IVHS Draft

IVHS: POTENTIAL IMPACT ON DISADVANTAGED COMMUNITIES

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INTRODUCTION

This paper explores the impact of transportation technologies on the social and economic well-being of central city residents and disadvantaged populations. Though members of poor communities have little political power or input into the decision-making process, transportation policy affects them in many ways. We demonstrate that the impacts of new projects on the earnings, wealth, health, education, and cultural amenities of disadvantaged residents can be measured. and that transportation project development, finance, and operations can be undertaken in a distribution-conscious way.

To estimate one fairly broad impact of IVHS transport policy, we use census data for the three case study Metropolitan Statistical Areas (MSAs): Houston, Minneapolis-St. Paul, and Portland, OR. To assess potential impacts on disadvantaged workers of IVHS projects we examine racial and income differences in travel time to work. Controlling for demographic characteristics, we estimate the relationship between commute time and income: and use measures of potential time savings from IVHS projects to simulate their impact on incomes and inequality. IVHS technologies have the potential to increase and improve access by central city residents to employment and to mitigate race and income disparity in travel time and perhaps earnings. Successful implementation of these technologies will result in declines in employment and earnings inequality.

THE CASESTUDYCITIES

Houston is the largest of the three case study cities. Table 1 shows that there were over 3 million residents in the Houston MSA in 1990. There were 2.5 million in Minneapolis-St Paul and 1.2 million residents in Portland. The populations of Houston and Minneapolis -St Paul (MSP) increased 13.6 and 16.6 percent respectively between 1980 and 1990. But the population of Portland decreased slightly (0.22 percent). In all three cities the non-white population grew faster than the white population. To point out the fastest growing group: the Asian population of Houston grew 146.8 percent. In MSP it grew 231.2 percent and in Portland the Asian population grew 93.4 percent.

Table 2 shows that the mean travel time for commuting to work (commuting by all means of transportation) was higher in Houston than in Minneapolis-St Paul and Portland in 1980 and 1990. This is as might be expected. given the larger size and decentralized nature of the Houston MSA. Travel time to work differed by racial ethnic group in each of the cities.

Travel time to work increased for whites in all three cities and decreased for non-whites in Houston and Minneapolis-St Paul. In Portland, mean travel time differed very little between whites and non-whites, but it differed among individual ethnic groups. In fact, the differences by race in mean travel time are obscured by the comparison of whites to all non-whites in all three cities. Houston provides the best example of this phenomena. Non-whites' mean travel time was longer than that of whites both years, but the difference between these two "groups" narrowed between 1980 and 1990. This narrowing was primarily due to the decrease in the mean travel time of blacks. who were the largest non-white group. Their mean travel time fell 6.66 percent. But all other non-whites had their travel time increase during the period. including the second largest group, Hispanics.

McLafferty and Preston (1991) use 1980 census data to examine gender and race differences in commute time throughout the New York City MSA. They find that black and hispanics have longer commute times, and that gender differences in commute times among whites are mostly explained by differences in industry and occupation. Differences between minorities and (white) women's commute times in 3 of 6 service industries they studied are also explained. In the other industries a significant difference remained. perhaps because employers located some (low-wage) jobs "near a white female labor force." Economic factors did not explain minority workers' longer commute times. The authors suggest that "racial discrimination in job and housing markets" have made them "transit captives."

The notion of a transit captive comes from the earlier work of Rutherford and Wekerle (1988). who examined "the impact of residential and workplace location and mode of transportation to work on the incomes of female and male workers." They used household survey data collected in Toronto, Canada to evaluate journey to work and income characteristics of transit riders and automobile users. As did McLafferty and Preston, they found women worked closer to home. "When travel costs are compared with potential income gains, (they) find that women, and particularly women using transit, have less to gain than do men by traveling farther to work."' For non-white workers it would be expected that they travel shorter times than whites because they receive lower pay - making a long commute less worthwhile.

Table 3 shows mean travel time by race and gender. In all three cities women's mean travel time to work is lower than it is for men. This was true in both years for whites and non-whites. previous research has shown that women tend to travel for a shorter time and distance to work than do men.' McLafferty and Preston (1991) found that although black and hispanic men and women did commute a longer time than whites, there was very little difference between black men and women and hispanic men and women in mean travel time. Table 3 supports this finding for white and non-white men and women in Houston and Minneapolis-St Paul, but not for Portland. In Portland both white and non-white commuters differ by gender in travel time to work.

Table 4 and Figure 1 show that in all three cities non-whites are twice as likely to use public transportation as are whites. This fact is likely to account for some of the racial difference in mean travel time. Figure 4 demonstrates how public transit use increased in Houston for both whites and nonwhites as it declined for both groups in the other two cities. The relationship of means of transportation and income disparity is multi-facetted in the literature. There are differences in financing the development of transportation projects, differences in pricing of the services, and differences in the access, quality, and speed of the service that need to be measured. In some cities the tax burden for financing transportation falls disproportionately on lower-income residents. Fares for mass-transit (relative to costs) are often higher for users from the central city (Hodge 1986). Access and quality have been found to differ by income group, as well, though commuters are guaranteed equitable quality of mass transit (by UMTA): age of vehicles, load factors, access to services. The measures sanctioned by UMTA are problematic; and the notion of what constitutes equal access is complicated by family structure, age, and other factors. Brian Taylor's "Unjust Equity: An Examination of California's Transportation Development Act" provides an insightful discussion about how funds from the "largest nonfederal public transit funding program in the country" are allocated. He finds "a proliferation in California of new, well-funded, and expanding suburban transit operators that attract few riders, whereas older, heavily patronized central city transit operators are forced to cut service because of funding shortfalls." New transport technologies would probably need to be applied more equitably to address inequality in access to jobs and income. Thus we now turn to a discussion of travel time and income.

Figures 2 - 4 show travel time for whites and non-whites who had less than median income. Median income for nonwhites in Houston in 1990 was $29,193. In MSP it was 33,612; and it was 33,000 in Portland. Whites' median income was $45.359 in Houston in 1990. It was 46,663 in MSP and 40,070 in Portland. In all three cities the majority of workers traveled to work in 45 minutes or less. The distribution of whites and non-whites traveling to work was fairly similar and changed in similar ways from 1980 to 1990. The majority of commuters with below median household income traveled to work in under 35 minutes. Any increase from 1980 to 1990 in the share of commuters traveling a longer time was dominated by commuters traveling over one hour. Among commuters traveling less than 35 minutes, those traveling 30-35 minutes seem to have cut their travel time slightly. (Non-whites seem more likely to have achieved this.)

Residences located in central cities tend to be located close to work, family and social institutions that serve their communities. Growth accommodated and fostered by expanded highway transportation in recent decades has fragmented residential areas and facilitated the development of large residential communities outside the cities.[3] Suburban dwellers have gained ease of transportation to work, higher property values, and similar benefits from transportation innovations while central city residents experienced declining access to jobs, business, and public services.[4] Below we model and estimate the effect of easing transportation to work on income inequality. We focus on mass transit and private vehicles because the majority of workers commute using these modes. All of the cities include other projects such as walking paths and bike routes in planned additions to their transportation infrastructures, but Census figures show that a very small share of total persons travelling to work walk or ride bicycles. In any case we would like to acknowledge the fact that policies developed for such projects can have disparate effects on neighborhoods and their residents.

THE MODEL

Residential location decisions and work decisions are intertwined in the long run. Persons may consider moving closer to work in order to reduce commute times or they may consider moving further away from the central business district in order to avail themselves of lower housing prices. Ultimately, there must be a trade-off between distance to work and housing prices. In the short-run, however, consumers are constrained in their housing choices and/or employment prospects. One reason for constraints on housing choices may be historic patterns of housing segregation of some groups near the inner-core and other groups in suburban areas. A reason for constraints on the location of employment prospects might be similarly related to historic patterns of location of certain businesses, like shopping malls and retail shops, near one group but far from another.

A reality for many cities, moreover, is that there is a mis-match between where firms are located and where people live. For example, many African Americans are concentrated in inner-city and older suburban cores. Newer and growing manufacturing firms often locate outside of the urban core. Minority workers may have to endure long commutes in order to avail themselves of these jobs. As another example, many white families have moved to new suburban developments, where housing prices are moderate. For some. commute times to professional jobs in the central business district may be substantial. Taking jobs closer to home often means taking a pay cut. In the short-run at least, locational decisions can be thought of as fixed. The choice is one of how long to commute to get to a job. This choice problem arises in part because wages are equal across space for each group.

Thus, at least in the short run, the choice that the consumer faces is really a choice between commute times and work. Or alternatively, the choice is between commute times and consumption which is constrained by income from work. Given wherever a particular group member happens to live and the distance between the group member's residence and employment prospect. the consumer chooses between expenditures on consumption goods and on time allocated to commuting. Longer commutes mean less time for work in this simple framework. Thus, it means lower earnings and thus, lower consumption. The choice, then, becomes one of spending time getting to work or spending time working. But a constraint is that wages are higher the farther away you commute. This constraint arises from the fact that in the short-run consumers are assumed to be unable to move closer to the better jobs. Without further specification on the relationship between wages and location and the variations that might hold for different groups, there is an ambiguous relationship between travel time and earnings.

To see this. consider a very simple conventional time-consumption choice model. Let C be consumption, t is navel time. L is time spent in work, w is wages, and p the price of consumption goods. Assume that all income is spent on consumption, so that earnings plus initial income equal consumption. Also assume that time spent at work equals available time less commuting time. The problem of the consumer can be thought of as one of choosing the combination of consumption and commuting so as to maximize a utility function given by U, subject to an income constraint and a time constraint. That is:

$$Max\ U = U\ (\ C,\ t\ )$$

subject to:

$$p \cdot C = w \cdot L + \overline{Y}$$
$$L = T - t$$

In general, the optimal allocation of time to travel, t*, will decline for increases in w. To see this, consider the case of a Cobb-Douglas utility function:

$$U = C^{\alpha} t^{(1-\alpha)}$$

The solution to the constrained maximization problem becomes:

$$t* = (1-\alpha)[\frac{\overline{Y}/p}{w/p} + T]$$

It is easy to see, moreover, that t* declines for increases in wages, but rises for increases in initial wealth, $\overline{Y}$, and available time, T. In other words,

$$\frac{\partial t*}{\partial w/p} < 0,\ \frac{\partial t*}{\partial \overline{Y}/p} > 0,\ \frac{\partial t*}{\partial T} > 0.$$

The last two derivatives suggest that the more wealthy and those with more time to spare are more likely to commute for longer periods than those with little wealth or little time to spare. Thus, for example, one would expect that mothers with young children--and thus with little time to spare--will have lower optimal allocations of time to commute than fathers. For evidence of this see Johnston-Anumonwo (1988). Part-time workers and those who do not own cars would also be expected to have lower optimal allocations of time to commuting.

Although other specifications of the utility function can reverse the finding of an inverse relationship between commutes and wages (for example a quadratic utility), the central point here is that under reasonable assumptions one can expect optimal commute times to decline as wages increase. But this would be true if we are willing to assume that wages themselves are unrelated to where people live and thus how long it will take for them to get to work. We must also need to assume that wages are unrelated to the initial wealth that might affect the form of transport available **to the worker.** That is, we must ultimately adopt the restrictive assumption **that car** ownership--which will reduce travel times for given distances--is independent of wealth if we want to assure that the simple inverse relationship between travel time and wages will hold. Clearly this assumption is too restrictive and generally will not conform to the experiences of most cities. Therefore. in the absence of such restrictions as the independence of earnings and wealth, the relationship between earnings and time traveled can no longer be signed unambiguously. The precise relationship, consequently, becomes a matter of empirical verification and is likely to vary from city to city and group to group.'

EMPIRICAL SPECIFICATIONS

The interest in the relationship between travel time and wages is to assess whether technological improvements in transportation that reduce travel time will also reduce racial earnings inequality. Using Census data we can estimate earnings equations which isolate the impacts of travel time from other factors such as industry and occupation.

To do this we must first invert the relationship isolated in the rational choice model sketched in the previous section. We noted that $t^*=f(w/p)$. We do not observe real wage rates, w/p, directly. What we observe is wage and salary incomes, conceptually equal to the product of the wage rate and hours worked, or $(w/p).L$. But $w/p=f^{-1}(t)$ and $L=T-t$, suggesting that in any empirical specification of earnings and travel time, travel time must be **considered** endogenous.

To assess the monetary return to commuting, we can estimate the effect of travel time on wage and salary earnings:

$$\ln(w/p\cdot L)=\ln(earnings)=\sum \beta_i X_i + \gamma \ln(t*) + \delta(L/T) + \mu$$

where t* is measured by average commute time to work, L/T is percent full time, measured by usual hours worked times weeks worked divided by 50 weeks. To obtain estimates of the coefficients, β, γ, and δ, we use the method of two stage least squares. The interpretation of γ is the percent change in earnings as a result of a one percent change in minutes spent commuting. The return to commuting, or the percent change in earnings as a result of a one minute increase in travel time, is given by: $\partial \ln(\text{earnings})/\partial t^* = \gamma/t^*$. To assess how differences in t* across groups and across years affect earnings inequality, we note that relative earnings inequality changes between 1980 and 1990 can be measured by:

$$\ln(I) = \ln\left[\frac{y_{80}^{B}/y_{80}^{W}}{y_{90}^{B}/y_{90}^{W}}\right] = \ln(y_{80}^{B}) - \ln(y_{80}^{W}) - \ln(y_{90}^{B}) + \ln(y_{90}^{W})$$

where y denotes wage and salary earnings and superscripts B and W denote nonwhites and whites, and subscripts 80 and 90 denote years 1980 and 1990. When ln(I) declines, inequality is diminishing. A uniform one minute reduction in travel time t* will decrease racial earnings inequality as:

$$\partial \ln(I)/\partial t* = \gamma_{80}^{B}/t_{80}^{*B} - \gamma_{80}^{W}/t_{80}^{*W} - \gamma_{90}^{B}/t_{90}^{*B} + \gamma_{90}^{W}/t_{90}^{*W} > 0.$$

Thus, our exercise is designed to estimate γ's for whites and nonwhites for the years 1980 and 1990 in order to determine the potential impacts on earnings inequality of technologies that reduce travel time.

RESULTS

The factors, other than commute time, that are included in the earnings equation are: percent full-time employment, central city residence, age, education, production/operative occupations, manufacturing industry, retail industry, and a dummy variable for unmarried females with young children. The log-earnings equation was estimated for Houston, Minneapolis/St. Paul, and Portland for 1980 and 1990 using U.S. Census Public Use Micro Samples. The results are shown on Table 5. Positive and highly significant coefficients are obtained for all three cities for both censuses on the percent full-time variables. Central city residence lowers nonwhite earnings in Portland and white earnings in Minneapolis/St. Paul. It raises white earnings in Houston in 1990, and leaves a statistically insignificant impact on the other years and groups. Thus, the impacts of central city residence--controlling for other facts--differ widely from city to city.

Age and education generally have positive impacts on earnings, as most human-capital models of earnings predict, although the coefficients for nonwhites in Minneapolis/St. Paul are not all statistically significant. The industry and occupation variables are not uniformly significant, although in every instance retail employment lowers wage and salary income. The last factor. other than commute time, is a dummy variable for unmarried women with young children. This factor consistently lowers earnings for nonwhites but not in all instances for whites. The coefficients, however, are not uniformly significant at the 5 percent level.

The estimated coefficients of commute time vary by year, group and city. In Houston, a one percent increase in commute time increases earnings for whites in 1980 and 1990. The estimated elasticities increased from 1980 to 1990 for whites, meaning that the payoff for longer commutes increased. In 1980 the elasticity was .14. By 1990 it was .46. That is, the payoff to commuting more than tripled for whites living in Houston. Although the mean commute time for whites did not change much in the intervening years (from 25.97 minutes to 25.98 minutes) the returns to commuting increased dramatically.

In contrast, the effect of commuting times on nonwhite earnings was negligible and statistically insignificant. Even though mean commute times diminished for nonwhites in Houston from 28.44 minutes in 1980 to 27.24 minutes in 1990, there was little impact of these reductions on earnings.

The effects of commute time on earnings in Minneapolis/St. Paul are statistically insignificant. except for whites in 1980. In 1990, however, the coefficients--although statistically insignificant--were positive for both whites and nonwhites. They were also larger for nonwhites than for whites. Ignoring the fact for a moment that these elasticities are statistically insignificant, one observes that the nonwhite elasticities exceed the white elasticities and that the gap widened between 1980 and 1990. That is, the payoff to commuting increased for nonwhites.

Still, nonwhite workers in Minneapolis spent less time commuting in 1990 than they did in 1980, with a mean travel time that fell from 22.42 minutes to 19.16 minutes as compared to a slight increase in travel time among whites (from 19.70 to 20.92 minutes). Thus, although there exists a payoff to longer commutes for nonwhites--presumably to good jobs in the suburbs--there may be barriers to nonwhites who wish to secure these good jobs.

The situation in Portland is quite different from the other two cities. Note that there is little difference in the average commute time between whites and nonwhites. In 1980 the averages were 21.23 and 21.20 for whites and nonwhites; in 1990 they were 22.01 and 22.15. Moreover, the effects of commute times on earnings for whites and nonwhites were negligible for both years. A one percent increase in travel time changed earnings by a statistically insignificant amount ranging from six one-hundredths of a percent to one tenth of a percent.

In summary, then, the effects of commuting times on earnings vary from city to city and group to group. And yet, there appears to be a consistent impact of uniform reductions in travel time on earnings inequality. A one percent across the board reduction in travel time would have reduced the growth of nonwhite-white earnings inequality for each city. Or stated differently, a one percent increase in travel time contributes to the growth in earnings inequality. We have computed the percentage change in I due to a one percent change in t^*, given by $\partial \ln(I)/\partial \ln(t^*)$. The results for Houston, Minneapolis/St. Paul and Portland are: .33 percent, .05 percent, and .17 percent. See figure 5. In other words, a one percent reduction in travel time to work lowers the ratio of earnings in 1980 to that in 1990 by five one hundredths to one third of one percent. That is, it reduces the racial earnings gap. Unfortunately, it does not reduce the gap by much. The computed elasticities are all less than one, meaning that there is but a minor responsiveness of changing racial earnings inequality to changes in travel time.

Earnings inequality widened in all three cities from 1980 to 1990. Although earnings increased for both whites and nonwhites in every instance, the percentage increase was greater for whites than for nonwhites. As a result, the ratio of nonwhite/white earnings in 1980 to that in 1990 rose. The increase was 8 percent in Houston, 7.5 percent in Minneapolis/St. Paul and 27.5 percent in Portland.[6] Thus, the widening and conspicuous gap in racial earnings can be reduced somewhat by improved transit or technological innovations that reduce travel times, but not by much.

Stated differently, widening earnings gaps are likely to be the consequence of increasing commutes that result in further isolation of inner-city nonwhites from good paying jobs in the suburbs. Reduction in commuting times--if uniform between whites and nonwhites--will not have an adverse impact on earnings inequality, as a result. Other public policies will have to be devised to reduce racial earnings inequality. Transportation policies alone may not be particularly effective. Nevertheless, neither will transportation policies that restrict themselves to equality in time-reductions necessarily contribute to the further widening of the earnings gap. Indeed, as our estimates show, equal reductions in travel time will lessen earnings inequality. While the lessening will not be great, and the effects will be quite inelastic, the impacts will be positive.

ENDNOTES

1. Hodge (1986) also noted that the "choice" to take public transportation is not a choice for the carless.

2. See Rutherford and Wekerle (1988), Ibipo Johnston-Anumonwo (1988) and McLafferty and Preston(1991).

3. Houston and Minneapolis-St Paul are better characterized by this statement than is Portland.

4. Gatzlaff and Smith (1993) provide an informed discussion of the effect on property values of monorail station location in Miami. They find residential property values were only "weakly impacted" but adverse impacts on property values were most likely to occur in lower income residential areas.

5. For example, consider the relationship between earnings and wealth:

$$w/p = \sqrt{Y/p}$$

Since for the Cobb-Douglas utility function:

$$t* = (1-\alpha)[\frac{Y/p}{w/p} + T]$$

it follows, then, that instead of reducing optimal commute time, increases in wages increases it, with this addition to the model.

6. These are instantaneous rates of change computed from the formula: $\ln(y_{80})^b - \ln(y_{80})^w$-: $\ln(y_{90})^b + \ln(y_{90})^w$

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Table 1: MSA Population by Race								
City	Year	Total	White	Black	American Indian. Eskimo. Aleut	Hispanic/ Spanish (Any Race)	Asian	Other race
Houston	1980	2,905,353	2,109,475	528,510	6,528	424,903	51,294	209,546
	1990	3,301,937	2,188,370	611,243	9,465	707,536	126,601	366,258
Mpls - St. Paul	1980	2,113,533	2,008,020	50,048	15,950	22,265	19,689	19,826
	1990	2,464,124	2,270,360	89,710	23,956	37,448	65.204	14,894
Portland	1980	1,242,594	1,158,249	33,385	8,831	24,34 1	23,971	18,158
	1990	1,239,842	1,124,963	38,695	11,307	44,049	56,360	18,517

Table 2: Mean Travel Time by Race
(Minutes)

City	Year	Total	White	Non-white	Black	American Indian. Aleut. Eskiio	Hispanic/ Spanish (Any Race)	Asian	Other Races
Houston	1980	26.56	25.97	28.44	30.45	21.78	24.71	25.83	24.37
	1990	26.34	25.98	27.24	28.20	30.66	25.23	27.99	25.22
Mpls - St. Paul	1980	19.79	19.70	22.42	24.37	16.54	21.68	21.88	24.23
	1990	20.83	20.92	19.16	19.56	20.15	20.20	17.28	21.98
Portland	1980	21.23	21.23	21.20	22.26	24.38	19.20	21.52	16.73
	1990	22.02	22.01	22.15	21.89	24.13	24.78	20.48	25.51

Table 3: Mean Travel Time by Race and Gender (Minutes)

City	Year	White		Non-white	
		Male	Female	Male	Female
Houston	1980	27.90	23.01	28.88	27.83
	1990	27.30	24.15	27.55	26.87
Mpls - St. Paul	**1980**	20.64	18.53	23.15	21.49
	1990	21.70	20.03	19.91	18.25
Portland	1980	22.10	20.08	24.05	18.11
	1990	22.65	21.21	24.19	19.82

Table 4: Public Transportation Use by Race								
City	Year	White	Non-white	Black	American Indian, Eskimo, Aleut	Hispanic/ Spanish (Any Race)	Asian or Pacific Islander	Other Race
Houston	1980	1.7%	7.2%	8.5%	3.9%	4.9%	3.0%	5.0%
	1990	2.7%	7.8%	9.4%	6.3%	6.1%	2.3%	7.2%
Mpls - St. Paul	1980	8.5%	18.4%	21.3%	10.2%	19.5%	16.3%	22.2%
	1990	5.2%	15.8%	18.0%	27.5%	7.0%	9.9%	7.6%
Portland	1980	7.9%	16.5%	19.6%	10.0%	8.6%	17.4%	8.3%
	1990	6.8%	14.1%	21.1%	15.8%	14.3%	8.7%	15.1%

Table 5: Two Stage Least Squares Estimates of Log-Earnings
Houston 1980, 1990
(T-statistics in Parentheses)

VARIABLES	WHITES 1980	NONWHITES 1980	WHITES 1990	NONWHITES 1990
Ln(Commute Time)	0.144881 (1.599)	-0.02171 (-0.159)	0.457957 (6.271)	-0.03377 (-0.282)
Percent Full-Time	2.614438 (22.485)	3.073786 (10.603)	2.350282 (23.680)	2.980797 (15.250)
Central City Residence	-0.03639 (-1.284)	0.007899 (0.102)	0.040452 (1.632)	-0.01825 (-0.399)
Age	0.005131 (4.061)	0.002531 (0.819)	0.007202 (6.885)	0.005063 (2.349)
Education	0.045569 (8.071)	0.017759 (1.730)	0.059307 (11.873)	0.027756 (3.993)
Production/Operator Worker	0.00747 (0.209)	0.075875 (0.996)	-0.00957 (-0.330)	-0.06349 (-1.252)
Manufacturing industry	0.087513 (2.430)	-0.03679 (-0.418)	0.025169 (0.785)	-0.06406 (-0.952)
Retail Industry	-0.08104 (-1.747)	-0.13985 (-1.515)	-0.03626 (-1.018)	-0.23618 (-4.074)
Ummarried Female with Young Children	0.118891 (1.109)	-0.01024 (-0.067)	0.073419 (0.656)	-0.19378 (-1.630)
Constant	4.757193 (20.286)	5.094974 (10.221)	4.224579 (19.867)	5.418833 (14.445)
Adjusted R-Square	0.27864	0.13831	0.26087	0.16034
DF	5021,9	1530,9	9097,9	3536,9
F-Stat	216.8822	28.4473	358.1068	76.2097
Sign. F	0	0	0	0

Table 5 continued: Two Stage Least Squares Estimates of Log-Earnings
Minneapolis / St. Paul 1980, 1990
(T-statistics in Parentheses)

VARIABLES	WHITES 1980	NONWHITES 1980	WHITES 1990	NONWHITES 1990
Ln(Commute Time)	-0.11525 (-2.135)	0.21769 (0.874)	0.022142 (0.365)	0.30248 (1.588)
Percent Full-Time	2.627444 (30.064)	2.554848 (5.624)	2.479405 (30.641)	2.371761 (7.329)
Central City Residence	-0.05175 (-1.871)	0.069572 (0.391)	-0.07261 (-3.182)	0.036501 (0.369)
Age	0.007517 (6.675)	-0.01081 (-1.295)	0.008987 (10.690)	0.004 (0.846)
Education	0.041279 (6.527)	0.016821 (0.640)	0.050621 (8.967)	0.054652 (3.615)
Production/Operator Worker	0.060415 (1.805)	-0.04284 (-0.211)	-0.02093 (-0.816)	-0.05626 (-0.497)
Manufacturing Industry	-0.02919 (-0.853)	-0.29092 (-1.415)	0.01244 (0.489)	0.019839 (0.164)
Retail Industry	-0.03096 (-0.788)	-0.55731 (-2.619)	-0.09151 (-3.043)	-0.155 (-1.107)
Ummarried Female with Young Children	0.04555 (0.363)	-0.3656 (-1.469)	0.176195 (1.726)	-0.05066 (-0.157)
Constant	5.549306 (36.427)	5.743419 (5.902)	5.606857 (35.123)	5.041226 (6.351)
Adjusted R-Square	0.37986	0.32599	0.34469	0.33636
DF	4324,9	146,9	7746,9	360,9
F-Stat	295.9071	9.32974	454.2136	21.79974
Sign. F	0	0	0	0

Table 5 continued: Two Stage Least Squares Estimates of Log-Earnings
Portland 1980, 1990
(T-statistics in Parentheses)

VARIABLES	WHITES 1980	NONWHITES 1980	WHITES 1990	NONWHITES 1990
Ln(Commute Time)	-.06207 (-0.751)	0.109831 (0.472)	0.067274 (0.876)	0.069463 (0.363)
Percent Full-Time	2.698179 (18.463)	1.268034 (2.437)	2.380479 (19.432)	2.605286 (5.887)
Central City Residence	0.011084 (0.244)	-0.25932 (-1.953)	-0.04114 (-1.253)	-0.03943 (-0.297)
Age	0.003411 (1.868)	0.013828 (2.205)	0.008746 (6.368)	0.001512 (0.227)
Education	0.035848 (3.581)	0.066448 (3.499)	0.049716 (5.587)	0.028064 (1.478)
Production/Operator Worker	0.208146 (4.139)	0.004473 (0.027)	0.021277 (0.543)	-0.29755 (-1.748)
Manufacturing Industry	0.014033 (0.260)	-0.33687 (-1.953)	-0.00447 (-0.102)	0.430521 (2.255)
Retail Industry	-0.09883 (-1.675)	-0.60238 (-3.298)	-0.14286 (-3.248)	-0.20731 (-1.353)
Ummarried Female with Young Children	-0.03976 (-0.281)	-0.28345 (-0.751)	-0.04968 (-0.319)	-0.45151 (-1.020)
Constant	5.439891 (19.947)	6.319497 (6.134)	5.469773 (21.439)	5.637523 (9.066)
Adjusted R-Square	0.26987	0.29149	0.23059	0.19284
DF	2429,9	131,9	4164,9	374,9
F-Stat	101.1278	7.39981	139.9605	11.17237
Sign. F	0	0	0	0

Figure 1: Public Transport Use by Race
(Percentage)

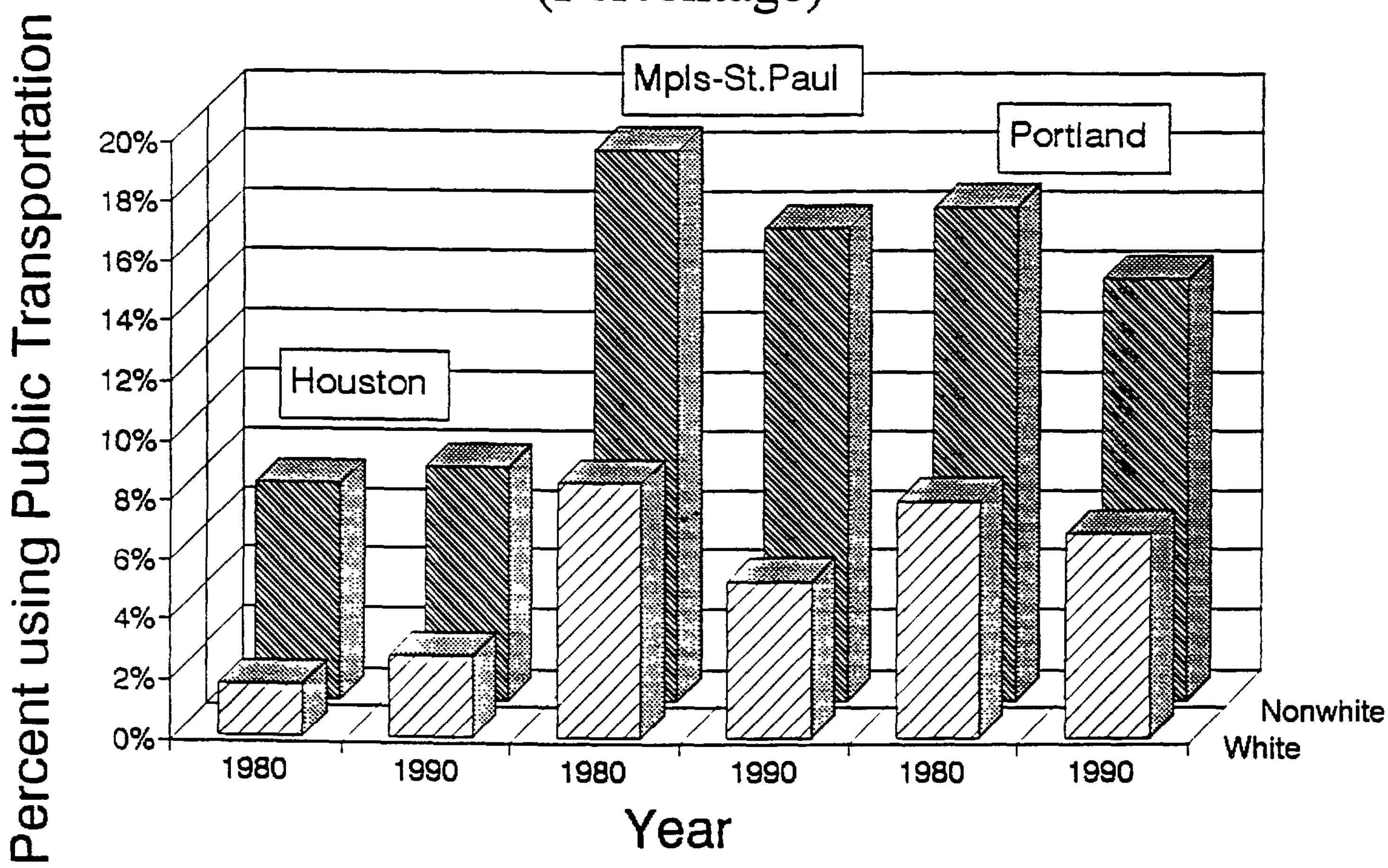


Figure 2: TRAVEL TIME BY RACE

Percentage of Persons Below Median Income

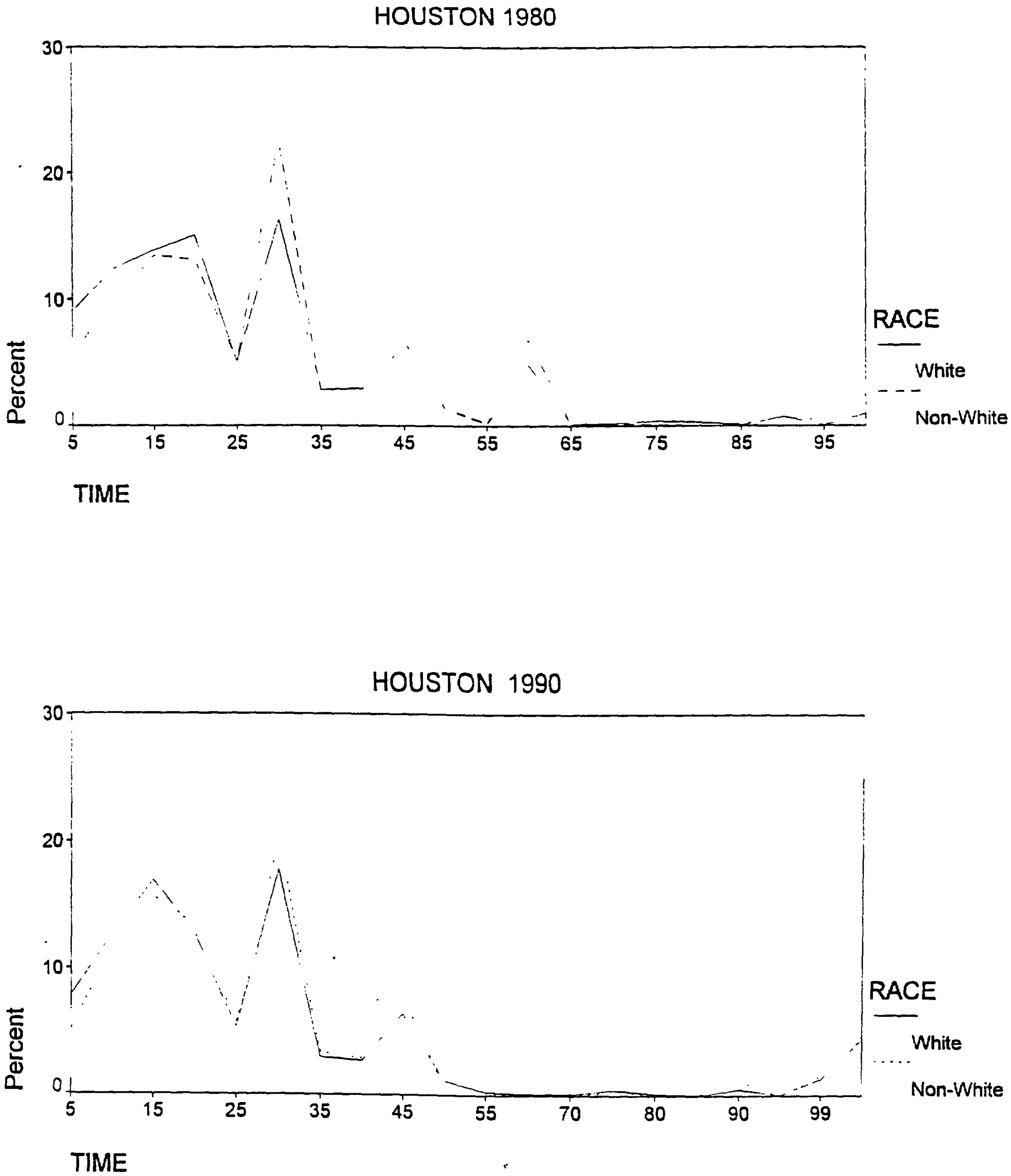
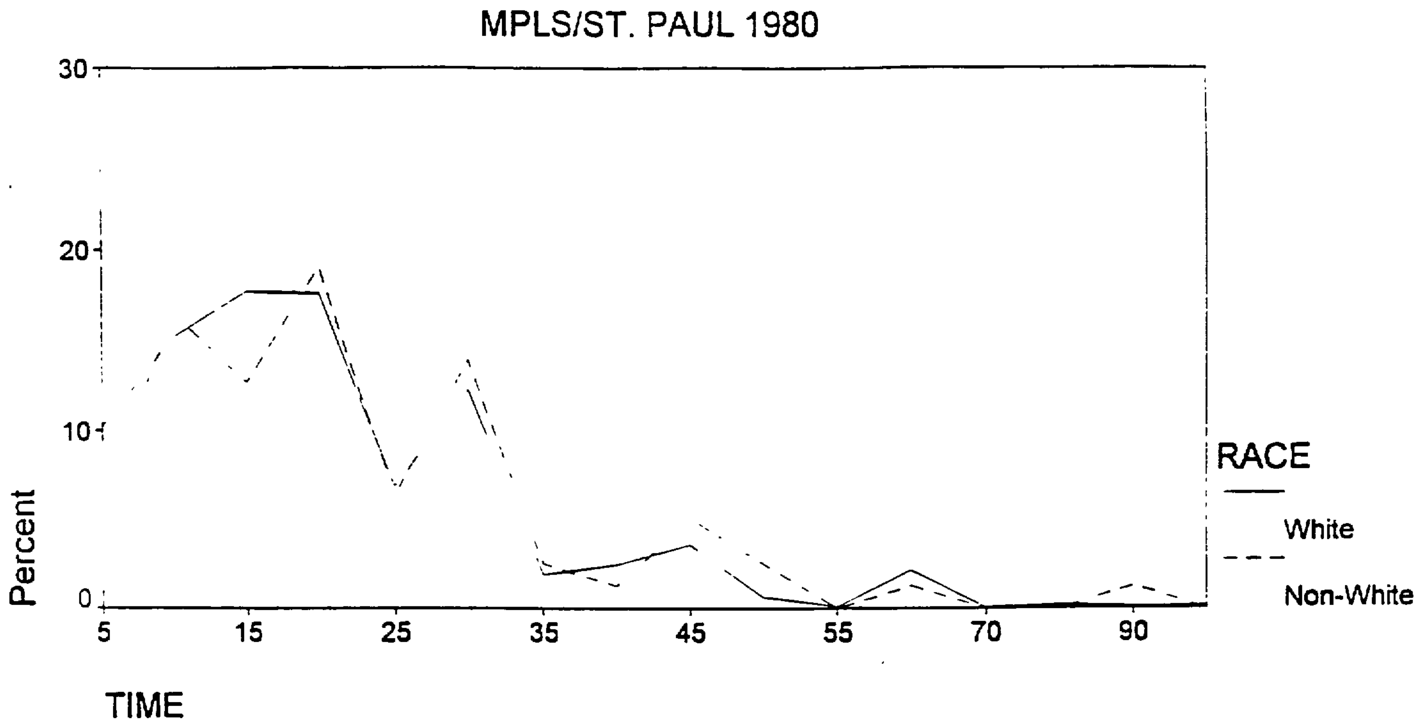


Figure 3: TRAVEL TIME BY RACE

Percentage of Persons Below Median Income



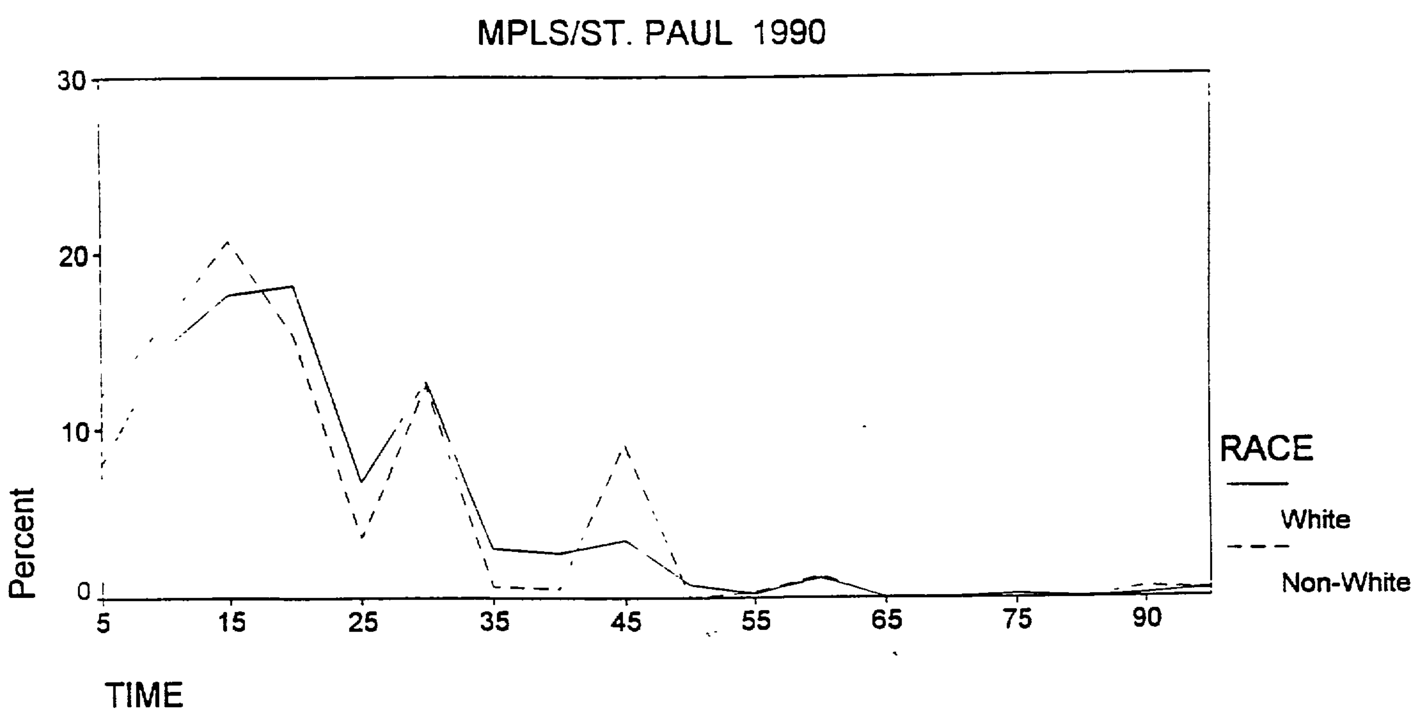
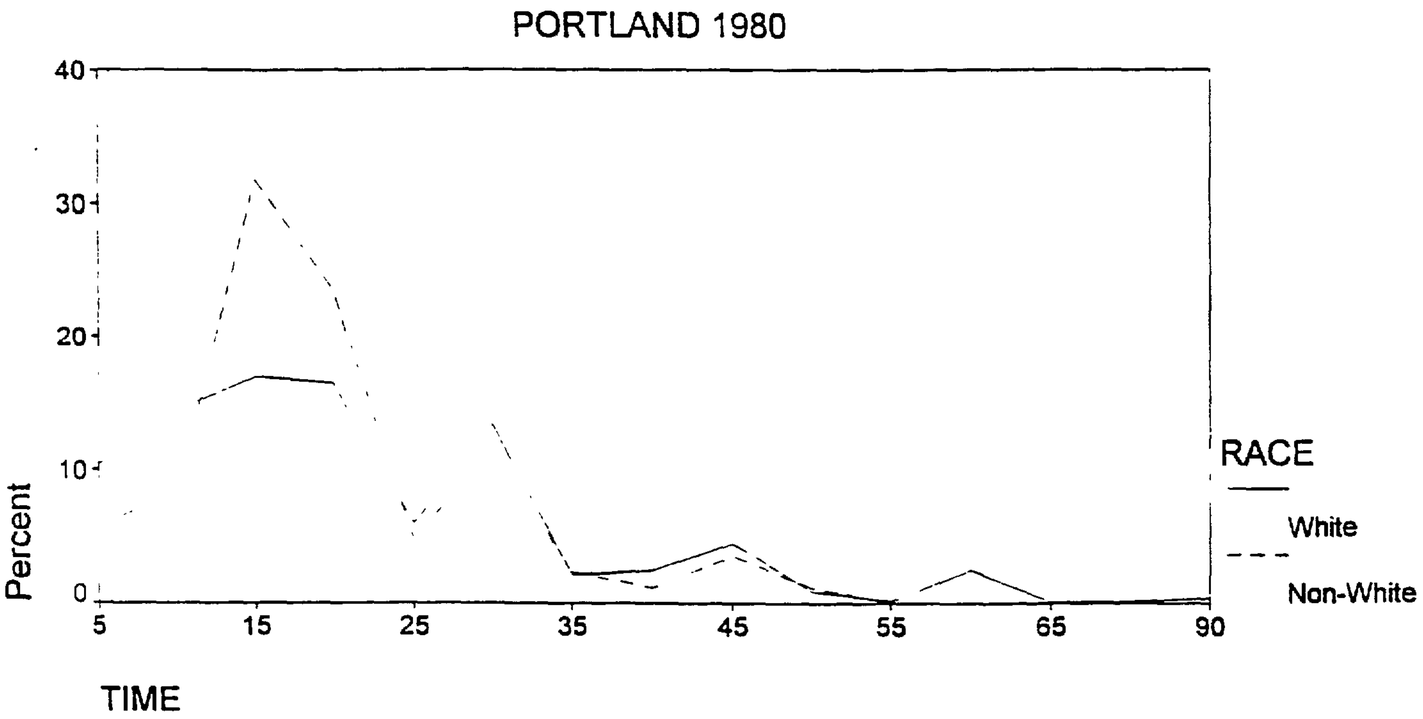


Figure 4: TRAVEL TIME BY RACE

Percentage of Persons Below Median Income



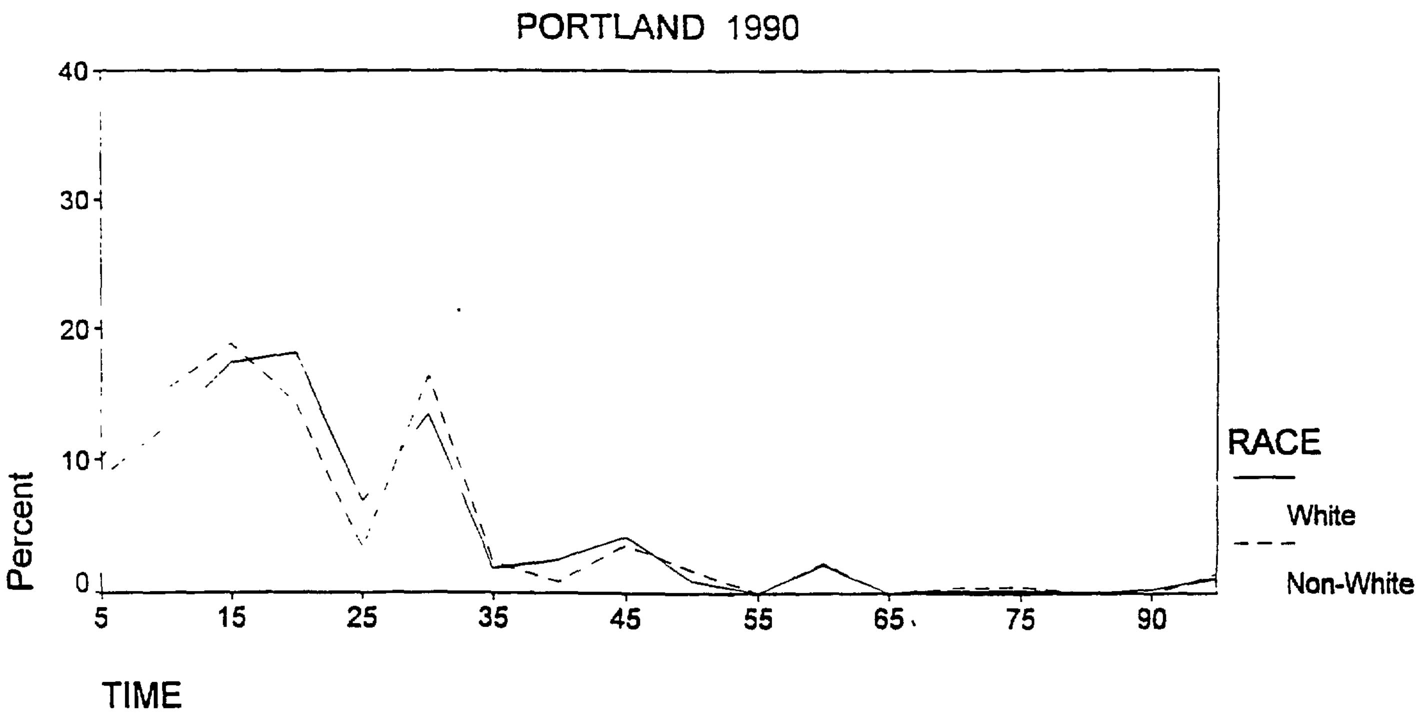


Figure 5: Elasticity of Earnings inequaiity

with Respect to Travel Time