Hayes, Seith, Verma, MDRC, September 2003.

A survey of 638 “randomly selected recipients of cash assistance or food stamps in Philadelphia in May 1995 who were single mothers, between the ages of 18 and 45, and resided in neighborhoods where either the poverty rate exceeded 30% or the rate of welfare receipt exceeded 20%, interviewed from April to February, 1999, and then again in November of 2001, indicated that:

“More women in the study owned cars in 2001 than in 1998 ( 32 percent, compared with 21 percent), but a majority of the sample still had to rely on public transportation to get to and from work, resulting in long average commutes.” (p. Sum-20)

“The majority of women in Philadelphia (57 percent) relied on public transportation to get to work in 2001, and only a minority (27 percent) drove a car. The average commuting time (one way) was 37 minutes, but this average masks a great deal of variability, with some respondents reporting no commuting time (for example, if they

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worked out of their homes babysitting or doing hair) and others reporting commutes of more than an hour each way (10 percent).<sup>26</sup>” (p. 103-4)

Footnote 26: “Based on data from the 1998 Urban change study for all four sites [Cleveland, Philadelphia, Miami, and Los Angeles], women in Philadelphia were substantially less likely than those in the other three sites to drive their own car to work (for example, 27 percent in Philadelphia versus 51 percent in Miami). Commuting time to work was also significantly longer in Philadelphia than in the other sites.” (p. 104) From: Polit, London, and Martinez. 2001. *The Health of Poor Urban Women: Findings from the Project on Devolution and Urban Change*. New York: MDRC.

“In the survey sample, transportation barriers also distinguished workers and nonworkers. As previously noted, the majority of workers in Philadelphia used public transportation to commute to work. In 2001, fully 75 percent of women in the survey sample reported not having a valid driver’s license or access to a vehicle. Only about half the women who had this barrier were working at the time of the 2001 interview, compared with 78 percent of those who did not.<sup>38</sup> Data from the ethnographic portion of the study highlight the hardships that many women from poor neighborhoods face in commuting via public transportation to service sector jobs that were typically located far from their residences.” (p. 114)

Footnote 38: “In an analysis of the 1998 Urban Change survey data from all four sites, Polit et. al. (2001) [see below] found that not only employment status but also employment stability was strongly related to the women’s means of transportation. Driving to work was most common among high-stability workers, while low-stability workers were most likely to rely on public transportation. Of course, employment and car ownership could have reciprocal effects: Women without a car might be constrained to jobs that they can accept, but having a job might increase the likelihood of having sufficient earning power to purchase a vehicle.” (p. 114)

**4) “Welfare Reform in Miami,” Brock, Kwakye, Polyne, Richburg-Hayes, Seith, A. Stepick, and C. Stepick, MDRC, June 2004.**

A study was done of “581 single mothers who were on welfare in May 1995 and who were mostly living in Miami-Dade’s poorest neighborhoods” surveyed in 1998 and 2001 after welfare reform got under way (p. Sum – 22).

“Many more women in the study owned cars in 2001 (56 percent) than in 1998 (36 percent). In the ethnographic sample [42 current and former welfare recipients – p. Sum-14] , many women talked about the importance of car ownership in a city that is spread out and lacks good transportation.”(p. Sum-27)

“For example, recent employer surveys in Chicago, Cleveland, Los Angeles, and Milwaukee found that the majority of openings for which welfare recipients were qualified were in suburban firms that had little experience in employing African-American workers and were located far from public transit stops. In these surveys , even

though most of the job openings were in the suburbs, most of the recently hired welfare recipients were working for inner-city, not suburban employers. Thus obtaining the more plentiful suburban jobs requires that adequate public transit systems (or transportation assistance) be in place and that agencies that are charged with helping recipients find employment keep them informed about job opportunities in suburban areas and help them to overcome racial discrimination. This kind of help may be especially important for inner-city welfare recipients, whose social networks are less likely to include stably employed neighbors who can act as informal sources of job referrals.” (p. 6) Studies cited were: Holzer, Harry. 1999. “Will Employers Hire Welfare Recipients?” *Focus* 20(2):26-30; Holzer, Harry and Michael A. Stoll. 2000. *Employer Demand for Welfare Recipients by Race*. JCPR Working Paper 197. Chicago: Joint Center for Poverty Research.

**5) “Community Service Jobs in Wisconsin Works: The Milwaukee County Experience” Robles, Doolittle, Gooden, MDRC, June 2003.**

Interviews at 47 work sites with 100 Community Service Job (CSJ) (a commonly assigned component of Wisconsin welfare-to-work programs) participants and direct supervisors from October 1999 to October 2000 indicate that:

“Of the [CSJ] participants who were given a choice of worksite, 43 percent chose one where they would acquire training; 41 percent chose a worksite that provided work activities that they already knew they liked or that employed people that they knew; and 15 percent said that they chose a worksite that was located close to their home or that had convenient transportation.” (p. 33)

“Related to child care – and also an influence on participation in assigned work activities – is transportation. CSJ participants reported significant difference in the time it took to get to their worksite, depending on whether or not they first needed to deliver their children somewhere. Most participants who had to drop off their children took longer than 20 minutes to get to their worksite. Only 16 percent of this group reported travel times of under 20 minutes, compared with 61 percent of participants who did *not* need to drop off their children on the way to their work site.<sup>11</sup> Two W-2 [Wisconsin Works] agencies mentioned offering transportation for CSJ participants’ children, who are picked up at home and brought to their local school or child care provider.” (p. 46-7)

Footnote 11: “No notable relationship was found between transportation time and the number of children that participants had. (p. 47)

**6) “Comparing Outcomes for Los Angeles County’s JUD-Assisted and Unassisted CalWORKs Leavers” Verma and Hendra, Prepared for HUD, HHS, and other public agencies, MDRC, January 2003.**

A survey was conducted of 372 CalWORK’s (California’s welfare-to-work program) recipients who stopped receiving welfare in quarter 3 of 1998 for at least 2 consecutive

months in Los Angeles County (Table A.1). The sample is divided into three groups: “Unassisted” those not receiving HUD assistance at the time of exit (174), “Project-based Assistance” receiving public housing or housing project based assistance (58), “Tenant-based Assistance” receiving Section 8 vouchers and certificates (140). (p. 3, 23)

**Table A.1 Commute Times of those who commute to work**

|                           | Unassisted | Project-based | Tenant-based |
|---------------------------|------------|---------------|--------------|
| Average Commute (minutes) | 28.3       | 24.7          | 29.3         |
| Drive Own Car             | 47.7       | 50.0          | 46.4         |
| Drive someone else's car  | 6.9        | 5.2           | 7.1          |
| Get a ride with someone   | 14.9       | 15.5          | 17.1         |
| Use public transportation | 24.7       | 25.9          | 20.0         |
| Walk                      | 6.9        | 8.6           | 8.6          |
| Work at home              | 5.7        | 1.7           | 7.9          |

(all in percent except second row)

“The commute times reported by the three groups appear to be relatively short, compared to the expectation that most former recipients live in inner city neighborhoods and far from places of employment. Unlike the northeastern cities with high concentrations of welfare, it’s possible that because Los Angeles County’s welfare population is more dispersed that welfare recipients are more likely to live closer to places of employment. An alternative explanation is that because of the transportation challenges in a county the size of Los Angeles, the welfare population is more likely to be connected to very local employment opportunities.” (p. 24).

**7) “Leavers, Stayers, and Cyclers: An Analysis of the Welfare Caseload,” Cynthia Miller, MDRC for HHS, November 2002.**

Using 1990’s administrative and survey data on welfare-to-work program participants in from Vermont, Minnesota, Connecticut, Florida, and a national program, the study divides its sample into: a) “Leavers” who received welfare for at least 6 consecutive months and subsequently left and stayed off welfare for 12 consecutive months. 80% of these people had one welfare spell during the follow-up period (four to six years), b) “Stayers” who never left welfare, or who had multiple welfare spells and spent most of the follow-up period on welfare. Most had two welfare spells and spent at least 70 percent of the follow-up period on welfare, c) “Cyclers” who had one welfare spell that was six months or less, or had multiple spells but did not spent most of the follow-up period on welfare. Most had two or more spells but spent less than 70% of the follow-up period on welfare. (p. 10-16).

Data was gathered on recipients (with families – mostly female headed single parent) response to seven “potential barriers to work”: child care problems, transportation problems, health or emotional problems, lack of work in the year prior to the random assignment, lack of high school diploma, the presence of children under age 6, and the presence of two or more children. Table A.2. (p. 18) of the report, indicates that:

**Table A.2. Potential Barriers to Work**

| Could not work at random assignment due to: | Stayers | Cyclers | Leavers | Difference between Stayers and Leavers | Difference between Cyclers and Leavers |
|---|---------|---------|---------|--|--|
| Child care problems                         | 69.2    | 52.7    | 58.9    | 10.3**                                 | -6.2**                                 |
| Transportation problems                     | 45.3    | 35.1    | 37.4    | 7.9**                                  | -2.3**                                 |
| Health or emotional problems                | 30.9    | 20.5    | 23.3    | 7.6**                                  | -2.8                                   |
| Sample Size                                 | 12,271  | 7,673   | 16,505  |  |  |

(\*\*) indicates statistically significant difference.

Transportation was the second most commonly cited barrier after child care and there was a statistically significant difference of 7.9% between the “transportation problems” share of “Stayers” on welfare, and “Leavers”.

In Figure 1B (p. 24) , the response of each program (Vermont Work Restructuring Program (WRP), Minnesota Family Investment Program (MFIP), the National Evaluation of Welfare-to-Work Strategies (NEWS) , and Florida Family Transition Program (FTP)) to the “Transportation problems” question is reported. “Again, the overall pattern found for the pooled sample is found for each program. For all programs, at least 30% cite “transportation problems”, and Stayers in each program are more likely than leavers to report problems with child care and transportation.(p. 24).

Table A.3, (p. 29), presents data for the Florida FTP program for Stayers and two groups of Leavers: “Non-Time Limit Leavers” who left welfare before reaching their time limit for termination of Welfare benefits, and “Time-Limit Leavers” who left when they reached their time limit for cessation of benefits.

The data indicate that Transportation problems were the most commonly cited barrier to employment for all three groups in the program.

**Table A.3. Transportation Problems of Welfare Clients**

| Could not work at random assignment due to: | Stayers | Non-Time Limit Leavers | Time-Limit Leavers |
|---|---------|------------------------|--------------------|
| Child care problems                         | 38.7    | 40.6                   | 31.3               |
| Transportation problems                     | 55.6    | 44.9                   | 34.4               |
| Health or emotional problems                | 35.5    | 21.6                   | 12.5               |
| Sample Size                                 | 43      | 439                    | 75                 |

Finally, Table A.4 (Table 10, p. 41), provides the following data for Program and Control groups of Stayers for the entire sample:

**Table A.4. Problems Reported by Welfare Clients (Stayers)**

| Could not work at random assignment due to: | Program | Control | Difference between Program and Control |
|---|---------|---------|--|
| Child care problems                         | 69.2    | 68.4    | 0.8                                    |
| Transportation problems                     | 45.3    | 42.5    | 2.8**                                  |
| Health or emotional problems                | 30.9    | 26.7    | 4.2**                                  |
| Sample Size                                 | 12,271  | 7,307   |  |

This data shows that across all the programs, among Control Stayers (traditional AFDC recipients in each state who were not in the welfare-to-work programs) transportation is the second most common barrier to employment cited by 42.5% of the sample, a slightly lower percentage than among Program Stayers. (p. 40, 41).

**8) “Welfare Reform in Cleveland: Implementation, Effects, and Experiences of Poor Families and Neighborhoods,” Brock, Coulton, London, Polit, Richburg-Hayes, Scott, Verma, MDRC, September 2002.**

Study notes that 80% of entry level job openings in the Cleveland-Akron Metropolitan area in 2000 were outside of the City of Cleveland. (p. 11)

“The challenge of reaching low-skill jobs in the suburbs is greatest for the approximately 50% of welfare recipients who rely on public transit. For example, for the average welfare recipient, an auto commute of 20 minutes results in access to 12.8 percent of entry-level job openings, while a commute of the same length via public transit yields access to only 1.9 percent of job openings. For a 30-minute trip, the auto commute provides access to 41.7 percent of the job openings, compared with 7.1 percent for a public transit commute. Thus auto commuting provides access to roughly six times as many job opportunities and commuting by public transportation. Alternatively, it would take public transportation commuters about 65 minutes to reach the same number of job opportunities as auto commuters can reach in 30 minutes. Each day, it would take an extra 70 minutes of commute time for public transit users to have equal access to job openings.” (p. 10)

“In this respect, Cleveland is a city in which employment is highly decentralized relative to other cities in the nation,<sup>20</sup> and the limited public transportation isolates poor neighborhoods from skill-appropriate employment opportunities. Given such a pattern, significant efforts are needed to assist workers in bridging spatial barriers. (p. 11)

Footnote 20: “Glaeser, Kahn, and Chu. 2001. Job Sprawl: Employment Location in U.S. Metropolitan Areas. Washington D.C.: Brookings Institution

The survey of 689 women TANF leavers in 1998 and 2001, identified three areas of material hardship: food, housing, and healthcare, and:

“Although not measured in the survey, the ethnography identified three other important domains of material hardship: lack of adequate clothing, lack of reliable transportation, and problems affording prescription and over-the-counter medications...Many women also noted that their lack of reliable transportation made it difficult for them to get to where the jobs were, to manage child care, and to get to better-quality, less expensive grocery stores.” (Footnote 35, p. 132)

#### **9) “The Employment Experiences of Public Housing Residents,” John M. Martinez, MDRC, September 2002.**

A 1999 survey was done of “all working age nondisabled heads of household who resided in public housing where “Jobs-Plus” (public housing welfare-to-work program) programs were to be implemented (Baltimore MD, Chattanooga TN, Cleveland OH, Los Angeles CA, St. Paul MN, and Seattle WA) (p. 6-7).

The survey found that among “Concerns associated with working full time”: “traveling to and from work” was a cited 9.6% of the time by respondents who were “employed within past year, full time” (sample size 731), 20.6% of those “employed within past year, part time” (out of 332), 24.7% of those “last employed more than one year ago (out of 338), and 36.3% of those “never employed” (out of 127).

The other six areas of concern were: “Making sure children were OK while at work, Worrying about safety traveling after dark, Arranging of repairs at unit (home), Losing

benefits because making too much money, Rent would be raised because making too much money, Having friends and relatives asking for money.”

Never-employed respondents were thus nearly four times more likely to mention transportation as an area of concern than the most connected group – those who had worked full time within the past year (36 percent versus 10 percent) and this difference is highly significant at the 1% level. (Table 5, p. 30, p. 36).

**10) “Welfare Time Limits: State Policies, Implementation, and Effects on Families”  
Bloom, Farrell, and Fink, Prepared for HHS, MDRC, July 2002.**

Report notes that in two states: North Carolina and South Carolina, “lack of transportation” and “unavailable transportation” are valid “exemption criteria” from welfare time limits. (Table A.3, p. 109)

**11) “Is Work Enough? The Experiences of Current and Former Welfare Mothers Who Work,” Polit, Widom, Edin, Bowie, London, Scott, Valenzuela, MDRC, November 2001.**

Data were collected from 1998-1999 in-home interviews with 2,860 women who had worked in the two-year period prior to the interview, and who in 1995 had been single mothers receiving welfare benefits and living in neighborhoods of concentrated poverty in large urban counties: Cuyahoga (Cleveland), Los Angeles, Miami-Dade, and Philadelphia.

The Women were divided into four groups: “1) Currently employed women who had worked in 19 or more of the 24 months before the interview (high employment stability); 2) currently employed women who had worked in 7 to 18 of the prior 24 months (moderate employment stability); 3) currently employed women who had worked in 6 or fewer of the prior 24 months (low employment stability); and 4) women who had worked in the prior two years but who were no longer working. (Two thirds of the women who had worked in the previous two years were working at the time of the interview.)” (p. ES-2, ES-3)

The 1,951 women who were currently working reported the following Table A. 5 (Table 3, p. 24):

**Table A.5. Problems Reported by Women**

|   | High Stability | Moderate Stability | Low Stability | All Currently Employed |
|---|----------------|--------------------|---------------|------------------------|
| Uses public transportation to get to work (%) | 28.1           | 37.5               | 43.7          | 33.2                   |
| Drives own car to work (%)                    | 47.1           | 35.8               | 26.1          | 40.5                   |
| Average number of minutes to commute to work  | 29.1           | 27.1               | 30.2          | 29.1                   |
| Sample size                                   | 1,075          | 579                | 297           | 1,951                  |

Group differences were significant at the 0.1% level.

The study states that:

“Transportation to work varied considerably in relation to employment stability. Almost half the high-stability group (47 percent) drove their own car to work, while only one fourth (26 percent) of the low-stability group did so. Low-stability workers were especially dependent on public transportation (44 percent). Only 43 percent of participants lived in a household with a car, ranging from 57 percent of the high-stability group to 37 percent of the low-stability group (not shown).

Transportation was an important issue for many of the ethnographic respondents [chosen for in-depth interviews – over a three to four year period – 30-40 families in each site – p. 10]. For example, Rosario, a moderate-stability ethnographic respondent from Miami, had held a job on and off for three years as a certified nurse’s assistant, providing home daycare. In that job, she earned the minimum wage and got no benefits working through an agency that employed her when it had the clients. Rosario had to use her car to get to her clients’ homes, so when she had a car accident, she was unable to continue working for the agency.

In contrast, Barbara, a high-stability ethnographic participant from Miami, and a better paying job with more regular hours and was able to repair her care when necessary, and thus maintain her job even in the face of car problems. Five months after her first interview, Barbara began working for the U.S. Postal Service as a full-time “casual” (temporary) employee for \$10 per hour. She stayed at that job for the next two years and even received a raise. However, a neighbor once asked to borrow Barbara’s car, and when she refused, he lashed out. Barbara reported:

Everybody think I'm making a lot [of money] ... they say, "Oh, Barbara at the Post Office now, she making plenty of money." ... I'm not making any money, [I get] \$300 plus take out what the government's taking out, I'm not going to be making anything. Yeah... that's why that man did that to my car. They flat all four my tires. They kicked my two side mirrors off. They rip my wind shield wipers off. They sucked the gas out of my tank... Because I wouldn't let the guy [use] my car. I know he did it, but you know, by the grace of God, I'm going to keep on going. The devil ain't going to stop me.

Barbara's experience may be an extreme case. However, the respondents in this study could seldom afford housing that included a garage, and to the extent that there were higher rates of car theft and vandalism in their neighborhoods, the Urban change women faced increased risk of car problems." (p. 34-5).

"Commuting time to work averaged around a half hour for women in the survey, but those using public transportation endured longer commutes.

For women in the survey sample, commuting from home to work took, on average, 29 minutes, one way, with times ranging from no commute (for those 5 percent of women who worked at home) to two hours or more. Some 74 percent of women reported that it took them a half hour or less to get to work, but a noteworthy minority (13 percent) said that it took them an hour or more each way (not shown). Differences in the commuting time among the three stability groups were significant, with the shortest commuting time being found among women in the high-stability group – that is, the group most likely to drive to work. The mean commuting time for women who drove to work was 22 minutes, compared with nearly twice as long (42 minutes) for those who relied on public transportation (not shown); in sum, those who depended on public transportation spent nearly an hour and a half each day, on average, in transit alone.

Several ethnographic cases speak to the difficulties these long commutes impose on the working poor. For example, Tina had to leave her home in northwest Philadelphia at 6 A.M. to make it to the hotel housekeeping job she took on the far South Side, near the airport, by 8 A.M. Because of this two hour commute, Tina's older daughter, a high school student, was responsible for getting her young siblings ready for daycare and getting them to the daycare van (which cost Tina \$50 per week) when it came. The van was frequently late, which thus delayed her older daughter's departure for school, making her tardy. Tina, who was combining work and welfare because the financial incentives and low wages continued to make her eligible for welfare, worried that school officials might report her daughter's repeated truancy to the welfare office, which could, in turn, result in a sanction." (p. 35).

Table A.6 (Table 4, p. 37) compares women who were currently employed with "women who worked in prior two years but were no longer employed".

**Table A.6. Public Transportation Use of Women based on Employment Status**

|  | Currently Employed | No Longer Employed | All Women who work |
|--|--------------------|--------------------|--------------------|
| Works/worked a regular day shift (%)               | 68.0               | 59.9               | 65.5               |
| Uses/used public transportation to get to work (%) | 33.2               | 45.7               | 37.1               |
| Sample size  | 1,951              | 909                | 2,860              |

All differences are significant at the 0.1% level.

No longer employed women were “...significantly less likely than currently employed women to have worked the day shift, and they were much more likely to have relied on public transportation.” (p. 36).

“Previously employed women who voluntarily left their jobs cited a variety of reasons, the most common being inadequate pay (11 percent of those who quit). The median hourly wage for those who cited this as their reason for quitting was \$5.15 per hour – the legal minimum wage at the time. Other common reasons for quitting included personal health problems or an injury (10 percent): interpersonal conflicts with coworkers or their boss (10 percent), child care problems (9 percent), a recent birth or pregnancy (9 percent), and transportation problems (8 percent).” (p. 39).

**12) “Matching Applicants with Services: Initial Assessments in the Milwaukee County W-2 Program,” Gooden, Doolittle, Glispe, MDRC, November 2001.**

Observations were made of 100 intake interviews in Milwaukee County at five different W-2 (Wisconsin’s Welfare-to- Work program) between May and August of 1999 (p. 58, 70).

Among nine “Employment sustaining” topics discussed, “Transportation” was the second most frequent after “Education”. The topics and frequencies were as follows: Child care 83%, Domestic Violence 4%, Education 95%, Housing 60%, Labor market discrimination 5%, Legal issues 41%, Medical issues--child 17%, Medical issues—self 65%, Transportation 85% (Table 5.1, p. 70).

The study notes that “Education, Transportation, and Child Care” were routinely covered in more than two thirds of the interviews observed (p 79).

Moreover: “Compared with the other employment barriers examined, such as transportation and housing, child care was less often cited as an impediment to working.” (p. 83).

“The topic of transportation was mentioned in 85 percent of the intake interviews. Among these applicants, 86 percent cited the bus as their primary means of transportation, and few had a driver’s license or a car.... The remaining 14 percent of applicants cited other primary means of transportation, including borrowing a car or getting a ride from relatives or friends. For the few who had cars and licenses, other circumstances made transportation unreliable, such as needed car repairs, impounded vehicles, a suspended driver’s license, or traffic fines. Only four individuals in the sample reported having both a valid driver’s license and access to a dependable car.” (p. 82)

**13) “SSP Plus at 36 Months: Effects of Adding Employment Services to Financial Work Incentives,” Lei and Michalopoulos, SRDC, July 2001.**

SSP is a Canadian financial incentive program that offers a supplement to earnings, in the form of monthly cash payments to people who left income assistance (IA) and worked full time (30 or more hours per week). “SSP Plus” adds a jobs-search and other employment services such as resume, coaching, self-esteem, and job leads, to the SSP financial incentives. (p. 3-4). The following reasons were given for not working by the respondents Table A.7 (Table 1, p. 12):

**Table A.7. Reported Reasons for Not Working**

| Not working and couldn’t take in a job in prior 4 weeks because of (%) | Overall | SSP Plus Group | Regular SSP Group | Control Group |
|--|---------|----------------|-------------------|---------------|
| Own illness or disability  | 13.2    | 12.5           | 14.8              | 12.4          |
| Lack of adequate child care  | 9.9     | 12.1           | 9.3               | 8.4           |
| Personal or family responsibility                                      | 12.1    | 11.0           | 12.2              | 13.1          |
| Going to school  | 7.2     | 11.4           | 5.2               | 5.1           |
| No transportation  | 5.8     | 6.6            | 5.2               | 5.5           |
| Too much competition   | 0.1     | 0.0            | 0.0               | 0.4           |
| Not enough education   | 4.5     | 1.8            | 6.3               | 5.5           |
| Not enough experience or skills  | 3.5     | 1.5            | 4.8               | 4.4           |
| Sample size  | 820     | 274            | 270               | 276           |

This study is based on a sample of 892 New Brunswick IA recipients between November 1994 and March 1995, who were: “single parents at least 19 years old who had received welfare in the current month and at least 11 of the prior 12 months. 293 were assigned to the SSP Plus program, 296 to the regular SSP program, and 303 to the control group (not enrolled in either program). (p. 5)

**14) “Monitoring Outcomes for Cuyahoga County’s Welfare Leavers: How Are They Faring?,” Verma and Coulton, MDRC and Case Western Reserve University, July 2001.**

Surveys were done of 6,151 single, female adult parent AFDC/TANF “leavers” (who had their cases closed in quarter 3 of 1996 and 1998 and not open within two consecutive months of closing) in Cuyahoga County Ohio. Of these, in-depth interviews were conducted with 306 TANF leavers who left cash assistance in quarter 3 of 1998. These interviews were conducted approximately 14 to 21 months after sample members exited welfare in 1998. (p. 1-2).

The interviewed sample reported the following Table A.8. (Table 3.5, p. 34):

**Table A.8. Commute Pattern of Former Welfare Clients**

|                            |                      |
|----------------------------|----------------------|
| Commutes to Work (%)       | All Employed Leavers |
| Average commute (minutes)  | 26.4                 |
| Drives own car             | 33.6                 |
| Drives someone else’s car  | 8.7                  |
| Gets ride with someone     | 13.1                 |
| Uses public transportation | 40.7                 |
| Walks                      | 6.5                  |
| Works at home              | 3.2                  |
| Sample size                | 306                  |

“Uses public transportation” was the most frequently cited way of getting to work.

**15) “What Works Best for Whom: Impacts of 20 Welfare-to-Work Programs by Subgroup,” Mchelopoulos and Schwartz, MDRC, January 2001.**

Data were gathered from random assignments of welfare recipients to 20 welfare-to-work and control group AFDC programs from 1986 to 1996 in: San Diego CA; Alameda, Butte, Los Angeles, Riverside, San Diego, and Tulare counties CA; Atlanta GA, Grand Rapids MI, Riverside CA; Columbus OH; Detroit MI and Oklahoma City OK; Portland OR; seven rural and urban counties in MN; Escambia County, FL. (ES-2 and ES-3).

A “Transportation problem” occurred in individuals said that they “had no way to get to the activity every day.” (p. 41).

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Table 2 (p. ES-7) and Table 4.2 (p. 43) show that 35.2% (7,212 out of 20,464) recipients had “transportation problems”. Moreover, families with transportation problems earn slightly more than half (\$7,212 per year) as much as families without transportation problems (\$13,252).

**16) “The Family Transition Program: Final Report on Florida’s Initial Time-Limited Welfare Program,” Bloom, Kemple, Morris, Scrivener, Verma, and Hendra, Manpower Demonstration Research Corporation (MDRC), December, 2000.**

72% of a sample of 1729 persons certified for AFDC/TANF benefits between May 1994 and February 1995 who were not employed at the time of this assignment reported that they were facing “at least one of five specific barriers to employment. By far the most commonly cited barriers were related to child care and transportation issues....” (p. 16, 230).

These individuals were randomly assigned to either a traditional AFDC “Project Independence” (PI) program (869), or to a new TANF “Family Transition Program” (FTP) (860) (p. 12, 35, 230). Initially FTP was much more generous with transportation assistance than PI had been. However, as these costs rose FTP reduced transportation assistance (p. 50).

In mid-1997 a more severe sanctioning policy for non-compliance with work and training requirements came into effect. “The four year client survey [of 519 persons of the 1729 above] targeted a set of questions to respondents who said that they had been sanctioned. Overall, nearly three-fourths of them agreed that they had violated the rule that they were accused of violating. Of those who agreed, nearly one-fourth reported that transportation problems had caused them to be non-compliant.” (brackets mine, p. 54, 56).

“A series of survey questions asked [the 860 surveyed] FTP group members to assess how much their decision about working had been affected by five particular features of FTP: employment and training services, support services, advice and assistance from staff, the financial incentives, and the time limit. Overall, 65% of respondents reported that their decisions had been affected “a lot” by at least one of these aspects of FTP. Figure 2.8 shows the results separately for each of the five program elements. The results show that the largest proportion of respondents – nearly half [49%] – said that their decisions had been strongly influenced [“a lot”] by support services such as child care and transportation. “ (p. 62-4, brackets mine.)

Within a five year follow up period (July 1995 to June 1996), FTP spend about \$748 (in 1996 Dollars) per sample member on “Transportation and ancillary services”, AFDC/Project Independence spent \$39 (p. 209). FTP recipients were employed in 3.7% to 15.1% more quarters over the next four years, and received 9.5% to 23.6% more income. (Table B.1, p. 260).

**17) “Reforming Welfare and Rewarding Work: Final Report on the Minnesota Family Investment Program, Volume I: Effects on Adults,” Miller, Knox, Gennetian, Dodoo, Hunter, Redcross, MDRC, September 2000.**

A survey was done between April 1994 and March 1996 of over 14,000 families who had been receiving, or who were applying for, welfare in the three urban counties of Hennepin (Minneapolis), Anoka, and Dakota and in the four rural counties of Mille Lacs, Morrison, Sherburne, and Todd. These families were randomly assigned to either the welfare-to-work “Minnesota Family Investment Program” (MFIP) or the AFDC system. The sample was further divided into “single parent families” and “two parent families”. Quarterly follow-up assessments of these two groups were done for up to three years after they entered the evaluation.

Single parent families were divided into “Long term recipients” “who had received welfare for two years or more when they entered the evaluation”, and “Recent Applicants” who “were applying for welfare or had been receiving benefits for less than two years when they entered the program (the majority were new applicants). Long-term recipients “were immediately subject to both MFIP’s employment-related mandates and its financial incentives.” Recent applicants “received MFIP’s financial incentives but did not face a mandate to work or participate in employment-related activities until they received benefits for 24 months.” (p. ES-1, 1). Table A.9 (Table 2.3, p. 46) provides the following information for Single-Parent families

**Table A.9 Reasons for Not-Working (Single Parents)**

| Among those not currently employed, percentage who agreed or agreed a lot that they could not work part time right now for the following reasons: <sup>a</sup> | Long-Term Recipients | Recent Applicants |
|--|----------------------|-------------------|
| No way to get there every day  | 49.1                 | 35.4              |
| Cannot arrange for child care  | 54.1                 | 47.4              |
| A health or emotional problem, or a family member with a health or emotional problem   | 28.2                 | 29.5              |
| Too many family problems   | 27.5                 | 30.1              |
| Already have too much to do during the day   | 25.2                 | 21.8              |
| Any of the above five reasons  | 82.5                 | 75.3              |
| Sample Size  | 3,208                | 6,009             |

<sup>a</sup> Part time is defined as a minimum of 10 hours per week. Full time is defined as 40 hours per week.

Two parent families were divided into “Recipients” who “had been receiving benefits for at least one month”, and “Applicants” who were applying for welfare when they entered the program. Recipients “received MFIP’s financial incentives, and most were required to participate in employment-related services, because they had already received welfare for more than six months.” Applicants “received MFIP’s financial incentives but did not face a mandate to work or participate in employment-related services until they had received benefits for six months.” (p. ES-5). For single-parent families transportation is the second most common barrier to employment (after child care) for both groups.

Table A.10. (Table 2.5, p. 55) provides the following information for Two-Parent families.

**Table A.10. Reporte Reasons for Not-Working (Two-Parent Families)**

| Among those not currently employed, percentage who agreed or agreed a lot that they could not work part time right now for the following reasons: <sup>a</sup> | Long-Term Recipients | Recent Applicants |
|--|----------------------|-------------------|
| No way to get there every day  | 41.7                 | 26.1              |
| Cannot arrange for child care  | 55.0                 | 41.3              |
| A health or emotional problem, or a family member with a health or emotional problem   | 33.0                 | 28.9              |
| Too many family problems   | 31.5                 | 26.2              |
| Already have too much to do during the day   | 30.0                 | 25.9              |
| Any of the above five reasons  | 79.3                 | 70.6              |
| Sample Size  | 1,523                | 733               |

For two-parent families who are “Long term recipients” transportation is again the second most common barrier after child care. Only among “Recent Applicants” (who may not be as familiar with these transportation issues) does transportation drop to (a close) fourth most common barrier.

Table A.11 (Table 4.13, p. 119) provides (self reported – except for “earnings” question) data on long-term recipients in the MFIP group in urban counties by the number of quarters they worked (at least) part-time in the follow-up period.

**Table A.11. Potential Employment Barriers**

| Characteristic (%)                             | Did Not Work | Worked Less Than 7 Quarters | Worked More Than 7 Quarters |
|--|--------------|-----------------------------|-----------------------------|
| Potential employment barriers                  |              |                             |                             |
| No high school diploma                         | 49.6         | 40.4                        | 23.2                        |
| No earnings in year prior to random assignment | 89.3         | 57.9                        | 54.8                        |
| Low sense of efficacy                          | 55.4         | 42.2                        | 37.8                        |
| Reported emotional/health problems             | 52.6         | 33.5                        | 21.6                        |
| Problems arranging for child care              | 57.9         | 55.9                        | 51.4                        |
| Problems with transportation                   | 61.3         | 48.7                        | 39.3                        |
| Sample size                                    | 131          | 330                         | 385                         |

Among self reported barriers to employment (or excluding “prior year earnings”), “problems with transportation” is other first (for those who “did not work”) or second after “child care” for those who worked more or less than 7 quarters. a self-reported value of “yes” is given when the respondent “agrees, or agrees a lot” to the statement. For example, “yes” on “problems with transportation” is given when respondent agrees, or agrees a lot, “that they could not work part time because they had no way to get to work”. (p. 119)

**18) “Barriers to the Employment of Welfare Recipients,” Corcoran, Danziger, Heflin, Kalil, Levine, Rosen, Seefeldt, Siefert, and Tolman, Ann Arbor, University of Michigan, Poverty Research and Training Center. 1999.**

A sample was taken in late 1997 of 753 single mothers with children who on the February 1997 welfare roles in an urban Michigan county. The women were between 18-54 years of age, non-hispanic white or African American, and U.S. citizens.

Fourteen barriers to employment were defined. “Transportation problem” was defined as “Does not have access to a car and/or does not have a driver’s license.” (p. 21).

47.1% of the women in the sample had this barrier and this was the most prevalent barrier. In the 1990 census 7.6% of all women ages 18-54 live in households with no vehicles available.

Other barriers were: Less than HS Education 31.4%, Low work experience 15.4%, Fewer than 4 job skills 21.1%, knows 5 or fewer work norms 9.1% , perceived discrimination 13.9%, major depressive disorder 25.4%, Post Traumatic Stress Disorder 14.6%, Generalized anxiety disorder 7.3%, Alcohol dependence 2.7%, Drug dependence 3.3%, Mother's health problem 19.4%, Child health problem 22.1%, Domestic violence 14.9%. (Table 3, p. 22).

The report notes that; "Almost half the women have transportation problems, and there is a 12.4 percentage point difference in the probabilities of working between those with and without access to a car or driver's license." (p. 13)

**19) "Executive Summary National Evaluation of Welfare-to-Work Strategies: Implementation, Participation Patterns, Costs and Two-Year Impacts of the Detroit Welfare-to-Work Program," Farell, MDRC, for U.S. Department of Health and Human Services and U.S. Department of Education, August 2000.**

"For many welfare recipients with young children, child care is the major obstacle to working or attending an education or job training program. Transportation is another barrier: unless an individual owns a car, or lives near a public transit stop – and can afford gas or transit fare – getting to a job or to an education or training program may be difficult. A third barrier, usually less formidable than child care, or transportation, may be getting the money to purchase the work uniform, school books, or other supplies necessary to start an education or training program."(p 30).

"Case managers reported that Detroit's poor public transportation system was a barrier to work at times." (p. 32)

Based on expenditure data collected between October 1992 and September 1993, the program spent an average of \$55 per member on "Transportation and Ancillary Services". (p. 61).

**20) "The Los Angeles Jobs-First GAIN Evaluation: First-Year Findings on Participation Patterns and Impacts," Freedman, Mitchell, and Navarro, Manpower Demonstration Research Corporation (MDRC), June, 1999.**

"Many of the nation's major urban areas have employment rates above the national average, little or no public transportation to connect inner-city residents to available jobs in the suburbs, and hard bureaucracies that can be hard to change."(p. ES-1)

"Critics [of a "Work First" approach] assert that programs emphasizing job search assistance may not work in many central cities, partly because the available jobs are often in the outer suburbs and many employers are inaccessible by public transportation. An important way to test this assertion is to estimate program impacts separately for each of the five GAIN administrative regions..... For instance the San Fernando Valley (Region 2) and San Gabriel Valley (Region 3) in the northern sections of Los Angeles County

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contain many of the newer suburbs and tend to be more prosperous than the older communities in the central and southern portions of the county.” (p. 15).

“The evaluation of Los Angeles DPSS’s earlier, basic-education focused GAIN program showed that impacts varied by region. Although the Los Angeles GAIN program as a whole did not have positive impacts through three years of follow-up, San Fernando Valley sample members (Region 2) achieved moderate earnings gains and relatively large reductions in AFDC receipt. In contrast, sample members from Southern (Region 5) experienced welfare reductions but no change in earnings.” (p. 16). “

**21) “Jobs First: Implementation and Early Impacts of Freedman, Mitchell, and Navarro, Manpower Demonstration Research Corporation (MDRC), June, 1999.**

41.1% of Manchester and New Haven, Connecticut, “Jobs First” Group Members said that “Support services such as child care or transportation” affected their decision about working. (p. 54).

Employed Job First participants reported an average one way transportation time of 21 minutes and an expenditure of 42\$ a month on transportation. (p. 116).

These data are from 379 Jobs First respondents interviewed in late 1998, 18 months after being assigned to the program (p. 19, 53).

**22) “Does SSP Plus Increase Employment? The Effect of Adding Services to the Self Sufficiency Project’s Financial Incentives,” Quets, Robins, Pan, Michalopoulos, and Card, May 1999.**

A sample of 892 of individuals, who had receive public income assistance for at least a year, between November 1994 and March 1995, in New Brunswick, Canada, were either assigned to receive a standard “Self Sufficiency Project” (SSP) financial incentive, or a “SSP Plus” package of incentives that included job search and related services, to get employment. (p. xxx – xxxvii).

A baseline survey indicates that 5.6% of 862 interviewed said that “no transportation” was the reason that they were “Not working and couldn’t get a job in the prior 4 weeks”. This figure rose to 6.3% for 286 individuals that were later assigned to the SSP-Plus program. Transportation problems were given as the reason for not getting a job at a higher rate than: “not enough education” (4.7% and 2.1%, respectively), “not enough experience or skills” (4.0%, 1.8%), “too much competition” (0.2%, and 0%), other (2.1%, 1.0%). Only “Any Reason”, illness or disability, personal or family responsibility, child care, and “going to school”, were cited more often. (Table 1.1, p. xxxix)

**23) “Big Cites and Welfare Reform; Early Implementation and Ethnographic Findings from the Project on Devolution and Urban Change,” Quint, Edin, Buck, Fink, Padilla, Simmons-Hewitt, Valmont, April 1999.**

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Transportation is widely recognized as a key factor in obtaining employment. All four major sites for welfare to work programs: Cuyahoga County, OWF; Los Angeles County, CalWORKSs; Miami-Dade County WAGES; and Philadelphia County, RESET, all offer “transportation support”. (Table 2.8, p. 43).

In Philadelphia, during their eight-week job search, recipients received \$138 to cover two months of transportation. (p. 162)

In California: “Other staff agreed that transportation is a barrier to employment and one employment specialist estimated that 95% of the recipients do not drive.” (p. 175).

**24) “Welfare Time Limits: An Interim Report Card” Dan Bloom, MDRC, April 1999.**

Notes that the Florida FTP study (see 1) above) indicates that only 28% said that “time limits” influenced their work decision a lot, whereas 49% said that “support services” like child care, and transportation, influenced their decision. (p. 59).

**25) “Connecticut Post-Time Limit Tracking Study,” Bloom and Hunter, MDRC, January 1999.**

A survey of 448 participants in the Connecticut’s “Temporary Family Assistance” (TFA) program six months after their cash benefits were discontinued in late 1997 when they reached their 21 month limit, indicates that of the 17% (or 76) of them who were unemployed (at the time of the interview), 6.5% attributed their unemployment to “transportation problems”. Transportation problems was tied for fourth of six reasons: “Can’t find a job” (48.4%), “Taking Care of Someone” (22.6%), “Health/Pregnancy” (9.7%), “Transportation problems” (6.5%), “In school” (6.5%), “Other” (3.2%). (Table 2: Employment Characteristics, and Section II.A.1.)

**26) “An Early Look at Community Service Jobs in the New Hope Demonstration,” Brach, Granger, Poglinco, July 1998.**

The 1994 New Hope Neighborhood Survey random sample of 700 respondents from two low income, high unemployment, zip codes in Milwaukee (see 9) above) which include 12,400 residents found that:

“Eighteen percent of adults who reported being jobless but available for full-time work cited lack of transportation as a reason for not having a job.” (Section III, C)

**27) “Evaluating Two Welfare-to-Work Program Approaches: Two-Year Findings on the Labor Force Attachment and Human Capital Development Programs in Three Sites,” Hamilton, Brock, Farrell, Friedlander, Harknett, MDRC, December 1997.**

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A sample of 6,963 Job Opportunities and Basic Skills Training (JOBS) enrollees at three sites (Atlanta GA, Grand Rapids MI, and Riverside CA) were asked at the time of their enrollment (from June 1991 to January 1994, depending on the site) what obstacles they anticipated for participating in the JOBS welfare-work-program. (p. 1, 31, Table 2.2, p. 31)

“Approximately 77% of JOBS enrollees anticipated at least one obstacle to welfare-to-work participation, with between 58 and 70 percent reporting that the cost of child care would prevent them from attending program activities. Lack of transportation was another commonly perceived barrier to participation, with 37% to 41% of enrollees reporting that this was a barrier. Health and emotional problems were also perceived as barriers to participation; between 19 and 21 percent reported that they could not participate in a welfare-to-work program because they themselves suffered from a health or emotional problem. Furthermore, 18 to 20 percent reported that they could not participate because a family member was suffering from a health or emotional problem.” (p. 30).

“For many welfare recipients with young children, the major obstacle to working or attending an education or job training program is child care. Another barrier confronted by many welfare recipients is transportation: unless an individual owns a car or lives near a public transit stop – and can afford gas or transit fare – getting to a job or to an education or training program may be difficult. A third barrier, usually less formidable than child care or transportation is getting the money to purchase the work uniform, school books, or other supplies necessary to start a job or education or training program.” (p. 96)

Grand Rapids and Riverside had less extensive public transportation networks, and JOBS staff indicated that transportation sometimes posed more of a problem. In Riverside – a sprawling county encompassing 7,208 square miles – remote home addresses (defined as being more than one mile from a public transportation stop) were the reason why some clients deferred from JOBS participation. Indeed ....in a typical month in Riverside, lack of transportation accounted for 7 percent of clients who did not participate. In Atlanta and Grand Rapids, transportation problems accounted for less than 1 percent of clients who did not participate.” (p. 99)

“The Family Support Act required states to reimburse and pay for child care, transportation, and other work related expenses (for example, uniforms, tools, equipment, books, and registration or licensing fees). The welfare department spend \$499 (on average) on support services. This amount varied substantially across the three sites. Atlanta paid quite generously for child care, transportation, and ancillary services (\$967), while Riverside spent very little (\$137), owing to very low JOBS child care costs.” (p. 164).

Table 7.3 (p. 171) analysis costs per member in the labor force attachment (LFA) JOBS experimental group (as opposed to the control group). It shows that Atlanta spend on average \$67 dollars a month per LFA member on transportation (53% of LFA group

members received transportation support averaging \$38 a month for an average of about three months totaling \$126). Grand Rapids spend on average only \$26 per month (no breakdown available). Riverside spent \$35 a month ( \$24 a month over about three months for a total of \$65 for 54% of group members). (p. 171).

**28) “Creating New Hope: Implementation of a Program to Reduce Poverty and Reform Welfare,” Brock, Doolittle, Fellerath, Wiseman, MDRC, October 1997.**

In 1994, a general household survey of two high unemployment and high poverty zip codes in Milwaukee that (53208 on the north side, and 53204 on the south side) suggested that about one adult in four, or 12,400 adults, was a “likely participant” in the “New Hope” program’s job access and other benefits. It was also found that about 18% of these adults who reported being jobless but available for full-time work cited lack of transportation as the reason for not having a job (p. ES-8).

Table 3.5 shows that there are very large differences between the time that it takes to drive to a job in a Milwaukee suburb and the time needed to reach the same job by bus. The table shows commute times by bus that are 3-6 times longer than driving times by car. (p. 44-45) The only public transportation available to inner city residents for this purpose (p. 42).

According to baseline New Hope survey data, 59% of participants do not have access to an automobile that they can use to drive to work. Similarly, an earlier (Employment and Training Institute, 1994) survey of residents of Milwaukee’s central city residents, including those who live in the two New Hope target areas, found that 64% of the unemployed job seekers who were interviewed did not own an automobile. Another 17% had an automobile but no valid license. Thus only 19% had an automobile and a license. “Not surprisingly, only 17% of the interviewed unemployed job seekers had applied for jobs in the WOW [Milwaukee suburban] counties.” (p. 44, brackets mine.)

**29) “Monthly Participation Rates in Three Sites and Factors Affecting Participation Levels in Welfare-to-Work Programs,” Hamilton, MDRC, January 1995.**

Data collected from the case files of 1,113 AFDC recipients from three sites (Atlanta, Georgia; Grand Rapids, Michigan; and Riverside, California) over two “typical” months (October and November, 1992) indicate that between 1%-28% of individuals who were not involved in the JOBS welfare to work program during these two months but who had attended a JOBS Orientation, cited “No transportation available” as their reason. Data is from Table 2 (Atlanta: 0.2/22.6=1%; Grand Rapids: 0.3/11.9=2.5%; Riverside 4.5/16.1=28%).

**30) “GAIN: Benefits, Costs, and Three-Year Impacts of a Welfare-to-Work Program,” Riccio, Friedlander, and Freedman, MDRC, September 1994.**

An survey of participants in California’s “Greater Avenues for Independence” welfare to work (GAIN) Program in the early 1990’s found that from 2% to 13% of those who ever

received a deferral from program participation within 11 months after orientation cited: “No transportation” as the reason for their first deferral. Data are from Table 2.2, p. 28: Alameda  $1.2/46.2=2.6\%$  sample size 602; Butte  $4/31.5=12.7\%$  sample size 200; Los Angeles  $1.1/48.9=2.2\%$  sample size 3013; Riverside  $1.2/48=2.5\%$  sample size 248; San Diego  $1.2/64.4=1.9\%$  sample size 247; Tulare  $6.2/53.3=11.6\%$  sample size 225.

Data on costs of support services for the Gain program across the six counties indicates that average observed and projected average total five year costs for the sample were \$261 for Transportation and \$225 child care. So that:

“It shows that, across all six counties, child care accounted for about 39% of the per experimental cost of all support services provided as part of the GAIN program, while transportation accounted for 45%, followed by ancillary services at almost 17%. Transportation cost more than child care per experimental because a much larger proportion of the experimental sample received transportation payments (57 percent) than used GAIN-funded child care (14 percent), as indicated in column A [of Table 3.3, p. 80-1]. However, as expected, the cost per person receiving transportation payments (\$387) was much lower than the cost person using child care paid for by GAIN (\$1,229), and indicated in column C.” (p. 79).

“Other support services” (i.e., transportation and ancillary costs) made up about 8.1% of total GAIN costs, child care was 5.1%, and program “operating costs” 87%. (p. 85, Table 3.2, p. 78).

Of a sample of 223 persons who “quit” their jobs within two or three years after a GAIN orientation in five counties (excluding Butte), 19% said that quit because of “transportation problems”. “Transportation problems” was the second most likely main reason for quitting after found better work (22%). other reasons cited with much less frequency than transportation were: “a desire not to work anymore (0.004 percent), wanting to return to welfare to receive medical benefits (0.004 percent), becoming pregnant (2 percent), planning to go to school (2 percent), having disagreements with spouses or mates because of work (3 percent), or having child care problems (4 percent).” (p. 184, 186)

“In most instances transportation problems did not occur because respondents had taken jobs so far away from their homes that they could not get to them, or because their means transportation was unreliable. Usually such problems arose because the respondent had to move, owing to a changing family situation or a sick relative.” (p. 186)

A survey of AFDC-FG (AFDC single parents, most with children no younger than 6, p. 14) “experimental” respondents (who were enrolled in GAIN) in Alameda, Riverside, San Diego, and Tulare Counties indicates that 4% out of 40% of respondents who “were not looking for a part-time or full-time job” (i.e. 10% of these individuals) said that “transportation problems” were the most important reason for not looking for a job.(Figure 5.1, p. 187)

A similar survey of an AFDC-FG “control group”, who were not enrolled in GAIN,

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indicates that 7% of 46% who were not looking for a job (or 15%) cited “transportation problems” as their main reason. (Figure 5.2, p. 189)

**31) “Unpaid Work Experience for Welfare Recipients: Findings and Lessons from MDRC Research,” Brock, Butler, and Long, MDRC, September, 1993.**

In assigning AFDC recipients to a “Community Work Experience Program” (CWEP) in the 1980’s at four sites: San Diego; Baltimore; Cook County, Illinois; West Virginia; and New York City, “MDRC’s studies of CEWP programs found that transportation availability was the single most important determining factor for where participants were placed. For example, in San Diego, counselors attempted to find positions that matched recipients backgrounds and interests and that were close to their homes. However, when a choice between these factors had to be made, geography was the determining factor, both because it minimized travel reimbursements and was more convenient for participants with home responsibilities.” (p. 31). Documented in: “Preliminary Findings from the San Diego Job Search and Work Experience Demonstration,” Goldman, Gueron, Ball, and Price, 1984, MDRC.

**Conclusion of Literature Review in Section A.2**

A large number of studies of employment conditions of former welfare recipients from multiple locations in the U.S. from 1990 to 2003, show that “transportation problems” affected 26% to 49% of these, mostly single mothers, and were among the top three most cited barriers to getting and keeping a job. In many cases transportation problems were second only to “child care” in importance, and in some cases they were the most important barriers. Transportation problems were also shown to cut long term yearly income in half, reduce employment “stability” (or length of job tenure), and impede completion of employment training programs.

These studies provide a completely impartial (“double blind”) confirmation of the importance of transportation to the employment, earnings, and job stability, of low-income workers.

**A.3 Review of Literature Pertinent to CBA**

**Evaluation of the National Job Corps Program**

One comprehensive CBA that has several points of importance for this study is that of the National Job Corps program (Mathematica, 2003). 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. Job Corps is distinguished from other programs by the intensive education, training, and support services it provides in a residential setting. This feature also makes Job Corps one of the most expensive

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education and training programs currently available to youths. As such, policymakers require information on its effectiveness. To meet this need, the U.S. Department of Labor sponsored the National Job Corps Study to examine implementation, measure the program's impacts on participants' employment and related outcomes, and assess whether the value of the program's benefits exceeds its costs. Details of the study as it pertains to the CBA approach used here are given in Appendix A.2.

The National Job Corps Study is based on a national random sample of all eligible applicants to Job Corps in late 1994 and 1995. The sampled youths were assigned randomly to either a program group or a control group. Program group members could enroll in Job Corps whereas control group members could not, but they could enroll in all other programs available to them in their communities.

Impacts were estimated by comparing the experiences of the program 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 impacts considered by this study fall into three broad categories: (1) the increased output produced by Job Corps participants which lead to increased earnings and fringe benefits, increased child-care costs and increased taxes (2) reduced use of other programs and services such as reduced use of other education and training programs, reduced use of public assistance and substance abuse treatment programs and (3) reduced criminal activity both by and against Job Corps participants. Impacts were monetized using market prices and benefits were measured by multiplying an estimate of the impact of the program by an estimate of the dollar value of the impact.

While nearly all the program costs are incurred during the time a program participant is in training, the benefits from the program may continue for many years after the youths leave the program. This calls for a longitudinal analysis of future year benefits. One critical aspect of the Job Corps CBA was that the four-year follow-up provided an outlet to having an empirical basis for future year benefits assessment. Only those outcomes that did not decline during the four-year observation period were assumed to grow in the future. Earnings impacts of program participants were analyzed to grow in the observation period. The authors also reviewed four other programs (Classroom Training Under Manpower Development Training Act, Private Sector Job-Specific Training, National Supported Work Demonstration program and Center for Employment Training in the Minority Female Single Parent Demonstration program) and found that although the focus of these training programs were different from that of the National Job Corps, earnings impacts do persist if the training program focused on multiple, more general skills but do not persist when training improves only one or two specific skills. Based on such information, the National Job Corps CBA assumed that the dollar value of the earnings impact persisted throughout the worklife of each participant. A discount rate of 4 percent was used in the study; sensitivity analysis showed that the benefits of the Job Corps program exceed costs unless discount rates of 10.5 percent or higher are used.

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### **Estimating Economic Impacts: A Study of Employment Programs for People with Disabilities**

A second study that is relevant from a methodological perspective is a CBA of employment programs for people with disabilities (Hemenway and Rohani, 1999). The study is important because it uses a clear and transparent approach in breaking down cost and benefits impacts. It estimates the costs of unemployment of persons with disabilities, the costs of vocational rehabilitation services for persons with disabilities, the costs of placing and maintaining persons with disabilities in employment and the earnings benefits and other benefits of vocational rehabilitation services for persons with disabilities.

The study is an example that links estimates of the impacts of the increased earnings of clients of the vocational rehabilitation system to the state economy. This, of course, is a strategy that is routinely used in many CBA on highway and transit investments. In the Florida disabilities study, increases in earnings that are stimulated in the economy through increased consumer spending and purchasing of goods and services were estimated using IMPLAN, a software package for economic impact analysis. Using county-level economic data on over 500 industries, IMPLAN allows for estimates of direct, indirect, and induced effects of increased spending in each industry. Direct effects include changes in economic activity due to changes or increases in spending and investment; indirect and induced effects refer to secondary effects, such as economic growth or decline, that occur as a result of direct effects. Based on the overall increase in annual earnings among vocational rehabilitation clients in closed cases of \$88.8 million in FY 1998, almost \$60 million in direct output, \$16.2 million in indirect output, and \$27 million in induced output will be generated, for a total of \$103.2 million in output. Economic stimulation resulting from increased earnings will also be responsible for generating an estimated 1,483 jobs, including 876 in direct employment, 209 in indirect employment, and 398 in induced employment.

### **Capturing Local Labor Market Dynamics: The Job Chain Approach**

In Input-Output (I-O) economic analysis of the kind possible with softwares such as IMPLAN, the input to the model is the dollar value of the travel costs savings (which are derived from estimates of travel time savings, safety benefits, and changes in operating costs) for industries that will benefit from a transportation investment. More sophisticated economic and forecasting economic models can also differentiate between the short-term impacts of constructing a transportation investment and the long-term impacts of maintaining and operating it, and the growth and expansion of user benefits over time. In addition, certain models are designed to simulate the behavior of individuals in response to changes in transportation costs, land prices, and other factors. Such models come much closer than I-O models to capturing the full range of potential benefits from transportation investments.

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While these types of economic impact assessment are invaluable to fully capture the benefits of traditional transit systems, we expect that such an assessment would not be fruitful in the case of JARC services. This is because such services connect a limited volume of riders in any one location, thereby rendering economic effects difficult to discern using traditional economic impact assessment models.

However, by opening up access by workers to any particular worksite, these services would lead to perturbation in local labor markets by increasing competition with workers who currently hold jobs there or affecting wages as the supply of labor changes. At the same time, the level of economic outcomes experienced by riders would be dictated by local labor market conditions, as we determined in Chapter 5. It may be recalled that county unemployment rate is not significant in the model, which predicts the propensity of riders to be unemployed prior to using the services. However, higher levels of unemployment have a small but significant effect on the propensity of riders to earn higher wages after use of the service and that every unit increase in unemployment rate increases the propensity of earning higher at the job to which riders are traveling to by about 1%. This implies that services in higher unemployment areas are being successful in targeting the service to appropriate areas or corridors, thus leading to better outcomes for riders. The basis for this result could be the “ceiling effect” referred to earlier. 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. Hence, it is very difficult for this group to find good-paying jobs on their own, just creating a greater “margin” for the JARC service to make a difference.

Given these considerations, it becomes important to simulate local labor market dynamics that result from infusion of labor by the transit services. This study was guided by an impact evaluation approach of economic development programs developed by one of the authors of this report (Persky *et al*, 2005), who explored a new framework for evaluating economic development projects and which is suited to simulating such local labor market dynamics. This framework, *the job-chain approach*, makes far more transparent both the potential justifications for economic development subsidies and the very real limitations that surround such activities. It also allows analysts to obtain a more accurate account of job creation avoiding many of the criticisms that accompany the ‘numbers games’ often associated with economic development evaluations.

Economic development projects create new jobs. Each new job can generate a job-chain if and when it is filled by an employed worker, who leaves behind another vacancy. In turn that vacancy may attract a worker from yet a third job and so on down the chain. Chains can be long or chains can be short. Chains end when an unemployed worker, someone previously out of the labor force, or an in-migrant to the labor market takes a vacancy. Fundamentally we claim that the proper evaluation of economic development projects requires an accounting of the welfare gains made along the various job chains generated by that project.

The second issue is that even if we count wages and jobs as benefits and even if we assume a situation with imperfect and non-clearing labor markets, we still have to take

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opportunity costs of labor into consideration. Many workers, including the unemployed, have an opportunity cost that is greater than zero. By moving into employment they may forgo other alternatives such as leisure time or government transfers. This cost has to be subtracted from any benefits to be attributed to employment creation programs.

The key issues emerging from the above discussion are the treatment of displaced demand and opportunity costs. Impact analysis has paid moderate attention to the former and virtually ignores the latter. Cost benefit analyses, while obsessed with the opportunity cost of capital and the choice of a discount rate, pay little attention to the opportunity costs for labor. As we have tried to show, adopting an evaluative framework that assumes an open economy with involuntary unemployment, means that the issue of labor's opportunity cost is too important to ignore.

Impact analysis is invariably focused on employment and income outcomes. Special care needs to be taken to ensure accurate accounting of jobs attributable to the program. The pitfalls here are many. Good impact analyses will distinguish between: direct and indirect jobs/incomes, new and retained jobs/incomes, part and full time jobs or incomes, new jobs that displace existing jobs/income and local versus non local jobs/income. Assuming that the above are accounted for accurately, a further dimension of establishing the counter-factual relates to the consideration of opportunity costs. In addressing alternatives foregone through the use of resources for the present project, analysis moves from pure accounting to evaluating the social worth of the project. However even here, standard practice in impact analysis and project evaluation does not go far enough. While the opportunity costs of capital are routinely reported in cost-benefit studies they feature sparingly in impact analyses. Opportunity costs of labor are rarely addressed in either form of analysis.

The current literature on economic development evaluation is characterized by a broad gulf dividing studies that meticulously count 100% of the wages of every new job as a net gain and those which credit only a small fraction of new wages. On the one hand, impact analyses count job and wage creation as output measures of success and expend great efforts in accurately counting jobs generated by a proposed (or ex-post, a completed) project. Markley and McNamara (1995) for example, in analyzing the economic impacts of a business incubator go to great efforts in calculating the wages and personal incomes earned by these employees and estimating a cost per job created as a measure of efficiency. Welfare gains in these studies are equated to the increases in personal income generated by new direct, indirect, and induced jobs.

This common approach to impact assessment greatly overstates outcomes. This is because it invariably fails to recognize that many workers at new subsidized facilities would have found alternative employment in the community or outside. The welfare gain to the individual worker from a new job will in general not be equal to that worker's wage. Rather it will be a much smaller amount, equal to the difference between wages on the new job and the worker's wage in his or her next best alternative. In the extreme case of smooth and perfectly functioning labor markets, these alternative wages will be close to the wage level on a new job. Indeed, this is why, in a fully-employed market, wages are not only a private cost to the

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business, but a social cost as well. In the full employment case, wages indicate the value of alternative production given up when a worker shifts to a new enterprise. In such a world, simply counting additional employment may not teach us very much about the efficacy of economic development programs (Courant 1994).

At the other end of the literature spectrum, researchers who are cognizant of the need to include opportunity costs often equate them with "reservation wages" i.e. the minimum wage acceptable for entering into employment. Empirical estimates of reservation wages of job seekers are generally quite high. Jones (1989) claims a figure of ninety percent of wages actually achieved. (For a lower figures, but still far more than zero, see Hodge, (1982) and Sridhar (1996).) These high reservation wages suggest that the actual welfare gains of new local employment are likely to be modest if not negligible.

It would seem that we are left with all or nothing. On the one hand impact studies credit new jobs with all the wages they generate, while the reservation wage studies give those jobs little if any weight. This book suggests that a realistic way out of this "all or nothing" dichotomy lies in recognizing that in real world labor markets new job formation begins a chain reaction that will affect many workers in addition to those who actually obtain the newly created jobs. In a less than fully employed economy, a tightening in the labor market allows underemployed workers all along the line to move up.

Another variation on the "all or nothing" theme, that pervades current state of the art impact analyses relates to multiplier calculations. When impact analysis is used as a method for documenting effects of a project the income or employment multiplier is taken as a key indicator. However, the multiplier only relates to truly additional income or employment in the local economy when there is excess capacity. Otherwise it just represents a shift from one activity to another as a result of the project with no real net gain. If the project results in the productive use of otherwise unemployed resources, the multiplier represents a net social benefit. The multiplier can thus represent an "all" or "nothing" outcome. Regular impact analysis is incapable of making this distinction. All multiplier effects are considered net gain.

Impact analysis acknowledges the interdependencies in the local economy. Much effort is exerted in mapping, documenting and measuring the effect of exogenous stimuli on local economic activity. As such, it is concerned with short-term and incremental change. It fails however to recognize that these short term and incremental shocks can have long term effects. In the current state of the art, no provision is made for incorporating cumulative effects, feedback mechanisms or endogenous change. While an impact analysis (and especially a cost-benefit test of a project) may often incorporate a time dimension, this is invariably for discounting the opportunity cost of the capital resources sunk into the project in order to arrive at an accurate estimate of the present project value.

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## Appendix B: Linking Datasets to Extend the Scope of Field-Collected Data

### B.1 Purpose of Linkage

The analysis presented in this report used a number of other datasets to extend the scope of the field data that were collected. Notable were:

- 1) Public Use Microdata Sample (PUMS) 2000, which was used in the program targeting analysis presented in Chapter 4;
- 2) Census Transportation Planning Package (CTPP) 2000, which was also used in the program targeting analysis presented in Chapter 4;
- 3) National Transit Database (NTD) 2002, which was used in the cost-effectiveness analysis presented in Chapter 6
- 4) National Longitudinal Survey of Youth 1979 (NLSY79) which was used in the longitudinal benefits estimation presented in Chapter 7
- 5) Current Population Survey (CPS), March 2002 supplement, which was used in augmenting the base year benefits estimation process presented in Chapter 7.

In this appendix, we describe the process by means of which the CPS was used in order to extend the scope of the JARC User Survey for base year benefit estimation. The CPS was used in two ways:

- 1) To “smooth” the interval-coded wage data from the JARC User Survey, described in Section Chapter 3;
- 2) To “collect” information on a variety of earnings and income-related factors (such as fringe benefits and tax rates) reported by CPS respondents that are “similar” to the JARC respondents and that are applied to the wage data collected on site to calculate net benefits; this process is described in Chapter 7.

### B.2 Smoothing Wage Distributions

The wage data in the JARC user survey is censored, ie, they are both bottom and top-coded. This approach was adopted to avoid the problem of item non-response but creates a problem at the Cost Benefit Analysis (CBA) stage, where we want to estimate base-year user, non-user and societal benefits as well as life-cycle benefits for the user.

This section describes the method by means of which the censored wage distribution is used to simulate continuous wage values. The approach employs the method of Propensity Score Matching to link censored wage values in the JARC User Survey to continuous wage values reported by “identical” persons in the Current Population Survey (CPS) 2002, which is an annual microdata file created by the Bureau of the Census that represents the noninstitutionalized U.S. population. Each month the Census Bureau interviews members of approximately 60,000 households concerning their demographic and employment characteristics, primarily to obtain information for estimating unemployment statistics. In March of each year, the bureau supplements the basic CPS with questions about incomes

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from a variety of sources received during the previous calendar year by each member of sampled households. The March supplement is called the Annual Demographic Survey. Each reporting unit (household, family, and person) is assigned a weight equal to the inverse of the probability of that unit's selection for interviewing. Weighted tabulations of variables included in the March CPS thus provide representative estimates of values for the entire non-institutionalized population.

The U.S. Census Bureau itself masks, or top-codes, large annual wage and salary incomes in public use micro-data samples (PUMS3) of the CPS (Weinberg, Nelson, Roemer, and Welniak, 1999) and other household surveys and censuses to prevent the disclosure of the identity of respondents reporting large incomes. However, such top-coding will not affect our wage smoothing, since the top-coding income threshold is very high and is almost certainly not exceeded by our target group – the JARC service riders.

For our continuous wage smoothing approach, we start by selecting the subset of the 2002 March Supplement CPS data for the areas where the JARC User survey was administered. Table B.1 shows the place names for the JARC survey sites and the corresponding CPS sites, from which data were considered for the wage smoothing exercise. Two of the sites had no corresponding CPS samples; for these sites, sampled values from similar CPS sites were allocated to the JARC samples.

**Table B.1 JARC User Survey Sites and Corresponding CPS Sites**

| <b>Site No.</b> | <b>JARC User Survey Site</b> | <b>Type of service*</b> | <b>Current Population Survey (CPS) MSA, CMSA, PMSA</b> |
|-----------------|------------------------------|-------------------------|--|
| 1               | Brockton, MA                 | FR                      | Brockton, MA PMSA                                      |
| 2               | Westchester, NY              | FR                      | New York, NY PMSA                                      |
| 3               | Monmouth County, NJ          | FR                      | Monmouth-Ocean, NJ PMSA                                |
| 4               | Weirton, WV                  | DR                      | Wheeling, WV-OH MSA (Ohio portion not identified)      |
| 5               | Howard County, MD            | FR                      | Baltimore, MD PMSA                                     |
| 6               | Spartanburg, SC              | DR                      | Greenville-Spartanburg-Anderson, SC MSA                |
| 7               | Chicago, IL                  | FR                      | Chicago, IL PMSA (DeKalb County not in sample)         |
| 8               | Bloomington, IL              | DR                      | Not in Sample  |
| 9               | Hennepin County, MN          | DR                      | Minneapolis-St., Paul, MN-WI MSA                       |
| 10              | La Crosse, WI                | FR                      | Not in Sample  |
| 11              | Minneapolis, MN              | FR                      | Minneapolis-St., Paul, MN-WI MSA                       |
| 12              | Jefferson Parish, LA         | FR                      | New Orleans, LA MSA                                    |
| 13              | Galveston, TX                | FR                      | Galveston-Texas City, TX PMSA                          |
| 14              | Cedar Rapids, IA             | DR                      | Cedar Rapids, IA MSA                                   |
| 15              | Fort Collins, CO             | FR                      | Fort Collins-Loveland, CO MSA                          |
| 16              | Loveland, CO                 | FR                      | Fort Collins-Loveland, CO MSA                          |
| 17              | Santa Rosa, CA               | FR                      | Santa Rosa, CA PMSA                                    |
| 18              | San Jose, CA                 | DR                      | San Jose, CA PMSA                                      |
| 19              | Oakland, CA                  | FR                      | Oakland, CA PMSA                                       |
| 20              | Hillsboro, OR                | DR                      | Portland-Vancouver, OR-WA PMSA                         |
| 21              | Portland, OR                 | DR                      | Portland-Vancouver, OR-WA PMSA                         |
| 22              | North Seattle, WA            | DR                      | Seattle-Tacoma-Bremerton, WA                           |
| 23              | King County, WA              | DR                      | Seattle-Tacoma-Bremerton, WA                           |

### **B.3 Definitions of Salary and Wages in the CPS**

The JARC User Survey asked the respondents of their earnings in terms of hourly wage rate in three categories: less than \$7 per hour; between \$7 per hour and \$9 per hour; greater than \$9 per hour. The CPS however reports money income from several sources including wages and salaries, self-employment income, property income (such as interest, dividends, and net rental income), cash transfers from government income maintenance programs and other cash receipts. For the purposes of this study, only wages and salaries were considered as equivalent of the wage rate reported in the JARC survey.

### **B.4 Exact Matching on Covariates versus Propensity Score Matching**

The method of Propensity Score Matching (PSM) is typically used to draw causal inferences regarding program outcomes in observational studies. As mentioned earlier, the “gold-

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standard” in assessing program outcomes is through randomly allocating similar individuals into “treatment” and “control” groups.

Two different methods were tried out for the purpose of smoothing the wage distribution in the JARC user survey: Exact Matching on Covariates (EMC) and Propensity Score Matching (PSM). Both methods used the same covariates for linking the JARC user survey to similar CPS respondents: location, age, gender, occupational categories, full-time or part-time employment status, education level and wage category. In both cases, a subset of the CPS data for the selected locations given in Table B.1 was used.

The CPS data was also reduced to include only workers in a selected set of “entry-level” job occupations. While definitions of “entry-level” jobs can be elusive, several authors have adopted detailed processes to cull out those jobs, which are appropriate for the skill set and educational levels of the low-income workers using the JARC services. In the CPS, there are 236 industrial classification codes, which are aggregated into 51 detailed industry groups and 23 major groups. There are 500 occupational classification codes for the employed, which are aggregated into 46-detailed groups and 14 major groups.

The process utilized in this report builds upon previous work in the definition of entry-level jobs. As noted in Sen *et al* (1999), there is little consensus on what constitutes an entry-level job. In that paper, occupations appropriate for public-assistance clients and low-skilled unemployed workers were identified using categories for entry-level occupations that were defined in Carlson and Theodore (1995). This latter paper constructed the list using the mathematical, reasoning and language requirements of various occupations as defined in the Dictionary of Occupational Titles (Iowa State Occupational Information Coordinating Committee 1995). In the Sen *et al* paper, this initial list of entry-level occupational definitions was expanded using expert advice. The final list includes over 150 occupations and occupational groups from a wide range of occupations across all industries.

We have utilized the above entry-level job classification scheme in selecting observations for the CPS subset from the relevant locations. It should be noted that in January 2003, the CPS adopted the 2002 Census industry and occupational classification systems, which were derived, respectively, from the 2002 North American Industry Classification System (NAICS) and the 2000 Standard Occupational Classification (SOC). The introduction of the new industry and occupational classification systems created a complete break in comparability at all levels of industry and occupation aggregation. When the new classification systems were adopted, BLS released only a limited history--back to January 2000--of employment data by industry and occupation. The estimates for 2000-02 were based on survey data that had been dual-coded on both the 1990 and the 2002 Census classifications (for more details, see BLS (2006)<sup>41</sup>).

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<sup>41</sup> U.S. Department of Labor, Bureau of Labor Statistics, Labor Force Statistics from the Current Population Survey (2006). *Historical CPS employment for 1983-99 on the 2002 Census industry and occupational classifications*. <http://www.bls.gov/cps/constio198399.htm>

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By means of the Exact Matching on Covariates, the CPS sub-sample and JARC User Survey were first sorted by the matching covariates (location, gender, age category, full-time or part-time employment status, educational level and wage category) and then linked using those covariates. Before the merging process was implemented, the covariates used for matching the two files underwent a standardized naming and formatting convention. Approximately 65 percent of the JARC respondents were linked to unique CPS respondents. However, since the CPS sub-sample has much larger number of observations than the JARC Survey, in many cases, multiple CPS records were linked to the same JARC respondent. In such cases, an average of the CPS hourly wage rates were calculated for each JARC respondent. The outcome of this process was a final continuous value of hourly wage that falls in the three-wage rate category for each JARC survey respondent.

The crucial difference between Propensity Score Matching (PSM) and other methods of matching is that in PSM, respondents on file are linked to a second file on the basis of a single composite score as opposed to multiple variables. In the PSM linkage of the CPS sub-sample to the JARC respondents, the two files were first appended. A single “propensity score” was then estimated for each observation using logistic regression, as a function of the covariates utilized, ie, location, gender, age category, full-time or part-time employment status, educational level and wage category. The propensity score is an estimate of the probability of an assignment to a particular group given a vector of observed covariates (Rosenbaum and Rubin, 1984). Popular uses of PSM include one-to-one and one-to-many matches that are based on distance-metric methodologies, weighting schemes, or matching on ranges. By controlling for demographic and other characteristics of a rider, two comparison groups are produced, as in a case-control match.

Two different methods were used in the PSM to link JARC respondents to CPS sub-sample respondents: a nearest neighbor method and Caliper matching method. In the nearest neighbor matching, we randomly order respondents in the JARC survey and the CPS sub-sample and then select the first JARC respondent and find the CPS respondent with the closest propensity score. In the case of the Caliper matching, we predefine a region within the (.01, .0001 interval) and then randomly select one CPS respondent that matches on the propensity score with a JARC respondent.

We did not find much difference in the final hourly continuous wage rates imputed by the two PSM matching methods. Nor did we find much difference between the EMC results and the PSM results. The PSM linkage methods tended to yield more long-tailed distributions of the smoothed hourly wage values compared to the EMC method. The difference between the mean and median hourly wage values yielded using PSM Caliper method was \$1.02 whereas for the ECM distribution, it was less than \$.50. It was decided to use the smoothed hourly wages from the ECM method only, for subsequent analysis. It needs to be noted that certain constraints were added to both the EMC and the PSM merging processes. For example, the lower limit of wage category 1 (less than \$7 per hour) was set at \$5.15, the minimum wage rate prevailing at the time. Further, even the EMC smoothed hourly wage distribution was quite long-tailed; the top 10 percent of the smoothed hourly wage rates were above \$20 per hour. Hence, only hourly wage values within the 10 percent and 90 percent of the distribution (between \$5.15 per hour and \$12.91 per hour) were retained for subsequent analysis.

**Table B.2 Smoothed wage values for each wage category**

| Smoothed Wage Category | Cut-Offs   | Percent of Employed Individuals | Width of Final Smoothed Distribution within 10% and 90 % Points (Min and Max) | Mean/Median of Smoothed Distribution |
|------------------------|------------|---------------------------------|---|--------------------------------------|
| 1                      | <\$7/hour  | 19.03                           | 5.15-5.18   | \$5.16/5.15                          |
| 2                      | (\$7, \$9) | 48.64                           | 7.65-8.33   | \$7.96/7.96                          |
| 3                      | >\$9       | 32.33                           | 9.06-12.91  | \$12.43/12.38                        |

Column 2 of Table B.2 gives the distribution of wages in the three income categories reported in the JARC user survey. The third column gives the distribution of JARC respondents in each wage category. The fourth column give the minimum and the maximum points of the smoothed wage distribution for each wage category; as described earlier these distributions were bottom and top-coded at the 10<sup>th</sup> and 90<sup>th</sup> percentile point of the actual smoothed wage distribution. The last column gives the mean and median hourly wage for each of the three wage categories.

The majority of the employed JARC riders are in wage category 2, earning between \$7.65 and \$8.33 per hour. Table – breaks down the estimated smoothed wage by five different factors: (I) the respondents' employment condition prior to using the JARC service (II) gender (III) whether or not they received public assistance within five years prior to starting use of the JARC service (IV) education level and (V) type of services used, Fixed Route (FR) or Demand Response (DR). The top number in every cell gives the percentage of respondents in a wage category who meet a particular condition. For example, 44 percent of workers in Wage Category 1 did not work prior to using the service, whereas 12.07 percent of workers in Wage Category I worked but earned less than what they earned after use of the service.

The mean smoothed hourly wage rate (the last row of Table B.2) shows that for Factor I, the average current wages are the lowest for those who did not work previously and highest for those who worked previously but earned less than they currently do. For factor II, gender, it can be seen that males earn \$0.66 per hour more than females. For Factor III, whether or not the respondent received any form of assistance in the last five years, it can be seen that those who did not receive assistance earn an average of \$1.14 per hour more than those received assistance. Those with some college or associate degree (Factor IV) earn more than others with lower levels of educational achievement. Finally, for Factor IV, type of transit service, FR riders earn \$1.21 per hour more on the average than DR riders.

### **B.5 CPS Earnings-Related Information**

The CPS March Supplement reports on a variety of earnings-related information. These include:

- 1) Fringe benefits
- 2) Income tax rates (federal and state)
- 3) Earned income Tax credit

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4) Property Tax

Of the above, we used only estimates of fringe benefits and federal and state income tax in this analysis.

## Appendix C: Estimation of Base Year User Impact Components

The quantities  $UB_{T,i}$  and  $UC_{T,i}$  are calculated in the following ways for each subgroup:

For Subgroups 1, 2 and 3, estimate the following User Benefit ( $UB$ ) components for time periods  $t-\delta$  and  $t$  as follows:

- $[UB_{t,I}]$  User Benefits related to earnings in “after” period: Determine new wages and expected tax payments based on annualized salary at time  $t$ .
- $[UB_{t-\delta,I}]$  User Benefit related to earnings in “before” period: For those respondents in Subgroups 2 and 3 who were previously working, determine prior (at time  $t-\delta$ ) wage and expected tax payments for prior annualized salary.
- $[UB_{t-\delta,I}]$  User Benefit related to earnings in “before” period: For Subgroup 1 users (who were previously not working) determine prior (at time  $t-\delta$ ) transfer payments such as welfare payments based on whether respondent who was previously unemployed reported receiving public assistance. Otherwise assume they were previously receiving unemployment benefits.

For Subgroups 1, 2 and 3, estimate the following User Cost ( $UC$ ) components for time periods  $t-\delta$  and  $t$  as follows:

- $[UC_{t,I}]$  User Cost related to travel in “after” period: Determine current travel costs (dollar cost of the fare they are currently paying to use the JARC service and monetized value of travel time).
- $[UC_{t-\delta,I}]$  User Cost related to travel in “before” period: For previously employed workers in both Subgroups 2 and 3, who traveled to their work locations, determine their mode of transportation and calculate the user costs (as a function of both dollar cost and monetized value of travel time).
- $[UC_{t-\delta,I}]$  User Cost related to time use in “before” period: For previously unemployed workers in Subgroup 1, determine the monetized value of leisure time (details of the leisure time estimation procedure is given in Appendix -).

For Subgroups 4 and 5, estimate the following User Benefit ( $UB$ ) components for time periods  $t-\delta$  and  $t$  as follows:

- $[UB_{t,I}]$  User Benefits related to earnings in “after” period: As in the case of CBA of training and other human capital development programs, these individuals are likely to face costs during the base year with benefits that arise in the future due to deferred earnings that accrue from enhancement of their skill sets or future job placement, reflecting users’ forgone employment opportunities while in school, job-training or job-searching. Although a

large proportion of these users reported receiving public assistance, these payments are not included, as these are not related to the trip. In some cases, however, job training stipends are given for some job readiness and job assistance training cases and these are related to receiving TANF payments; user benefits in the after period are composed entirely of a random assignment of training stipends to those adults enrolled in job training program. All other earnings-related benefits that accrue due to the trips enabled are assumed to be 0 in base year  $t$ .

- $[UB_{t-\delta,1}]$  User Benefit related to earnings in “before” period: Respondents in Subgroup 4 and 5 are assumed to previously be entirely dependent on welfare or other transfer payments. Hence, all earnings-related benefits in the prior (at time  $t-\delta$ ) period are assumed to be 0.

For Subgroups 4 and 5, estimate the following User Cost ( $UC$ ) components for time periods  $t-\delta$  and  $t$  as follows:

Travel-Related User Costs:

- $[UC_{t,1}]$  User Cost related to travel in “after” period: Determine current travel costs (dollar cost of the fare they are currently paying to use the JARC service and monetized value of travel time).
- $[UC_{t-\delta,1}]$  User Cost related to travel in “before” period: For those non-workers who previously accessed the same trip destination by an alternative transportation mode, determine the user costs (as a function of both dollar cost and monetized value of travel time).

Non-Travel Related User Costs:

- $[UC_{t-\delta,1}]$  User Cost related to time use in “before” period: For Subgroup 4 and 5 workers who previously did not undertake job training or job searching, determine the monetized value of leisure time (a description of leisure time and estimates are given in ---).
- $[UC_{t,2}]$  User Cost related to child-care use in “after” period: Using the same procedure as in the case of Subgroups 1, 2 and 3, assign Subgroup 4 and 5 users “with” and “without” children. For Subgroup 4 and 5 workers who previously did not undertake job training or job-searching, assign child-care costs. For those who did undertake such activities prior to use of the JARC service, we assume that their child-care costs, if any, cancel out between the before and after periods.

Subgroup 6 consists of workers or non-workers who are using the JARC service for non-work related social or health-related purposes. This group differs from the other groups in the sense that they do not incur any changes to their earnings potential as a result of the trip. However, they do incur changes in travel cost and this accounts for their change in net

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benefit as a result of using the service. For Subgroup 6, estimate the following User Cost ( $UC$ ) components for time periods  $t-\delta$  and  $t$  as follows:

- $[UC_{t,I}]$  User Cost related to travel in “after” period: Determine current travel costs (dollar cost of the fare they are currently paying to use the JARC service and monetized value of travel time).
- $[UC_{t-\delta,I}]$  User Cost related to travel in “before” period: For those non-workers who previously accessed the same trip destination by an alternative transportation mode, determine the user costs (as a function of both dollar cost and monetized value of travel time).

## Appendix D: Estimation of Non-User Benefit Components

The quantities  $NoUB_{T,I}$  and  $NoUC_{T,I}$  are calculated in the following ways for each subgroup:

For Subgroups 1, 2 and 3, estimate the Non-User Benefit ( $NoUB$ ) components that result from the use of JARC services, for time periods  $t-\delta$  and  $t$  as follows:

- $[NoUB_{t,1}]$  Non-user Benefits related to reductions in transfer payments in the “after” period and to potential for increased alternative uses of these public revenues: Determine the amount of public assistance payments reduced at time  $t$ .
- $[NoUB_{t,2}]$  Non-user Benefits related to income taxes revenues generated by these subgroups “after” period: Determine income tax generated due to income changes at  $t$ .
- $[NoUB_{t,3}]$  Non-user Benefits related to reductions in societal costs of private transportation use in “after” period: Subgroups 2 and 3 were previously employed and used alternative modes of transportation to access their work locations. Base year includes benefits to the region in terms of improvements in air quality and reduced accident risk, Green House Gas (GHG) and congestion costs are calculated at \$0.39/mile.
- $[NoUB_{t,4}]$  Non-user Benefits related to local labor market dynamics in “after” period: By going to work in a new work location, Subgroups 1 and 2 creates an impact on the local labor market dynamics. One element in estimating non-user benefits is that the gains of programs connecting (relatively low unemployment) work sites with (relatively high unemployment) 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 including displacing workers from their current jobs to jobs higher up in the job chain. As these chain members move up they each make modest gains based on their next best alternatives. The sum of these gains to non-users in the local labor markets to which JARC carries new workers, is the fourth non-user benefit. Local labor market benefits are estimated for the origin ( $NoUB_{t,4,O}$ ) end as well as the destination (job) end ( $NoUB_{t,4,D}$ ) of trips.

For Subgroups 1, 2 and 3, estimate the Non-User Cost ( $NoUC$ ) component that result from the use of JARC services, for time periods  $t-\delta$  and  $t$  as follows:

- $[NoUC_{t,1}]$  Non-user Cost of subsidizing JARC program: As the previous chapter showed, the Cost Per Ride of JARC services far exceed the amount recovered from the farebox. Determine the amount of subsidy to each JARC rider from non-users at time  $t$ .

Based on the above categories of non-user benefits, we can group “non-users” of the JARC program into three categories:

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Category 1 ( $C_1$ ): *General Non-Users*: General Non-Users accrue benefits due to reductions in and alternative uses of transfer payments as well as increased tax revenues due to income increases by JARC riders. Hence, for this group:

$$NoUB_t(C_1) = NoUB_{t,1} + NoUB_{t,2}$$

Category 2 ( $C_2$ ): *Regional Non-Users*: Regional Non-Users gain due to decreases in societal costs of transportation, as previous automobile users now travel by public transportation.

$$NoUB_t(C_2) = NoUB_{t,3}$$

Category 3 ( $C_3$ ): *Local Labor Market Non-Users*: Local Labor Market Non-Users gain due to job chain perturbations caused by JARC riders.

$$NoUB_t(C_3) = NoUB_{t,4}$$

## Appendix E: Tables of User, Non-User and Societal Benefits by Labor Market Outcomes

**Table E.1 Base Year user, Non-User and Societal Net Benefits for Trips to Higher Wage Destinations**

| Measure   | Wage at Destination | Scenario I | Scenario II | Scenario III |
|---|---------------------|------------|-------------|--------------|
| <b>Users</b>  |                     |            |             |              |
| Average Incremental Net User Benefit ( $\Delta NUB_t$ )       | Higher (=yes)       | 7,909.26   | 7,909.26    | 7,909.26     |
|   | Higher (=no)        | 2,105.81   | 1,062.00    | 1,062.00     |
| Average Net User Benefit to Program ( $APUBC_t$ )             | Higher (=yes)       | 3.39       | 3.39        | 3.39         |
|   | Higher (=no)        | 1.53       | 1.02        | 1.02         |
| <b>Non-Users</b>  |                     |            |             |              |
| Average Incremental Net Non-User Benefit ( $\Delta NNoUB_t$ ) | Higher (=yes)       | 884.14     | 884.14      | -5,259.30    |
|   | Higher (=no)        | 879.02     | 879.02      | -2,099.07    |
| Average Non-User Benefit to Program Cost Ratio ( $ANoUBC_t$ ) | Higher (=yes)       | 1.00       | 1.00        | -1.19        |
|   | Higher (=no)        | 1.11       | 1.11        | -0.43        |
| <b>Society</b>  |                     |            |             |              |
| Average Incremental Net Societal Benefit ( $\Delta NSB_t$ )   | Higher (=yes)       | 8,227.00   | 8,227.00    | -1,791.29    |
|   | Higher (=no)        | 3,992.83   | 226.52      | -1,968.67    |
| Average Societal Benefit to Cost Ratio ( $ASBC_t$ )           | Higher (=yes)       | 4.35       | 4.35        | 0.24         |
|   | Higher (=no)        | 2.99       | 2.48        | 0.76         |

**Table E.2 Base Year User, Non-User and Societal Net Benefits for Trips by Level of Education**

| Measure   | Non-High School Graduates | Scenario I | Scenario II | Scenario III |
|---|---------------------------|------------|-------------|--------------|
| <b>Users</b>  |                           |            |             |              |
| Average Incremental Net User Benefit ( $\Delta NUB_t$ )       | High School (=yes)        | 1,526.12   | 788.68      | 788.68       |
|   | High School (=no)         | 4,162.11   | 3,362.05    | 3,362.05     |
| Average Net User Benefit to Program ( $APUBC_t$ )             | High School (=yes)        | 1.69       | 1.22        | 1.22         |
|   | High School (=no)         | 2.09       | 1.73        | 1.73         |
| <b>Non-Users</b>  |                           |            |             |              |
| Average Incremental Net Non-User Benefit ( $\Delta NNoUB_t$ ) | High School (=yes)        | 153.39     | 153.39      | -1,959.36    |
|   | High School (=no)         | 1,160.81   | 1,160.81    | -2,811.26    |
| Average Non-User Benefit to Cost Ratio ( $ANoUBC_t$ )         | High School (=yes)        | 0.93       | 0.93        | -0.18        |
|   | High School (=no)         | 1.14       | 1.14        | -0.71        |
| <b>Society</b>  |                           |            |             |              |
| Average Incremental Net Societal Benefit ( $\Delta NSB_t$ )   | High School (=yes)        | 1,649.54   | 912.10      | -2,176.85    |
|   | High School (=no)         | 5,415.06   | 4,591.06    | -1,845.24    |
| Average Societal Benefit to Cost Ratio ( $ASBC_t$ )           | High School (=yes)        | 3.01       | 2.54        | 1.40         |
|   | High School (=no)         | 3.42       | 3.06        | 0.39         |

**Table E.3 Base Year User, Non-User and Societal Net Benefits for Trips to Destinations Perceived to be Inaccessible Without Service**

| Measure   | Destination Perception | Scenario I | Scenario II | Scenario III |
|---|------------------------|------------|-------------|--------------|
| <b>Users</b>  |                        |            |             |              |
| Average Incremental Net User Benefit ( $\Delta NUB_t$ )       | Inaccessible (=yes)    | 2,815.69   | 2,328.45    | 2,328.45     |
|   | Inaccessible (=no)     | 3,944.05   | 2,994.23    | 2,994.23     |
| Average Net User Benefit to Program ( $APUBC_t$ )             | Inaccessible (=yes)    | 1.83       | 1.64        | 1.64         |
|   | Inaccessible (=no)     | 2.08       | 1.59        | 1.59         |
| <b>Non-Users</b>  |                        |            |             |              |
| Average Incremental Net Non-User Benefit ( $\Delta NNoUB_t$ ) | Inaccessible (=yes)    | 374.57     | 374.57      | -2,549.65    |
|   | Inaccessible (=no)     | 1,194.82   | 1,194.82    | -2,532.13    |
| Average Non-User Benefit to Cost Ratio ( $ANoUBC_t$ )         | Inaccessible (=yes)    | 0.65       | -0.50       | -0.50        |
|   | Inaccessible (=no)     | 1.36       | 1.36        | -0.57        |
| <b>Society</b>  |                        |            |             |              |
| Average Incremental Net Societal Benefit ( $\Delta NSB_t$ )   | Inaccessible (=yes)    | 3,196.83   | 2,691.55    | -2,571.97    |
|   | Inaccessible (=no)     | 5,219.66   | 4,255.59    | -1,492.60    |
| Average Societal Benefit to Cost Ratio ( $ASBC_t$ )           | Inaccessible (=yes)    | 2.75       | 2.57        | 0.69         |
|   | Inaccessible (=no)     | 3.63       | 1.40        | 0.64         |

## Appendix F: Model I of Dynamic Microsimulation – Longitudinal Model of Wages

### F.1 Model of Growth in Wages

We develop a series of models to examine systematic differences in inflation-adjusted wages between the experimental and control groups. In order to analyze outcome level difference between the two groups, we posit an initial random effects model

$$ad\_wage_i = X_i\beta + Z_ib_i + \varepsilon_i \quad (1)$$

where  $ad\_wage_i$  is the  $n_i$  dimensional response vector of adjusted wages for subject  $i$ ,  $1 \leq i \leq N$ ,  $N$  is the number of respondents,  $X_i$  and  $Z_i$  are  $(n_i \times p_i)$  and  $(n_i \times q)$  dimensional matrices of known covariates,  $\beta$  is the  $p$  dimensional vector containing the fixed effects,  $b_i$  is the  $q$  dimensional vector containing the random effects, and  $\varepsilon_i$  is an  $n_i$  dimensional vector of residual components. The presence of the random effects explicitly recognizes natural heterogeneity amongst the NLSY79 subjects. The design matrix  $X$  consists of the demographic, attitudinal, immigration and language, parental as well as the policy variables given in Table F.1. In the models considered here, we consider only one random effect, the intercepts, which are assumed to be subject-specific<sup>42</sup>.

It might be noted that random effects for time-independent covariates might in general be interpreted as subject-specific corrections to the overall mean structure of  $ad\_wage$ . This makes them very similar to random intercepts, although time-independent covariates do enable one to model differences in variability between subgroups of respondents or measurements. The random intercepts allow us to account for natural heterogeneity amongst respondents as well as omitted variables relating to intrinsic factors that are not easily available from the observed data. We could have introduced additional random effects for those covariates that vary over time; however, our purpose here is to start with an initial model that allows to model the mean of  $ad\_wage_i$  adequately and yet identify “outlying individuals”, which is enabled by the introduction of random intercepts. It needs to be noted in addition that the sheer size of the models (12,492 subject-specific random intercepts plus about 36 fixed effects per model for the case of the model with the entire sample) already posed computationally burdensome for the Maximum Likelihood (ML) estimation.

In initial models, we model  $\varepsilon_i \sim N(0, \sigma^2 I_{n_i})$  which assumes that all the variability in the data, which is not taken into account by the random effects (which model the stochastic variability between subjects) is purely measurement error. Later on, this assumption is relaxed to allow for a more realistic covariance structure for the residuals. The random effects is taken to be

<sup>42</sup> An initial one-way random effects Analysis of Variance (ANOVA) or unconditional means model, which partitions the variation of the outcome variable  $ad\_wage$ , yielded an intraclass correlation coefficient  $\rho$  of close to .49 indicating that roughly half the total variation in  $ad\_wage$  is attributable to differences between respondents.

$b_i \sim N(0, D)$ ; the covariance structure for the random effects are modeled to be a general unstructured covariance matrix, ie, a symmetric positive (semi-) definite matrix  $D$ , which does not assume the random effects covariance matrix to be any specific form. It needs to be noted that the data structure is quite unbalanced, with non-equal time-periods per respondent.

A series of models with different variables and covariance structure of the residuals were examined. With our unbalanced data with many repeated measurements per respondent, it might have been the case that the random intercepts explained most of the variation. However, this was not the case. It was clear from the residual structure of the initial models that the within-respondent errors were still correlated over time. The “band-diagonal” shape of the estimated error covariance matrix indicated that an autoregressive error covariance matrix might be appropriate.

Four different models of *ad\_wage* were estimated:

Model IA: One-way random effects ANOVA model: This model allows us to examine the behavior of *ad\_wage* in the absence of covariates; the role of this model is simply to serve as a benchmark to compare reduction in the  $-2$  Log-likelihood statistic and other statistics with the full model.

Model IB: Model with Covariates on Full Sample: The purpose of this model is to examine trends in *ad\_wage* with respect to the covariates for the full NLSY79 sample.

Model IC: Model with Covariates on Economically Disadvantaged Sample: The purpose of this model is to yield predictions of *ad\_wage* and changes in wage rates over time for economically disadvantaged individuals. The outputs of this model was allocated to Subgroups 1, 2, 3 and 5 JARC respondents as described in Chapter -.

Model ID: Model with Covariates including Governmental Training Dummy on Economically Disadvantaged Sample: The purpose of this model is to yield predictions of *ad\_wage* and changes in wage rates over time for economically disadvantaged individuals. The outputs of this model were allocated to Subgroup 4 JARC respondents as described in Chapter -.

Table F.1 the variables used in the study.

Table F.2 shows the parameters estimates of the base, one-way random effects ANOVA model (Model IA), and the other three models, all with an AR(1) structure for the residuals. Table F.3 shows the fit statistics. All three models with covariates show a marked reduction in the  $-2$  Log-likelihood statistic as well as other fit statistics such as the AIC and BIC, with the best being Model ID. The autoregressive parameter  $\rho$  remains more or less the same in all three models at about .6, indicating that correlations between temporally adjacent *ad\_wage* values for the same respondent is quite high.

Table F.1: Explanation of Variables used

| NAME                                      | LABEL   | Type      | Coding for Dummy  | Classification          |
|---|---|-----------|---|-------------------------|
| <b>Response Variable</b>                  |   |           |   |                         |
| ad_wage                                   | adjusted (to 2002) wage and salary                  | Contiuous |   |                         |
| <b>Respondent's Demographic Variables</b> |   |           |   |                         |
| age                                       | Age of R  | Contiuous |   | defined time-varying    |
| white                                     | race: white   | Dummy     | 1=white   | not time-varying        |
| black                                     | race: black   | Dummy     | 1= black  | not time-varying        |
| male                                      | gender: male  | Dummy     | 1=male  | not time-varying        |
| South_14                                  | living in South region at the age of 14             | Dummy     | 1= in South at the age of 14                              | not time-varying        |
| urban_14                                  | living in urban at the age of 14                    | Dummy     | 1= in Urban at athe age of 14                             | not time-varying        |
| d_public                                  | whether received public supports                    | Dummy     | 1='recipients for public support'                         | internal time-varying   |
| grade_com                                 | the highest grade completed by respondent           | Contiuous |   | internal time-varying   |
| in_school                                 | Whether currently enrolled in school                | Dummy     | 1='currently in school'                                   | internal time-varying   |
| marital                                   | marital status                                      | Dummy     | 1 never married; 2 married, spouse present;3 other        | internal time-varying   |
| children                                  | no. of Childeren                                    | Contiuous |   | internal time-varying   |
| live_fm                                   | living with father and mother at age of 14          | Dummy     | 1= living with father and mother at age of 14             | not time-varying        |
| sibling                                   | no. of siblings                                     | Contiuous |   | ancillary time-varying  |
| male_pay                                  | male adult living with respondent work for pay      | Dummy     | 1=male adult living with respondent work for pay          | contextual time-varying |
| fmale_pay                                 | female adult living with respondent work for pay    | Dummy     | 1=female adult living with respondent work for pay        | contextual time-varying |
| <b>Immigration and Language Variables</b> |   |           |   |                         |
| forn_lan                                  | Whether spoke the foreign language during Childhood | Dummy     | 1="Foreign language spoken at home during Childhood       | not time-varying        |
| lan_spn                                   | foreign language: spanish                           | Dummy     | 1="Spanish spoken at home during Childhood                | not time-varying        |
| lan_oth                                   | foreign language: other                             | Dummy     | 1="Other foreign language spoken at home during Childhood | not time-varying        |
| US_14                                     | living in US at the age of 14                       | Dummy     | 1= in US at the age of 14                                 | not time-varying        |

Table F.1 (contd.) Explanation of Variables Used

| NAME                         |   | LABEL      | Type  | Coding for Dummy       |
|------------------------------|---|------------|---|------------------------|
| <b>Attitudinal Variables</b> |   |            |   |                        |
| at_control                   | attitude: control over life   | Dummy      | 1= control over life  | internal time-varying  |
| at_plan                      | attitude: make things work if planned                               | Dummy      | 1= make things work if planned  | internal time-varying  |
| at_m_nv                      | attitude: expect to marry over 31                                   | Dummy      | 1= expect to marry over 31  | internal time-varying  |
| at_ed_5                      | attitude: expect in school 5 years from now                         | Dummy      | 1= expect in school 5 years from now                                    | internal time-varying  |
| at_wk_5                      | attitude: expect to work 5 years from now                           | Dummy      | 1= expect to work 5 years from now                                      | internal time-varying  |
| at_oc_mg                     | attitude: expect to at the position of professional or manager      | Dummy      | 1= expect to at the position of professional or manager                 | internal time-varying  |
| ed_35                        | attitude: more education if unable to support family at age 35      | Dummy      | 1= more education if unable to support family at age 35                 | internal time-varying  |
| wel_35                       | attitude: on welfare if unable to support family at age 35          | Dummy      | 1= on welfare if unable to support family at age 35                     | internal time-varying  |
| con_work                     | attitude: continue to work even not have to                         | Dummy      | 1= continue to work even not have to                                    | internal time-varying  |
| <b>Parental Variables</b>    |   |            |   |                        |
| m_grade                      | the highest grade completed by mother                               | Continuous |   | ancillary time-varying |
| m_full                       | mother/step mother work full time for pay                           | Dummy      | 1= mother work full time  | ancillary time-varying |
| f_grade                      | the highest grade completed by father                               | Continuous |   | ancillary time-varying |
| f_full                       | father/step father work full time for pay                           | Dummy      | 1= father work full time  | ancillary time-varying |
| m_oc_mg                      | mother/step mother's occupation is manager or professional          | Dummy      | 1=mother/step mother's occupation is manager or professional            | ancillary time-varying |
| f_oc_mg                      | father/step father's occupation is manager or professional          | Dummy      | 1=father/step father's occupation is manager or professional            | ancillary time-varying |
| <b>Policy Variables</b>      |   |            |   |                        |
| govt                         | in governmental job & training program for any year during 1979-'82 | Dummy      | 1= in governmental job & training program for any year during 1979-1982 | defined time-varying   |
| d_no_veh                     | had no access/own the vehicle for any year during 1979-1982         | Dummy      | 1=no access/own the vehicle for either year during 1979-1982            | defined time-varying   |

**Table F.2 Fixed effects parameter estimates of four longitudinal models of adjusted wages**

|              | Model    | IA     | Model     | IB     | Model       | IC     | Model      | ID     |
|--------------|----------|--------|-----------|--------|-------------|--------|------------|--------|
| Effect       | Estimate | StdErr | Estimate  | StdErr | Estimate    | StdErr | Estimate   | StdErr |
| Intercept    | 15101.2  | 234.8  | -21386.3* | 1591.1 | -21505.35** | 2356.0 | -21209.8** | 2359.8 |
| age          |          |        | N/A       | N/A    | 392.9*      | 75.5   | 369.2*     | 75.9   |
| at_control   |          |        | 2091.4*   | 308.5  | 1617.9*     | 392.9  | 1609.5*    | 392.5  |
| at_ed_5      |          |        | -142.4    | 302.0  | 718.9       | 430.8  | 704.3      | 430.3  |
| at_m_20      |          |        | 1974.2*   | 329.3  | 146.2       | 422.2  | 209.8      | 422.3  |
| at_oc_mg     |          |        | 5211.4*   | 943.2  | 2405.6      | 1788.5 | 2335.5     | 1786.0 |
| at_plan      |          |        | 1934.2*   | 288.1  | 2595.7      | 397.0  | 2555.9*    | 396.6  |
| at_wk_5      |          |        | 668.9     | 529.5  | 2866.5      | 737.9  | 2951.6*    | 737.4  |
| black        |          |        | -1266.3** | 722.8  | -1737.1*    | 819.3  | -1623.6    | 819.5  |
| children     |          |        | -275.6*   | 50.2   | 15.4        | 73.1   | 14.6       | 73.1   |
| con_work     |          |        | 485.4     | 368.9  | 94.2        | 486.7  | 111.5      | 486.1  |
| d_public     |          |        | -1298.2*  | 142.2  | -1444.9*    | 196.4  | -1441.4    | 196.4  |
| ed_35        |          |        | 494.4     | 428.7  | 420.4       | 594.9  | 453.7*     | 594.1  |
| f_full       |          |        | 713.1*    | 352.7  | 961.4       | 433.7  | 900.5      | 433.8  |
| f_grade      |          |        | 166.2*    | 49.5   | N/A         | N/A    | N/A        | N/A    |
| f_oc_mg      |          |        | -1367.8*  | 4002.0 | N/A         | N/A    | N/A        | N/A    |
| female_pay   |          |        | -211.8    | 329.7  | 534.0       | 454.5  | 497.2      | 454.0  |
| form_lan     |          |        | 1513.0    | 404.9  | 773.4       | 498.0  | 899.1      | 499.1  |
| grade_com    |          |        | 1652.1*   | 53.1   | 1299.0*     | 77.5   | 1309.2*    | 77.6   |
| govt         |          |        | -2128.3   | 1326.5 | N/A         | N/A    | -798.9     | 651.3  |
| group        |          |        | -3309.7*  | 421.8  | -1866.7     | 390.7  | -1657.3574 | 454.3  |
| group X govt |          |        | 327.2     | 1378.5 | N/A         | N/A    | -782.9     | 863.2  |
| in_school    |          |        | -1407.7*  | 105.2  | -1690.6     | 209.3  | -1690.7    | 209.3  |
| lan_oth      |          |        | N/A       | N/A    | N/A         | N/A    | N/A        | N/A    |
| lan_spn      |          |        | N/A       | N/A    | N/A         | N/A    | N/A        | N/A    |
| live_fm      |          |        | N/A       | N/A    | 839.1       | 498.3  | 804.7      | 497.7  |
| m_full       |          |        | 1169.1*   | 336.4  | 1765.7      | 492.4  | 1760.5*    | 491.9  |
| m_grade      |          |        | 201.7*    | 63.1   | N/A         | N/A    | N/A        | N/A    |
| m_oc_mg      |          |        | -10.1     | 1630.1 | N/A         | N/A    | N/A        | N/A    |
| male         |          |        | 9907.3    | 283.1  | 7932.5*     | 390.2  | 7955.8*    | 389.7  |
| male_pay     |          |        | 746.4     | 458.3  | 445.6       | 542.3  | 355.5      | 542.5  |
| marital      |          |        | 598.9*    | 80.9   | 379.0       | 128.0  | 379.0      | 128.0  |
| sibling      |          |        | -206.1    | 60.9   | -131.5      | 67.1   | -123.4     | 67.1   |
| South_14     |          |        | -806.7*   | 311.9  | -274.9      | 423.1  | -365.2     | 423.8  |
| time1        |          |        | 1231.5*   | 29.9   | 462.4       | 90.8   | 488.0*     | 91.1   |
| time2        |          |        | -20.6*    | 1.4    | -10.5       | 2.2    | -10.6      | 2.2    |
| urban_14     |          |        | 256.9     | 347.8  | -317.5      | 445.5  | -300.2     | 444.9  |
| US_14        |          |        | -974.9    | 984.4  | -2149.3     | 978.8  | -1913.7    | 981.0  |
| wel_35       |          |        | -237.4    | 317.8  | -658.6      | 412.0  | -608.8     | 411.7  |
| white        |          |        | 1542.4*   | 640.2  | 736.4       | 676.2  | 681.7      | 675.4  |

**Table F.3 Measures of fit and covariance parameter estimates for four longitudinal models**

|   | Model IA |        | Model IB |        | Model IC |        | Model ID |        |
|---|----------|--------|----------|--------|----------|--------|----------|--------|
| Effect  | Estimate | StdErr | Estimate | StdErr | Estimate | StdErr | Estimate | StdErr |
| <b>Fit Statistics</b>                         |          |        |          |        |          |        |          |        |
| -2 Log Likelihood                             | 765201.8 |        | 2493081  |        | 74353.4  |        | 743535.1 |        |
| AIC   | 765207.8 |        | 2489344  |        | 743613.4 |        | 743609.1 |        |
| BIC   | 765207.8 |        | 2489634  |        | 743823.8 |        | 743831.5 |        |
| AR(1)   | N/A      |        | 0.6999*  | 0.003  | 0.6352*  | 0.006  | 0.6552*  | 0.0063 |
| <b>Covariance Parameters and Sample Sizes</b> |          |        |          |        |          |        |          |        |
| UN(1,1)                                       | 1.18E+08 |        | 1.52E+8* |        | 7.E+07   |        | 6.E+07   |        |
| Residual                                      | 1.45E+8* |        | 1.30E+8* |        | 9.E+07   |        | 8.E+07   |        |
| <i>N</i>                                      | 12,492   |        | 12,492   |        | 2,659    |        | 2,659    |        |
| <i>N X T</i>                                  | 202,976  |        | 202,976  |        | 31,863   |        | 31,863   |        |

## F.2 Results

We proceed with a discussion first of the control variables and find that all three models estimate that the initial status of *ad\_wage* (from the fixed effects intercept) is negative but that wages grow at a rate of between \$800 to \$1200 dollars per year, controlling for other factors. Models IB, IC and ID include a quadratic *time* trend, to accommodate the fact that adjusted wages of respondents grow rapidly in the initial years followed by a dampening effect; the estimated quadratic effect is rightly negative. Model ID in Table - shows that several parental and demographic variables of the respondent are statistically significant in the model.

Model IB (estimated on the full sample) shows that in general, an increase in the highest educational grade earned by parents contributes positively to mean *ad\_wage*. This confirms that our use of parental level of education as a way to define whether or not respondents come from economically disadvantaged families, hold for the purposes of our analysis. Children of parents working in managerial or professional positions also experience a positive effect on adjusted wages compared to those with parents who hold blue-collar jobs as do children of full-time employed parents. The results of the demographic variables indicate that white respondents appear to earn about \$1542 more than non-white respondents and those who lived in the southern states at the time they were 14 years of age experience \$806 less in mean wages compared to those who lived elsewhere. Living with parents at the age of 14 also improves mean salaries and wages during the observation window. Every additional year of education leads to an addition of an estimated \$1652 in mean *ad\_wage*. Immigration and language variables appear to have little effect on mean *ad\_wage*.

The above parental, demographic and immigration-type factors are somewhat easy to interpret because they can be assumed to be time-invariant. However, some, but not all time-varying covariates can pose serious problems of interpretation. This is due to potential

endogeneity, ie, the possibility of reciprocal causation between  $y_{i,t}$  and  $x_{i,t}$  at time  $t$  for respondent  $i$ . In general, endogeneity can cause a variety of problems that are well documented in an extensive literature. To identify which factors are suspects for the endogeneity problem in our problem, we employ a taxonomy of variables given by Singer and Willet (2003), who classified time-varying predictors in longitudinal settings into four groups: defined, ancillary, contextual and internal<sup>43</sup>; this taxonomy classifies variables from the least problematic to the most problematic as far as the endogeneity problem is concerned. Classification is based on the degree to which a predictor's values at time  $t$  are (1) assignable a priori and (2) potentially influenced by the respondent's contemporaneous outcome. Our best judgment of which predictors in our model fall into which group is given in the last column of Table F.1. It is sufficient to note here that the policy variables, the immigration and language variables, the parental variables and some of the demographic variables are not problematic for this purpose. However, several demographic variables and almost all of the attitudinal variables that have been introduced in the model to control for intangible motivation-type reasons are internally time-varying (meaning they describe a respondent's potential status over time) are quite problematic because these are likely to be jointly determined with earnings levels.

For the purposes of this analysis, we proceed with these potentially endogenous variables as if they were fixed and determined a priori at time  $t$ , leaving assessment of the extent of the problem and adoption of remedial action to future research. It might be noted that since the optimal choice of inputs in every survey period generally depend on the random intercepts  $b_i$ , it is likely that some partial correlation between  $ad\_wage$  at time  $t$  and explanatory variables in other years will exist if the random intercepts are not controlled for. The attitudinal variables are highly significant and point to the fact that more motivated respondents who are in control over their lives and have a better attitudes towards their economic futures are more likely to earn more compared to others. As far as the internally time-varying  $d\_public$  is concerned, receipt of public assistance leads to a statistically significant mean reduction in  $ad\_wage$  of \$1298 in Model IB compared to those who reported not receiving such assistance. Being in school leads to an estimated decrease in contemporaneous wages of close to \$1400. This is reasonable as investing in education points to deferred incomes.

Model IC indicates that experimental group members earn an average of \$1867 less than control group members, controlling for other factors. This is indicative of individuals with transportation problems facing a loss of wages to impediments to mobility during the economically formative years of young adulthood, compared to those who do not face such mobility constraints. They appear to suffer a disadvantage that persists over 20 years of their careers, controlling for the factors that we have. Model IB, estimated on the full sample, estimates a significant return to those who do not face transportation problems during the intervention window for both individuals who were enrolled in job training programs and those who were not. Due to the presence of the interaction terms, the model structure allows us to distinguish between the so-called premium that accrues to respondents by the second intervention that we have considered, ie, *govt*. The slope estimates indicate for those who participated in the governmental employment training program, having transportation

<sup>43</sup> The taxonomy of time-varying predictors are discussed in Appendix A.

problems leads to an estimated \$2982 less on the average compared to those who own a car. This effect is significant at the .05 level<sup>44</sup>.

For the group which was not enrolled in governmental training programs, the model predicts that facing transportation problems leads to \$3310 less on the average in adjusted wages compared to those who did not experience problems with mobility. This effect is also significant at the .05 level.

When we consider the sub-sample of economically disadvantaged individuals, these large differences between the experimental and control groups are reduced but nevertheless still exist and are significant. For individuals who underwent training, the premium enjoyed by those who did not face transportation problems is \$2440 annually, compared to those who faced mobility constraints. For people who did not go through training, the control group earns \$1657 more than the experimental group. The results indicate that the average respondent facing transportation problems during their economically formative years of their lives suffers a disadvantage that persist over 20 years of their careers, controlling for the factors that we have.

The random effects reflect how much the respondent-specific profiles deviate from the overall average profile. As noted earlier, the random intercepts are intended to capture unobserved factors that might affect the respondent's ability to earn at a certain level and other omitted factors surrounding the respondent's lives that are not directly observable. The mean of the vector  $\hat{b}_i$  is zero and therefore, by evaluating the largest and the smallest estimated random intercepts, we can evaluate respondents whose initial statuses are different from the bulk of the respondents. The Empirical Bayes (EB) estimates  $\hat{b}_i$  of  $b_i$  in Model IB depicted as a histogram in Figure - shows that the distribution is very long-tailed indicating that there are clearly some outlying individuals.

In the following, we conduct an investigative analysis of these outlying individuals and summarize our results by means of a narrative synthesis. In order to do this, we select the 100 subjects who most positively deviate from overall average profile (which we will call Group A) and the 100 subjects who most negatively deviate from the average (Group B). It is clear that on a variety of factors, there are strong differences between these two groups. Group B respondents are more likely to be foreign-language speakers at home, especially Spanish and to be residing outside the United States when they were 14 years of age. Contrary to expectations, Group B parents have more years of education and more likely to be employed full-time than Group A parents. Group B respondents are more likely to have been in the rural South at the time they were 14. Group A respondents are more likely to have positive

<sup>44</sup> The slope for the ( $govt=1$ ) group is  $(\hat{\beta}_{d\_no\_veh} + \hat{\beta}_{d\_no\_veh \times govt} d\_no\_veh)$  and the standard error is  $se_{(\hat{\beta}_{d\_no\_veh} + \hat{\beta}_{d\_no\_veh \times govt})} = \sqrt{\text{var}(\hat{\beta}_{d\_no\_veh}) + \text{var}(\hat{\beta}_{d\_no\_veh \times govt}) + 2 \text{cov}(\hat{\beta}_{d\_no\_veh}, \hat{\beta}_{d\_no\_veh \times govt})}$ . The slope for the ( $govt=0$ ) group is simply  $\hat{\beta}_{d\_no\_veh}$  with a standard error of  $\sqrt{\text{var}(\hat{\beta}_{d\_no\_veh})}$

attitudes than Group B. The median years of schooling of Group A and Group B respondents are about the same.

One perceptual or cognitive issue is useful to consider regarding the difference between Groups A and B. Group A respondents were much less likely to perceive transportation to be a problem in the intervention years than Group B. Whereas about 21 percent of Group A respondents reported that they faced access barriers and could not get to where they needed to go easily, more than 40 percent of Group B respondents were likely to do so. About 25 percent of Group A respondents who did not have access to a vehicle reported transportation to be a problem compared to 46 percent of Group B respondents who did not have access to a vehicle.

### F.3 Conclusions

Based on a random effects model, we are able to estimate that a gap does exist between those economically disadvantaged individuals who faced transportation problems in their adolescence and young adulthood compared to those who do not. The model presented here estimates that for those who participated in governmental employment-training programs, facing transportation problems leads to an estimated \$2440 less on the average compared to those who did not, an effect which is significant at the .05 level.

We find that many of the control variables introduced in the model are significant. For example, the labor force participation of parents, their schooling levels as well as several demographic factors such as those that pinpoint to respondents who resided in the early teens in rural areas in the southern states are likely to affect adjusted wages and salaries over the twenty year observation window. Further, the attitudinal variables are highly significant and point to the fact that more motivated respondents who are in control over their lives and have a better attitudes towards their economic futures are more likely to earn more compared to others.

The analysis of the empirical Bayesian estimates of the random intercepts allowed us to identify respondents that are most different from the overall mean profiles in their initial status. We found that those respondents with the largest intercept are much less likely to report perceiving transportation as a problem than those with the smallest intercepts. Non-car owners are less likely to perceive transportation to be a problem for respondents with large positive random intercepts compared to those with large negative intercepts. This could point to the fact that the former type of respondents who did not have access to a vehicles were more likely to have travel alternatives in the form of accessible public transportation, ride-sharing alternatives or that they lived in close proximity to jobs, retail and commercial centers to which non-motorized transportation are an alternative compared to the later group of respondents.

Prior research has shown that perceptions of great distances between employment locations and home residences are a strong barrier to obtaining and maintaining employment and that this perceptual measure is correlated with lack of driver's licenses, reliable cars or no cars and lack of public transportation. As distances between home locations and jobs continue to

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increase over time in both urban and rural areas, it becomes necessary to balance the debate on governmental subsidies to targeted transportation services for carless individuals in disadvantaged neighborhoods, with their long-term earnings potential and the long-term societal benefit that accrues by enabling individuals without the means for personal mobility to avoid dependence on public assistance, unemployment benefits and other forms of governmental assistance.

Needless to say, the empirical investigation of the research question posed in this appendix is fraught with all types of problems. A sample of the potentially most damaging problems is the following: Some of the control factors vary over time whereas others do not. We take note that some of the time-varying predictors can pose interpretative difficulties, as they are potentially endogenous. Several demographic factors relating to schooling and employment, attitudinal factors and involvement in job training programs might be jointly determined with wages. We defer an analysis of endogeneity to future research but we have discussed variables that are most likely to be problematic. Secondly, different individuals might be subject to the influence of different types of factors. As noted by Hsiao (2003), “when explaining individual behavior, one may extend the list of factors *ad infinitum*”; this is certainly the case with our sample of NLSY respondents. In this analysis, we address this problem with the introduction of random effects that captures respondent-specific heterogeneity. Further, although the NLSY does not suffer from severe sample attrition (with a retention rate of 77.5% over the more than 20 years), item non-response in the covariates over repeated years might lead to missing data and an unbalanced dataset. This necessitates on our part a method that is robust to unbalanced data structures, which we have utilized in this analysis.

In addition, for the purpose of inference, to assess if a statistically significant “economic premium” accrues to the group with no reported transportation problems, correct variances need to be estimated, so that testing is valid. We have attempted to complete a systematic analysis of the sources of variation and to fit an error structure to the models that explains correlations in the repeated observations. Further, we checked for heteroscedasticity in the estimated model to verify if this is a source of problem and found that variances are more or less constant over time.

Finally, the problems posed by simultaneous participation in different interventions should be addressed. In our case, the first intervention is problems with transportation while the second is enrollment in governmental job training programs. Millions of dollars are spent every year in the United States to help targeted groups earn their economic independence by providing various job and training programs. Therefore, the effectiveness of those programs has drawn much attention and has been extensively studied in order to provide recommendations on how the nation's employment and training system could be improved. Interaction terms were added to the modeling structure to examine if the effect of car ownership

## Appendix G: Model II of Dynamic Microsimulation – Forecasting Wages Over Time

The oldest NLSY79 was 45 years old in 2002. In order to accommodate wage growth trajectories of older JARC riders, we need to forecast future wages of NLSY79 respondents. We build on the models presented for the economically disadvantaged NLSY79 respondents presented in Appendix – for this purpose.

Model IIA: Divide the sample of NLSY79 respondents in the year 2002 into  $j=1, \dots, J$  categories determined by combinations of age category, gender, group membership *group* which takes a value of 1 when a respondent was a member of the experimental group as defined in Chapter 7 and 0 otherwise) and educational level (5 educational levels described in Chapters 7). Let  $w_j$  be the mean value of predicted wage (obtained from the models in Appendix F) for the  $j$ th category of respondents. Our goal is to develop a model of  $w_j$ , which can be used to predict future values of wages and annual changes in wages for older age categories of Subgroup 1,2, 3 and 5 JARC respondents, ie:

$$w_j = \beta_0 + \beta_1 d\_gender_j + \beta_2 d\_group_j + \beta_3 educatn_j + \beta_4 age\_cat_j + \varepsilon_j$$

where  $d\_gender$  ( $1=$ male) and  $d\_group$  ( $1=$ experimental) are dummy variables and *educatn* gives educational level whereas *age\_cat* gives age categories. Weighted Least Squares (WLS) was used for parameter estimation to account for heteroscedasticity (with a weight of  $n_j$  or the sample size within the  $j$ th category, which is the appropriate weight for the means of  $n_j$  homoscedastic variables).

Model IIB: In order to predict future wages and wage growth rates for Subgroup 4, Model IIA was modified to include *govt* and its interaction with *group*. Once the allocation of Model IIB outputs are made to JARC respondents by age category and gender, we can obtain forecasted wage rates for JARC respondents who underwent job training (who are allocated wage growth curves for  $group=0$  and  $govt=1$  from Model IIA) as well as the baseline condition relevant to this group (ie, wage conditions that would have resulted if Subgroup 4 underwent job training but did not have access to the JARC service or  $group=1$  and  $govt=1$ ).

Tables G.1 gives the results. The *RMSE* and  $R^2$  of both models indicate that percentage of the variation in the  $w_j$ 's as well as the average prediction errors are both reasonable for forecasting. Model IIA predicts that, controlling for gender, age category and education level, experimental group members (those who faced transportation problems), earn about \$2,100 less annually than control group members. The magnitude of this coefficient is close to that of the group variable in Model IC, which was about \$1,900. Model IIB predicts that experimental group members who underwent job training earn \$2412 less than control group members who underwent job training. Experimental group members who did not undergo job training is estimated to earn \$2025 less than control group members who were not in job training programs.

**Table G.1: Weighted Least Squares estimates of Model IIA and Model IIB**

|                        | <b>Model IIA</b> |                   | <b>Model IIB</b> |                   |
|------------------------|------------------|-------------------|------------------|-------------------|
|                        | <b>Estimate</b>  | <b>Std. Error</b> | <b>Estimate</b>  | <b>Std. Error</b> |
| <b>Intercept</b>       | -1,1312.0*       | 1,478.39          | -1,1085.00*      | 1,379.54          |
| Gender (1=male)        | 9,786.46*        | 712.20            | 8,738.92*        | 617.02            |
| Group (1=experimental) | -2,109.44*       | 711.57            | -2,024.45*       | 784.70            |
| Age_cat                | 425.74*          | 37.91             | 408.35*          | 32.99             |
| Educate                | 2,682.37*        | 226.24            | 3,024.49*        | 223.87            |
| Govt                   |                  |                   | -2,643.39*       | 1,012.97          |
| Group X Govt           |                  |                   | -388.09          | 1,293.57          |
| Measures of Fit        |                  |                   |                  |                   |
| $R^2$                  |                  | 0.83              |                  | 0.77              |
| <i>RMSE</i>            |                  | 3,644.37          |                  | 4,019.27          |

## Appendix H: Model III of Dynamic Microsimulation – Duration Model of Carlessness Post Employment

Table H.1 gives the distribution of carlessness duration (in years between their first job and the ownership of a car) for all economically disadvantaged NLSY79 respondents (the negative values are of those respondents who acquired a car before their first job).

**Table H.1 Carless in years after first job**

| Carlessness<br>(in years after first<br>job) | All Economically<br>Disadvantaged<br>Respondents | Control Group<br>Sub-sample | Experimental<br>Group Sub-<br>sample |
|--|--|-----------------------------|--------------------------------------|
| -13  | 0.08   | 0.00                        | 0.07                                 |
| -12  | 0.00   | 0.00                        | 0.00                                 |
| -11  | 0.15   | 0.00                        | 0.10                                 |
| -10  | 0.04   | 0.04                        | 0.00                                 |
| -9   | 0.12   | 0.00                        | 0.10                                 |
| -8   | 0.08   | 0.07                        | 0.01                                 |
| -7   | 0.12   | 0.01                        | 0.10                                 |
| -6   | 0.35   | 0.16                        | 0.16                                 |
| -5   | 0.54   | 0.22                        | 0.41                                 |
| -4   | 0.62   | 0.25                        | 0.50                                 |
| -3   | 0.66   | 0.20                        | 0.69                                 |
| -2   | 1.20   | 0.87                        | 0.89                                 |
| -1   | 0.97   | 1.04                        | 0.77                                 |
| 0  | 3.06   | 2.96                        | 2.45                                 |
| 1  | 3.64   | 3.31                        | 3.74                                 |
| 2  | 4.41   | 4.35                        | 4.75                                 |
| 3  | 5.65   | 5.34                        | 5.50                                 |
| 4  | 9.72   | 10.53                       | 9.59                                 |
| 5  | 13.90  | 17.44                       | 11.86                                |
| 6  | 36.20  | 36.17                       | 39.78                                |
| 7  | 6.16   | 5.55                        | 6.74                                 |
| 8  | 3.95   | 4.45                        | 3.14                                 |
| 9  | 2.36   | 1.94                        | 2.58                                 |
| 10   | 1.78   | 1.38                        | 2.12                                 |
| 11   | 0.85   | 0.74                        | 0.87                                 |
| 12   | 0.62   | 0.49                        | 0.60                                 |
| 13   | 0.97   | 0.95                        | 0.83                                 |
| 14   | 0.31   | 0.47                        | 0.19                                 |
| 15   | 0.39   | 0.39                        | 0.37                                 |
| 16   | 0.19   | 0.14                        | 0.11                                 |
| 17   | 0.27   | 0.08                        | 0.34                                 |
| 18   | 0.08   | 0.09                        | 0.01                                 |
| 19   | 0.35   | 0.27                        | 0.37                                 |
| 20   | 0.12   | 0.12                        | 0.09                                 |
| 21   | 0.12   | 0.00                        | 0.16                                 |

The time duration of NLSY79 respondent without a car following acquisition of a car is assumed to follow a hazard function,  $\lambda_i(t)$ , expressed as:

$$\lambda_i(t) = \lambda(t; Z_i) = \lambda_0(t) \exp(Z_i' \beta)$$

where  $\lambda_0(t)$  is an arbitrary and unspecified baseline hazard function,  $Z_i$  is a vector of explanatory variables including gender, group, educatn, age and raise in annual wages between  $t$  and  $t-1$  and the  $\beta$ 's are the associated parameters.

The estimated parameters of the model are given in Table H.2.

**Table H.2 Parameter estimates of carlessness after first job duration prediction model**

| Variable    | Estimate | Std. Error | Hazard Ratio |
|-------------|----------|------------|--------------|
| Group       | 2.46     | 1.04       | 11.78        |
| Educatn     | 0.75     | 0.49       | 2.13         |
| Gender      | -1.34    | 0.88       | 0.27         |
| Age         | 0.47     | 0.16       | 1.59         |
| Wage_growth | -0.01    | 0.01       | 0.98         |

The hazard ratios in Table H.2 (also called relative risks) provided some insights into the contribution of the different covariates into carlessness. The hazard ratio estimate is 11.78 for group, implying that the hazard function for the experimental group is larger than that for *the control group*. In other words, individuals in *the experimental group* was carless after being employed for the first time longer than those in *Group*=0. Increases in education levels decrease the chances of carless duration, whereas being male decreases carlessness duration by 73 percent. The predictions of carlessness duration from this model were used to construct Cost Scenario 3 in the CBA.

## Appendix I: Program Targeting and Perceptual Factors

### I.1 Program Targeting Analysis

In continuing our analysis comparing the demographics of the users of regular transit versus those using the JARC-funded transit services, we are looking at variables such as vehicle availability, educational attainment, and gender. We are interested in testing for differences in the proportions of the selected variables between the two data sets – the PUMS (5%) sample and the user survey of JARC services.

The method used is hypothesis testing using test of proportions. Our hypothesis in testing the population proportions is

$$H_0: p_1 - p_2 = 0$$

$$H_a: p_1 - p_2 \neq 0$$

Where  $p_1$  is the proportion of each variable being tested in the PUMS data set and  $p_2$  is the proportion of the same variable in the user survey. The variables that we are testing are vehicle availability, gender, and educational attainment.

**Table I.1. p-values for the Tests of Proportion**

| Service |                 | N   | Vehicle Ownership | Gender | Welfare | Educational Attainment |
|---------|-----------------|-----|-------------------|--------|---------|------------------------|
| TYPE    | Fixed Route     | 353 | <0.0001           | 0.0106 | <0.0001 | <0.0001                |
|         | Demand Response | 142 | <0.0001           | 0.3926 | <0.0001 | <0.0001                |
| AREA    | Large Metro     | 184 | <0.0001           | 0.2907 | <0.0001 | <0.0001                |
|         | Small Metro     | 162 | <0.0001           | 0.3584 | <0.0001 | 0.0392                 |
|         | Rural           | 156 | <0.0001           | 0.0049 | <0.0001 | <0.0001                |

A look at Table I.1 reveals that of the four variables that are compared, only the gender variable has a high enough p-value to accept the null-hypothesis. In other words, the user survey and the PUMS data from the respective sites have a similar distribution of males and females in the population. The p-values for the other three variables are very low and indicate that the null hypothesis should be rejected indicating that the two data sets are statistically different.

### I.2 Procedure for Median JARC Travel Time with Distribution of Census Travel Times

Table I.2 illustrates the procedure for one of the surveyed sites, namely Westchester Transit Authority, NY. First, the median travel times of each census tract (available from the

Census data) in Westchester County were estimated. Second, these median travel times were divided into quintiles. The first quintile consisted of census-reported median travel times between 0 minutes and 22.3 minutes, the second quintile from 22.3 minutes to 24.9 minutes and so on. Third, the median JARC survey travel time was estimated to be 20 minutes. This falls into the first quintile. In this case the JARC riders had a median travel time that was shorter than the times traveled by the majority of commuters throughout the County of Westchester.

**Table I.2 Sample Calculation for Assigning Quintiles - Westchester County**

|   | Q1     | Q2        | Q3        | Q4        | Q5    |
|---|--------|-----------|-----------|-----------|-------|
| <b>Median travel times</b>                                      | 0-22.3 | 22.3-24.9 | 24.9-29.7 | 29.7-31.8 | 31.8+ |
| JARC median in Westchester County = 20 minutes (first quintile) |        |           |           |           |       |

### I.3 Model of Variations in Perceived Service Importance of Workers

Since the JARC program is targeted to lead to employment outcomes, we are interested in analyzing these perceptual trends separately for commuters. In particular, we are interested in examining factors, which contribute to variations in the perceived importance of the service by commuters. To study contributors to variations in subjective importance, we estimated an ordered probit model of PSI, which exploits the fact that the scale on which respondents ranked the level of importance has a natural (ordinal) ranking (these results have been presented in Thakuria (2006) but will be repeated here for the sake of completeness).

Let the PSI scale be termed  $y_i$ . This response variable  $y_i$  has  $M=4$  possible outcomes. PSI of transit service is a subjective concept and lends itself well to latent variable modeling. The observed values are assumed to arise from an unobservable latent variable  $y_i^*$ , where

$$y_i^* = x_i\beta + \varepsilon_i \quad i = 1, 2, \dots, n \quad (1)$$

where  $\beta$  is a  $k \times 1$  parameter vector, the  $x_i$ 's are the exploratory variables describing various sociodemographic, service characteristics and usage patterns, employment-related factors and transportation choices and  $\varepsilon_i$  is a univariate stochastic error term. The assumption here is that the latent variable is continuous and it underlies the ordinal responses on PSI and that there are thresholds that partition the real line into a series of regions corresponding to various ordinal categories. Our goal is to model  $p[y_i=m]$ ,  $m=1, \dots, 4$  given the  $x_i$ 's and we are most interest to see the marginal effects of  $x_i$  on  $p[y_i=4]$ , holding other effects constant.

#### A Model of All Workers

The first model was estimated using data on those commuting to work. Here the probability that the service is ranked “very important”, “important”, “somewhat important” or “not important” is modeled using various socio-demographic, service characteristics and usage

patterns and employment-related factors. 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 likely 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 is 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).

### **A Model of Workers Traveling to the Same Workplace**

The JARC service is considered to be very important also by workers who did not switch employers after they started using the service. Presumably they are using the service to improve travel reliability, change job start time or to decrease costs that they were incurring on alternative modes. In a second model that was estimated on the subset of respondents who were traveling to work in the same destination where they used to work before using the JARC service, the probability that the service is ranked "very important", "important", "somewhat important" or "not important" is modeled using various socio-demographic, service characteristics and usage patterns, employment-related factors as well as previous

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mode usage characteristics to the workplace. As shown earlier, mode shifts to the JARC service occurred from private automobile, taxicab, etc.

The major activity changes that probably have accrued to this sub-group are job start-time changes and change to a more convenient or less costly mode. The type of service is not significant for this sub-group. Conversely, for this subset of respondents, car ownership and education are significant in the model. The variables URBAN and FREQ are also significant factors in perceived service importance.

About 72 percent of the riders who are now using a JARC transit service to travel to a work destination to which they used to travel to before, either saved time (50 percent) or incurred about the same travel time (22 percent), compared to a prior, alternative means of travel. However, the effect of the TIMESAVE variable is small - the variable is not significant in the EWDM; an increase in time savings by a minute increases the probability of ranking the service as very important by only 0.04 percentage points. The time-savings effect is probably captured by the additional mode-specific prior mode controls in the model.

Exploratory analysis also showed that the average travel time dropped for riders who previously used public transit, by 7.8 minutes and by 18.2 minutes for those that previously walked. Increases in travel time were experienced by previous automobile users (1.1 minutes), taxi users (8.4 minutes) and those that shared rides (3.0 minutes).

The time-savings are quite different for Fixed Route (FR) and Demand Responsive (DR) riders. For example, whereas previous auto users lost almost 4 minutes on the average by switching to a fixed route service, demand response service riders gained about an average of 3 minutes. Previous transit riders gained 5 minutes by switching to a FR transit service, but gained a substantially higher 11 minutes or so on the average, by switching to a DR service. Although the time increases are not too large (to previous auto, taxi, and shared-ride users), dollar cost is probably the overriding reason for the switch. Inconvenience with scheduling trips with friends, co-workers and relatives may have also played a part.

The prior modes of AUTO, CAB and PASS are significant in the model. Riders who switched from driving to the transit service in order to access the (same) job site are about 3 percentage points more likely to rank service importance as very high compared to those riders who switched from other modes. Previous transit and walkers are about 6 and 9 percent more likely to do the same. Previous taxi riders and shared ride users are most likely to rank the service as very important (20.6 and 10.3 percentage points respectively). Individuals who previously used taxis to access work were most likely to rate the services very important, among individuals who switched modes.

The major strategy that the Federal Transit Administration (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. Program managers at the local levels have been monitoring services for outcomes, as a way to evaluate if the service is meeting its intended goals. Outcome measures that are useful to consider include the proportion of new workers in the labor force served, proportion

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transported to higher-paying jobs and savings in travel times. Yet, with the target population under consideration and with the nature of the journey-to-work involved and the perceptions of lack of travel alternatives, it is important that perceptual measures such as the one described here be used along with the “hard” measures. Monitoring such a measure would enable program managers to assess whether the services are continually meeting the needs of the most transit-dependent of individuals in their communities, who perceive cognitive distance and lack of travel alternatives to be among the major barriers to accessing work.

In sum, the JARC service is critical to frequent users who appear not to have immediate alternative modes. They rely on the service for their livelihood. While JARC services are available to the general public, and are used by a wide range of riders, the low-income riders accessing work find the service very important. This is especially true for those who used others modes to commute to work (automobile, taxi and car pooling) prior to using the JARC service and those that had at least a high-school education. Therefore, the crucial objective of the services of providing a means to get to work seems to be met. The subjective measure, PSI, has been used to identify links to more objective measures such as frequency of use, thereby making this a more robust exercise. The results indicate that the PSI is indicative of extreme transit dependency, calling for use of these types of measures in addition to quantitative impact measures, in evaluating low-income transit services.

**Table I.3: Travel times for Different Trip Types**

| Travel Time<br>(in minutes) | Work trips |                       | Work-Supportive Trips |                       | Non-Work Trips |                       |
|-----------------------------|------------|-----------------------|-----------------------|-----------------------|----------------|-----------------------|
|                             | Percent    | Cumulative<br>Percent | Percent               | Cumulative<br>Percent | Percent        | Cumulative<br>Percent |
| 0 to 5                      | 2.46       | 2.46                  | 3.69                  | 3.69                  | 9.84           | 9.84                  |
| 5 10 15                     | 25.12      | 27.59                 | 26.64                 | 30.33                 | 32.79          | 42.62                 |
| 15 to 30                    | 50.25      | 77.83                 | 48.77                 | 79.10                 | 40.98          | 83.61                 |
| 30 to 45                    | 15.27      | 93.10                 | 14.34                 | 93.44                 | 8.20           | 91.80                 |
| 45 to 60                    | 2.96       | 96.06                 | 2.87                  | 96.31                 | 6.56           | 98.36                 |
| > 60                        | 3.94       | 100.00                | 3.69                  | 100.00                | 1.64           | 100.00                |

**Table I.4: Travel Times compared to Service Area Mean Travel Times**

| Difference from service area<br>mean travel time | Work trips |                       | Work-Supportive<br>Trips |                       | Non-Work Trips |                       |
|--|------------|-----------------------|--------------------------|-----------------------|----------------|-----------------------|
|  | Percent    | Cumulative<br>Percent | Percent                  | Cumulative<br>Percent | Percent        | Cumulative<br>Percent |
| < regional mean by 15 or more                    | 16.15      | 16.15                 | 15.45                    | 15.45                 | 34.43          | 34.43                 |
| 15 to 0 less than mean                           | 42.71      | 58.85                 | 45.49                    | 60.94                 | 22.95          | 57.38                 |
| 0 to 5 more than mean                            | 8.33       | 67.19                 | 8.15                     | 69.10                 | 11.48          | 68.85                 |
| 5 10 15 more than mean                           | 19.79      | 86.98                 | 18.45                    | 87.55                 | 19.67          | 88.52                 |
| 15 to 30 more than mean                          | 8.33       | 95.31                 | 7.73                     | 95.28                 | 4.92           | 93.44                 |
| 30 to 45 more than mean                          | 1.56       | 96.88                 | 1.72                     | 97.00                 | 4.92           | 98.36                 |
| 45 to 60 more than mean                          | 1.56       | 98.44                 | 1.72                     | 98.71                 | 0              | 98.36                 |
| > regional mean by 60 or more                    | 1.56       | 100.00                | 1.29                     | 100.00                | 1.64           | 100.00                |

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## Appendix J: Hierarchical Linear Models of Site-to-Site Variations in Outcomes

### J.1 Hierarchical Linear Models of Selected Ridership Outcomes

In order to statistically assess the extent of site-to-site variations in the four indicators discussed in Section 5.4 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. In order to net out program effects on outcomes, we use Hierarchical Linear Models (HLM) (Byrk and Raudenbush, 1992; Kreft and De Leeuw, 1998; Snijders and Bosker, 1999) to model binary outcomes (Wong and Mason, 1985) as a function of individual rider attributes, economic and spatial characteristics of the sites and transit service characteristics. The outcomes examined here are binary: Thus the study design, according to HLM terminology, has two levels: site-level factors and individual-level factors clustered within sites. There are several reasons why an HLM is appropriate for these types of data:

- 1) First, a multilevel model provides a convenient framework for studying multilevel data. Such a framework encourages a systematic analysis of how covariates measured at various levels of a hierarchical structure affect the outcome variable and how the interactions among covariates measured at different levels affect the outcome variable. One of the frequently examined cross-level interaction effects is how the macro context affects the impact of a covariate at the micro level. A example would be to examine cross-level effects of site-level labor market conditions and individual-level education-levels and to see if site-level labor marker conditions make a difference in outcomes experienced by individuals with similar education levels.
- 2) Second, multilevel modeling corrects for the biases in parameter estimates resulting from clustering. In contrast to the popular belief, ignoring multilevel structure can result in biases in parameter estimates as well as biases in their standard errors. The more highly correlated the observations are within clusters, the more likely that ignoring clustering would result in biases in parameter estimates. Our job is to explore if the data are clustered within sites and to incorporate these fact in modeling outcomes.

3) Third, multilevel modeling provides correct standard errors and thus correct confidence intervals and significance tests. When observations are clustered into higher-level units, the observations are no longer independent. Independence is one of the most basic assumptions underlying traditional linear and binary regression models. When the clustering structure in the data is ignored and the independence assumption is violated, the traditional linear and binary models tend to underestimate the standard errors. The following is an intuitive argument for this statement. The observations in the same cluster tend to be more similar in their outcome measures if clustering matters regarding the outcome measures. Similarity within a cluster implies that we can, to some extent, predict the outcome of an observation if we know the outcome of another observation in the same cluster. This suggests that not every observation provides an independent piece of information and that the total amount of information contained in a sample with clustering is less than that in a sample without clustering.

## **J.2 Research Issues**

In this section, we are interested in determining what explains the four illustrative economic outcomes and non-economic outcomes described earlier. All variables used in the analysis are given in Table J.1.

We posit that these employment and non-employment outcomes vary as a result of two levels of factors:

- 1) Individual-level factors: (i) Demographic information such as gender, age, receipt of public assistance in the past and education levels and (ii) Transportation information such as time traveled to destination and car ownership.
- 2) Site-level factors: (i) Regional economic and labor market information represented by an urban/rural dummy and regional unemployment rates (ii) Travel and transportation conditions in the area such as percent of commuters traveling to work alone and median travel time to work (iii) JARC service characteristics given by a fixed-route/demand-responsive dummy.

The main questions that are the focus of the statistical analysis are as follows:

- 1) How much do sites vary in the employment and non-employment outcomes?
- 2) Is the strength of association between individual factors and employment and non-employment outcomes similar across regions or do they vary due to site-level factors?

## **Preliminary Site-To-Site Analysis**

Preliminary unconditional means analyses or one-way random effects Analysis of Variance (ANOVA) established that there are substantial site-to-site variations in all employment and non-employment outcomes considered. For this and the remainder of the analysis, we eliminated data from 3 sites due to limited sample size and extensive missing values, bringing the total number of sites in the analysis to 20. These 20 sites had non-missing responses for 534 respondents. In this section, these results are discussed.

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The results from the unconditional means analyses are summarized in Table J.2. The ratio of those who did not work before using the service to those who is estimated to be  $\exp(-1.6351)=0.19$ , which is the same as the sample ratio of these two groups (note the model is estimated for all riders surveyed; as a proportion of this traveling to work only, the same proportion of “new workers” is .27). This effect is significant at the .05 level indicating that there is substantial site-to-site variation in *EMP\_BEF*. The intercept random effect variance significantly different from 0 indicating that for this data, using a one-level binary logit model would be problematic. 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.

Similarly, the ratio of those who earned more after using the service to those who earned the same or lower is estimated to be 0.07, which is also significant at the .05 level. The intra-class coefficient estimated to be .09 shows that close to 10% of the variability in *WAGE\_HIGHER* can be attributed to variations between sites, lower than in the case of *EMP\_BEF*. Finally, the ratio of those who saved time after using the service to those who did not is estimated to be 0.57. Again, the intra-class coefficient indicates that close to 12% of the variation in this dichotomous outcome is attributable to differences in the travel time conditions between the different sites in the sample.

Table J.1. Explanation of Variables Used

| Variable                                      | Type       | Explanation  |
|---|------------|--|
| <b>Outcome/Response Variables</b>             |            |  |
| <i>EMP_BEF</i>                                | Dummy      | 1 if respondent was unemployed prior to using the service                |
| <i>WAGE_HIGHER</i>                            | Dummy      | 1 if respondent reported earning more after using the service            |
| <i>T_SAVINGS</i>                              | Dummy      | 1 if respondent reported saving time after using service                 |
| <i>N_ACCESS</i>                               | Dummy      | 1 if respondent reported inability to access destination without service |
| <b>Site-Level Explanatory Variables</b>       |            |  |
| <i>D_URBAN</i>                                | Dummy      | 1 if resident of large or small urban area                               |
| <i>DRIVE_ALONE_PERCENT</i>                    | Continuous | Percent of commuting public driving alone                                |
| <i>UNEMPLOY_PER</i>                           | Continuous | Percent of civilian labor force unemployed                               |
| <i>D_SERVICE</i>                              | Dummy      | 1 if fixed-route   |
| <b>Individual-Level Explanatory Variables</b> |            |  |
| <i>D_GENDER</i>                               | Dummy      | 1 if male  |
| <i>D_CAROWN</i>                               | Dummy      | 1 if respondent owns a car   |
| <i>D_HIGH_SCHOOL</i>                          | Dummy      | 1 if high school graduate and higher                                     |
| <i>AGE</i>                                    | Continuous | In years   |
| <i>D_ASSISTANCE</i>                           | Dummy      | 1 if respondent reported earning public assistance in last 5 years       |
| <i>TRAVEL_TIME</i>                            | Continuous | Travel time of current trip in minutes                                   |

**Table J.2: Parameter Estimates and Standard Errors from One-Way Random Effects**

| <i>Parameter</i>                            | <i>EMP_BEF</i> | <i>WAGE_<br/>HIGHER</i> | <i>T_SAVINGS</i> | <i>N_ACCESS</i> | <i>H_EDU</i> |
|---|----------------|-------------------------|------------------|-----------------|--------------|
| Fixed Effect Intercept                      |                |                         |                  |                 |              |
| Coefficient                                 | -1.6351*       | -1.54*                  | -0.5543*         | -0.4155*        | -0.7487      |
| Standard Error                              | (0.1572)       | (0.1829)                | (0.1829)         | (0.09)          | (0.1307)     |
| Random Effect Intercept                     |                |                         |                  |                 |              |
| Variance                                    | 0.64           | 0.3588                  | 0.4313           | 0.6012          | .9379        |
| Standard Error                              | (0.1590)       | (0.1305)                | (0.1276)         | (0.1602)        | (0.1773)     |
| Intra-site correlation <sup>45</sup> $\rho$ | 0.16           | .10                     | .12              | .15             | .22          |
| Generalized $\chi^2 / DF$                   | 0.94           | 0.87                    | 0.96             | 0.99            | 1.05         |
| <i>N</i>                                    | 534            | 534                     | 534              | 479**           | 534          |

\* Significant at the .05 level.

\*\* The model for ACCESS was estimated for all riders but there were missing values for about 50 riders.

The estimated *N\_ACCESS* fixed effect coefficient is –0.42 indicating that about 66% of the respondents believe that they do not have any travel alternatives to go to their current destination. The intra-class coefficient shows that close to 18% of the variability in *N\_ACCESS* can be attributed to variations between sites.

### J.3 HLM Binary Logit Models of Employment and Non-Employment Outcomes

Although the intra-class coefficients in the above analysis are not very large, they offer statistical evidence that variations in outcomes exist due to factors associated or are unique to the sites. To what can the site-to-site variations in outcomes be attributed? Are they present due to the fact that individuals within sites differ from those in other sites? Or are they present due to overarching effects of the macro-levels factors present in each site? In order to understand these issues, HLM models of employment and non-employment outcomes were estimated using micro or individual level variables as well as variables that represent the labor market/economic conditions as well as operating characteristics of sites. Significance of cross-level interactions allows us to examine whether macro-level factors impose structural effects that allow individual outcomes to vary across sites.

To examine site-to-site variations, we estimate a random intercept model after controlling for site-level and individual-level factors. Ideally, we should have been able to estimate an HLM with random intercepts and slopes but the context of the study did not allow the estimation of so many parameters. With 534 observations and 20 sites, we have an average

<sup>45</sup> The intra-site correlation is estimated as  $\rho = \sigma_u^2 / (\sigma_u^2 + \sigma_e^2)$  where  $\sigma_u^2$  is the variance of the random effect and  $\sigma_e^2 = \pi^2 / 3$  is the variance of the standard logistic distribution.

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of 26.7 observations per site; however, the variation in the number of observations per site is very large, given that we were able to get large sample sizes for some of the fixed route services and only limited cases for some projects operating smaller vans. Hence, we have restricted this analysis to one of random intercepts only, that is, sites are allowed to vary by intercepts, enabling us to introduce site-specific effects. Table J.3 shows the estimates of the fixed effects of the models for the four binary outcomes, *EMP\_BEF*, *WAGE\_HIGHER*, *T\_SAVINGS* and *ACCESS*.

Table J.3 shows that no variables uniformly affect the two illustrative outcome measures of *EMP\_BEF* and *WAGE\_HIGHER* significantly. Location partly explains the propensity of prior unemployment and higher wage placements significantly; rural services were more likely to be transporting individuals who were previously unemployed than urban services (the model predicts that urban residents are 0.12 percent less likely to be unemployed previously compared to rural residents). This could be due to the fact that urban services are transporting individuals who might have been employed previously close to where they live or might have availed of transportation alternatives such as other transit services or carpooling alternatives, although perhaps at higher costs to them. These jobs that urban riders held previously (or the shift they worked in) might have also been low-paying; this is partly supported by the significant *D\_URBAN* coefficient indicating a greater propensity of urban workers to be employed in higher-paying jobs after starting use of the service (urban workers are 2.4 percent more likely than rural workers to be using the service to *ACCESS* higher paying jobs).

The share of commuters driving alone to work does not appear to be an important factor for any of the four outcomes. This variable was introduced in order to reflect in the models the expectation that a smaller percent of commuters driving alone to work would reflect that travel alternatives exist in the area. However, at least for larger metropolitan areas, there is likely to be so much small-area variation in the level of accessibility that this area-wide measure of travel alternatives was not able to pick up this effect on the outcomes under consideration.

Interestingly, the *UNEMPLOY\_PER* variable is not significant in the *EMP\_BEF* model. This could be partly attributed to the fact that there is great deal of small-area variability in unemployment rates and using county-level unemployment rates was not sharp even to discern the effects of regional labor market conditions on the propensity of riders to be previously unemployed. Areas with higher levels of unemployment have a small but significant effect on *WAGE\_HIGHER*; every unit increase in unemployment rate increases the propensity of earning higher at the job to which riders are traveling to by about 1%. This implies that services in higher unemployment areas are successful in targeting the service to appropriate areas or corridors, thus leading to better outcomes for riders. The basis for this result could be the “ceiling effect” referred to earlier. 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. Hence, it is very difficult for this group to find good-paying jobs on their own, just creating a greater “margin” for the JARC service to make a difference.

Practitioners and program managers have been most interested in differences in outcomes of fixed-route versus demand-responsive services. As noted earlier, 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<sup>46</sup>. The *WAGE\_HIGHER* model estimates that demand-responsive services are more likely to place individuals in higher-paying jobs. Fixed-route services are predicted to be 14.5 percent less likely to make high-wage job placements than demand-responsive services. Fixed route services are also less likely to be transporting individuals who were previously unemployed.

Car owners are significantly less likely to be previously unemployed. It is likely therefore that car owners were already in the labor force but have switched to the JARC service for reasons of difficulty with scheduling, higher costs of operations and so on. However, car owners did not report being significantly more likely to have earned higher after using the JARC service. Riders with high-school degree and higher are significantly more likely to have been previously unemployed and to be traveling to a new job in their careers. This sounds somewhat counter-intuitive since we would expect that these individuals should have already been in the labor force but it could be these individuals were facing some life difficulties (although the survey data is limited on factors relating to crime records, substance issues, exposure to domestic violence and other factors that would impede even a well-educated person's access to the labor force, we do know from the survey that a greater proportion of individuals with a high-school degree were likely to report receipt of public assistance in the last 5 years). A second explanation could be that these riders were previously members of the workforce but had lost their jobs due to various reasons and therefore they are different from chronic hard-to-place individuals who were never employed. However, since the question "did you ever work before" was not asked in the survey, we are unable to pinpoint an exact reason.

The interaction effects also yield insights into the propensity for riders to be previously unemployed and for the propensity for previously workers to be earning higher. Controlling for the other variables, high-school graduates using FR services tend to earn higher. High school graduates in areas with greater unemployment rates are less likely to be employed prior to using the service compared to high-school graduates in areas of lower unemployment rates. Urban car-owners are less likely to be previously unemployed. While

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<sup>46</sup> 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 with the eventual termination of the service.

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the sign of the other interaction terms appear to be intuitive, none of these other terms are significant in the model.

We now turn our attention to the two non-economic variables, *T\_SAVINGS* and *N\_ACCESS*. Respondents are 21% more likely to report savings in time in urban areas compared to rural areas. Riders of FR services are less likely to report savings in travel time compared to DR services although this effect is not significant. Not surprisingly, car owners, who were likely to be fulfilling the trip purpose using a private auto prior to using the service, are also less likely to report timesavings compared to non-car owners. The model also predicts that an increase in current travel time of a minute will reduce the probability of time-savings by about 3%. Urban car-owners are more likely to report time savings than rural car-owners; also car-owners who switched to FR services are less likely to save time compared to car-owners who switched to DR services (the average time difference between those who switched from private auto to FR services is -3.59 minutes; those switching from cars to DR services gained 3.18 minutes; overall switching from cars to the JARC service led to a net loss of an average of about a minute).

Regarding *N\_ACCESS*, urban riders and riders of FR services are less likely than rural and DR riders to perceive a lack of travel alternatives to the destination to which they were traveling. Car ownership increases the propensity of *N\_ACCESS* by about 14%; earlier we had alluded to the fact that it is likely that car owners were already in the labor force but have switched to the JARC service for reasons of difficulty with scheduling, higher costs of operations and so on. Finally, the model predicts that after controlling for the individual and site-level variables, every minute increase in trip time increases the probability of *N\_ACCESS* by about 0.1% indicating that trip length does play a role in the subjective view of the rider on the lack of travel alternatives.

Table J.3: Estimates of fixed effects for the four outcomes

| Fixed Effects                | MODEL I<br>(EMP_BE1=1) |         | MODEL II<br>(WAGE_HIGHER=1) |        | MODEL III<br>(T_SAVINGS=1) |        | MODEL IV<br>(N_ACCESS=1) |        | Model V<br>(H_Edu=0) |        |
|------------------------------|------------------------|---------|-----------------------------|--------|----------------------------|--------|--------------------------|--------|----------------------|--------|
|                              | Estimate               | ME**    | Estimate                    | ME**   | Estimate                   | ME**   | Estimate                 | ME**   | Estimate             | ME**   |
| Intercept                    | -2.99<br>(3.02)        | .       | -0.29<br>(3.27)             | .      | 3.53<br>(3.83)             | .      | -3.07<br>(3.88)          | .      | 0.28<br>(3.13)       | .      |
| D_URBAN                      | -0.08*<br>(0.02)       | -0.0012 | 0.31*<br>(0.12)             | 0.024  | 0.48*<br>(0.10)            | 0.211  | -0.27<br>(0.69)          | -0.057 | -0.72<br>(0.44)      | -0.121 |
| DRIVE_ALONE_PERCENT          | 0.01<br>(0.02)         | 0.0001  | -0.003<br>(0.03)            | -0.000 | -0.024<br>(0.04)           | 0.010  | 0.03<br>(0.03)           | 0.007  | 0.00<br>(0.03)       | 0.000  |
| UNEMPLOY_PER                 | 0.18<br>(0.19)         | 0.0027  | 0.14*<br>(0.05)             | 0.011  | -0.13<br>(0.27)            | 0.057  | 0.14<br>(0.27)           | 0.029  | -0.00<br>(0.21)      | 0.000  |
| D_SERVICE                    | 0.61<br>(0.85)         | 0.0091  | -1.82*<br>(0.67)            | -0.145 | -0.34<br>(0.69)            | 0.149  | -0.23*<br>(0.10)         | -0.048 | 0.46<br>(0.44)       | 0.077  |
| D_GENDER                     | 0.01<br>(0.26)         | 0.0001  | 0.11<br>(0.26)              | 0.008  | 0.033<br>(0.24)            | 0.014  | 0.39<br>(0.22)           | 0.081  | -0.04<br>(0.25)      | -0.007 |
| D_CAROWN                     | -1.26*<br>(0.55)       | -0.0189 | -1.19<br>(1.04)             | -0.095 | -0.37<br>(0.89)            | 0.162  | -0.67*<br>(0.25)         | -0.141 | -0.82*<br>(0.42)     | -0.137 |
| D_HIGH_SCHOOL                | 1.62*<br>(0.58)        | 0.0243  | -0.75<br>(0.69)             | -0.060 | -0.73<br>(0.67)            | 0.321  | 0.05<br>(0.68)           | 0.011  | -<br>(0.68)          | 0.000  |
| AGE                          | -0.02*<br>(0.008)      | -0.0003 | 0.001<br>(0.01)             | 0.001  | 0.001<br>(0.01)            | 0.000  | 0.005<br>(0.01)          | 0.001  | -0.03*<br>(0.01)     | -0.005 |
| D_ASSISTANCE                 | -0.31<br>(0.30)        | -0.0046 | 0.68*<br>(0.31)             | 0.054  | 0.02<br>(0.28)             | 0.008  | 0.03<br>(0.28)           | 0.006  | 0.15<br>(0.29)       | 0.025  |
| TRAVEL TIME                  | 0.001<br>(0.001)       | 0.0001  | -0.009<br>(0.008)           | -0.001 | -0.06*<br>(0.01)           | 0.026  | 0.005*<br>(0.002)        | 0.001  | -0.01<br>(0.01)      | -0.002 |
| D_URBAN X D_HIGH_SCHOOL      | -0.58<br>(0.63)        | -0.0165 | -0.18<br>(0.69)             | 0.009  | -0.15<br>(0.58)            | -0.007 | -0.29<br>(0.55)          | -0.021 | -<br>(0.55)          | -      |
| D_URBAN X D_CAROWN           | -0.92*<br>(0.46)       | -0.0130 | -0.13<br>(0.85)             | 0.014  | 0.70<br>(0.79)             | 0.011  | 0.52<br>(0.25)           | 0.038  | -<br>(0.25)          | -      |
| D_SERVICE X D_HIGH_SCHOOL    | -0.88<br>(0.87)        | -0.0124 | 1.73*<br>(0.67)             | 0.108  | 0.75<br>(0.63)             | 0.010  | -0.50<br>(0.22)          | -0.038 | -<br>(0.22)          | -      |
| D_SERVICE X D_CAROWN         | 1.61<br>(0.75)         | 0.0907  | 1.35<br>(0.93)              | 0.090  | -0.72<br>(0.74)            | 0.010  | -0.20<br>(0.09)          | -0.012 | -<br>(0.09)          | -      |
| UNEMPLOY PER X D_HIGH_SCHOOL | -1.23*<br>(0.20)       | .008504 | -0.53<br>(0.30)             | -0.004 | -<br>(0.30)                | -      | -<br>(0.30)              | -      | -<br>(0.30)          | -      |
| UNEMPLOY_PER X D_CAROWN      | 0.21<br>(0.26)         | .001676 | -0.04<br>(0.29)             | -0.013 | -<br>(0.29)                | -      | -<br>(0.29)              | -      | -<br>(0.29)          | -      |
| Random Effect (Intercept)    |                        |         |                             |        |                            |        |                          |        |                      |        |
| Variance                     | 0.1965                 |         | 0.3628                      |        | 0.4313                     |        | 0.7467                   |        | 0.1150               |        |
| Standard Error               | (0.2201)               |         | (0.3288)                    |        | (0.227)                    |        | (0.4238)                 |        | (0.09249)            |        |
| Generalized $\chi^2/DF$      | 1.55                   |         | 0.98                        |        | 0.91                       |        | 1.01                     |        | 0.99                 |        |
| N                            | 534                    |         | 534                         |        | 534                        |        | 479                      |        | 534                  | *      |

\*Significant at .05 level

\*\* Marginal Effect. For interaction terms, (say between  $x_1$  and  $x_2$ ) these were estimated as follows:

$\beta_{12}F(1-F) + (\beta_1 + \beta_{12}x_2)(\beta_2 + \beta_{12}x_1)F(1-F)(1-2F)$  where  $\beta_{12}$  is the estimated coefficient of the interaction of  $x_1$  and  $x_2$  and  $\beta_1$  and  $\beta_2$  of the individual variables.

## Appendix K: Marginal Cost of Labor Market Outcomes

In this section, we examine the marginal effects of the four different labor market outcomes on total annual expenditures ( $TOT\_EXP$ ) incurred for the sampled JARC services. The purpose of doing so is to examine the change in total annual expenditures with an addition of each trip that meets each of the four labor market outcomes considered, for example: “How much does one additional trip that serves a particular outcome change total expenditures?”

Two different models are estimated: an Ordinary Least Squares (OLS) model of  $TOT\_EXP$  and a Tobit model of  $TOT\_EXP$ , the parameters of which are estimated by Maximum Likelihood (since the dependent variable,  $TOT\_EXP$ , is censored, the Tobit form is more appropriate). Four different models are estimated by each estimation method, for each labor market outcome  $LM_k$ :

$$TOT\_EXP_j = f(RIDERSHIP, TYPE, AREA, LM_k)$$

where  $TOT\_EXP_j$  is the total annual expenditure expended by the  $j^{th}$  service and  $RIDERSHIP$  is total annual ridership,  $TYPE$  is a service type dummy (which is 1 when the service is fixed route) and  $AREA$  is a second dummy variable (which is 1 when the area of operation is a large metro). The Tobit Model is of the form:

$$TOT\_EXP_j^* = X_j' \beta + \varepsilon_j$$

$$TOT\_EXP_j = \begin{cases} 0 & \text{if } TOT\_EXP_j^* \leq 0 \\ TOT\_EXP_j^* & \text{if } TOT\_EXP_j^* > 0 \end{cases}$$

where,

$X_j$  is a vector of independent variables identified above

$\beta$  is a vector of parameters,

$$\varepsilon_j \sim N(0, \sigma^2)$$

$TOT\_EXP^*$  is an uncensored or latent (unobserved) variables of vehicle expenditure  
 $TOT\_EXP_i$  is the observed dependent variable.

The latent variable  $TOT\_EXP^*$  is assumed to represent desired total annual expenditures made by the  $j^{th}$  service, thus allowing for negative values.  $TOT\_EXP$  will be the same value of  $TOT\_EXP^*$ , when this latent variable is greater than zero. However, negative and zero spending are replaced by a single value of zero for observed expenditure  $TOT\_EXP_i$ . The parameters were estimated using the Maximum Likelihood (ML) estimation. We did not see any evidence of heteroscedasticity.

The marginal effects of the four labor market outcomes are given in Table IV. We find that the marginal effects of all four labor market outcomes on total expenditures are

negative, by holding total ridership, area of service and type of operation constant. The magnitude of the coefficients for the two models are not too different. The marginal effect of trips to destinations previously perceived to be inaccessible on total annual expenditures is the smallest indicating that the change in total cost in meeting this labor market outcome is the smallest of all outcomes examined. Holding ridership, the type of service and the area of operation constant, the cost of transporting an additional rider who perceive that the trip destination was previously inaccessible is reduced by \$0.24 (from the OLS model) and \$0.56 (from the Tobit Model).

*Ceteris paribus*, *TOT\_EXP* is estimated to reduce the most by trips incurred by non-school graduates. The marginal effect is -21.81 (from the OLS) and -19.77 (from the Tobit). The magnitude of the new work trip and higher wage trip marginal effects are very similar.

These results point to the fact that the services are efficiently targeting the desired population. The marginal changes in enabling additional trips that allow the four labor market outcomes to be met are all negative, indicating that at the margin, the total annual expenditures are reduced with additional trips meeting those outcomes.

**Table K.1. Marginal Effects (in US dollars) of Different Labor Market Outcomes**

| Labor Market Outcome ( $LM_k$ )                             | OLS<br>Marginal<br>Effect | ML Tobit<br>Marginal<br>Effect |
|---|---------------------------|--------------------------------|
| New Work Trip   | <b>-8.62</b>              | <b>-7.76</b>                   |
| OLS <i>t-value</i>  | -1.73                     |                                |
| OLS $R^2$   | 0.75                      |                                |
| Tobit $\sigma$  |                           | 3533.32                        |
| Higher Wage Trip  | <b>-8.39</b>              | <b>-7.42</b>                   |
| OLS <i>t-value</i>  | 1.76                      |                                |
| OLS $R^2$   | 0.75                      |                                |
| Tobit $\sigma$  |                           | 3667.52                        |
| Trip by Non-High School Graduate                            | <b>-21.81</b>             | <b>-19.77</b>                  |
| OLS <i>t-value</i>  | -3.66                     |                                |
| OLS $R^2$   | 0.85                      |                                |
| Tobit $\sigma$  |                           | 4563.99                        |
| Trip to Destination Previously Perceived to be Inaccessible | <b>-0.24</b>              | <b>-0.56</b>                   |
| OLS <i>t-value</i>  | -0.06                     |                                |
| OLS $R^2$   | 0.69                      |                                |
| Tobit $\sigma$  |                           | 2563.63                        |

Controlling for Total Ridership, Location Type and Service Type (estimates are from separate regressions on *TOT\_EXP*, total annual expenditures on the service; the first regression is estimated by Ordinary Least Squares and the second is a Tobit Model, the parameters of which are estimated by Maximum Likelihood)

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## Appendix L: Estimation of Value of Leisure Time

### L.1 Leisure Time Lost

The estimation of the value of leisure time is based on Greenberg's method (Greenberg, 1997). The value of leisure time lost is estimated by understanding the reservation wage of the individual entering the labor force or making a switch in employment. This switch can be a result of substitution effect (increase in wages resulting in increased value of leisure time) leading to individuals sacrificing leisure and spend more time at work. It is this category of leisure time lost that we are trying to estimate.

According to economic theory, an individual chooses not to work if the person's market wage is lower than the person's reservation wage (the minimum wage for which the person would be willing to work). Otherwise, the individual chooses to work, and hours worked are adjusted to equate the reservation and market wages (Anandan, 2002). This becomes an issue for non-workers for whom the prior wage information is missing.

As discussed in the previous paragraph, a reservation wage is the wage rate at which a person is exactly indifferent between working and not working. Labor economics notes that "the person will not work at all if the market wage is less than the reservation wage; and the person will enter the labor market if the market wage exceeds the reservation wage" (Borjas 2000).

We are estimating the value of leisure time for the respondents of the user survey who have been divided into six categories based on their current and prior employment status. For individuals who are working now and were working before, the opportunity cost of an additional hour of leisure time is the wage rate. It is in this context that the estimation of the reservation wage assumes significance. Individuals will be willing to enter the labor force only if the new wage is greater than the reservation wage rate. If not, they will choose to stay out of the labor force. We assume those who were not working before entering the labor force with the help of the JARC-funded transportation services, will set their reservation wage rate to their prior earnings.

According to Greenberg, the value of the leisure time is the difference between the reported earnings increase and the participant surplus estimated as a function of the change in hours worked, the change in wage with respect to the reservation wage, and the elasticity of labor supply. The assumptions underlying this analysis are that the labor supply curve is elliptical. Greenberg does account for different shapes of the labor supply curve by providing correction factors.

### L.2 Steps in Estimation of Value of Leisure Time

- 1) Requires an estimate of the percentage of earnings changes attributable to hours increases that should be counted. (We are assuming that the respondents were either

- 
- not working before ( $h_0/h_1 = 0$ ); or they were working full-time before and after ( $h_0/h_1 = 0.9$ )
- 2) Estimate the prior wage rate of the individual using the wage imputation model presented in Appendix G.
  - 3) If we assume that the prior wage rate is the respondent's post-JARC reservation wage rate, then the ratio of reservation rate to current wage can be computed, provided the prior wage is known.
  - 4) We assume that the respondent's supply of labor is completely inelastic ( $e = 0$ ). Then we can estimate the dollar value of leisure time lost. In our assumption of inelasticity, we acknowledge that this may not be true, but the results do not fluctuate much according to Greenberg's estimates.
  - 5) Armed with the ratios of hours of work and wage rates, one can then make use of the matrix to estimate the participant surplus for any individual.
  - 6) In order to do so, we aggregate the computed ratio of reservation wage to the current wage into discrete bins as presented in Greenberg's Table 1 (Greenberg, 1997). These discrete values are 0, 0.25, 0.5, and 0.75. The computed ratio values are assigned to these bins and then the participant surplus multiplier is obtained from the table.
  - 7) The participant surplus is estimated by multiplying the estimates of earnings increases calculated by Greenberg with the current wage of the individual.
  - 8) The value of the leisure time is calculated by subtracting the participant surplus from the current wage.

### Sample calculation

1. Prior annual income = \$6786 = Reservation Wage
2. Current annual income = \$16657 = Post-program wage
3. Ratio of reservation wage to current wage =  $6786/16657 = 0.4 \sim 0.5$
4. From Table 1 of Greenberg, with  $h_0/h_1 = 0$  and  $W^r_1/W_1 = 0.5$ , find the estimates of percentage of earnings increases attributable to increase in participant surplus.
5. Participant surplus is 39.3% from table 1.
6. Participant Surplus =  $0.393 \times 16657 = \$6546.20$
7. Participant's lost leisure =  $16657 - 6546.20 = \$10,110.80$
8. Ratio of lost leisure to current wage =  $10110.80/16657 = 0.61$

### L.3 Results and Discussion

The value of lost leisure is estimated for the respondents in the user survey. The leisure time is estimated for Subgroup 1 (those that were not working before the JARC service). Assuming the elasticity to be zero, and imputed prior earnings to be their reservation wage, we estimate the participant surplus and then the value of lost leisure. The mean value of lost leisure is \$3638 for the respondents in group 1 (Table L.1).

**Table L. 1 Value of leisure lost**

| Mean    | Std. Dev. | N  | Minimum      | Maximum  |
|---------|-----------|----|--------------|----------|
| 3638.41 | 2484.33   | 59 | -289.3797000 | 10576.85 |

The value of leisure lost is compared with the current wage of the individual respondent from the user survey. The average ratio is 0.254 (Table L.2) with a minimum of -0.066 and a maximum ratio of 0.390.

**Table L. 2. Ratio of Leisure Lost to Current Wage**

| Mean      | Std. Dev. | N  | Minimum    | Maximum   |
|-----------|-----------|----|------------|-----------|
| 0.2541956 | 0.1248304 | 59 | -0.0660673 | 0.3905275 |

#### **L.4 Conclusions**

The value of leisure time lost has been estimated in this section based on the method proposed by Greenberg. Assumptions have been made regarding the reservation wage rate and the elasticity of the labor supply based on published research. The results indicate that the average value of the leisure time lost ranges between 6% and 39% of their current wage. Thus, the net worth of employment made accessible by employment transportation services should be discounted by this value in order to get a sense of the true benefits to the individual.

## Appendix M: Estimation of Benefit to Cost Ratios

In Section 7.5.4, we noted that 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.

As noted, one way to avoid this phenomenon in the CBA considered here is to calculate:

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

where the quantity on the left hand side is the Total Societal Benefit to Total Program Cost. Figure M.1 gives these quantities for the case of all subgroups.

Figure M.1: Average User, Non-User and Societal Benefit to Program Cost Ratios

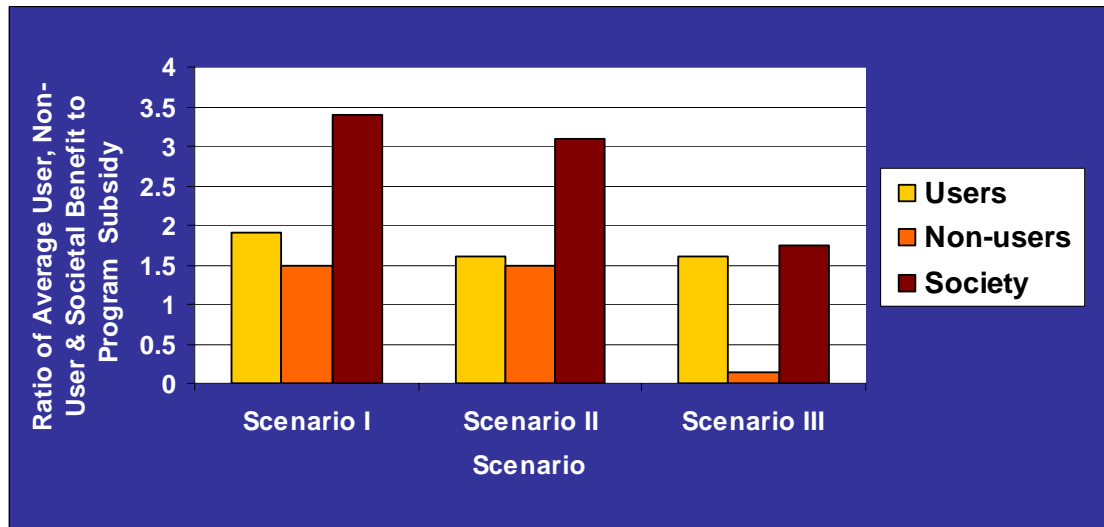


Figure M.1 show that the use of the services is estimated to lead to a net gain in economic benefit to users, non-users and society. As a baseline, for every dollar of program subsidy, a return of \$1.9 in net economic gains accrues to the user. The rate of return varies considerably by type of user, 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. These numbers are close to the estimates presented in Figure 7.3, but here the rule given in (M.A) is followed.

Figure M.1 also gives the non-user benefit generated by each user to total JARC program cost. 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”?

We find from Figure 10 that when benefits to the tax-paying public and commuters in the region alone are considered (as in Scenarios I and II), for every dollar of JARC investment, there is a return of about \$1.5 to non-users. These gains accrue 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. Taking these user and non-user impacts into account, we estimate that societal benefits are close to \$3.5 for Scenario I (when users’ value of leisure time foregone are not taken into account); these societal returns drops to \$3.1 in the case of Scenario II (when estimates of such user impacts are taken into account).

However, the non-user and societal benefit estimates in Scenarios I and II do not take into account the impacts of new workers on local labor markets. 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. In most benefit analysis, these types of impacts are not included, thus greatly inflating the true societal benefit estimates of economic and social service programs. On the average, these (negative) labor market impacts to non-users are about \$4,253 in the base year. When such labor market impacts are factored in (as in the case of non-users in Scenario III), the estimated returns to non-users drop to about 20 cents to a dollar of program subsidy and final societal benefits of the JARC program are estimated to be \$1.65 to a dollar of program investment.

### **Reasons for Presenting $ASBC$ , $APUBC_t$ and $ANoUBC_t$**

The following discussion summarizes why we presented  $ASBC$ ,  $APUBC_t$  and  $ANoUBC_t$  as opposed to Total Societal Benefit to Total Program Cost ( $TSBC$ ). in the body of the report.

- 1) 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

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or lose on the average from JARC investments on that user. This is given by  $ASBC$  and consequently  $APUBC_t$  and  $ANoUBC_t$ .

- 2) There are practical reasons for favoring the average measures over the total benefit to program cost measures as well. The incremental net user benefit data are highly skewed, with several large and positive observations as well as a few large, negative observations. The former occurs when individuals self-reported a combination of income change and time savings that lead to a highly beneficial “after service use” estimate of net incomes. The latter occur especially in the case of Subgroup 1 when incomes in the prior period are larger than the current (after service use) period. Prior incomes could be higher when individuals lost their higher-paying jobs before they used the service and took a lower-paying job after using the service resulting in large negative net benefits. Averaging, as in the case of  $ASBC$ ,  $APUBC_t$  and  $ANoUBC_t$  smooth out these irregularities but summing, as in the case of the  $TSBC$ , greatly exaggerates the irregularities.
- 3) There is multivariate missingness in the data. That is, there is item nonresponse for several variables in the input data to the calculation of the “before” and “after” indices, in both the numerator as well as the denominators of the quantities in (M.A). When summing to create  $TSBC$ , we encounter a number of missing values, resulting in the need to do case deletion. This is not a problem when we create the  $TSBC$  measure for the aggregate case as in Figure M.1, but leads to significant reduction in sample size when considering subgroups of users, types of service and other breakdowns of the sample. In these situations, the indices  $ASBC$ ,  $APUBC_t$  and  $ANoUBC_t$  are preferred.

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## Appendix N: PFC Method to Estimate Labor Market Impact

### N.1 Introduction

In this appendix, the gains or losses to workers in the labor market (non-users) are estimated. The methodology for doing cost benefit analyses of transportation projects has evolved over time and reflects a rigorous approach to measuring willingness to pay as a key indicator of consumer surplus. In stepping outside this core methodology researchers must be careful to avoid double-counting benefits already counted in that approach. Put somewhat differently, exceptions to that accepted approach must be carefully justified. In initial work, the benefits and costs were segmented as listed in Table N.1, with the costs and benefits derived from numerous sources.

**Table N.1: Benefits and costs of JARC users and non-users**

|                  | <b>Benefits</b>  |   | <b>Costs</b>  |                            |
|------------------|--|---|---|----------------------------|
|                  | <i>Already working</i>   | <i>Not already working</i>  | <i>Already working</i>  | <i>Not already working</i> |
| <b>Users</b>     | Change in earnings   | Transfer payments such as welfare payments or unemployment benefit earnings | Tax payments, transportation expenditure, time lost in travel, and possibly childcare expenditures  |                            |
| <b>Non-users</b> | Savings in transfer payments including welfare payments or unemployment benefits, tax payments by people not previously working, benefits to employers in the form of tax breaks |   | Cost of the transportation program, Childcare subsidies for portion of the riders, Cost of job training programs also for a portion of the riders |                            |

This simple approach revealed that the benefits far outweighed the costs for both the users and non-users. However, this back-of-the-envelope method is an approximation at best and issues pertaining to double counting and accuracy need to be addressed with the help of a rigorous framework. In the current context, the willingness to pay approach has not been made use of.

The key argument for not using a willingness to pay approach in the present study is that the vast bulk of the benefits identified here accrue not to the transit riders themselves, but to a range of other people not directly involved in the transit rider's decision to use a employment transportation service. As such the willingness to pay of the JARC rider cannot be expected to include the gains to these other individuals.

At the simplest level, gains accruing to tax payers through reduced use of income transfer programs by service riders cannot be expected to directly influence the decisions made by those riders. Riders' willingness to pay will not take into account gains to other parties.

The same basic observation applies to our treatment of wage gains. Our approach to measuring the gains of programs connecting (relatively low unemployment) work sites with (relatively high unemployment) 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. The chains are predictable, but of course we do not know the exact identities of the people involved

Similarly, individuals obtaining employment as part of child care programs linked to the present job placement are not directly involved in the transit decision of the specific transit rider in the study. Indeed, that transit rider could hardly be expected to know the opportunity cost of the child-care worker or service they employ, let alone take it into account in making their transit decision.

**Table N.2: Distribution of previous activities of Workers in the PFC Data Set**

| Classification of Workers<br>from User Survey | Worker's Previous Activity | Previous activities<br>of those hired (%) |
|---|----------------------------|---|
| Previously Working                            | Low wage jobs              | 23.6                                      |
|   | Lowest wage jobs           | 23.9                                      |
| Not already working in area                   | Unemployment               | 20.2                                      |
|   | Out of labor force         | 22.0                                      |
|   | In-migrant                 | 10.1                                      |

## N.2 Research Approach

The central observation in our approach is that many employment transportation services connect (relatively low unemployment) work sites with (relatively high unemployment) residential areas. As a result, workers using these services are expected to represent lower social opportunity costs than those workers who would otherwise take the jobs in question. To estimate how much lower we must look not only at the worker who fills the job, but also at the expected chain of labor market consequences of that job placement.

Drawing on the work of Persky, Felsenstein and Carlson (PFC) (2004), we can estimate expected labor market chains for different unemployment rates. For the typical low-skill job opening the following table suggests the distribution of the previous activities of those hired<sup>47</sup>.

Based on this distribution we can simulate the probabilistic chain set off by the job placement. Some chains stop immediately because the worker was unemployed, out of the labor force or an in-migrant. Other chains may go on for a number of steps as employed workers move from one job to another, presumably improving their wages or working conditions along the way. Of course, employed workers leave an opening behind them, for others to fill. Based on PFC's data, we estimate that on average one

<sup>47</sup> These entries represent averages for the two lowest wage groups in PFC.

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new placement at the low skill level generates just a bit less than one other vacancy at the same level or lower. These chains thus have an average length of about two. Chains are ended when an unemployed worker, someone out of the labor force, or an in-migrant, takes an opening along the chain.

Along an expected chain we can trace the likely gains of the workers involved. For those already employed, this is simply the difference between the new wage and the old wage, i.e. the old wage is their opportunity cost. For those unemployed, out of the labor force, or in-migrating we must estimate an opportunity cost for them in their previous activity.

The opportunity costs of these non-employed workers should be based on their likely alternatives to the job in question. We propose that the central determinant of these alternatives is the unemployment rate in their residential area. Thus non-employed workers from residential areas with differing unemployment rates will have differing opportunity costs. Following PFC, we key this opportunity cost to the proportion of the unemployed who are involuntarily unemployed. For these we take an opportunity cost of only 25%, these are workers with poor chances of employment or who can expect to be unemployed a considerable percent of the year. For the voluntarily unemployed (roughly unemployment rates up to 3.5%) we take an opportunity cost of 75%, these are workers with good prospects of employment throughout the year.

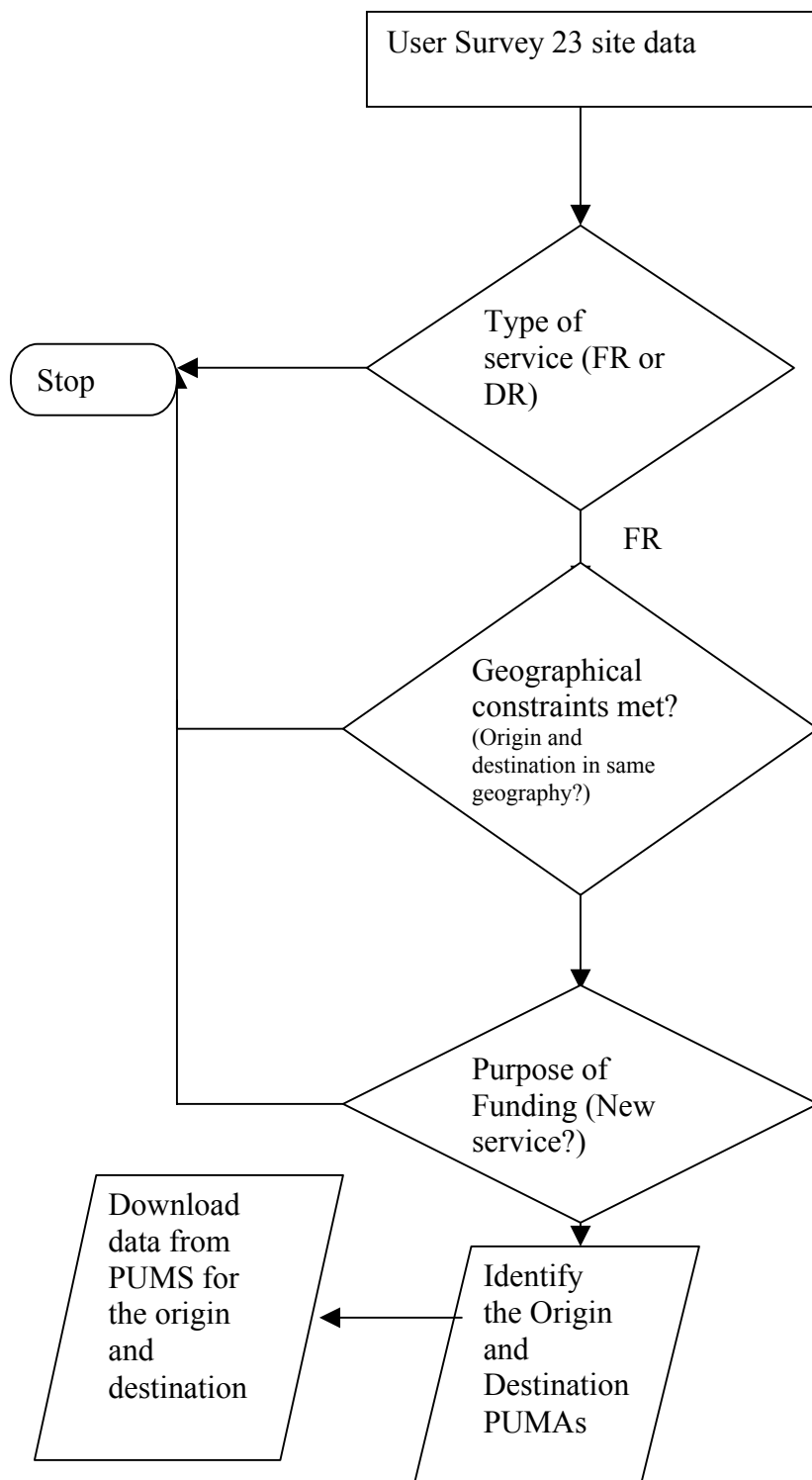
Armed with these individual opportunity costs we can construct a social benefit measure associated with a given job placement. PFC estimates an average for low-skill workers of 65% of the wage. But this figure is sensitive to the unemployment rate of the relevant residential community. It will vary depending on where the initial hire lives.

### **N.3 Estimation of the probability of unemployment of an individual**

Thus the critical step in our methodology is to estimate the expected unemployment rate of actual JARC commuters and compare it to the expected unemployment rate of similar workers living in the work site areas. These estimates are based on two logit equations, one for each area. Data are from the 2000 PUMS produced by the Census Bureau. All members of the labor force are included. For each area, on the left hand side of the equation is the unemployment status of the worker (1=unemployed, 0=employed.) On the right side of these equations are included a number of explanatory variables associated with an individual labor force member's employment status: education, age, age squared, vehicle availability, gender, last year's earnings, and welfare dependence. In addition the right side of each equation includes the unemployment rate of the public use microdata area (PUMA) in which the individual lives.

Once these equations are estimated we can use them to estimate a pair of expected unemployment rates for actual JARC participants in the survey sample data. The first ( $u_{ij}$ ) is participant  $j$ 's expected unemployment rate given her/his actual place of residence. The second ( $u_{wj}$ ) is the expected unemployment rate of someone with identical characteristics living in the workplace area.

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**Figure N.1: Site Selection for Benefits Estimation**

In fact the job has gone to worker  $j$  living in area  $r$ . We assume that in the absence of JARC the job would have gone to a similar worker residing in  $w$ . Under this assumption

the social gain attributable to JARC is the difference in the social benefits of the actual r-resident getting the job and the w-resident getting the job. PFC gives us the machinery for estimating each of these once we have the expected values of  $u_{rj}$  and  $u_{wj}$ . These estimates are made as a fraction of the actual wage. This procedure is carried out for each participant for a given JARC program.

#### N.4. The Binary Logit Model

We are using a two-stage binary logit model with the first stage estimating the model parameters using the PUMS data and the second stage predicting the rate of unemployment of an individual respondent from the JARC user survey.

The model estimates the expected unemployment rate for an individual based on the individual's characteristics such as age, vehicle availability, the educational attainment, and gender. Apart from these, we have used the unemployment rate of the region in to identify the origin and the destination.

**Table N.3. The Binary logistic model parameters**

| Variable                                      | Type       | Explanation   |
|---|------------|---|
| <b>Outcome/Response Variables</b>             |            |   |
| <i>EMPREC</i>                                 | Dummy      | 1 if respondent was unemployed prior to using the service |
| <b>Site-Level Explanatory Variables</b>       |            |   |
| <i>UNEMPLOY</i>                               | Continuous | Percent of civilian labor force unemployed                |
| <b>Individual-Level Explanatory Variables</b> |            |   |
| <i>AGE</i>                                    | Continuous | In years  |
| <i>AGESQR</i>                                 | Continuous | In years  |
| <i>EDURECOD</i>                               | Dummy      | 1 if high school graduate and higher                      |
| <i>SEXRECOD</i>                               | Dummy      | 1 if Male   |

The analysis consists of a statistical model using some of the variables compiled from the PUMS data. These variables are age, gender, unemployment rate of the region, and education level. Variables such as vehicle availability and public assistance status of the individual were considered for inclusion. The employment status of the individual (employed or not) will be the independent variable with the other variables being dependent variables. The age variable used in this analysis represents the age for each record in whole number years. The gender variable is coded so that females are coded with a "0" and males are coded as "1".

The education level for the people included in the dataset was recoded into three categories. Individuals with a college education or more were recoded to a "0". If the individual had some high school attainment they received a "1". Individuals with less than a high school education were coded with a dummy value of 2.

The employment data from the PUMS dataset was divided into those who were employed, those who were unemployed, and those who were not in the labor force. Those not in the labor force include people under the age of 16, people in school, retired people, and people who are no longer looking for employment. The unemployment rate of the PUMAs is calculated by eliminating those not in the labor force.

The general form of the model is represented in equation 1.

$$(U)_i = f(\text{age, age-squared, gender, and education level}) \dots\dots\dots(1)$$

Where, U is the employment status of the individual.

The results of the binary logit analysis are summarized as follows in Table N.5. The model parameters in Table N.5 are representative for one site.

**Table N.4. Model Parameters**

| Parameter  | DF | Estimate | Standard Error | Wald Chi-Square | Pr > ChiSq |
|------------|----|----------|----------------|-----------------|------------|
| Intercept  | 1  | 0.3360   | 0.5086         | 0.4364          | 0.5089     |
| AGE        | 1  | -0.1193  | 0.0293         | 16.5495         | <.0001     |
| age_sq     | 1  | 0.00123  | 0.000384       | 10.2129         | 0.0014     |
| sexrecod 0 | 1  | 0.4070   | 0.0698         | 33.9998         | <.0001     |
| edurecod 0 | 1  | -0.4192  | 0.1251         | 11.2289         | 0.0008     |
| edurecod 1 | 1  | 0.1678   | 0.1062         | 2.4938          | 0.1143     |

\* Significant at 0.05 level

From the above table it is evident that the variables age, and gender are significant at the 5% level. The results from the PUMS data are then used to predict the employment status of the respondents from the user survey.

## N.5 Overall Labor Market Aspect of Non-User Benefits and Costs

The benefits and costs as discussed in the beginning of this appendix, can be divided into non-users and user categories. Transportation is but one aspect impacting the employment status of an individual. Studies have shown that factors such as job-training, education, age, gender, the local labor market all play a very significant role in facilitating the employment of an individual. In this appendix, we are focusing on the impact of transportation on an individual's employability and subsequently their earnings. These impacts can be on non-users or private.

### Non-User Benefits

The non-user benefits and costs are calculated as follows. The benefits are estimated based on the opportunity costs of the individuals. The costs to society are displacement

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costs, tax subsidies, and the cost of provision of transportation. The predicted rates of unemployment for the survey respondents are used in the PFC method to estimate the opportunity costs of the individuals. This process is repeated once for each individual by placing him or her in the origin tract and the destination tract. The difference in opportunity costs between the origin and the destination give an estimate of the labor market aspect of non-user benefits. The results are discussed next.

The social benefits for this sample are typically greater for individuals with access to a private automobile, and the respondents who indicated that they either were not working prior to their current job or were working before but made less than they were making currently in wages. This serves to highlight the fact that the JARC-funded services are helping people move up the labor chain (as surmised in our estimation of social benefits) and are also capturing some choice riders who for various reasons choose the transit service over their automobile. While the benefits to society are important, the private benefits are the more important attribute in determining the mode choice of individuals.

## **N.6 Conclusions**

This appendix has provided an insight into the benefits (both to society and the individual) that can be attributed to the transportation service. This helps in refining the approach of using the wages earned as the total benefit accruing from access to transportation. We have made use of the concept of opportunity costs and the difference in them between the origin and destination of the transportation service as an estimator of benefit. At the same time, caution should be exercised in using these numbers. These numbers reflect that the benefits are definitely to be had because of the transportation service and provide a range of the benefits for society as well as the individual. Further refinement can be made by focusing on the issues mentioned in the previous section as well as by refining the costs and benefits associated with childcare.

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