PUBLIC TRANSIT & EMPLOYMENT OUTCOMES:
PROJECTING THE IMPACT OF THE JOB ACCESS &
REVERSE COMMUTE PROGRAM

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By

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ABSTRACT

The Department of Transportation’s Job Access and Reverse Commute program began in 1998. Since then, millions of dollars have been distributed in funding throughout the country. However, as the Government Accountability Office has reported at length, there has been little evaluative work done to assess the program’s success in connecting low-income workers to new job opportunities. These newer job opportunities, often located outside the urban core of a half-century ago, are characterized at length in John Kain’s spatial mismatch hypothesis of 1968 and the extensive literature and studies that followed it. Does discrimination and lack of access lead to continued lower employment opportunities for low-income, often minority, workers? I use Philadelphia as a case study to project the impact of the implemented JARC programs on the city’s workers. Using census tract-level data, this paper will identify the tracts affected by JARC-funded public transit improvements. These improvements or additions were chosen regionally based on their potential to increase accessibility to employment centers in and around the city of Philadelphia. Using regression models to estimate median household income, this paper estimates the effects of an increased level of transit. This is accomplished by increasing the level of public transit in the identified tracts, as the improvements will do, to predict how incomes will change. Such income increases, though not large, indicate a positive relationship between improved transit options and higher wages.
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SECTION 1. INTRODUCTION

In the late 1990s, following the welfare reform, the Job Access and Reverse Commute (JARC) program began as a means for increasing the transportation options of low-income workers. As the welfare changes stipulated, recipients can no longer count on benefits for the long haul; they actively need to look for employment. JARC aims to broaden the job prospects of these low-income workers that often rely on public transit in rural and urban areas. The Federal Transit Administration (FTA), within the U.S. Department of Transportation (DOT), provides grants to transit authorities, metropolitan planning commission and other regional/local entities to supplement existing transportation options and create new ones through the JARC program.

JARC was created in the 1998 Transportation Equity Act for the 21st Century (TEA-21) transportation bill as a discretionary fund program and reauthorized in the 2005 transportation bill, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), as a formula-based program. Regional and local jurisdictions apply for federal funds with proposed plans to improve or supplement the existing transit following an analysis of area public transit. This analysis includes identification of job markets outside of the center cities and those not easily accessible by public transit. The proposed improvements vary from additional bus or shuttle service, more night owl service, or van pools. In addition, many of the
regional plans incorporate the logistics of information dissemination about these new or improved transit options directly into the program’s proposal.

An example of a successful program is the Georgetown Metro Connection buses. In 2000, the Georgetown area of Washington, D.C., received funds to implement new bus service to the affluent neighborhood. While many residents owned cars and could park them on the streets, zoning restrictions and lack of space discouraged the approximately 17,000 workers of the neighborhood’s busy commercial area from commuting by car. Parking garage prices were too costly for low-wage workers and the number of workers heavily outweighed the available spaces in the area’s garages. Without a Metrorail station nearby, workers were forced to rely on Metrobuses with limited, and often unreliable, service. The JARC program’s service supplements the Metrobus service and focuses on getting people from the three closest Metro stations to Georgetown’s main commercial corridors. The Metro Connection buses far exceeded the original projections of carrying 800 passengers per day. Within months of opening word of the service had spread and by the two-year mark the blue buses carried more than 4,000 workers (and tourists) to and from Georgetown each day. The program received a total of approximately $2 million in funding through the JARC program.1

In the Atlanta area, the area’s metropolitan planning organization recognized the difficulties for many low-income workers to reach job-rich areas. Two-thirds of the new jobs were located in the suburbs and only “half of the region’s jobs were

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1 Community Transportation Association Information Station, JARC briefing #13, p. 1-2.
accessible by transit.” 2 Using nearly $3 million in funding through JARC, the Metropolitan Atlanta Rapid Transit Authority (MARTA) coordinated with the city’s surrounding counties to improve transportation options. For example, MARTA partnered with Cobb County Transit to allow free transfers between the two systems. This lessens costs for lower-income workers to reach the myriad of job opportunities in southern Cobb County. An integral part of the overall plan’s success was a marketing and public awareness campaign that targeted potential commuters. As reported by MARTA, “improved transit options provide low-income and welfare-to-work recipients access to approximately 1,700 new employment sites in areas with more than 1,500 business locations and 50,000 potential jobs.” 3

These are two of many programs implemented using JARC and matching funds throughout the United States. JARC was one of many programs created in response to the 1990s welfare reform act. However, as recent program restructuring emphasize, policymakers need to understand the value of improved public transit options to continue effectively utilizing and advocating for them. SAFETEA-LU, as mentioned, changed the funding mechanisms for JARC from a discretionary to a formula-based program. Whereas funds were previously designated congressionally, the SAFETEA-LU formulas significantly alter the specific allocations to states and metropolitan areas. The formula allocations are based on the number of low-income residents in the given

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2 Community Transportation Association Information Station, JARC briefing #9, p. 1.  
3 Community Transportation Association Information Station, JARC briefing #9, p. 2.
area applying for JARC funding. In addition to these funding shifts, there have been changes in the requirements for the regional and state-level bodies charged with selecting and allocating funds at the local levels. As a result, many transit agencies and regional planning commission have expressed concern and frustration at being able to utilize the JARC funding.

In this paper, by analyzing the impact of the relatively new JARC-funded transportation programs, we can better direct future policy discussions about funding and other resources. Specifically, after laying out the existing literature in this field, I include some background on Philadelphia, which is used as a case study in my analysis of the JARC program. Following that I lay out my methodology for indexing the level of public transit by tract in Philadelphia, identifying the JARC-affected tracts, and analyzing the potential impact of the program’s improvements. Positive, yet moderate, labor market effects of the program are visible in the increased household incomes projected for tracts where JARC-funded improvements occurred.

SECTION 2. LITERATURE REVIEW

This type of program is a part of the policy legacy of John Kain’s spatial mismatch theory, which connected the growth of suburbanization in America with the

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4 Based on the Federal Transit Administration’s (FTA) Authorization Fact Sheet for JARC, 60% of funds go to recipients in areas with populations over 200,000. 20% go to states for areas with less than 200,000 people and 20% of funding goes to states for use in non-urbanized areas. States have the discretion to transfer funds between urban and non-urbanized areas, but all grantees must be selected through a competitive process.

rising unemployment rates of minorities. Kain (1968) hypothesized that racial segregation in housing, against a backdrop of “postwar suburbanization of employment,” affected distribution of black employment and lowered job opportunities for blacks. Using 1950s survey data from Chicago and Detroit, Kain suggested that these employment issues were linked to the physical distance from jobs, lack of information about available jobs, and employer discrimination. Using residency ratios to analyze the proportion of blacks in a neighborhood, his results showed that the farther away from the high density black neighborhoods, the lower the black employment ratios. The results remained the same across industry and type of work reinforcing the hypothesis that discrimination and distance from jobs affected job opportunities.6

With middle class residents leaving U.S. cities in droves, Kain’s spatial mismatch hypothesis led to years of debate and influenced policymakers for decades. Its importance re-emerged in the late 1980s and early 1990s with a growing and increasingly visible gap between the middle class and poorer segments of the population. In the 1990s, literature reviews by Harry Holzer (1991), John Kain (1992), Keith Ihlandfeldt (1992), among others, concluded that the evidence gave moderate to strong support of Kain’s hypothesis. Ihlandfeldt and Sjonquist summarized the evidence and problems with the growing body of evidence in their 1998 article, “The Spatial Mismatch Hypothesis: A Review of Recent Studies and Their Implications for

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Welfare Reform.” The authors point to the variations among metropolitan areas and
omitted variable bias in explaining employment variability among low-income workers
in the studies. For example, negative neighborhood effects or family characteristics are
not accounted for, depending on what level of data is used. Issues also often arise in
trying to extrapolate results from one metropolitan area to others throughout the
country. However, clear evidence abounds to support the spatial mismatch hypothesis
that “high levels of housing segregation and poor transportation for reverse commuters
may play a … dominant role in explaining the labor market problems of the inner-city
poor.” 7

Three main policy approaches stemmed from Kain’s spatial mismatch
hypothesis. First, the “dispersal strategy” advocates believed that moving urban
residents to suburbs would end the mismatch. Housing vouchers, through the
Department of Housing and Urban Development, and other forms of housing
assistance were the means used for accomplishing this. A second approach, discussed
most fully in this proposal, is the “mobility strategy.” The mismatch for low-income,
urban residents can be lessened by effectively connecting people to the suburban job
opportunities through transportation improvements and information networks. Lastly,
the “development strategy” pushed for attracting new jobs to urban areas. All three
approaches are used, to varying degrees of success, and rely on diverse sources of
funding and promotion. As Karen Chapple argues in her article summarizing Kain’s
policy legacy, local planners need to take greater responsibility and play a larger role

for “anti-poverty initiatives” in their cities. At the local level, officials can target the approaches to their city’s needs and budget.

Research by Raphael and Stoll (2001) and Ong and Miller (2005), among others, emphasize the relationship between car ownership and employment opportunities for low-wage workers. Ong and Miller analyzed local transportation and survey data in the Los Angeles metropolitan area. Their study showed that the lack of access to a car – so-called “transportation mismatch” – is a better predictor of job market outcomes for an individual than actual distance from job opportunities. For Los Angeles, and transferable to other metropolitan areas, using public transit is “cumbersome” compared with commuting by car.8 These issues only reinforce the problems for low-income workers who cannot afford to own a car. Raphael and Stoll’s work shows that car ownership rates are closely correlated with age and level of education. These relationships exist across racial and ethnic groups, though ownership rates are higher for whites than for other groups.9

To address these commuter issues through public transit, Holzer, Quigley and Raphael used the expansion of the Bay Area Rapid Transit (BART) system to test accessibility of suburban employment centers. Two new commuter rail stations opened in the late 1990s and “provides a direct public-transit link between the predominantly white, high-growth, and low-unemployment suburban cities of Oakland’s eastern

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suburban ring and the metropolitan area’s largely white, low-growth, and high-unemployment urban core.” Holzer, et al, used this scheduled expansion to test how patterns of minority employment may be affected by the improved “reverse commute” public transit opportunities. Telephone surveys of area businesses, just prior to the station’s opening and one year later, showed improved employment for Hispanics. Specifically, hiring of Hispanic workers within 6 miles of the new station increased significantly after it opened and the study finds an overall higher propensity for businesses to hire Hispanic workers following the BART station opened, at a rate of approximately 10 percent. Since this increase in demand did not coincide with a net rise in Hispanic employment rates in the area, the authors assert that the new stations have improved, or lowered, commuting costs for this segment of the population. Hispanic workers could spend less time or money getting to their places of employment with the new BART stations, effectively increasing their wages. In addition, the authors note that the impact of the new transportation options could have been even greater had the opening of the new rail line been more widely publicized. The JARC programs take all of these factors into account with plans that lower costs and commuting time and include a public awareness campaign component.

11 Employment outcomes for blacks were stagnant overall, but the authors point to limitations of this natural experiment with the origin of the new transit line near a Hispanic, not black, residential neighborhood.
13 Holzer, et al.
In connecting this spatial mismatch literature and research to JARC programs, the U.S. Government Accountability Office (GAO) has expressed concern from the program’s outset about assessing how successful such programs will be in helping low-income workers reach job opportunities. Prior to JARC’s start, GAO recommended that DOT include performance criteria and specific goals so that proper evaluation could follow each individual program and lead to “national, generalizable evidence of the program’s performance.”\(^{14}\) The FTA’s 2003 evaluation of JARC, five years after it began, did not include more than anecdotal evidence from the programs’ grantees. However, while many find this frustrating, the GAO reports also duly notes that there are no perfect performance measures at the national level because of the variety and individuality of the programs around the country, both rural and urban ones.

SECTION 3. PHILADELPHIA BACKGROUND

The city of Philadelphia, the fifth largest city in the United States, has been losing residents for years. In just the last 15 years alone, the population shrank by eight percent to under 1.5 million residents.\(^{15}\) This mirrors the plight of many older American cities. Although more and more Americans are living in a metropolitan region, many cities themselves have bled residents for decades. And with the exodus of residents to the suburbs, as Kain’s spatial mismatch hypothesis builds on, so too went employment opportunities. For example, between 1970 and 1980, Philadelphia lost

\(^{14}\) GAO Testimony, August 20, 2004

140,000 jobs as large factories and other employers moved out of the city to the
suburbs.16

Again, as Kain and other researchers have chronicled, the overwhelmingly
more affluent segments of the population fled the cities. This left Philadelphia, like
many other cities, with a lower-income population to find employment at a shrinking
number of jobs. As Table 1 below illustrates, both the number of residents and the
number of workers in Philadelphia has decreased at a much faster rate than any other
county in the Delaware Valley region over the past fifteen years.17 In addition, as Ong,
Miller, Raphael and Stoll report in their respective research, ownership of a car is
correlated with level of education and job market outcomes. As Table 1 indicates, the
percentage of Philadelphia households without a car is 36 percent, almost triple that of
the next closest county. This only further exacerbating the difficulties of lower-income
Philadelphia residents, often with less overall resources in finding jobs, to easily access
the suburban centers of employment.

16 Kenneth Jackson, Crabgrass Frontier, p. 267.
17 The Delaware Valley region encompasses Philadelphia and its suburbs in Philadelphia and New
Jersey. Parts of the State of Delaware are often included as well in this “tri-state region,” but this paper
will use the regional boundaries overseen by the Delaware Valley Regional Planning Corporation and
refer to the region as including the list of counties in Table 1. Map of the region, for reference purposes,
is included at the end of the paper as well.
Table 1. Philadelphia metropolitan region

<table>
<thead>
<tr>
<th>County</th>
<th>% of Carless Households 2000</th>
<th>Projected % Change in Employment (2000 - 2025)</th>
<th>% of Major Employers Accessible by Transit</th>
<th>% Change in Residents (1990 - 2000)</th>
<th>% Change in Workers (1990 - 2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burlington (NJ)</td>
<td>5</td>
<td>15.6</td>
<td>90.3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Camden (NJ)†</td>
<td>13</td>
<td>6.9</td>
<td>94.4</td>
<td>-2</td>
<td>-7</td>
</tr>
<tr>
<td>Gloucester (NJ)</td>
<td>6</td>
<td>22.9</td>
<td>57.1</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Mercer (NJ)†</td>
<td>12</td>
<td>12.3</td>
<td>87.5</td>
<td>-8</td>
<td>-9</td>
</tr>
<tr>
<td>Bucks</td>
<td>5</td>
<td>20.5</td>
<td>58.5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Chester</td>
<td>5</td>
<td>26.3</td>
<td>71.1</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Delaware</td>
<td>11</td>
<td>11.5</td>
<td>87.5</td>
<td>-4</td>
<td>2</td>
</tr>
<tr>
<td>Montgomery</td>
<td>6</td>
<td>15</td>
<td>67.3</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Philadelphia*</td>
<td>36</td>
<td>1.8</td>
<td>100</td>
<td>-13</td>
<td>-14</td>
</tr>
<tr>
<td>Region</td>
<td>16.8</td>
<td>12.8</td>
<td>83.2</td>
<td>-1</td>
<td>-1</td>
</tr>
</tbody>
</table>

Source: Delaware Valley Regional Planning Commission

* The city of Philadelphia has the same geographical boundaries as Philadelphia County.
† Camden County includes the city of Camden; Mercer County includes the city of Trenton.

Graph 1. Method of travel

Source: U.S. Census Data, Summary File 3, 2000
Regional Public Transit Options

Without regular access to a car, many of these lower-income workers rely on public transportation to commute to jobs. The city has a large network of public transit options. However, like in many cities, this network of transit options was created mainly to bring people from the suburbs to downtown. Regional workers efficiently traveled to Center City Philadelphia during the peak, standard office hours. The Southeastern Pennsylvania Transportation Authority (SEPTA) is the country’s fifth largest public transportation system. Buses, trolleys, subways, light rail and commuter rail carry nearly 300 million riders annually. The popular commuter rail lines and many bus routes extend beyond the city’s limits to New Jersey and Pennsylvania.

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18 SEPTA, “History of SEPTA,” online at: http://www.septa.org/inside/history.html
suburbs. Across the Delaware River from Philadelphia, New Jersey Transit (NJ Transit) operates the third largest public transportation provider in the country. Although much of their bus and rail routes are in Central and Northern New Jersey, about a tenth of their ridership is in the 4 NJ counties included in Table 1 above.\textsuperscript{19} Lastly, the Port Authority Transit Corporation (PATCO) runs direct, efficient, and frequent, commuter light rail service, known as the High-Speed Line, from six NJ suburbs through the city of Camden and then to four Center City stations.

\textit{JARC and Delaware Valley Regional Planning Commission (DVRPC)}

While a large number of transit options exist throughout the Philadelphia region, as stated above, these were created to mainly draw workers into the city for jobs. For many Philadelphia residents, this is not a concern. As Graph 1 above illustrates, a large proportion of residents travel to work by a car. Whether inside or out of the city’s limits, the availability of public transit is likely not a significant factor in the job search for these workers. For those lower-income workers who are more likely to rely on public transportation, however, DVRPC has taken the lead in assessing the region’s employment centers and transit options. DVRPC is the regional body in control of JARC programs and since JARC began in 1998, it has emphasized the importance of three main factors—cost, distance traveled, and travel time—in helping workers reach jobs through new and improved transit options. Specifically, funds were disbursed to the transit organizations discussed above and other non-profit

\textsuperscript{19} DVRPC plan, p. 14.
organizations, to increase the frequency of buses and trains at off-peak times, create vanpools, add bus extender services, among other options.

**JARC Funding in the Philadelphia Region**

In 2002 alone, the FTA allocated $6 million in JARC funds to SEPTA. This, combined with funds to NJ Transit and other regional transit, has helped forward the Delaware Valley Regional Planning Commission’s regional access-to-jobs strategy. However, SEPTA funding through JARC has dropped significantly in recent years. The agency received $3.4 million dollars in 2004 and the following year that amount was more than halved to $1.6 billion. The agency is concerned about funding for existing programs and not optimistic about room for further JARC-funded expansions of service.²⁰

**SECTION 4. CONCEPTUAL MODEL**

Since true national evaluation of JARC programs’ ability to connect low-income workers to job is limited to date, I use Philadelphia as a case study to project the impact of the area’s JARC programs. As discussed in the previous section, Philadelphia’s growth patterns mimic those of many former industrial cities, with employers resettling in the suburbs ringing the city proper and a transit system originally designed to bring workers into the city’s center. Thus, programs for other

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urban areas may prove to have similar affects for its workers. However, decennial
census data and other sources provide limited to no data for testing the relatively young
program’s success thus far.

Have low-income workers, that are more reliant on public transit, benefited
from these improved and new transit options? JARC’s goal is to increase job
opportunities for lower-income workers through these transportation improvements.
What are the expected benefits to these workers from the JARC-funded transit
changes? Since, as Ihlanfeldt and Sjonquist discuss, there are a number of personal,
household, and neighborhood characteristics that influence whether someone will work
or look for work, I will use household income in this paper instead of employment
rates to avoid these endogeneity concerns. In theory, if one’s job opportunities
increase, there is greater opportunity for those looking for work to find and remain at a
job that fits their qualifications. Transit improvements and new options can help
workers reach places of employment more efficiently, quickly, and cheaply. This
allows workers to hopefully spend less time commuting to work, spend less money on
their commute, and be more reliable in their job attendance patterns. Taken together,
this would effectively increase the income of workers as they devote less of their
paycheck to commuting, retain their jobs for longer, and can conceivably vie for
higher paying jobs with increased access to opportunities. Discussed in detail in the

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21 This follows the logic of Holzer, et al. in their Oakland BART study, discussed in the Literature
Review section, and the net benefits for Hispanic workers of the new rail stations.
section below, I suggest that there is a link between how the level of service from public transit in a census tract and workers’ income.

SECTION 5. DATA AND METHODOLOGY

To answer this question, I use 2000 U.S. Census data on the city of Philadelphia’s 381 census tracts from Summary File 3. The variables I use can be found in the Data Appendix. In the final analysis, data on 361 census tracts since a number of the tracts did not include data on transit usage. No visible patterns in terms of location or tract characteristics were seen for the tracts not included.

First, I create an indicator for the level of public transit for each tract. To do this I use data on tracts where a high percentage of people commute by public transit and control for factors that could indicate populations where there is likely a low car ownership rate, and thus ridership is not purely reflective of good service.

\[ Y = \beta X_1 + \beta X_2 + \varepsilon \]

\{ where Y is the percent of people commuting via public transit and X_1 is the vacancy rate and X_2 is percent of households on public assistance \}

Using \(\varepsilon\) from the regression equation above to account for people using public transit merely because of financial constraints, I create the new indicator variable, \(GoodTransit\), for how well-served a census tract is by its public transit options.\(^{22}\)

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\(^{22}\) From the adjusted continuous variable created from \(\varepsilon\), I divided it into both a 5-level categorical variable and the dummy variable \((GoodTransit)\). I checked the variable’s creation by comparing the
Next, I estimate an OLS regression model for median household income based on the independent variables of education, race, children at home, and good public transit for each of the census tracts:

\[
\log(\text{Income}) = \beta_1 \text{GoodTransit} + \beta_2 \text{Race} + \beta_3 \text{Education} + \beta_4 \text{WorkOSPhilly} + \beta_5 \text{CommutingTime} + u
\]

{ Where \text{Income} is median household income, \text{GoodTransit} is defined above, \text{Race} represents the race categories in the Data Appendix, \text{Education} represents the levels of education in the Data Appendix, and \text{WorkOSPhilly} indicates whether city residents commute outside of Philadelphia for jobs and \text{CommutingTime} measures the average times commuting to work by public transit as described in the Data Appendix.}

NOTE: I do not include a variable to account for car ownership because of the high correlation between income and ownership of a car.

Next I identify the census tracts affected by the transit improvements by mapping out the city’s JARC programs. These included the tracts where improved transit routes stopped (generally with new stops, additional early/late shift worker-timed service or an increased frequency of service) and those tracts within a half-mile walk to these stops. Using Google and Census maps, I only include tracts where the walk was logistically feasible. In addition, although no direct transit improvements were made on the city’s Market-Frankford subway line, I include the tracts along the adjusted variable with the original Census data variables of \text{perpubtransit}, \text{perpubasst} and \text{HHinc} (see Data Appendix).
line’s western end. This line terminates at the 69th Street Terminal and a number of the JARC-improved bus routes leave from this location.23

To project the impact of the JARC programs on changing median household income, I assume that the JARC-improved transit will raise the level of service within the tract. In the model above, I set the dummy variable GoodTransit equal to one. I use the point estimates from the regression above to then project the impact of JARC on household income.

23 These included the tracts of seven active station stops west of 30th Street Station. All are within a 15-minute train ride of the 69th Street Terminal. With the short ride and frequent service, this additional leg of the trip is a conceivable one for a worker’s total commute. See map of SEPTA transit system in the appendix.
SECTION 6. RESULTS

Table 2. Different Measures of Public Transit

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transit Variables †</strong></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td>Model 4</td>
</tr>
<tr>
<td>Level of Public Transit Svc (<em>Good Transit, dummy variable</em>)</td>
<td>.077 ** (.038)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Public Transit Svc (Categorical variable)</td>
<td></td>
<td>.035* (.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Public Transit Svc (continuous variable)</td>
<td></td>
<td></td>
<td>.844 *** (.272)</td>
<td></td>
</tr>
<tr>
<td>Public Transit Usage (% tract)</td>
<td></td>
<td>-1.36 *** (.220)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control Variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Af-Am (% tract)</td>
<td>-1.66 ** (.075)</td>
<td>-1.48 ** (.073)</td>
<td>-1.47 * (.077)</td>
<td>-1.43 ** (.072)</td>
</tr>
<tr>
<td>Asian (% tract)</td>
<td>-1.28 *** (.230)</td>
<td>-1.27 *** (.230)</td>
<td>-1.55 *** (.249)</td>
<td>-1.31 *** (.23)</td>
</tr>
<tr>
<td>Hispanic (% tract)</td>
<td>-.34 ** (.131)</td>
<td>-.307 ** (.133)</td>
<td>-1.46 *** (.14)</td>
<td>-.243 * (.134)</td>
</tr>
<tr>
<td>HS graduates (% tract)</td>
<td>1.45 *** (.370)</td>
<td>1.46 *** (.370)</td>
<td>1.56 *** (.316)</td>
<td>1.42 *** (.367)</td>
</tr>
<tr>
<td>College graduates (% tract)</td>
<td>1.25 *** (.372)</td>
<td>1.21 *** (.435)</td>
<td>1.01 ** (.396)</td>
<td>1.08 ** (.434)</td>
</tr>
<tr>
<td>Advanced degrees (% tract)</td>
<td>1.28 *** (.329)</td>
<td>1.28 *** (.328)</td>
<td>2.12 *** (.303)</td>
<td>1.28 ** (.323)</td>
</tr>
<tr>
<td>Commute b/w 30 - 45 minutes (% tract)</td>
<td>-1.42 *** (.368)</td>
<td>-1.55 *** (.398)</td>
<td>.48 (.43)</td>
<td>-1.87 *** (.411)</td>
</tr>
<tr>
<td>Commute b/w 45 and 60 minutes (% tract)</td>
<td>-.103 (.528)</td>
<td>-.256 (.550)</td>
<td>1.93 *** (.517)</td>
<td>-.544 (.554)</td>
</tr>
<tr>
<td>Commute more than 60 minutes (% tract)</td>
<td>-1.33 *** (.372)</td>
<td>-1.45 *** (.385)</td>
<td>.042 (.403)</td>
<td>-1.71 *** (.396)</td>
</tr>
<tr>
<td>Working outside city limits (% tract)</td>
<td>1.27 *** (.196)</td>
<td>1.30 *** (.195)</td>
<td>.891 *** (.196)</td>
<td>1.29 *** (.193)</td>
</tr>
<tr>
<td>Constant</td>
<td>9.6 *** 9.66 ***</td>
<td>9.7 *** 9.8 ***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-Sq</td>
<td>.631</td>
<td>.64</td>
<td>.64</td>
<td>.65</td>
</tr>
<tr>
<td>F-Statistic</td>
<td>57.26 ***</td>
<td>57.19</td>
<td>59.42</td>
<td>58.66</td>
</tr>
<tr>
<td># of Observations</td>
<td>363</td>
<td>363</td>
<td>363</td>
<td>363</td>
</tr>
</tbody>
</table>
NOTE: *Significant at p < .10, ** Significant at p < .05, *** Significant at p < .01; (Standard Errors)
* Control group: Whites, HS dropouts, commuting less than 30 minutes for work within Philadelphia
† Note: 1st three transit-related variables of interest in table above were constructed controlling for poorer neighborhoods, the last transit-related variable included (public transit usage) was taken directly from the Census data.
◊ Note: Commute time variables refer only to workers commuting by public transit.

Table 3. Varying Models using selected level of Public Transit Service variable (goodtransit)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
<th>Log (HH income)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Public Transit Svc (goodtransit)</td>
<td>0.199 *** (.036)</td>
<td>0.076 ** (.037)</td>
<td>-0.203 *** (.036)</td>
<td>0.077 (.056)</td>
<td>0.153 *** (.042)</td>
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<tr>
<td>Control Variables:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Af-Am (% tract)</td>
<td>-0.32 *** (.063)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian (% tract)</td>
<td>-1.21 *** (.237)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic (% tract)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.294 ** (.132)</td>
</tr>
<tr>
<td>Minority Neighborhood (50% of tract)</td>
<td></td>
<td></td>
<td></td>
<td>-0.030 (.053)</td>
<td>.18 *** (.06)</td>
</tr>
<tr>
<td>Maj. College Grads (50% tract)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.87 *** (.367)</td>
</tr>
<tr>
<td>HS graduates (% tract)</td>
<td>2.41 *** (.281)</td>
<td>2.78 *** (.32)</td>
<td>1.87 *** (.367)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College graduates (% tract)</td>
<td>1.76 *** (.402)</td>
<td>2.47 *** (.416)</td>
<td>1.98 *** (.42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced degree (% tract)</td>
<td>1.75 *** (.32)</td>
<td>1.43 *** (.344)</td>
<td>1.37 *** (.337)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commute b/w 30 - 45 mins (% tract)</td>
<td>-2.84 *** (.378)</td>
<td>-1.29 *** (.364)</td>
<td>-1.73 *** (.38)</td>
<td>-2.7 *** (.37)</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Applied Results for Model 1

<table>
<thead>
<tr>
<th>Level of Public Transit</th>
<th># of Tracts</th>
<th>Median Income (Actual by tract, all tracts)</th>
<th>Median Income (Actual, JARC tracts only)</th>
<th>Median Income- (Predicted, JARC tracts only)</th>
<th>Median Income- (Predicted, post-JARC changes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Served</td>
<td>167</td>
<td>$29,633</td>
<td>$24,774</td>
<td>$25,468</td>
<td>$25,468</td>
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<tr>
<td>Under Served</td>
<td>196</td>
<td>$35,986</td>
<td>$32,884</td>
<td>$31,810</td>
<td>$34,356</td>
</tr>
<tr>
<td>All tracts</td>
<td>361</td>
<td>$32,953</td>
<td>$28,642</td>
<td>$28,492</td>
<td>$29,707</td>
</tr>
</tbody>
</table>

Overall Results

Looking at Model 1, reported in Table 2, which controls for neighborhood/tract characteristics associated with income such as race and level of education, there is a
positive relationship between level of public transit available in a tract and the median household income. As estimated in Model 1, on average, household income is 7.7 percent higher in Philadelphia neighborhoods well-served by public transit, holding all else equal. I chose to focus on this transit dummy variable, \( \text{goodtransit} \), in this analysis as a conservative “middle ground” among the three point estimates modeled by the different specifications of the adjusted level of transit. Therefore, the model predicts household incomes will rise slightly in the tracts that have benefited from JARC-funded improvements since the 2000 Census. For those tracts not already well-served by existing public transit, the rise in household income suggests the moderate, yet positive impact of JARC programs in improving job opportunities, as seen in the increased annual income of approximately $2,500 in Table 4. This equates to $200 additional each month for a household.

**Different measures of public transit**

In the first table, all of the different variables for level of public transit service by tract show a positive relationship between level of transit and household income. These variables all attempt to control for tracts where the Census-recorded high level of transit usage can likely be attributed to a lack of other transportation options (e.g. – car ownership) that often exist in poorer neighborhoods. For each of these adjusted variables, this positive relationship exists, as seen in Table 2. When the non-adjusted variable (percentage using public transit) is used as a measure of the level of service, the relationship with household income is estimated as a negative relationship. A one
percentage point increase in transit ridership is correlated with an approximately 1.3 percent decrease in income, which follows the logic stated earlier that there is a strong relationship between poorer households and a heavy reliance on public transit.

**Household characteristics**

In comparing Model 1 with the restricted models in Table 3, one sees that controlling for race/ethnicity and level of education appears to have similar properties with respect to their effect on the point estimate of living in a neighborhood that is well-served by public transit. When removing the race/ethnicity control variables, the estimate for public transit remains the same and the point estimates for the varying levels of education rise to account for the related effects no longer being controlled for by race/ethnicity. These relationships also appear in the correlations between these variables in the data set.

In addition, when all these other control variables are removed from the model, the public transit coefficient more than doubles. This reinforces the importance of including a set of these variables in the model in order to accurately project the impact of improved public transportation. Without them, the transit coefficient would likely be upwardly biased. Even when using this adjusted variable for the level of transit service, there remains a relationship—though a relatively weak one—between level of service and level of education. As the level of education in a given tract increases, the level of
service decreases slightly. This logically follows the generally-accepted theory that people without cars will look to live closer to other available forms of transportation, as much as their finances will allow.

**Commuting time**

When you control for the quality of transit service, rather than just the amount of people using public transit, the models in Table 2 show a distinctly different relationship between commuting times and median household income. In Model 3 of Table 2, the point estimates are positive and fluctuate greatly. As discussed below, commuting times negatively affect income, holding all else constant, when you control for the quality of transit within the tract.

The link between commuting time and level of transit seems inextricably linked and difficult to analyze. Across all models, however, there appears a trend of greatest effect of income on commuting time for those traveling between 30 and 45 minutes to their job. Although those commuting longer than 45 minutes are still estimated to make less than the control group of those commuting 30 minutes or less, it does not affect household incomes as strongly. Those commuting under 30 minutes are likely to be those living in or near Center City, where household incomes are higher and people mainly make a short trip to nearby employment by choice. Those in the middle ranges and upper ranges of commute times likely live farther outside of the

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24 The Census data shows a positive, but weak, correlation, between the lower levels of education (not a high school graduate, high school level, some college) and GoodTransit with a correlation coefficient ranging from 0.06 to 0.17. In higher levels of education (Associates degree, Bachelor, or advanced degree) there is a comparable weak negative correlation with GoodTransit with correlation coefficients ranging from –0.03 to -0.15,
Center City and have to commute farther to where a majority of Philadelphia employment is located.

*Reverse Commute*

Across all models shown here, there is a highly statistically significant, and strong, positive relationship between household income and working outside the city limits, holding all else equal. A one percentage point increase in the amount of people in a tract working outside Philadelphia more than doubles the median household income, holding all else constant. This reinforces one of the main tenets of the JARC program, that many job opportunities have relocated outside of cities like Philadelphia and city residents need improved access to these higher-paying opportunities. As the

**SECTION 7. CONCLUSION**

From the results here, there appears to be a positive, small, yet noteworthy, relationship between improving public transportation and raising household income. If the JARC-funded programs are truly targeted to fill missing holes in the local public transportation options, then such programs can help workers reach new job opportunities or decrease the time or cost of reaching their existing places of employment. The results above show a clear positive effect of working outside the city on household income. If the JARC-funded improvements help inner-city workers reach
job centers outside the city, as many are designed to do, this will only increase the impact of the improvements.

Limitations of Research

Of course, there are limitations to this research. First, the relatively small number of tracts affected by JARC-funded routes identified here – 65 total – brings up obvious and understandable concerns about extrapolating effects from these results. Second, although the argument has been made that the demographic and public transit characteristics of Philadelphia overlap with many other cities, the JARC programs are designed and implemented at the regional or local level. The methodology used here does not address the actual implementation of the programs, so that is not a concern. However, DVRPC’s analysis of the needed transit improvements will differ inevitably from that done by other regions and the implementation of improvements here, based on such analysis, obviously influences the results.

Recommendations and Policy Implications

As GAO recommended from the program’s inception, FTA and the regional-level organizations need to continue to improve their methods of evaluating the JARC programs – in the most cost-effective ways possible. One low-cost way is to survey riders on the different affected bus routes and other services to evaluate how riders’ commutes, costs, and job experiences changed. Such empirical evidence can go a long way to securing future funding from the federal, state, and local levels for the existing
program or additional ones that have similar characteristics. As funding sources continue to tighten their purse strings, such evidence will become more and more important.

In addition, more shared reporting between regional entities, most easily facilitated by FTA, would help enhance the analyses of the needed public transit in a region and the implementation of these projects. For example, the extensive work done in the Philadelphia metropolitan region by the Delaware Valley Regional Planning Commission should be a model for other regional entities. DVRPC analyzes data (travel patterns, employment centers, etc.), coordinated service between service providers, worked with community organizations, and continues to reevaluate the progress and additional opportunities.

Beyond analysis and implementation concerns, the implications of such a program for helping low-income workers dependent on public transportation are large. JARC must use every opportunity at the local, state, and federal level to assert its importance in helping connect these workers to job opportunities. Creating access to new employment centers and decreasing the time, number of transfers, and costs of a commute makes a world of difference to all, but especially to someone making a low wage with few other resources or support. A relatively low-cost program, the potential benefits to a household, neighborhood, and city are immeasurable.
BIBLIOGRAPHY


Cilurso, Karen. Senior Regional Planner, Delaware Valley Regional Planning Commission.


Zubrzycki, Kathleen E., Management Analyst, Budget Department, Southeastern Pennsylvania Transportation Authority. Interview on January 31, 2007.


CITY OF PHILADELPHIA REGIONAL MAP

Source: Delaware Valley Planning Commission
Source: SEPTA
### DATA APPENDIX

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
<th>Sample Size</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Max</th>
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<tbody>
<tr>
<td>PerWhite</td>
<td>Percent of white population in census tract</td>
<td>370</td>
<td>0.461</td>
<td>0.362</td>
<td>0</td>
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<td>PerAfAm</td>
<td>Percent of African-American population in census tract</td>
<td>370</td>
<td>0.430</td>
<td>0.37</td>
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<td>1.0</td>
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<tr>
<td>PerHispanic</td>
<td>Percent of Hispanic population in census tract</td>
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<td>0.075</td>
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<td>0.89</td>
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<td>PerAsian</td>
<td>Percent of Asian population in census tract</td>
<td>370</td>
<td>0.039</td>
<td>0.065</td>
<td>0</td>
<td>0.72</td>
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<tr>
<td>PerOther</td>
<td>Percent of other races population in census tract</td>
<td>370</td>
<td>0.069</td>
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<td>PerPubAsst</td>
<td>Percent of population in census tract receiving public assistance in 1999</td>
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<td>PerHHKids</td>
<td>Percent of HHs with children under 18 in census tract</td>
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<td>0.291</td>
<td>0.11</td>
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<td>1.0</td>
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<td>PerPubTransit</td>
<td>Percent of workers in census tract that commute to work using public transit *</td>
<td>363</td>
<td>0.280</td>
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<td>0.045</td>
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<td>PerUnder30</td>
<td>Percent of workers/tract that commute using public transit in under 30 minutes</td>
<td>346</td>
<td>0.069</td>
<td>0.078</td>
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<td>PerUnder45</td>
<td>Percent of workers/tract that commute using public transit in 30 to 44 minutes</td>
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<td>0.086</td>
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<tr>
<td>PerUnder60</td>
<td>Percent of workers/tract that commute using public transit in 45 to 59 minutes</td>
<td>368</td>
<td>0.050</td>
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<tr>
<td>PerHourPlus</td>
<td>Percent of workers/tract that commute using public transit in an hour or more</td>
<td>368</td>
<td>0.077</td>
<td>0.062</td>
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<td>0.48</td>
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<td>PerHS</td>
<td>Percent of 25+ population/tract that graduated high school</td>
<td>370</td>
<td>0.322</td>
<td>0.111</td>
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<tr>
<td>PerSomeColl</td>
<td>Percent of 25+ population/tract that took some college classes</td>
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<td>PerAssoc</td>
<td>Percent of 25+ population/tract that complete Associate’s degree</td>
<td>370</td>
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<td>PerCollGrad</td>
<td>Percent of 25+ population/tract that received Bachelor’s degree</td>
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<td>0.105</td>
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<tr>
<td>PerAdvDeg</td>
<td>Percent of 25+ population/tract that received Master’s/ Professional/Doctoral degree</td>
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<td>0.085</td>
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<td>0.667</td>
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<td>VacancyRate</td>
<td>Percent of vacant housing units per tract</td>
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<td>0.086</td>
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<td>0.875</td>
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<tr>
<td>HHInc</td>
<td>Median Household income per tract (dollars)</td>
<td>368</td>
<td>$33,132</td>
<td>$17,926</td>
<td>$6,311</td>
<td>$200,001</td>
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<tr>
<td>PerWorkOSPhilly</td>
<td>Percent of workers/tract that work outside of Philadelphia</td>
<td>362</td>
<td>0.203</td>
<td>0.087</td>
<td>0.025</td>
<td>0.598</td>
</tr>
</tbody>
</table>

* The 2000 U.S. Census long form question on mode of transportation to work asks to indicate mode used for most of the distance. Only one form of public transportation should be marked for each person.

Data Source: 2000 U.S. Census, Summary File 3, City/County of Philadelphia, PA