
Transportation & Work:
Exploring Car Usage and Employment Outcomes
in the LSAL Data

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This research is a secondary analysis of data from the Longitudinal Study of Adult Learning (LSAL), a project of the National Center for the Study of Adult Learning and Literacy (NCSALL) funded by the Institute of Educational Sciences. More information about LSAL is available at: <http://www.lsal.pdx.edu>.

1. INTRODUCTION

The relationship between work and transportation has long been an important focus of transportation research. After the passage of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, or “welfare reform,” attention turned to the role of transportation in job search and employment outcomes. While much of the work in this area focused on the welfare-to-work transition, there is a need to expand the analysis to other factors. Additionally, there is room to improve upon the measures used to examine this issue. Data provided by the Longitudinal Study of Adult Learning provide an opportunity to conduct this type of research. Focusing on adults without a high school degree, the data set includes information on car ownership as well as employment history, literacy proficiency, and measures of social networks. This analysis addresses the role of car usage in employment outcomes such as employment status, average weekly wages, and weeks worked per year. It postulates that car ownership is an important employment tool for adults of low educational attainment in Portland, even in the context of other factors such as social networks/resources (social capital) and literacy skills (human capital).

2. BACKGROUND

2.1 Literature Review

Researchers have addressed issues of transit accessibility, spatial mismatch and the effect car ownership has on job searches as well as on employment retention, work hours, wages, and other employment outcomes. While much of the literature focuses on the welfare-to-work transition, there is growing interest in the importance of transportation for all low-income job seekers.

A number of studies cite transportation as a major problem for individuals making the transition from welfare to work. Some highlight the impact of transportation on the job search. Not having a car can pose a barrier for job seekers – for some positions, applicants without a car are not even considered. Once an individual does land a job, a

lack of stable transportation often contributes to absenteeism and other problems cited by employers as some of the main reasons why those making the transition from welfare to work are not always successful (Holzer et al., 2001; Fletcher et al., 2002; Goldberg, 2001). Holzer et al. find in their survey of employers that worksites accessible by public transportation report less absenteeism than those that are less accessible (2001). Not only do transportation problems threaten employment stability, but other benefits may also be jeopardized. Welfare recipients in many states face stiff penalties if they do not meet employment requirements, including the reduction or complete loss of financial and food aid (Goldberg, 2001).

One reason why transportation presents such a problem for job searches and regular attendance of those transitioning from welfare to work is the hardship imposed by spatial mismatch. Spatial mismatch is the idea that many low-income people, especially welfare recipients, live in the central city. Many jobs, however, especially those most suited for those newly entering the workforce from welfare, are located in the suburbs. Some research indicates this separation is decreasing, but very slowly (Wachs and Taylor, 1998). A 1998 study by the U.S. General Accounting Office (GAO) indicated that 70 percent of jobs for entry-level workers were located in the suburbs (1998).

Getting to suburban jobs can be difficult for job seekers without cars because public transportation options are usually inadequate. Public transit often does not serve areas where suburban employers are located. Another 1998 study found that while 98 percent of welfare recipients lived within a quarter-mile of public transit, only 32 percent of entry-level jobs were located in areas in similar proximity to public transportation services (Goldberg, 2001). Additionally, transit service to suburban locations is often provided only during peak hours and does not adequately serve shift workers. It can also be prohibitively expensive for some commuters, and aid for reduced fare is not readily available in many communities (Wachs and Taylor, 1998; GAO, 1998). Finally, no matter what the quality of public transportation, the time required to use that mode causes problems for job seekers who must trip-chain, for example, to transport children to childcare. These problems also exist for suburban job seekers without cars, for the

quality of public transportation between suburbs is no better than that connecting central city to suburb. In fact, many suburban employees do not locate in areas where there is public transit. In short, public transportation is not as effective a transportation option for welfare recipients transitioning to work as are cars or non-fixed route services (Blumenberg and Ong, 2001).

Many authors point to the disproportionate household responsibilities assumed by women as a contributing factor to women's differences in travel (see Spain, 1996). These additional responsibilities for children and household tasks mean that women take more trips to complete their errands and often link these trips with their commute to or from work. This implies that women have different mobility needs, and that the general transit problems described above are exacerbated for women.

Car ownership can be a mixed blessing for low-income workers. On the positive side, cars help job seekers overcome the problems presented by dependence on public transit. Spatial mismatch is no longer a barrier, as car owners can seek employment in a broader range of locations. In addition, car ownership helps those workers who have to balance other responsibilities, such as taking children to childcare. Finally, Fletcher et al. (2002) show that car ownership can improve job retention and earnings. Raphael and Rice (2002) found in their study that car ownership has a strong effect on the probability of an individual being employed as well as on the number of hours they work per week. Generally, car ownership better enables job seekers to look for jobs. They can consider work outside of regular transit service hours, and they can travel faster, more safely, and more flexibly than with public transportation (Wachs and Taylor, 1998). Even reliance on borrowing cars and carpooling can be important transportation options (Blumenberg and Ong, 2001).

However, there are also substantial negative aspects of car ownership. The large expense is one example. Many of the cars owned by low-income people are older and require a lot of maintenance. The constant need for expensive repairs can be a burden for a low-income car owner (Sawicki and Moody, 2000; Goldberg, 2001). Other costs, such as

insurance and fees, also add expenses. A study of low-income populations in Milwaukee found that a majority of non-drivers who had lost their car registration or driver's license lost it because of unpaid traffic fines rather than for more serious violations of traffic codes (Pawasarat and Stetzer, 1998). Also, car ownership can cause a problem for public transportation. Wachs and Taylor (1998) argue that while shuttles and other alternative transportation options can help some job seekers land a job, once they earn enough money they purchase a vehicle and abandon public transportation. As a result, the public transportation provider soon loses the critical mass of riders needed to maintain service. Finally, there are the problems associated with all single-occupancy commuting, such as increased pollution and traffic congestion.

Despite all that has been written, it remains difficult to reach firm conclusions about the importance of car ownership. The high cost of car ownership and the burden that it puts on low-income families are major problems and it is unclear if the benefits outweigh the costs. A few studies have found that improved access to public transportation can have positive effects on employment outcomes (Sanchez, 1999; Kawabata, 2003), suggesting that a strategy that focuses on improving transit service may help low-income workers.

Finally, a few authors question the importance of transportation for employment outcomes altogether. Chapple (2001) found through qualitative interviews that social networks were more important for female welfare recipients looking for work than was transportation. Brown and Barbosa (2001) found through their work with female welfare recipients that lack of transportation did not pose a substantial barrier to their ability to find and retain employment. Instead, the women in their program reported that constraints due to transportation and childcare were “socially acceptable excuses,” and named other problems, such as domestic violence and substance abuse, as “real” obstacles that challenged their success in employment. Even studies that highlight the importance of transportation for employment also acknowledge the need for a well-rounded approach, incorporating other services such as skill development, job readiness, and childcare. (GAO, 1998; Fletcher et al., 2002).

Along those lines, many programs designed to ease the transition from welfare to work are focused specifically on skill development and on GED preparation. The idea is that a strong skill base is an important factor in an applicant's ability to gain employment. Studies have shown that earning a GED can, over time, improve earnings (Tyler et al., 2000).

Five years after the passage of welfare reform, the concern has moved beyond assessing only whether former welfare recipients are finding jobs. Since many people are being transitioned off the welfare rolls, and many more job seekers never received welfare in the first place, it is important to look at employment outcomes for all low-income people (Fletcher et al., 2002). Additionally, it is clearly not enough to look only at an individual's employment status. Data concerning wage and job retention are also critical for measuring the effect of welfare reform and other policies on low-income people (Holzer et al., 2001).

The previously reviewed articles address the role of car ownership in the transition from welfare to successful employment. That research has also hinted at other personal characteristics, such as education, job skills, and social networks, that may be key to understanding employment outcomes. Few studies have had access to data sufficient to quantify these effects, however.

2.2 Research Problem

The cited research demonstrates the importance of car ownership for the employment of welfare recipients, especially for women. Based on this work, one would expect that car ownership would have a positive effect on the employment status of adults in the sample of non-high school graduates. One might also expect that car ownership would be more important for women and would thus have a stronger effect on the probability of their employment. The null hypothesis, then, would be that car ownership should not have any effect on employment status, weekly wages, or weeks worked. The questions that led this research are as follows:

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1. What is the relationship between car ownership and employment for non-high school graduates?
 2. Do other factors such as literacy proficiency and social networks mediate the need for car ownership?
 3. How do these effects differ between men and women?

Data from the Longitudinal Study of Adult Learning (LSAL) provide an opportunity to study the effect of car ownership on a population of adults with low educational attainment, spread across the Portland Metropolitan area. The LSAL dataset includes information on work history, educational history, and personal resources. Additionally, study data include literacy scores based on a standardized literacy skills test.

The adults in the study are not all low-income. In fact, quite a few are very far from low-income. However, as all of the respondents had not earned a high school diploma or General Education Development (GED) certificate at the start of study, they comprise a group that might be assumed to be at-risk. The LSAL data provide an opportunity to look at a group that is generally lower-income with less education as a way to broaden the research beyond studies on welfare-to-work. Education levels are mostly standard across the study sample, allowing for an analysis that can identify the effect of car ownership, literacy skill level, and other factors on employment outcomes.

3. THE LONGITUDINAL STUDY OF ADULT LEARNING (LSAL)

3.1 Data

The data come from the Longitudinal Study of Adult Learning (LSAL),¹ a project of the National Center for the Study of Adult Learning and Literacy (NCSALL), funded by the Institute for Education Sciences (formerly the Department of Education). The goal of the research is to better understand how adults develop literacy skills over time; how adult education programs contribute to literacy abilities; and how changes in literacy ability are

¹ The data will be available for public use only after all data is collected and primary analysis completed. Contact the author for more details on the statistical procedures utilized in the analysis.

related to an individual's personal, social, and economic life (Reder and Strawn, 2002). Study respondents are adults who did not earn a high school diploma or GED before 1998.

LSAL is a panel study that includes 934 respondents. Data collection began in 1998. Respondents were selected by random phone sample; the target group consisted of adults age 18-44 who had not earned a high school diploma or GED. Participants in Adult Basic Education (ABE) classes or in GED preparation classes were oversampled to create an analytic study group. Those selected are not necessarily native English speakers, but all respondents have proficient English-speaking skills. Three sets of interviews, or waves, have been conducted with panel members; the first three waves were conducted in three consecutive years. The study is currently in its fourth wave of data collection. The fourth wave began two years after the third, and the fifth and final wave of data will be collected 2004-2005. A retention rate of 90 percent of panel members has been achieved through quarterly communications via phone, email, mail and/or visits maintained between LSAL and respondents and their contacts.

Data are collected through in-depth, in-person interviews. The interview queries respondents about their work history, participation in classes, self-study, and a variety of other topics. The sessions also include the Test of Applied Literacy Skills (TALS)² standardized assessment of literacy. A literacy score is generated based on a range of points and is measured in five levels of literacy function.

Finally, it is important to note that all cases in this analysis were weighted to correct for sample bias. Respondents who were enrolled in classes were over-sampled in Wave 1 over those not enrolled in classes in order to provide additional data about the classroom experience. The weighting procedure standardizes all data so analysis may be generalized to the entire Portland regional population of adults who, in 1998, had neither a high school diploma nor a GED.

3.2 Comparison of LSAL and the Portland Metropolitan Region

Table 1 provides a comparison between study respondents and the population of the Portland tri-county area, which includes Clackamas, Multnomah, and Washington counties. This does not in any way make for a perfect comparison, mainly because the study population focuses specifically on adult, non-high school graduates, while the Portland area data comes from the 2000 Census and includes the entire population. The numbers are meant to give an “order of magnitude” look at how the study sample differs from the Portland population, and to highlight the similarities. Age is not reported; the LSAL range is fixed because the sample was limited to participants who were between 18 and 44 years of age in 1998. Respondents’ ages fell between 21 and 48 at Wave 3.

Table 1. Descriptive Statistics, Comparison of LSAL and Portland Tri-County Area

	LSAL ³	Portland Tri-County Area ⁴
Women	49.1	51.3
Men	50.9	48.7
Minority	34.6	17.2
African American	11.0	2.9
Asian	4.0	5.2
Latino	10.2	8.0
Native American	13.0	0.8
White	62.4	82.8
Married at Wave 3	53.9	55.0
Born out of the U.S.	10.0	11.9
Has GED or HS Diploma	16.3	87.4
At or Near Poverty Level	20.5	9.1
Median household income	\$33,800	\$48,500
Average household size	3.74	2.53
Percent at Level 1 literacy proficiency	10.5	15.0

² The TALS is a product of the Educational Testing Service (ETS). For more information on the test, see: <http://www.ets.org/testcoll/index.html>.

³ This is the weighted LSAL study sample as described in Section 3.

⁴ Demographic data come from Census 2000 Summary File 3 (SF 3) – Sample Data. Literacy data come from The State of Literacy in America (1998).

These descriptive data yield a few interesting findings. First, minorities represent a higher percentage of respondents in the study than they do in Portland. The difference in poverty level between the two groups is also noticeable. At Wave 3, 20.5 percent of respondents were at or near the poverty level, compared to only 9.1 percent of the three-county population overall living at or below the poverty level.

The issues on which little difference between the two groups can be detected are also interesting. The percent of respondents who were married was similar to those married in Portland overall. The proportion born out of the U.S. was also similar in both groups. As expected, the percentage of respondents who had earned a GED or high school diploma between 1998 and the 2000-2001 study year was much lower than for Portland overall. Interestingly, employment rates were higher for study respondents than for the Portland three-county area, but median household income was lower for the former. Household size was larger in the study sample than for Portland overall.

3.3 Why This Data Set Is Useful

While the focus of the LSAL is on literacy, the data provide information on many aspects of the respondents' lives, such as family life, work history, educational history, and formal and informal learning experiences. Since the study collects data not only on primary modes of transportation and work history but also education and social life, the LSAL allows for a unique analysis of the effect of car ownership in the context of other respondent characteristics. These include literacy level (based on a standardized test) and social networks (based on a series of questions about the assistance from friends to which respondents have access). The sample used in this analysis focuses on respondents who were active in the workforce and living in Oregon during the third year of data collection, 2000-2001. Results can be generalized to adults meeting that profile in the Portland Metro area.

While previous research has addressed the link between car ownership and employment, this analysis is unique for a number of reasons. First, this study addresses a different demographic group than those examined by previous studies, where education level is

generally the same across the whole sample. Much of the previous research has focused on welfare mothers. By contrast, while the LSAL group does include persons at-risk of becoming low-income or falling into poverty, many respondents in the sample do not fit that description. In fact, only five percent of respondents received welfare benefits in the year prior to data collection. Approximately sixteen percent received food or housing support. Therefore, the data provide an opportunity to examine the factors that influence the entire range of income levels represented in the sample. Second, the analysis includes two variables that have not appeared in this form in other studies. The first is the literacy proficiency score, not assumed based on education level but measured through a standardized test. The second element is the inclusion of the social resources variable, which operationalizes “social networks” and measures the amount of resources an individual has to help them when they need it. The variable takes into account whether or not a person has friends and family members to help them with childcare, transportation, and money.

4. METHODS

The following regression models test the research questions listed on page five. They focus on three employment outcomes: employment status, average weekly wage and

Table 2. List of Regression Models

<i>Model</i>	<i>Type of Analysis</i>	<i>Dependent Variable</i>	<i>Equation</i>
Model 1	Logistic Regression	Currently Employed (Yes or No)	The log of E (whether or not someone is employed) is predicted by D (demographic controls), C (car ownership), H (human capital measures of GED and literacy proficiency), and S (social resources)
Model 2	Linear Regression	Average Weekly Wage	WW (weekly wage) is predicted by D (demographic controls), C (car ownership), H (human capital measures of GED and literacy proficiency), and S (social resources)
Model 3	Linear Regression	Weeks Worked Last Year	WKW (weeks worked) is predicted by D (demographic controls), C (car ownership), H (human capital measures of GED and literacy proficiency), and S (social resources)

weeks worked per year. The differences between men and women are measured by running the models for the entire sample and for men and women separately. They are listed in Table 2.

4.1 Discussion of Variables

Dependent Variables

The three dependent variables are tested because each offers a different measure of employment outcomes. In order to gauge individuals' success and stability in work, simply understanding whether or not someone is employed on a given day is inadequate. Wage and retention, as measured by average weekly wage and weeks worked per year, must also be taken into account.

Independent Variables

Independent variables were identified in the literature and included based on a test of significance.⁵ Some variables that did not meet the significance test, such as minority

Table 3. Independent Variables

<i>Independent Variable</i>	<i>Description</i>
Female	Respondent's gender (1 = female, 0 = male)
Age at Wave 3	Respondent's age in 2000-2001
Has Children Under Age 2	Indicates whether or not the respondent has a young child in 2000-2001
Minority	Indicates that respondent has identified himself/herself as African American, Asian, Latino, or Native American
Own Car	Indicates that respondent identified "My own car" as primary mode of transportation
High School Diploma/GED	Indicates that respondent earned a high school diploma or GED before 2000-2001 but after recruitment into the study
Literacy Score	The respondent's score on the TALS literacy test
Social Resources Factor	A factor score based on respondent's access to help and assistance from friends and family

⁵ Variables tested at a level of .05 significance. See Hosmer and Lemeshow, 1989.

status and high school diploma/GED, were included based on the theoretical model used in the analysis. The independent variables are listed in Table 3.

Demographic Variables

The models use age, gender, and minority status including African American, Asian, Native American and Latino. Martial status is excluded because of its high level of correlation with other variables in the model, such as age. This study uses “child under two years of age” as an indicator for young children.

Workforce Status

Respondents who were not active in the workforce in Wave 3 were excluded from the analysis to eliminate error associated with including those not looking for work. Cases were excluded if the respondent was out of work longer than 26 weeks and indicated that he or she was not job-hunting while out of work because of other activities such as homemaking, illness or disability, or school or training. Other studies, such as Raphael and Rice (2002), use a variable indicating student status to account for those out of the workforce due to school or training.⁶

Car Ownership

The LSAL survey asks respondents about their primary mode of transportation and provides four possible responses: “My own car,” “Someone else’s car,” “Public transportation,” “Other: bike, walk, etc.” The dummy variable included in the model is derived from this survey question, and indicates those respondents who own a vehicle and who use it as their primary transportation mode. While the measure may exclude some who own a vehicle but do not often drive and choose to use public transit or another mode, the high cost of car ownership suggests that this would not be very common

⁶ LSAL respondents who lived outside of Oregon are excluded from the analysis, so all data pertains to the Portland Metro Area. It is safe to assume for this analysis that labor markets are comparable within the region, so it was not necessary to account for this variance in the model. It is possible that a few of the respondents in the sample live in Oregon but outside of the Portland Metropolitan region. There are not enough of these cases to affect the analysis, however, nor would the labor market differences be substantial enough to skew the results.

among respondents in this sample. Other research (Raphael and Rice, 2002) uses data that show the presence of a car in a household. So, even in a situation where there is one car for a two-adult household, both adults may be listed as car owners. The LSAL variable may be a better measure of car access because it excludes vehicles that are not functional or vehicles that are used primarily by other family members.⁷ This measure will be referred to as “car ownership” throughout the paper.

Literacy Proficiency

This variable is based on a score from the TALS standardized assessment test. The scores range from 1 to 500 points and refer to levels of functional literacy proficiency. The scores are not meaningful in themselves; rather, they allow for comparisons among different populations and for studies such as this one that examine the relationships between literacy and other factors (Statistics Canada, 1995). For example, Level 1 is the lowest level of literacy and is associated with a level of functionality that requires *locating*, or matching information listed in a question to that provided in a document. Higher levels involve *cycling*, or matching information by meeting a number of issues posed in a question; *integrating*, or comparing and contrasting; and *generating*, or using information provided in a document and other background information to give an answer. The proportion of Americans who perform at Level 1 numbers 23.7 percent, while 49.6 percent perform at Level 1 or 2 (Statistics Canada, 1995). Oregon literacy rates are higher than national levels; only 15 percent of adults perform at the lowest literacy level, while 38 percent perform at Level 1 or 2 (Reder, 1996).

Social Resources

This variable attempts to measure resources in terms of the friends and family members to whom a respondent can turn for help with money, childcare, and transportation. It is designed to account for a respondent’s social networks in the model. A factor analysis

⁷ Blumenberg and Ong suggest in their research that car ownership alone may not be the best measure of car usage, as many people borrow cars, carpool, etc. There were few LSAL respondents who indicated that “Someone else’s car” was their main mode of transportation. The number of such respondents, however, was not large enough to warrant a consideration of car usage versus car ownership in this analysis.

was conducted to create a factor score variable for a respondent's social resources. This variable included the following questions:

Are there people in your life who will:

- Give you time? (e.g.: childcare, moving)
- Help you with emotional support?
- Help you with transportation?
- Help you with money?
- Help you with daily chores?

The questions were designed to get at the issue of turbulence, or the ability of respondents to cope with conflicts and issues that might disrupt the flow of their daily lives. The factor analysis revealed one factor, with a chi-square of 4.607, degrees of freedom of 5, and significance of .466. The factor was not significant, meaning that it was not significantly different from the data, and does in fact fit the data set.

4.2 Study Limitations

One limitation of the study is that it does not address the issue of colinearity between car ownership and employment outcomes. Other research (Raphael and Rice, 2002) acknowledges that there may be two-way effects between these two variables and uses two-stage least squares regression to sort them out. This procedure was beyond the scope of this analysis, which means that the results cannot be relied upon for determining causality.

Another limitation of the study is that it does not account for spatial differences in respondent home and work locations. There are substantial differences in transit access between different areas of Portland, and a job seeker's transit accessibility from home may contribute to his or her ability to find and maintain employment.

5. DESCRIPTIVE STATISTICS

Table 4 provides descriptive data on many of the variables included in the model. The age range in the sample is limited due to the parameters set by the study design. There is

substantial variation in weeks worked in the last year – the median was 52 weeks, or a full year, but the responses range from 12 to 52 weeks. The range in household income was also substantial – almost \$200,000 per year.

Table 4. Descriptive Data

	Median	Mean	Range	St. Deviation
Age	29	29.8	26	8.3
Number of Children	1	1.0	6	1.1
Household size	3	3.74	9	1.88
Weeks Worked	52	46.6	40	9.4
Weekly Wage	434	507.0	2009	360.4
Household Income	33,851	42,147	199,966	34,195

Car usage is addressed in Figure 1. Sixty percent of study respondents use cars as their primary mode of transportation. This figure is consistent with findings reported in the literature – approximately 36 percent of low-income people do not own a car (Goldberg, 2001).

Figure 1. Primary Mode of Transportation (in percent)

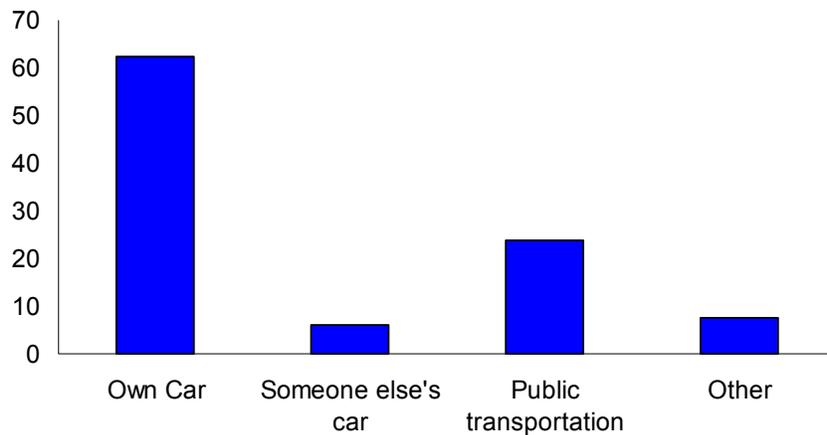


Table 5 shows something about car ownership among different groups within the sample. Many more women did not use cars as their primary mode of transportation than men. Interestingly, respondents at or near the poverty level more often used a car as their primary mode of transportation than did respondents with incomes solidly above the poverty level.

Table 5. Car as Primary Mode Crosstabulation

	Own Car is Primary Mode (percent)
Women	59
Men	65
Had Car at Wave 1	63
Did Not Have Car at Wave 1	62
At or Near Poverty Level	72
Above Poverty Level	61

6. REGRESSION RESULTS

The results of the analysis are reported in the order of the research questions. See Table 6.

6.1 *What Is the Impact of Car Ownership on Non-High School Graduates?*

Car ownership had a significant, positive effect in each of the three models. It improved the likelihood of being employed (Model 1) by 80 percent – all things constant, respondents who used a personal vehicle as their primary form of transportation were much more likely to be employed than those without access to a personal vehicle. The effect on average weekly wages (Model 2) was approximately \$275, and the effect of weeks worked (Model 3) was approximately eight and a half weeks. Colinearity poses a challenge in interpreting these results. Causality cannot necessarily be inferred from these results, only that a strong relationship exists between the variables. However, what is notable is that these results are consistent with the literature.

There may be a few explanations for these findings. First, job seekers who own vehicles have greater flexibility in their search than those who are dependent on other modes. They can search farther and at different times, and this flexibility may allow them more choice in employment and it may make them more competitive for steady, higher-paying positions. The other issue is that a personal vehicle, when in proper working condition, is a reliable, dependable mode of transportation. Unlike employees who rely on public transit or friends who drive them to work, drivers can generally be sure that they will

make it to work on time. This decreases their tardiness or absenteeism, thus contributing to better wages and longer job retention.

Table 6. Regression Results, Entire Sample

	Employed, Y/N ^a	Average Weekly Wage ^b	Weeks Worked ^b
	Model 1	Model 2	Model 3
Woman	1.07 (0.07)	-256.019 (-7.008)	2.993 (2.643)
Age at Wave 3	1.06 (9.56)	0.197 (0.086)	0.171 (2.444)
Has children under age 2	1.78 (1.17)	56.573 (1.025)	3.614 (2.001)
Minority	0.53 (5.28)	151.56 (3.824)	-1.277 (-1.061)
Own car is primary mode of transportation	1.84 (4.58)	275.803 (6.741)	8.588 (7.026)
High School Diploma/GED	0.97 (0.01)	-57.792 (-1.156)	2.135 (1.426)
Literacy score	1.01 (2.69)	0.936 (2.156)	0.00 (3.023)
Personal resources factor	1.05 (0.07)	28.214 (1.527)	0.738 (1.213)
Constant	0.19 (2.5)	116.834 (0.777)	20.172 (4.416)
Chi-Square (F statistic for models 2 & 3)	28.74	15.374	9.806
-2 Log likelihood (Significance for models 2 & 3)	356.32	0.000	0.000
	0.110 Nagelkerke R Square	0.258 Adjusted R Square	0.144

Results significant at the .05 level or greater are in bold.

a. The Exp(B) (odds-ratio) and Wald statistic are reported for each variable; Wald in parentheses.

b. The B coefficient and t statistic are reported for each variable; coefficient in parentheses.

The outcomes from the demographic variables were generally in line with other research. While gender was not significant in determining employment status (Model 1), it was significant for predicting average weekly wage and weeks worked. All else constant, the effect on wage (Model 2) was negative, meaning that women earned \$250 less per week than men. The effect on weeks worked (Model 3) was positive, and had the effect of three more weeks worked per year. These results are in line with literature that suggests that many women take lower-paying, part-time jobs. Also, these patterns may be related to the employment pressures imposed by welfare reform. It is interesting that in this sample, being female did not make a person more or less likely to be employed.

Age is significant in the logistic regression model for employment status (Model 1). The odds ratio is 1.05, meaning that all things being equal, a respondent at a given age is about five percent more likely to be employed than a respondent who is one year younger. The effect of age on wages (Model 2) was not significant. The effect on weeks worked per year (Model 3) was positive; being one year older improved weeks worked by approximately two weeks. These results can probably be attributed to life cycle effects – as adults age they are more likely to take higher-paying, steady jobs.

The effect of having young children was not significant in predicting employment status (1) or weekly wages (2). It did have a significant and positive effect on weeks worked (3). All else constant, having children under age two resulted in approximately three and a half more weeks worked in the previous year. This may be explained by parents' need for greater stability in employment. The next section contains a more detailed description of the differences between women and men.

Racial minority status was significant for predicting employment status and weekly wage, but not for weeks worked. The odds ratio for employment status was .526. This means that all things being equal, minorities were approximately 50 percent less likely to be employed than whites. The effect on average weekly wage, however, was positive. Minority status resulted in approximately \$150 more in weekly earnings. It may be that

the inclusion of literacy proficiency in this model explains the discrepancy between this and other research.

5.2 *How Does the Role of Car Ownership Change in the Context of Other Factors, Such as Levels of Literacy Proficiency and Social Resources?*

Step analysis allowed an examination of how the addition of other human capital variables to the model affected the role of car ownership in explaining employment outcomes. The added human capital variables were high school diploma or GED, literacy proficiency, and social resources. This statistical procedure calculates the model with demographic variables only, and then adds the additional variables to allow close examination of the effects. If the difference between a new step and the previous step is significant, it means that the new variable added significant explanatory power to the model. Table 7 shows the results; car ownership was still significant when the additional factors were included in the model. The addition of the human capital variables did not have significant effects.

Table 7. Model Summary, Entire Sample

	Employed, Y/N	Weekly Wage	Weeks Worked
	Model 1	Model 2	Model 3
	Nagelkerke	R Square	R Square
Step 1 Demographic Variables	0.058	0.141	0.031
Step 2 Car Ownership	0.1	0.258	0.134
Step 3 Diploma or GED	0.1	0.261	0.139
Step 4 Literacy Proficiency	0.11	0.271	0.157
Step 5 Social Resources	0.11	0.276	0.16

The high school diploma/GED was not significant in any of the models, nor did it add much to the explanatory power of the models. This may be because so few of the respondents had earned a certificate: only 116 out of the entire sample of 934. Also, studies have shown that the benefits of GED attainment do not manifest in the first few years (Tyler, 1998).

The results of the literacy score appear small because they are based on a scale of 500 points. However small, the results are still significant. The effect of a one-point increase in literacy score is significant, resulting in an odds ratio of 1.005. This means that a one-point increase in literacy proficiency improves one's chances of being employed (1) by 0.05 percent. The effect on average weekly wage (2) is significant; all things constant, a one-point increase results in 90 additional cents per week. The effect on weeks worked (3) is negligible, but significant. The effect of literacy proficiency did not improve the explanatory power of the model.

That the literacy score was significant and the GED was not shows that the certificate is not a good proxy for proficiency, at least for this group. Instead, these results suggest that regardless of whether or not a respondent has earned the GED, gains in literacy proficiency can contribute to improvements in employment outcomes. This finding may be significant for policy, suggesting that the most important focus for adult education programs should be skill improvement rather than the GED test specifically.

The effect of a respondent's resources was not significant in any of the models, nor did it have much impact on the R Square measure.

5.3 How Do These Effects Differ between Men and Women?

Car Ownership

While car ownership had a significant, positive effect in each of the three models tested on the whole sample, the effects on men and women were different. Car ownership was not significant in predicting employment status for women (Model 1_w), but men who used a car as their primary mode of transportation (Model 1_m) were almost five times more likely to be employed than those who did not. Why is car ownership so much more important for men than for women? Given that women's travel behavior often involves more trip-chaining than men, this result is curious. Perhaps it is tied in with colinearity – men make more money, so they may be more likely to own a car, which also means they are more likely to be employed. This result may also reflect the impact

Table 8. Regression Results, Men and Women

	Employed, Y/N ^a		Average Weekly		Weeks Worked ^b	
			Wage ^b			
	Women Model 1 _w	Men Model 1 _m	Women Model 2 _w	Men Model 2 _m	Women Model 3 _w	Men Model 3 _m
Age at Wave 3	1.11 (7.87)	1.01 (0.061)	-2.091 (-0.866)	1.006 (0.264)	0.226 (2.087)	0.000 (0.664)
Has children under age 2	2.5 (1.08)	0.47 (0.994)	-125.275 (-2.602)	197.632 (1.576)	4.301 (1.912)	-0.141 (-0.041)
Minority	0.417 (3.8)	0.567 (1.9)	-38.747 (-0.969)	227.414 (3.263)	0.421 (0.249)	-3.452 (-1.864)
Own car is primary mode of transportation	0.726 (0.386)	4.96 (15.002)	123.706 (2.837)	311.824 (4.522)	6.716 (3.584)	10.813 (5.987)
High School Diploma/GED	0.494 (1.97)	3.616 (4.188)	2.936 (0.056)	-63.52 (-0.823)	2.363 (1.086)	1.59 (0.74)
Literacy score	1.01 (6.87)	1.001 (0.069)	-0.712 (-1.676)	1.985 (2.795)	0.000 (4.269)	0.000 (0.77)
Personal resources factor	1.097 (0.146)	0.916 (0.106)	27.2 (1.769)	66.257 (1.793)	0.861 (1.163)	-0.17 (-0.162)
Constant	0.016 (5.7)	1.238 (0.019)	596.655 (3.791)	-263.504 (-1.137)	11.333 (1.761)	29.955 (4.636)
Chi-Square (F statistic for models 2 & 3)	33.06	22.19	5.635	8.11	6.243	6.048
-2 Log likelihood (Significance for models 2 & 3)	157.54	172.233	0	0	0	0
	0.244	0.166	0.163	0.267	0.149	0.145
	Nagelkerke R Square			Adjusted R Square		

Results significant at the .05 level or greater are in bold.

a. The Exp(B) and Wald statistic are reported for each variable; Exp(B) in larger print.

b. The B coefficient and t statistic are reported for each variable; coefficient in larger print.

of culture/tradition, where men are more likely to drive than women and are more likely to take the car in a one-car household.

Car ownership was significant in predicting average weekly wages and weeks worked for women and men. The effect on wages (Model 2_w and 2_m) was approximately \$120 per week for women, and \$300 per week for men. Women with a car worked about seven more weeks per year (Model 3_w) than those without, while men with a car worked 11 more weeks (Model 3_m) than men without a vehicle. In these results, car ownership appears to have stronger effects for men than for women. Again, this may suggest that women are more likely to make do with transportation alternatives such as public transportation and carpooling.

GED or High School Diploma

The effect of a respondent having a GED or high school diploma was not significant for women in any of the models and was not significant in predicting average weekly wage (Model 2_m) and weeks worked (Model 3_m) by men. The variable did contribute to predicting employment status (Model 1_m), however. Men who held a GED or high school diploma were three and a half times more likely to be employed than those who did not. Although a deeper analysis of the GED's impact on employment status is beyond the scope of this study, it may be conjectured here that this result can be explained by gender differences in occupation. The diploma or GED certificate may be more important for jobs with higher prestige, and it is possible that men in the study were more likely to be employed in these occupations.

Literacy Proficiency

Literacy proficiency also varied by gender. Remember, the TALS is based on a 500-point scale, so the effect can be significant even though the value attached to one point is small. The variable was not significant in predicting the employment status of men (Model 1_m), but the odds ratio was 1.01 for women (Model 1_w). The effect on weeks worked was also significant for women but not for men. A one-point increase in score has a significant and positive relationship with weeks worked (Model 3_w), although the

effect is very small. The effect on average weekly wages was significant for men but not for women. A one-point increase in score would increase a man's weekly earnings (Model 2_m) by approximately two dollars. Literacy was important for women's employment status and weeks worked, and important for men's wages. These results also may be explained by the higher likelihood of women to have part-time jobs, and support studies suggesting women are more likely to take part-time, lower-skilled jobs. Literacy proficiency helps them gain and keep employment, but perhaps there is a wage ceiling for women who did not graduate from high school. The results would suggest that the same does not hold true for men; literacy proficiency can help increase their earning potential.

Personal Resources Factor

The effect of a respondent's resources was not significant in any of the models, although this factor did have substantial effects on the explanatory power of the weekly wage models. This may mean that having strong social networks helps people get into higher paying jobs. It may also mean that people in higher paying jobs are more likely to have friends and family with the resources to help them with money, childcare, and transportation if they need it. The results are not significant, and no causality can be inferred from them. However, the effect of this variable in the model does suggest that there is a relationship between earnings and the strength of social networks that should be explored further.

Demographic Variables

There were also demographic differences between men and women. Age was significant in predicting the employment status of women in the sample, but not for men. The odds ratio was 1.11, meaning that an increase of one year in age improves the likelihood of a woman being employed (Model 1_w) by 11 percent. Age was not significant for men or women in predicting average weekly wage (Model 2), but it was significant in predicting weeks worked by women (Model 3_w) – one year in age resulted in approximately .226 more weeks worked. Why is age more important for women than for men? Previously

discussed findings suggest that the presence of a young child increases stability— perhaps this factor becomes more influential over time.

This analysis is further supported by findings related to the presence of a young child. The presence of young children did not make a difference in earnings or weeks worked by men in the sample. The effect of having children less than two years of age was not significant in predicting the employment status of women (Model 1). It was, however, significant in predicting the average weekly wage and weeks worked of women. The presence of young children decreased weekly wages of women (Model 2_w) by \$125, and increased their weeks worked (Model 3_w) by four weeks. This means that women with young children earn less but work more. Again, this may be explained by the uncertainty created by a young child. Women may be less able to maintain steady employment at a higher paying job because of the conflicts that arise when their childcare falls through or when children are ill. At the same time, they may take steady, part-time work that is more flexible and easier to keep.

Minority status was significant for predicting employment status for women and earnings and weeks worked by men. The odds ratio on the employment status of women (Model 1_w) was .417, meaning that all things being equal, minority women were approximately 60 percent less likely to be employed than white women. The effects on the employment outcomes of men were mixed. Minority status had a positive effect on weekly wages (Model 2_m), increasing weekly earnings by approximately \$230. The effect on weeks worked was negative, however. All things constant, minority status had the effect of approximately three and a half fewer weeks worked (Model 3_m) for minority men than white men. Again, this may be explained by the effect of accounting for literacy proficiency in the model.

5.4 Model Summary

Table 9 compares the outcomes of each of the models. They show very different results. The models had different strengths for men and women together and separately. The strongest results were for employment status of women and wages for men. There was

virtually no difference in the three sub-samples in terms of weeks worked. This means this combination of variables was strongest in explaining variations in employment status and wages, but other factors not accounted for in the model influence weeks worked.

Table 9. Model Summary, R Square

	Employed, Y/N	Weekly Wage	Weeks Worked
All	0.110	0.258	0.144
Women	0.244	0.163	0.149
Men	0.166	0.267	0.145

7. DISCUSSION

Some of the most interesting findings of this research revolve around the effects of car ownership, literacy score, resources, and GED/high school diploma. Contrary to other research that found personal connections and resources to be more important than car ownership, this study finds that the effect of resources on employment outcomes, while contributing to the explanatory power of the model, is not significant. Perhaps this is due to factors particular to this location, its slightly different population, or differences in the measures of variables. It may also be that resources and social connections are just too difficult to quantify.

The findings on car ownership are mostly in line with other research. Overall, car ownership does appear to have an important relationship to employment status, wages, and weeks worked. However, when the relationships are measured for men and women separately, the differences in the findings between this and other research emerge. This research strongly suggests that car ownership is more influential for men than for women. The effects of having a car as primary transportation resulted in a much higher likelihood of being employed, and the effects on wages and weeks worked were almost twice as high as the effects on those outcomes for women. Why is this? The literature suggests that car ownership would be more important for women because of the childcare and household duties they must balance with work. Perhaps differences in social networks play a role here. If women have more support from friends and family – people who help with money, childcare, and transportation – perhaps access to a car is less important. It

may also be that women are simply more likely to make do with transportation alternatives, while men are more likely to drive. This would be especially true in one-car households.

It is hard to know for certain, without taking a more careful look at the types of jobs women take and the distances that they travel to work, but it may be that they are more likely to take service-oriented jobs closer to home, making public transit a more manageable option.

The added information provided by the literacy score and GED/high school diploma variables is interesting in light of this new data on car ownership. Having a GED or high school diploma is only significant in predicting the employment status of men. The car is important, and both car access and literacy scores have significant effects on many of the employment outcomes. Having a car as a primary mode of transportation makes a respondent four times as likely to be employed. Car ownership also improves earnings by several hundred dollars and increases weeks worked by up to eleven weeks. It may be that some of these effects can be attributed to colinearity. A two-stage least squares analysis would be required to better understand this relationship. Ultimately, these findings show that car ownership is important for this group, even when literacy proficiency and social networks are accounted for. They also show that literacy proficiency and transportation are independent of one another in the impact they exert on employment outcomes.

8. IMPLICATIONS FOR PLANNERS

The results of this analysis suggest several implications for planners, both in terms of how future research on the connection between transportation and work should be conducted, and also in terms of policy responses to this issue.

Personal Context in Research

This research introduced a number of variables that were very individual in nature and provided a very personal context for the role of transportation in the work lives of LSAL respondents. Specifically, the difference in results between the high school diploma or GED and the actual literacy score shows how individual characteristics have an effect. The ability to look at three different measures of employment outcomes was also important for this research. Most transportation studies do not collect such in-depth, personal data.

As the LSAL study demonstrates, collecting this type of information can be worthwhile, even though such an effort can be expensive and time-intensive. Perhaps other interdisciplinary datasets provide similar opportunities for transportation research. Furthermore, different personal-level data may also have been helpful in understanding the car-employment connection in this analysis. What are an individual's preferences on transportation? If the person was not driving, or if that individual did not own a car, why? Is it because he or she could not afford it? Or are the reasons tied to other factors, such as personal preferences or the quality of alternate transportation options in Portland? Or did the respondent lose his or her license or vehicle for some other reason?

Integrate Services

The results of this analysis show that both transportation and literacy proficiency are important, but are not necessarily connected to one another in affecting employment outcomes. Analyses of their impact must be developed independently. However, the research also shows that those needing one of these types of services may also be in need of the other. One policy solution is to work towards integrating services for people who need them. This is a policy response already recognized – the Federal Transit Administration (FTA), for example, requires that grant programs integrate public transit and other services. Tri-Met, the public transit provider in Portland, coordinates workforce development, childcare, and other programs in its welfare-to-work planning.

Consider New Options

While this research does not conclusively find that car ownership directly leads to improvements in wages and job retention, it does show that the relationship between these elements is strong, even when other factors such as literacy proficiency are accounted for. The literature review addresses some of the reasons why single-occupancy commuting may help people find and maintain employment: this transportation mode provides the dependability and flexibility that can be critical for people struggling to balance other pressures in their lives. At the same time, the literature also addresses many of the unique burdens introduced by car ownership. The cost of purchasing and maintaining a car, as well as paying for insurance, fuel, fees, and other expenses, can outweigh the benefits of owning a car for families trying to survive on minimum wage. Furthermore, there are the societal costs associated with the additional vehicle-miles traveled that result from increased car ownership.

Policy responses to this issue should move beyond the misleading dichotomy between transit or car ownership. Other options to provide maximum flexibility and minimum burden should be instituted. Shared-car programs may provide one viable solution. Other programs, such as those that provide funds for vehicles that are used for carpooling, may also help address the problem.

9. CONCLUSION

This research used data from the Longitudinal Study of Adult Learning to examine the role of car usage in employment outcomes. The results indicate a strong relationship between car ownership and employment status, average weekly wage, and weeks worked per year. Additional analysis shows that this relationship remains strong even when other factors, such as education level, literacy proficiency, and social networks are accounted for in the model. Interestingly, the relationship varied by gender. Car usage generally was more influential in the employment outcomes of men than of women. These results show that car usage is important for non-high school graduates in Portland, and that while literacy proficiency is important as well, its impact is separate from car ownership. This

work seems to suggest some directions for programs geared toward helping individuals with low educational attainment find and maintain employment. The answer may not necessarily lie solely with car ownership assistance; indeed, as suggested by this research, a combination of literacy proficiency training and flexible transportation alternatives would likely have the greatest impact.

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