

Travel Characteristics and Transportation Energy Consumption Patterns of Minority and Poor Households

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Results of a recent investigation of travel behavior and transportation energy use by minority and poor households are presented and interpreted in terms of the known effects of household demographic characteristics on vehicle ownership and travel demand. When income and residential location are controlled, black (and to a lesser extent, Hispanic and poor) households were found to have fewer vehicles regularly available than did comparable white or nonpoor households, and their vehicles tended to be older and larger, and therefore having significantly lower fuel economy. Blacks were also found to rely more heavily than other groups on public transportation and carpools for their work travel and, partly as a result, to have significantly longer average travel times. Because of depressed vehicle-ownership rates and less fuel-efficient vehicles, the average black, Hispanic, and poor household travels significantly fewer miles per year but consumes somewhat more fuel than does the average white or nonpoor household. The major finding in this study of significant racial differences in vehicle availability and use by low-income central city households challenges the conventional wisdom that racial variations arise solely in response to differences in income and housing location. It was concluded that because cross-sectional data sets cannot capture the dynamics of income, they cannot identify the persistently poor who tend to be concentrated in certain demographic subgroups (primarily black and female-headed households). Because capital goods and the resources needed to keep them in efficient working order are usually acquired in relatively prosperous years, households for which prosperity is rare or nonexistent may be expected to have depressed rates of vehicle ownership and use, and their vehicles may be expected to have relatively lower fuel economy than seemingly comparable but only temporarily poor households.

Selected results from a research program being conducted at Argonne National Laboratory (ANL) for the U.S. Department of Energy's Office of Minority Economic Impact are presented. In keeping with that office's mandate, the program is directed toward (a) determining the energy consumption and expenditure patterns of minority groups relative to those of other population groups, (b) assessing the impacts of existing or proposed government energy policies and programs on minorities, and (c) identifying options for modifying those policies and programs to alleviate anticipated hardships, particularly on low-income individuals.

The research program has documented patterns of residential energy demand and expenditures by minority and poor house-

holds and has developed a series of analytical tools to measure the effects of energy policies and programs on those patterns (1-3). Because transportation energy (expressed as fuel used in private vehicles) accounts for more than one-half of the energy expenses of the average U.S. household (\$1,317 from a total of \$2,380 in 1983), recent research has begun to focus on identifying the characteristics of travel and fuel consumption, as well as expenditures by minority and poor households (4). To date, three transportation-related reports have been completed or are in progress. One documents patterns of vehicle ownership, travel, and transportation fuel use, as well as expenditures by minority and poor households, and is summarized in this paper (5). The other two reports assess the impacts of potential energy conservation strategies on minority and poor population groups and the effect of past fuel shortages on those groups (6,7).

BACKGROUND

Approach

This paper is primarily expository. Travel characteristics and transportation fuel consumption patterns of minority households (as defined by race or ethnicity) are described and the patterns are compared with those of otherwise equivalent non-minority households—controlling is made for income, residence location, and, in some cases, age of householder. Significant differences between minority and nonminority households, based on standard statistical tests, are identified and interpreted.

The analytical approach consisted of a literature review and survey analysis. Selected aspects of minority travel behavior and fuel use reported in previous studies were reviewed, as were similar studies of low-income households (8-11). The review indicated that although certain aspects of the subject have been examined in earlier work, those investigations were either tangential to the main focus or were limited to a discrete subset of travel behavior (e.g., the journey to a job). No comprehensive analysis of overall travel behavior and fuel use by minority and poor households was identified in the literature.

In this paper, data on households—the basic unit of travel demand and fuel use—are displayed for five population groups based on survey respondents' self-reporting of their household income and the racial or ethnic origin of the householder. These groups are (a) blacks (including black Hispanics); (b) Hispanics (excluding blacks); (c) whites (excluding Native Ameri-

cans, Asians, or Pacific Islanders); (d) poor (all blacks, Hispanics, whites, or other ethnic groups whose household income is less than 125 percent of the federally defined poverty threshold); and (e) nonpoor (all other households).

Because surveys generally report income categorically, the survey records processed at ANL were assigned to poor or nonpoor groups based on the federal poverty definition for the year of interest, rounded to the nearest income breakpoint. Poor and nonpoor data sum to national totals. For survey data processed at ANL, the white, black, Hispanic, and other categories were also made mutually exclusive so they also would sum to national totals. (Because Hispanics may be of any race, survey results for whites, blacks, and Hispanics reproduced from other sources do not sum to national totals.)

Data Sources

Primary data sources were the 1977 Nationwide Personal Transportation Study (NPTS), the 1979-1981 Transportation Panel (TP) of the Residential Energy Consumption Survey (RECS), and the 1980 Annual Housing Survey (AHS) (12-14). Secondary sources incorporated through published reports included the 1970 and 1980 Department of Commerce censuses, the 1972 and 1980 Consumer Expenditure Surveys, the 1983 Residential Transportation Energy Consumption Survey (RTECS), and the 1969 NPTS (4,8,15-19). Published documents were used instead of the RTECS public use tape because it was unavailable at the time of the analysis. For a more complete discussion of the characteristics, strengths, and limitations of our major data sources, see (5).

Although survey analysis was clearly the most appropriate analytical method for this study, it does have inherent limitations. Most notably, because none of the data sources oversampled any racial or ethnic group, even the numerically largest category of interest—black households—represents less than 10 percent of the observations of any survey and may be subject to considerable sampling error. Although sampling error probably did not prevent identification of major differences between groups, it did constrain the analysis of more subtle, but still potentially significant, differences. For example, in the TP data set, only 40 to 80 black households were sampled each month and there was no control for multiple (and thus highly correlated) observations of the same household. Therefore a cross-classification of monthly TP data by no more than one parameter at a time (e.g., race, income, or residence location) was made, and the data was smoothed to reduce the high month-to-month variation in subgroup means.

National data bases such as those used in the analysis cannot depict the fine details of travel patterns (particularly those that reflect local conditions), and limited sampling constrains further probing for underlying factors that differentiate the travel behavior of poor and minority households. Nonetheless, national data do provide the raw material for a reasonably complete sketch of travel and fuel use. That sketch reveals several statistically significant differences, some attributable to variations in demographics, others at least partially inexplicable at this stage of analysis. Further detail would require the use

of local data bases that would increase comprehensiveness but reduce the ability to generalize to national patterns and trends.

VEHICLE AVAILABILITY

The number and types of private vehicles available to households have an important bearing on the quantity and modal distribution of household travel and, ultimately, on their fuel use. Households with no vehicles generate extremely little vehicular travel (even considering borrowing from friends or relatives), while multivehicle households make more than twice the average number of daily trips (12). The NPTS and TP data reveal significant differences in vehicle availability between white and minority households and between poor and nonpoor households.

Vehicles Per Household

Research has repeatedly shown that vehicle availability is related to household size and composition, income, and residence location. In 1980, households with incomes under \$10,000 had an average of 0.95 vehicles, compared to 2.47 vehicles in households with incomes over \$35,000. The variation widened when disaggregated by residence location from 0.6 for low-income households in central cities of standard metropolitan statistical areas (SMSAs) to 2.65 for high-income rural households (14). Vehicle availability also varied from 1.17 for elderly households (those with household heads 60 or more years old) to 1.78 for nonelderly households, and again the variation widened by location (from 0.83 for elderly households in central cities to 1.94 for nonelderly suburban households) (14).

Because disproportionate shares of minority households reside in central cities and have low incomes, as a group they may be expected to have below-average vehicle availability (16). However, this should be partly offset by the lower proportion of elderly householders in minority households (15). As shown in Table 1, however, even when income, residence location, and age of household head, or householder, are controlled, large differences in vehicle availability persist between white and minority households, as well as between poor and nonpoor households (see also Figure 1). Because (a) the poverty definition is related to family size, which is also related to vehicle availability, and (b) elderly households are omitted from these comparisons, certain categories of poor households have more vehicles, on average, than nonpoor households. Differences are highlighted by comparing vehicle-ownership distributions for each of the population groups. As shown in Figure 2, more than 36 percent of black households and 27 percent of Hispanic households were without vehicles in 1977, compared with only 12 percent of white households. White zero-vehicle households were significantly more likely to be elderly than were their black or Hispanic counterparts (64 percent versus 35 percent and 30 percent, respectively). Because the elderly are more likely to live in smaller households with fewer licensed drivers and make fewer work trips, differences in age structure between white and minority house-

TABLE 1 AVERAGE NUMBER OF VEHICLES PER NONELDERLY HOUSEHOLD, BY RESIDENCE LOCATION AND HOUSEHOLD INCOME FOR EACH POPULATION GROUP, 1980

Household Characteristic	Household					All
	White	Black	Hispanic	Poor	Nonpoor	Households
SMSA Central City ^a	1.50	0.96	1.02	0.67	1.49	1.31
<\$10,000	0.90	0.50	0.53	0.63	0.83	0.70
\$10,000-19,999	1.28	1.04	1.15	1.14	1.20	1.20
\$20,000-34,999	1.79	1.59	1.74	NA	1.73	1.73
>\$35,000	2.22	2.01	^b	NA	2.20	2.20
SMSA Suburbs	2.00	1.37	1.68	1.39	2.01	1.94
<\$10,000	1.42	0.73	1.18	1.36	1.23	1.32
\$10,000-19,999	1.64	1.32	1.47	1.75	1.59	1.59
\$20,000-34,999	2.10	1.81	2.11	NA	2.08	2.08
>\$35,000	2.53	2.25	2.66	NA	2.52	2.52
Non-SMSA	2.00	1.27	1.68	1.33	2.05	1.92
<\$10,000	1.42	0.78	1.12	1.27	1.33	1.29
\$10,000-19,999	1.83	1.60	1.75	1.93	1.79	1.80
\$20,000-34,999	2.25	2.02	2.27	NA	2.24	2.24
>\$35,000	2.74	2.08	2.54	NA	2.71	2.71
All Households	1.91	1.13	1.43	1.15	1.91	1.78

^aSMSA = standard metropolitan statistical area.

^bNot reported because of a large variance in observed data.

Source: Ref. 14. Standard errors are not shown because they cannot be computed from the data tape, and published documentation is not yet available.

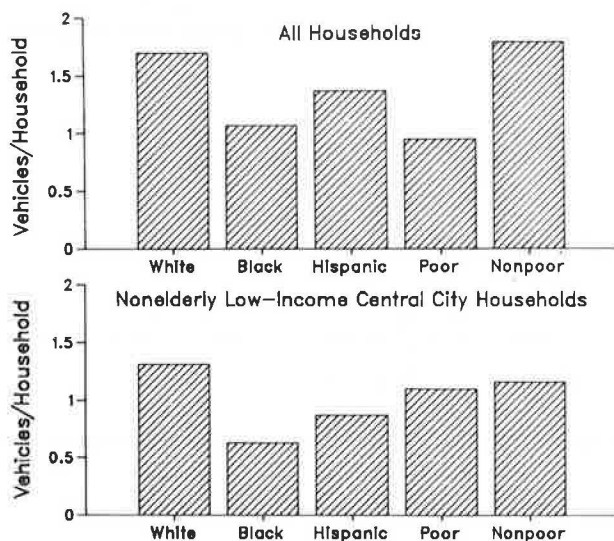


FIGURE 1 Vehicle availability of all households and nonelderly low-income households by population group, 1980.

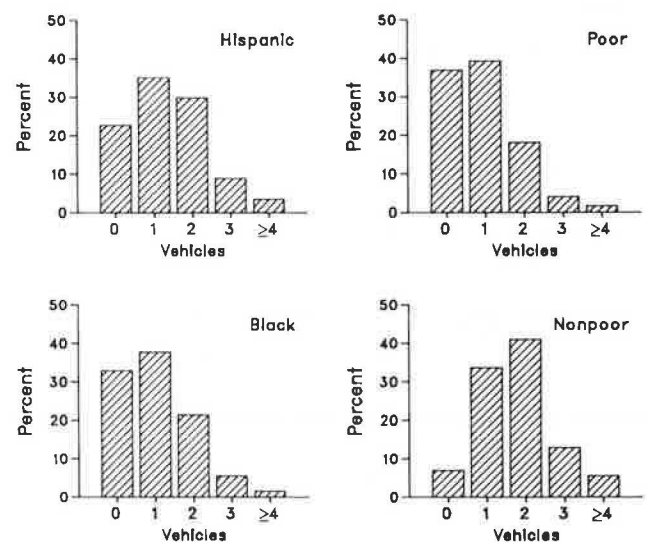


FIGURE 2 Distribution of households by number of vehicles available for each population group, 1977.

TABLE 2 VEHICLE-MILES PER HOUSEHOLD FOR SINGLE-VEHICLE NONELDERLY LOWER-INCOME HOUSEHOLDS BY POPULATION GROUP, 1977

Household and Location	All			Households
	White	Black	Hispanic	
All Households with				
Incomes <\$7,500	10720	7392	10096	10223
	(837)	(780)	(1582)	(657)
All Low-Income Households				
SMSA Central City	11716	5587	8179	9869
	(2219)	(675)	(1641)	(1463)
SMSA Suburbs	11411	11253	11138	11339
	(1185)	(2546)	(1973)	(1002)
Non-SMSA	9533	7700	^a	9776
	(963)	(1491)		(863)

Note: Numbers in parentheses are standard errors.

^aNot reported because of a large variance in observed data.

Source: Ref. 12.

holds may obscure other important differences in travel patterns and fuel use. Therefore, certain of the comparisons in this paper (Tables 1 and 2, and Figures 3 and 4) are limited to nonelderly households.

Although the distinctive demographic characteristics of minority and poor households explain some of the variation in their vehicle availabilities, one must look further to explain remaining differences. Clearly, most of minorities' reduced vehicle availability is in lower-income households regardless of residence location. Some may be attributable to local variations in the spatial distributions of low-income white and minority households and to the relative accessibilities of their neighborhoods to public transportation. Similarly, relative densities may vary between predominantly white and minority neighborhoods, and this may influence the supply of off-street parking and other factors that make private-vehicle ownership more or less desirable. However, none of these factors explains why the differences tend to lessen and ultimately disappear as income rises.

How do low-income minority households differ from low-income white households? Initially, it was hypothesized that the compositions of white, black, and Hispanic households in the lowest income category (under \$7,500 in 1977 dollars) may differ. If minority households tend to have fewer adults (or more specifically, fewer licensed drivers), vehicle ownership could be expected to be lower than in white households. As shown in Figure 3, however, systematic differences in the average number of vehicles per licensed driver, when income and residence location are controlled, suggest that household composition is probably not a key factor.

It was next speculated that perhaps white, black, and Hispanic households in the lowest income category have systematically different average incomes. If large enough, these differences could make it impossible to control fully for income. Using 1980 data (14), mean incomes were calculated for each of four income categories (<\$10,000, \$10,000–19,999, \$20,000–34,999, and ≥\$35,000) and compared across population groups. Except in the highest income group, all differences were approximately what might be expected in survey data

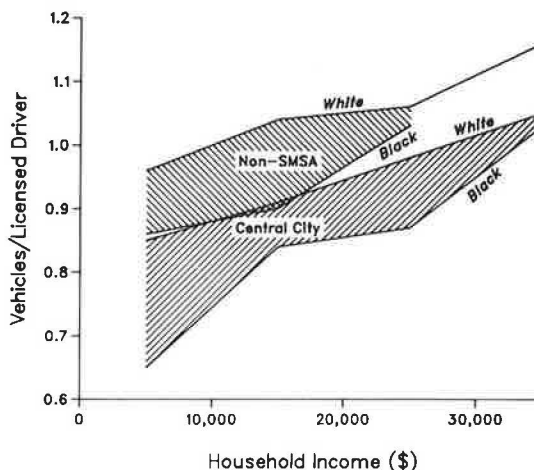


FIGURE 3 Vehicles per licensed driver in nonelderly black and white households by income category and residence location, 1977.

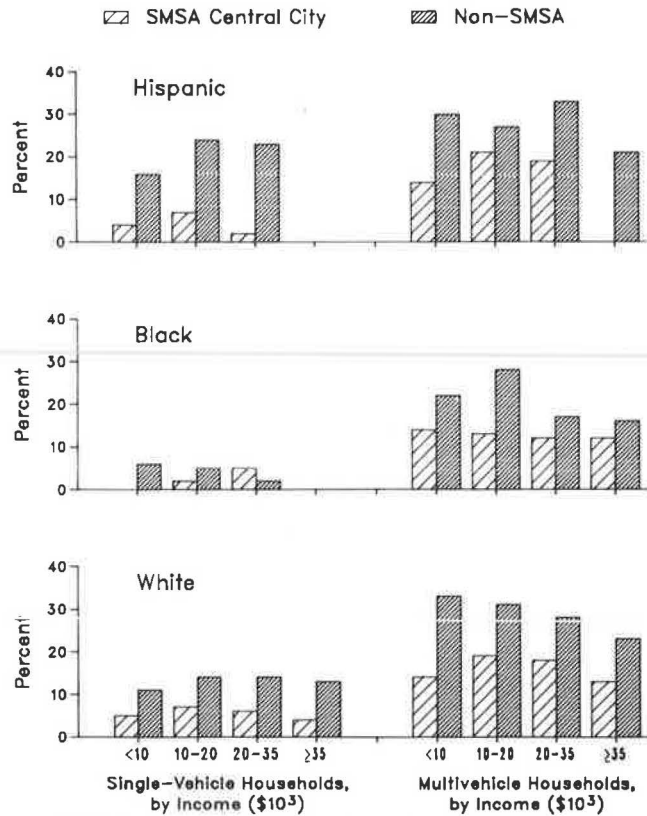


FIGURE 4 Percentage of trucks and vans in vehicles available to white, black, and Hispanic single- and multivehicle nonelderly households, 1980.

(generally ± 1 percent). Hence, this too was rejected as highly unlikely.

A related but far more plausible hypothesis was then framed: if income fluctuations temporarily place many generally middle-class households in the low-income category, perhaps that category is much more heterogeneous than is apparent in cross-sectional data sets. Compared with the "persistently poor," who have extended periods of low annual income, these "temporarily poor" households can be expected to have more accumulated wealth (including vehicles) and greater access to capital and to retain a lifestyle more in keeping with their long-run average incomes. The growing body of research using a decade of longitudinal data from the University of Michigan's ongoing Panel Study of Income Dynamics (PSID) strongly supports this hypothesis (20). Only 7 percent of the PSID sample had total money incomes below the federally defined poverty threshold in 1978, but nearly 25 percent fell below that threshold in at least one of the prior 10 years (20). These temporarily poor are not very different from the U.S. population as a whole. By contrast, the persistently poor (those below the poverty threshold in at least 8 of the prior 10 years) are heavily concentrated in two overlapping groups—black and female-headed households (20–22). Perhaps because of this concentration, the mean duration of poverty periods recorded in PSID varies from 3.4 years for whites to 6.5 years for blacks (21). Cross-sectional data sets, by definition, obscure these kinds of important distinctions in long-run income (particularly at the lower end of the range), making it extremely difficult, if not impossible, to control for this key parameter in data anal-

ysis. Thus, the two groups, low-income blacks and low-income whites, may not be strictly comparable.

Vehicle Characteristics

The vehicles available to minority and poor households tend to be somewhat older and substantially less fuel-efficient than those available to white households. As shown in Table 3, vehicles in minority households were, on average, 0.6 to 0.7 years older than those in white households in 1977 (12). Much of the difference appears related to income (vehicles in poor households were more than 2 years older than those in nonpoor households). However, when both income and age of household are controlled, the difference widened in the lowest income group. Again, this may be attributable to differences in long-run average incomes of white and minority households.

Figure 5 shows that in 1983 white households were more likely to have four- or six-cylinder models than were black or Hispanic households. Their automotive fuel economy was 2.2 mi/gal (mpg) greater than in black households and 1.5 mpg greater than in Hispanic households. Truck fuel economy was about the same (4). Because whites and Hispanics tend to have substantially more trucks (with lower fuel economy) than do blacks (Figure 4), the average fuel economy of all vehicles available to minorities is somewhat closer to that of whites (differing by 1.5 to 1.6 mpg).

Evidence suggests that the gap in fuel economy between vehicles in black and white households has grown since 1979. Figure 6 displays average fuel economy for vehicles in white, black, and poor households over the 28 months from June 1979 through September 1981 (13). While a slight upward trend is seen for vehicles in white households (averaging 4.7 percent when calculated over the three summer driving seasons), no such improvement is apparent for vehicles in black or poor households. In fact, their average fuel economies dropped by a comparable margin.

Vehicle Use

Household use of vehicles (in annual miles per vehicle) tends to vary with household income, residence location, and age of householder, and with the number of vehicles available to the household. The lower use of vehicles in black, Hispanic, and poor households (Table 4) appears to reflect the distinctive distributions of each of the subpopulations with respect to these variables. However, when both income and residence location are controlled, the data reveal significant differences in miles per vehicle between blacks and whites, particularly for low-income households in central cities. Because of depressed vehicle-ownership rates, one would expect minority households to have somewhat higher vehicle use, on average, than that of white households with comparable incomes. This is true for Hispanics, but not for blacks. Among low-income households in central cities, black-owned vehicles are driven less than two-thirds as far as white-owned vehicles [4,097 versus 6,819 mi per year (12)] as shown in Figure 7. Presumably, lower use in black households reflects a series of factors, including (a) local conditions that reduce the attractiveness of

TABLE 3 AVERAGE AGE OF HOUSEHOLD VEHICLES BY HOUSEHOLD CHARACTERISTICS FOR EACH POPULATION GROUP, 1977

Householder Age and Household Income	White	Black	Hispanic	Poor	Nonpoor	All Households
Household Income						
<\$7,500	8.1	8.9	8.8	8.7	7.7	8.2
(.08)	(.21)	(.36)	(.10)	(.10)	(.07)	
<60 yr	7.8	8.7	8.9	8.3	7.6	8.0
(.10)	(.28)	(.39)	(.11)	(.14)	(.09)	
≥60 yr	8.4	9.1	^a	9.4	7.8	8.5
(.12)	(.30)		(.17)	(.15)	(.11)	
\$7,500-14,999	6.8	6.8	7.4	7.6	6.7	6.8
(.05)	(.17)	(.27)	(.17)	(.05)	(.05)	
<60 yr	6.9	6.6	7.3	7.5	6.7	6.8
(.06)	(.18)	(.27)	(.18)	(.06)	(.06)	
≥60 yr	6.7	8.1	^a	^a	6.8	6.9
(.12)	(.49)			(.12)	(.12)	
\$15,000-24,999	6.2	5.9	6.1	NA	6.1	6.1
(.05)	(.20)	(.28)		(.05)	(.05)	
<60 yr	6.2	5.7	6.1		6.1	6.1
(.05)	(.20)	(.29)		(.05)	(.05)	
≥60 yr	6.2	^a	^a		6.3	6.3
(.15)				(.15)	(.15)	
≥\$25,000	5.4	5.5	^a	NA	5.4	5.4
(.06)	(.30)			(.06)	(.06)	
<60 yr	5.4	5.5	^a		5.4	5.4
(.07)	(.31)			(.06)	(.06)	
≥60 yr	5.5	^a	^a		5.5	5.5
(.18)				(.18)	(.18)	
All Households	6.5	7.1	7.2	8.5	6.3	6.6
(.03)	(.11)	(.17)	(.08)	(.03)	(.03)	
<60 yr	6.4	6.7	7.1	8.1	6.2	6.4
(.03)	(.12)	(.17)	(.10)	(.03)	(.03)	
≥60 yr	7.2	8.5	8.3	9.4	6.8	7.3
(.07)	(.24)	(.65)	(.16)	(.07)	(.07)	

Note: Numbers in parentheses are standard errors.
^aNot reported because of a large variance in observed data.
Source: Ref. 12.

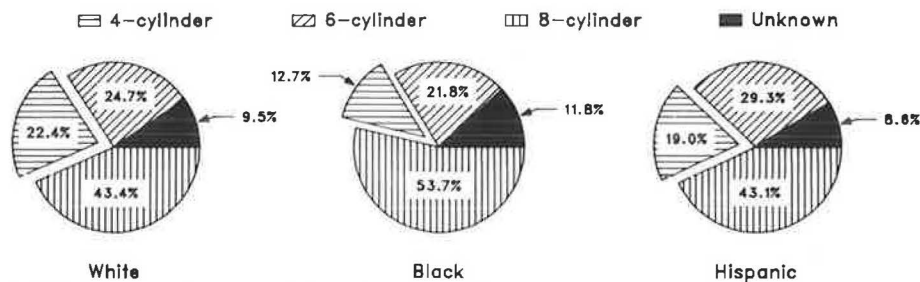


FIGURE 5 Engine size distribution of vehicles in white, black, and Hispanic households, 1983.

driving (e.g., scarce parking, traffic congestion); (b) their older, less reliable vehicles; and (c) a greater prevalence of informal travel arrangements such as loaning of vehicles, the mileage from which is not reflected in the data.

HOUSEHOLD TRAVEL

Total Travel

Black, Hispanic, and poor households travel substantially less than the average U.S. household. Although much of the difference is due to the large numbers of minority and poor households without vehicles, a statistically significant difference remains when the data are summarized for only those households with vehicles (Figure 8). Because miles of travel vary significantly with household income (Figure 9), much of this difference reflects the lower incomes of minority versus white households. However, when income, residence location, householder age, and vehicle ownership are controlled, a clear disparity is evident between black and white low-income single-vehicle households in central cities (Table 2). Again, these differences may be due to (a) older, less reliable vehicles, and limited ability to pay for expensive repairs; (b) local conditions (e.g., parking cost and availability, traffic congestion, transit accessibility), all of which raise the cost or otherwise reduce the attractiveness of private-vehicle use; and (c) greater vehicle loaning among particular population subgroups.

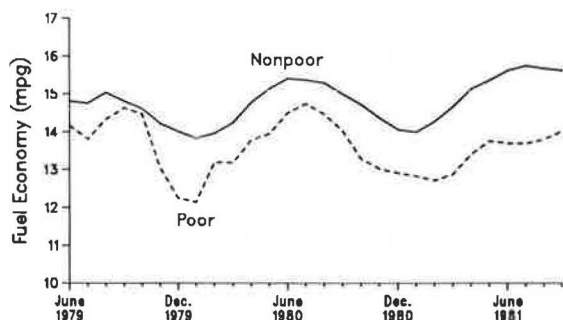


FIGURE 6 Fuel economy of vehicles in white, black, and poor households, June 1979-September 1981.

Travel to Work

The attributes of work trips with the greatest relevance to overall minority travel patterns and energy use are their length and spatial characteristics, mode split, and average private-vehicle occupancy. Even when residence location is controlled, minority work trips tend to exhibit distinctive patterns for many of these attributes. Because of space limitations, the following discussion focuses on average trip lengths and mode split. Spatial characteristics and vehicle occupancies are discussed elsewhere (5).

Trip length is characterized in terms of either distance or duration such as travel time. Both provide a useful description of travel patterns, but respondent-reported distance is often subject to considerable error; therefore, duration tends to be a more reliable measure. Duration varies somewhat with income and residence location, but other factors—including mode split, distribution of commuter flows, and size of metropolitan area—are at least as important. As shown in Table 5, suburban work trips tend to be somewhat longer than average and non-SMSA work trips tend to be somewhat shorter. All else being equal, work trips also tend to lengthen with increasing income. However, the difference in mean travel times between whites and blacks, and to a lesser extent between whites and Hispanics, is considerably greater than the variation by either

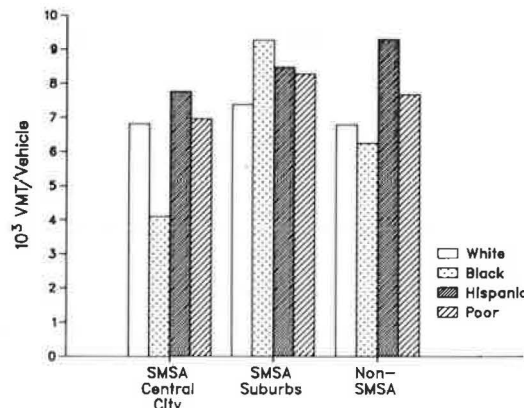


FIGURE 7 Annual vehicle-miles of travel (VMT) for low-income households by residence location and population group, 1977.

income or location. Blacks have significantly longer work trips than whites. When both income and residence location are controlled (see Figure 10), the difference persists, particularly for workers living in metropolitan areas. Among central city residents, only at the highest income level is the mean trip length of black workers approximately equal to that of white workers (14).

About one-half of the variation is explained by differences in mode split. In 1980, the overwhelming majority of white

workers (>72 percent) drove alone and only 5 percent used public transportation for their work trips. Most minority workers also drove alone (55 percent of blacks and 60 percent of Hispanics), but as a group they were far more dependent on public transportation (nearly 19 percent of black and 13 percent of Hispanic workers). An additional 25 percent of minority workers used carpools or vanpools, compared with 21 percent of white workers (14).

When the data are controlled for residence location and the

TABLE 4 ANNUAL MILES PER VEHICLE BY HOUSEHOLD CHARACTERISTICS FOR EACH POPULATION GROUP, 1977

Household						All
Characteristic	White	Black	Hispanic	Poor	Nonpoor	Households
Household Income						
<\$7,500	6953	5700	8423	7157	6680	6923
(229)	(374)	(793)	(260)	(300)	(206)	
\$7,500-14,999	8824	8965	9792	9207	8865	8894
(267)	(711)	(1004)	(792)	(272)	(256)	
\$15,000-24,999	9972	9063	8962	NA	9882	9882
(326)	(964)	(1309)		(313)	(302)	
≥\$25,000	10086	10879	^a	NA	10055	10055
(406)	(1771)			(416)	(393)	
Residence Location						
SMSA Central City	8807	7235	8430	6964	8819	8609
(269)	(421)	(697)	(361)	(265)	(239)	
SMSA Suburbs	9808	12084	8494	8282	9983	9858
(285)	(1024)	(1025)	(532)	(291)	(275)	
Non-SMSA	8718	7150	10173	7675	8880	8684
(257)	(659)	(1829)	(378)	(279)	(246)	
Householder Age						
<60 yr	9774	8907	9006	8790	9798	9696
(202)	(429)	(537)	(345)	(202)	(197)	
≥60 yr	6390	5310	6816	4681	6696	6327
(206)	(581)	(1351)	(354)	(224)	(199)	
All Households	9142	8234	8808	7613	9276	9082
(201)	(367)	(556)	(260)	(206)	(193)	

Note: Numbers in parentheses are standard errors.

^aNot reported because of too few observations for statistical stability.

Source: Ref. 12.

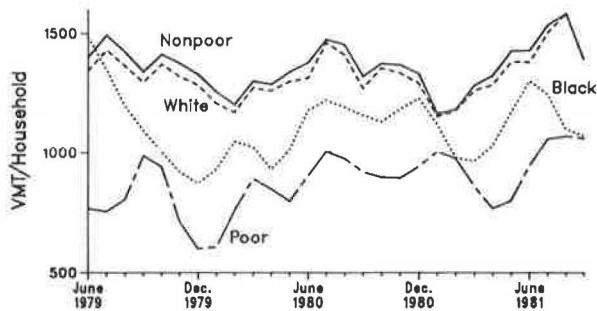


FIGURE 8 Monthly vehicle-miles of travel (VMT) per household, by population group, June 1979-September 1981.

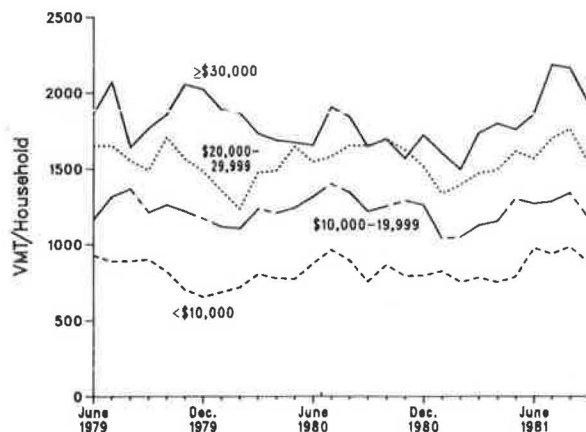


FIGURE 9 Monthly vehicle-miles of travel (VMT) per household by household income category, June 1979-September 1981.

comparison is limited to only those households with vehicles regularly available, the magnitude of mode-split differences among the three groups is reduced. As shown in Table 6, however, minority workers are still significantly more likely to rely on ridesharing and public transportation. Among black workers, ridesharing appears to substitute for public transportation as SMSA size declines. The remaining intergroup differences presumably reflect a series of local factors—including differences in accessibility and level of service of transit and highway systems, spatial characteristics of commuter flows, and vehicle-ownership distributions—that are obscured in national data sets.

FUEL CONSUMPTION AND EXPENDITURES

Household Fuel Consumption

The average vehicle-owning household consumed approximately 88 gal per month of transportation fuel (almost all gasoline) in 1980. Black households consumed slightly less (approximately 84 gal), and poor households consumed considerably less (approximately 68 gal) (13). Figure 11 illustrates these rates, as well as the trend over the 28 months from June

1979 through September 1981. Although white and nonpoor households show a slight downward trend (probably understated because the summer 1979 fuel shortage depressed the initial rates in the time series), consumption rates for black and poor households appear to have risen.

By 1983, black households with vehicles were consuming an annual average of 1,180 gal (98.3 gal per month), compared with 1,211 gal (100.9 gal per month) in Hispanic households and 1,103 gal (91.9 gal per month) in white households. This suggests a slight increase (<5 percent) in the rate for the average white household and a more substantial rise (17 percent) for the average black household. This increase even exceeds the percentage drop in real gasoline price, providing further evidence that vehicle fuel economy in black households improved relatively little over this period, even discounting growth in the average number of vehicles per black household.

Household Fuel Expenditures

In 1983, the average white household spent \$1,307 on motor fuel; average black and Hispanic households spent somewhat more—\$1,398 and \$1,418, respectively—but the differences are not statistically significant(4). Over time, however, evidence suggests a tendency toward elevated expenditure levels in black households. As shown in Table 7, the relative gasoline expenditures of these two groups changed little from 1972 to 1983. For each of these survey years, black households consistently spent 3 percent to 7 percent more on gasoline than did white households.

Between 1972 and 1980, real fuel expenditures rose 44 percent for the average white household, compared with 51 percent for the average black household. Although both dropped by comparable margins between 1980 and 1983, the net increase over the entire 12-year period was 18 percent for white households and 23 percent for black households. Much of this variation is attributable to the income distributions of white and black households. Between 1972 and 1980, fuel expenditures of households in the highest income bracket increased by only 6 percent; between 1980 and 1983 they declined more than 15 percent. On net, these wealthier households reduced their real fuel expenditures by roughly 10 percent between 1972 and 1983. This suggests that the fuel price increases of the 1970s had a greater economic impact on black and low-income households than on white and high-income households.

SUMMARY AND CONCLUSIONS

The first comprehensive investigation of overall travel behavior and transportation fuel use by minority and poor households is documented in this paper. Unlike more narrowly defined research on the subject, this analysis brings together the most relevant information from a variety of national-level data sources. The resulting data base reveals distinctive patterns of household vehicle availability and utilization, travel, and fuel use, and observed differences between population groups can be related to differences in their demographic characteristics and in the attributes of household vehicles owned by or regularly available to them.

TABLE 5 MEAN WORK TRIP LENGTH BY RESIDENCE LOCATION AND HOUSEHOLD INCOME FOR WORKERS IN EACH POPULATION GROUP, 1980

Worker Characteristic ^a	All					Workers
	White	Black	Hispanic	Poor ^b	Nonpoor ^b	
All Workers (mean minutes)	21.1	26.2	23.2	20.5	21.9	21.7
Residence Location ^c						
SMSA Central City	20.8	28.2	24.7	22.4	22.4	22.4
SMSA Suburbs	22.6	25.0	22.7	20.5	23.0	22.8
Non-SMSA	18.3	21.3	18.2	20.4	21.9	21.7
Household Income						
<\$10,000	15	22	19	17	17	17
\$10,000-19,999	17	23	19	19	18	18
\$20,000-29,999	18	25	20	NA	19	19
>\$30,000	18	21	19	NA	19	19
All Workers (mean miles) ^d	8.6	9.0	8.5	7.2	8.8	8.6

^aExcludes persons who work at home. Standard errors of 1980 Census estimates (Ref. 16) are extremely small. Hence, even very small differences are statistically significant. Standard errors are not yet available for Ref. 14.

^b"Poor" travel time estimates are based on ratio of "poor" to all workers from Ref. 14; "Nonpoor" estimates are computed from "poor" and Ref. 16 values.

^c1980 SMSA definitions and boundaries.

^dNot shown by income and location because estimates are less reliable than time estimates and because little variation is apparent in totals.

Sources: Refs. 14 and 16.

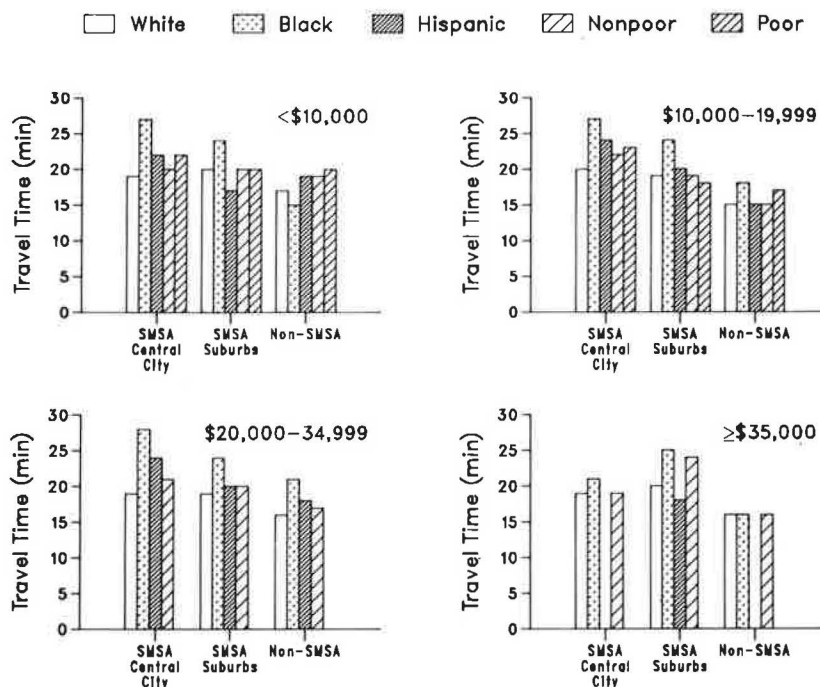


FIGURE 10 Mean work trip travel times, by residence location and household income for each population group, 1980.

TABLE 6 WORK TRIP MODE SHARES BY SMSA SIZE AND VEHICLE AVAILABILITY FOR WHITE, BLACK, AND HISPANIC WORKERS, 1980

SMSA and Mode ^a	Households with Vehicles			All Households		
	White	Black	Hispanic	White	Black	Hispanic
Large SMSA - Central City						
Drive alone	68.1	61.0	56.4	61.7	48.5	43.7
Shared ride	16.3	18.6	26.1	15.6	16.6	23.2
Public transportation	13.3	19.3	16.8	20.2	34.0	32.2
Other	2.3	b	b	2.5	b	b
Large SMSA - Suburbs						
Drive alone	74.0	70.4	65.2	73.2	65.3	62.5
Shared ride	18.5	18.7	29.2	18.5	19.8	29.9
Public transportation	5.5	10.1	4.0	6.2	14.3	6.1
Other	2.0	b	b	2.1	b	b
Medium SMSA						
Drive alone	77.3	70.8	68.7	76.1	63.8	65.3
Shared ride	18.4	22.6	26.9	18.6	23.5	27.2
Public transportation	2.2	6.2	b	3.0	12.1	b
Other	2.1	b	b	2.3	b	b
Small SMSA - Central City						
Drive alone	78.6	62.1	74.0	77.4	56.4	70.8
Shared ride	17.1	26.9	25.4	17.2	28.3	26.7
Public transportation	1.6	b	b	2.2	12.4	b
Other	2.8	b	b			
3.2	b	b				
Small SMSA - Suburbs						
Drive alone	79.1	74.1	82.0	78.8	67.7	80.4
Shared ride	18.5	23.3	14.3	18.5	28.6	16.1
Public transportation	b	b	b	b	b	b
Other	2.0	b	b	1.7	b	b
Non-SMSA						
Drive alone	75.0	61.0	69.4	74.3	55.1	66.8
Shared ride	22.2	36.6	27.8	22.6	40.7	30.1
Public transportation	0.6	b	b	0.7	2.5	b
Other	2.2	b	b	2.3	b	b

Note: In percentages.

^aExcluding work-at-home and walk trips.

^bNot reported because of a large variance in observed data.

Source: Ref. 16.

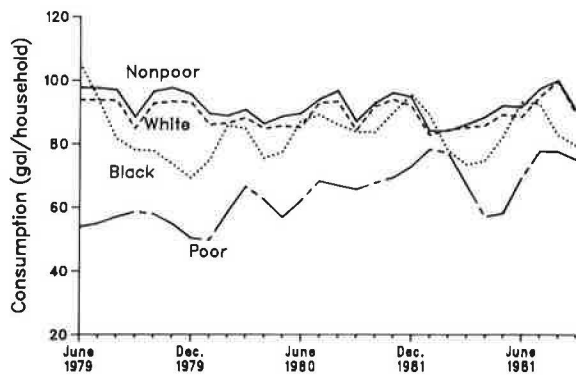


FIGURE 11 Monthly transportation fuel consumption by black, white, poor, and nonpoor households, June 1979-September 1981.

In general, this research confirms the broad relationships between household demographic characteristics (primarily income and residence location) and vehicle use built up over many years of transportation research. Such findings as the greater reliance of blacks on public transportation for their work travel (and, partly as a result, their significantly longer

TABLE 7 ESTIMATED ANNUAL GASOLINE EXPENDITURES, BY HOUSEHOLDS WITH VEHICLES, 1972, 1980, AND 1983

Household Characteristic	Survey and Year of Data		
	CES 1972	CES 1980-81	RTECS 1983
Population Group			
White	927	1,350	1,071
Black	949	1,438	1,146
Hispanic	NA	NA	1,162
Residence Location			
SMSA Central City	859	NA	957
SMSA Suburbs	987	NA	1,143
Non-SMSA	947	NA	1,126
Household Income^a			
<\$5,000	581	606	698
\$5,000-9,999	749	1,028	836
\$10,000-14,999	960	1,090	905
\$15,000-19,999	1,106	1,366	1,047
>\$20,000	1,292	1,730	1,228
All Households	930	1,381	1,080

Note: Estimates in 1980 dollars per household except where noted.

^aRTECS income ranges are in 1983 dollars. Thus, a small portion of RTECS households may be classified in the next-higher bracket and their expenditures may slightly reduce the average shown for that bracket.

Sources: Ref. 4, 17, 18.

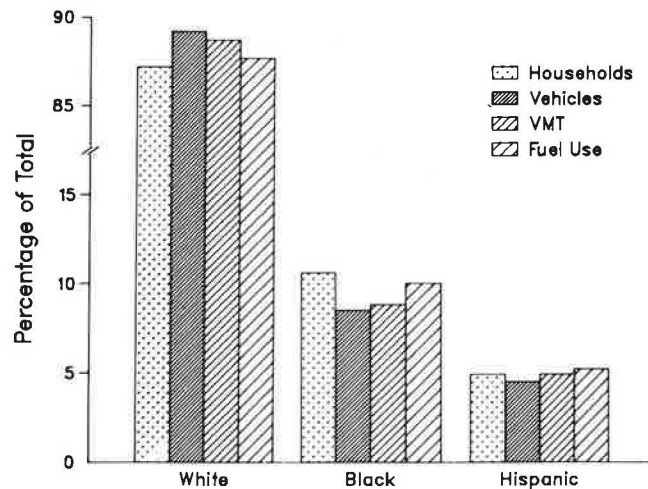


FIGURE 12 Distributions of households, vehicles, vehicle-miles of travel (VMT), and fuel consumption by population group, 1983.

average travel times) also concur with previous research (8). Other findings, however, most notably that significant racial differences exist in vehicle availability and use by low-income households, challenge the conventional wisdom that racial variations arise solely in response to differences in income and housing location. The data suggest that there may be important differences between black and white low-income households, particularly in the yearly fluctuation or dynamics of income, but quite likely in more subtle factors as well. Cross-sectional data sets are not designed to capture these fluctuations, and the data sets are not widely used in local and national-level transportation planning.

Among vehicle-owning households, the average black household travels fewer miles yet consumes more fuel than the average white household. For both blacks and Hispanics, the deficit in vehicle availability is evident in Figure 12. Because Hispanics may be of any race, the shares sum to more than 100 percent. Blacks represented 10.6 percent of all households in 1983, but had only 8.5 percent of all private vehicles. These vehicle-owning households accounted for 8.8 percent of all vehicle miles, but used 10 percent of the transportation fuel consumed by U.S. households. Similarly, Hispanics represented 4.9 percent of all households, held 4.5 percent of all private vehicles, and traveled 4.9 percent of all vehicle-miles, yet consumed 5.2 percent of the transportation fuel used by U.S. households.

The vehicles available to minority and poor households tend to be older and larger, and hence have lower average fuel economy, than the vehicles available to white and nonpoor households. Moreover, evidence suggests that the fuel economy gap has grown over the past several years as affluent households purchased newer and more fuel-efficient models. Quite likely, the fuel economy gains achieved since the late 1970s are only now beginning to reach minority and poor population groups.

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