

ADAPTING TO HIGHER GASOLINE PRICES:
THE U.S. EXPERIENCE

by

K.H. Schaeffer*
3 Acacia Street
Cambridge, MA 02138, USA

One result of the Arab Oil Embargo in 1973-74 was a sharp increase in the price of gasoline. With OPEC's power in the ascendancy, this price increase was followed by additional major price increases in 1979 and 1980. These price increases taken together increased the nominal cost of gasoline in the United States by about 300 percent, and in inflation adjusted constant dollars by about 75 percent. This paper describes how the average American household, which in 1972 allocated 3.5 percent of all personal consumption expenditures for gasoline, dealt with these price increases.

THE ADAPTIVE MECHANISMS.

There are many ways in which a household can adapt to higher gasoline prices. If their resources are sufficient, household members can pay up and save less, or they can give up some "luxury" in other expenditure areas to pay for these extra transportation costs. Household members can drive less by staying home, combining trips, or sharing rides. They can switch to public transportation, where this is available, or shift from chauffeuring the youngsters to bicycling by the youngsters, or find a job closer to home, or shop closer to home, or give up an extra vehicle in a multi-vehicle household, or buy a more fuel efficient vehicle. Another solution might be for an employed household member to take a second job, or for an additional household member to obtain paid employment, even if this means purchasing another vehicle and driving more. Especially over the long run, there is truly a legion of ways in which a household can adapt to a rise in gasoline prices.

Many of the adaptive mechanisms may be quite unconscious. It is a well-known fact that vehicle ownership and vehicle utilization are related to the family life cycle.(1). Particularly in the long run, the adaption to higher gasoline prices may occur as the family moves from one life cycle stage to another. However, these adaptations occur together with a host of other changes: marriage, the birth of a child, the choice of a new home, a new job, the last child leaving home, and retirement. As a result, a family may not be conscious that its life cycle decisions today are made differently than yesterday when energy prices were lower.

Until the Arab Oil Embargo and resultant energy crisis, motor vehicle transportation enjoyed some seventy years of nearly uninterrupted growth. In this multigenerational growth period innumerable problems were solved by owning more vehicles, by having more drivers, and by driving greater distances. Thus, just an end to this growth trend would be a major adaption to higher gasoline prices.

Finally, gasoline is an intermediate good. Probably no one buys gasoline for the sake of consuming gasoline; people buy it to fuel their vehicles.

*The author, an adjunct associate professor of planning at Columbia University, retired from the U.S. Transportation Systems Center where he was responsible for motor vehicle demand studies. The opinions expressed are the author's and not necessarily those of the U.S. Department of Transportation.

Except when one drives for the pure joy of driving, driving is also an intermediate good. We drive to go somewhere, where we expect to do something. This is the final good. Giving up one final good, as for instance a dinner at a restaurant to which one must drive, can save sufficient resources to "pay" for the increased cost of driving on many other trips. Therefore one does well to look for small adaptive transportation changes -- not large ones.

THE MEASUREMENT PROBLEMS.

How can one measure these small changes? The social scientist's favored tool, the survey, is too rough a measure to detect minute changes in the use and ownership of motor vehicles. Sampling errors and shifts in the universe (non-comparable data) can easily overwhelm the detection of these small but significant changes. A reasonable alternative is macroeconomic time series data. While the absolute accuracy of most of these data can be questioned, they tend to be of good relative accuracy. However, when dealing with macroeconomic measures of the United States economy, we are immediately confronted by two factors which can swamp any change due to adaptive behavior. These two factors are the steady growth of the United States society and the substantial inflation of the past decade. Special procedures are needed to neutralize these factors.

Motor vehicles are used primarily by household units. Within the household, members will cnauffeur each other. In multi-vehicle households, members will trade vehicles among one another if a special trip requires a special vehicle or if a vehicle is inoperative. From this it follows that to maintain the same level of motor vehicle mobility, the ratio of motor vehicles per household must be maintained. One objection to this conclusion arises from the fact that the average household size declined during the past decade, from 3.06 persons per household in 1972 to 2.73 persons per household in 1981.(2). Thus, one could assume that fewer motor vehicles per household are needed to maintain equal mobility. On the other hand, most of the decline is due to fewer children per household. The number of persons per household eighteen years of age and older has decreased only from 2.03 in 1972 to 1.96 in 1981.(2). In addition, the ratio of persons in the labor force to the number of households remained essentially constant during the past decade.(3). Since it is the adults, and particularly the working adults, within the household who require motor vehicles for household mobility, it appears appropriate to use the ratios of motor vehicle ownership, travel, and expenditures per household as measures of the motor vehicle mobility of the American public. Fewer children, or persons without driver's licenses, do not increase a household's motor vehicle mobility, though they may impact the type of vehicle people own.

Throughout this report, where appropriate, data are normalized to the household level. This unfortunately highlights a current anomaly in United States statistics. The official United States Government estimate of the number of households is based on decennial census data (1970 and 1980) and on major household surveys conducted every year in March. With these methods, the Bureau of the Census arrived at one estimate for the number of American households in 1980 that is based on the 1970 decennial census and the subsequent annual March surveys, and on another and more accurate estimate that is based on the decennial 1980 census. The latter estimate is higher by roughly 1.5 million households with about 4 million persons. In this paper, I used the estimates based on 1970 decennial census data and the subsequent annual March survey data to show the changes from 1979 and prior years to 1980, and the 1980 decennial census estimates to show the trends from 1980 to subsequent years. In early 1982, the Bureau of the Census

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issued revised estimates for the years 1971 through 1979 which distribute the discrepancies over the entire decade. Since some data series which implicitly utilize the decennial census survey data have not yet been revised according to the new demographic estimates, I considered it prudent to use the unrevised estimates and the two 1980 values.

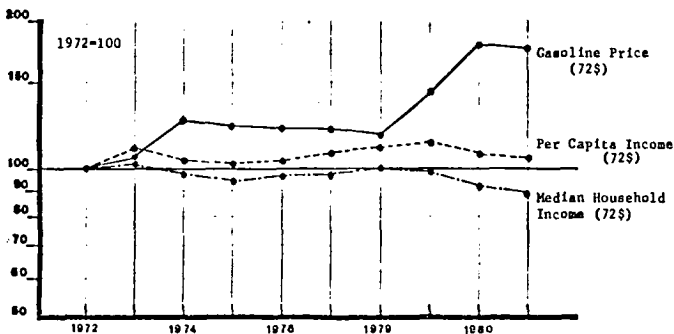
During the past decade, there was continual inflation in the American economy, reaching at times levels of over 12 percent annually. To discount these inflationary pressures, constant dollars were used in the analysis. The constant dollars are 1972 dollars. The overall ("All Items") Consumer Price Index of the United States Department of Labor was used as the deflation factor to estimate constant 1972 dollars from current dollars.(3).

The analysis usually refers to motor vehicles rather than passenger cars. Whenever this occurs, "motor vehicle" includes passenger cars, station wagons, pick-up trucks and vans, or in other words, every four-wheeled motor powered road running vehicle that has a gross vehicle weight of less than 4.5 metric tons. In the United States, nearly one-fourth of all households own one or more trucks and about one in fifty owns a truck and no car.(4). Thus, trucks are far too available for motor vehicle transportation to be neglected in the analysis. To the contrary, motorcycles and mopeds are sufficiently rare in both ownership and use that they can be omitted from the analysis. According to the Federal Highway Administration, in 1980 motorcycles accounted for just one percent of all motor vehicle travel in the United States.(5).

THE GASOLINE PRICE INCREASES.

In the United States, the price of a gallon (3.8 litres) of gasoline increased from about \$0.35 in 1972 to about \$1.35 in 1981.(6). Much of this four-fold price increase was caused by the general inflation. In constant dollars, gasoline prices increased between 1972 and 1981 by 75 percent. (Figure 1). This real increase occurred as a 22 percent price jump in 1974, and again as 22 percent price jumps in both 1979 and 1980. In the intervening years, the price of gasoline in constant dollars decreased, although even in those years current dollar prices increased.

Figure 1: Gasoline Prices and Income



Sources: (6), (7), and (9)

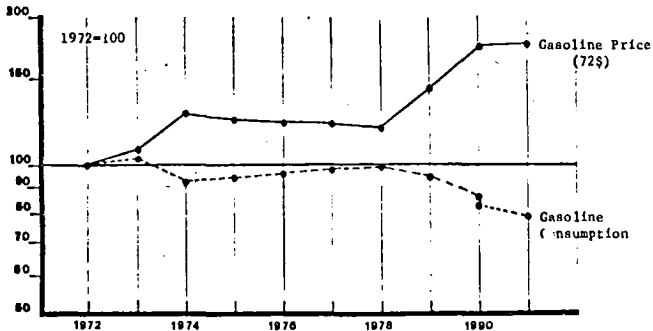
These real increases in the price of gasoline occurred against the backdrop of a stagnated economy. Between 1972 and 1981, median household income dropped by 10.5 percent in constant dollars.(7).(Figure 1). Mean household income dropped less -- by 7.5 percent in constant dollars. Mainly due to the declining fertility rate, which since 1973 has been below replacement level (8), real per capita income rose by 5.6 percent. However, much of this rise occurred in 1972-73 when real per capita income rose by 4.6 percent. Since 1979, real per capita income has been declining.(9).

Against this economic backdrop, it becomes important to distinguish between general belt tightening which will last as long as the economy is in the doldrums, the so-called "pent up demand," and adaptations that signify new trends in motor vehicle ownership and use.

THE IMPACT THROUGH 1981.

Gasoline consumption declined somewhat as a result of the 1974 real price increases.(Figure 2). This decline was relatively inelastic (-0.41) and short-lived. Between 1974 and 1978, gasoline consumption increased at the same annual rate (1.03 percent) at which real gasoline prices declined. The 1979 and 1980 data, with elasticities of -0.27 and -0.36 respectively, again demonstrate the inelasticity of gasoline consumption in the face of rising real prices. But by 1981 the price/consumption relationship changed with a vengeance. Though the real gasoline price increased only marginally, about 1 percent, consumption dropped by 6.3 percent. The measure of elasticity for this relationship is a very elastic -10.46!

Figure 2: Gasoline Price and Consumption per Household



Sources: (2), (6), and (9)

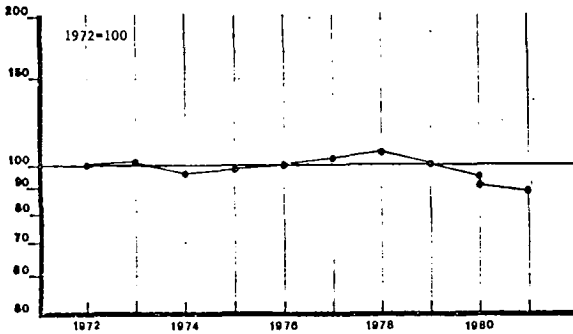
If less gasoline is consumed, people either drive less or increase the fuel efficiency of their driving. Figure 3 illustrates the changes in vehicular travel per household. The trend of this line corresponds in direction to the gasoline consumption trend, but is far less pronounced in magnitude. In the critical year 1980-81, driving was reduced only by 2.3 percent. This accounts for about one-third of the decline in fuel consumption. An additional three percentage points of the decline can be explained by the increased fuel economy of the new vehicles compared to

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those that were being scrapped. In 1981, roughly 7 percent of the registered motor vehicle fleet was less than one year old, and these vehicles were roughly 45 percent more fuel efficient than the vehicles which were scrapped.(10). There are several explanations for the remaining one percentage point reduction in gasoline consumption. It could be due to more fuel efficient vehicle maintenance and driving, or due to measurement errors in the estimates for vehicular travel (11), or due to some combination of these factors.

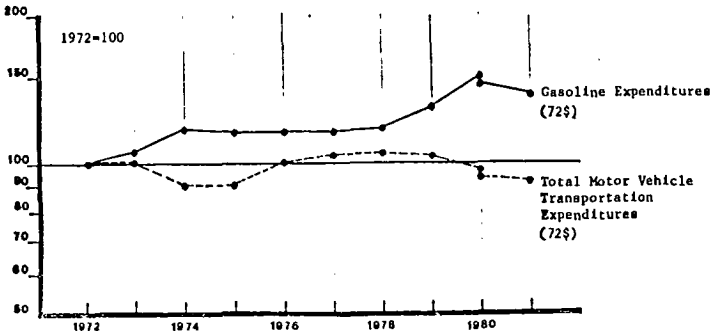
Figure 3: Vehicle Travel per Household



Sources: (2), (5)

Even these reductions in gasoline consumption left the average household with 47 to 50 percent higher real gasoline expenditures in 1980 than in 1972. (Figure 4). Furthermore, even with the decline in fuel consumption in 1981, the average household's real gasoline expenditures were still 40 percent above their 1972 level.

Figure 4: Expenditures for Gasoline and Total Motor Vehicle Transportation Per Household



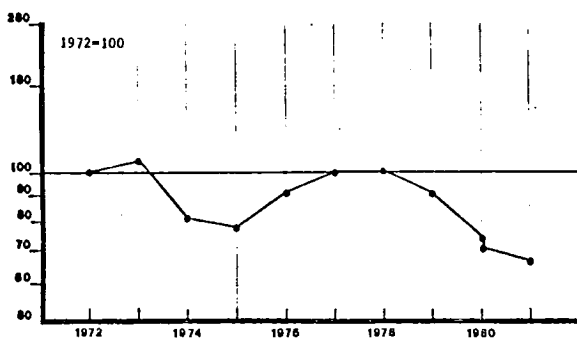
Sources: (2), (6), and (9)

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Where did the money for these expenditures come from? Whatever may be the answer on the disaggregate level, on the aggregate level reductions in other motor vehicle transportation associated expenditures paid for the increased gasoline expenditures. In the years of the sharpest gasoline price increases (1974, 1979 and 1980), total motor vehicle transportation expenditures in constant dollars declined. As gasoline prices increased, the sale of new motor vehicles declined.(Figure 5).

Figure 5: New Motor Vehicle Sales per Household



Sources: (2), (10)

This, however, is the extent to which the expenditure patterns that followed the two gasoline price increases resemble each other. After the sharp expenditure and motor vehicle sales decline of 1974 and the minor decline in 1975, both motor vehicle sales and expenditures expanded in the next three years. This expansion was apparently related to the accelerated annual growth in employment which also occurred in these years. Though the gasoline price increase of 1974 temporarily led to a decline in driving and in new motor vehicle sales, it did not divert the average American household from its long-term trend toward increased motor vehicle ownership. (Figure 6). Through 1979, the registered motor vehicle fleet expanded at a greater rate than the number of households.

After the second price increase (1979-80), motor vehicle sales and expenditures continued their decline even after the price of gasoline had stabilized. Furthermore, motor vehicle ownership per household began to decline. The motor vehicle sales decline of 1981-82 was quite unexpected to the economic forecasting services and the automobile industry which had expected the "normal" cyclical sales recovery.(12).

The continued decline in motor vehicle expenditures and sales apparently has its origin in an attitudinal change that dates back to the first energy crisis. At that time, people began to decide to hold on to their cars longer. The result was sharply reduced scrappage rates.(Figure 7).

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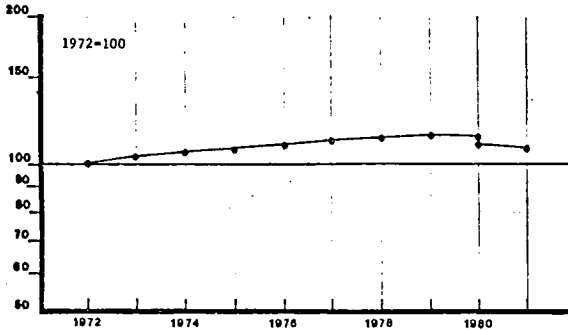
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1982 INDEX VALUES (PRELIMINARY)

	'82 Index (P)	% Change from '81
Median HH Income (72\$)	NYA	
Per Capita Inc. (72\$)	104.8	-0.8
Gasoline Price(72\$)	156.8	-10.6
Gas. Consump. per HH	79.6	+0.7
Gas. Exp. per HH (72\$)	124.8	-10.1
MV Exp.(72\$) per HH	87.6	-4.1
MV Exp. Share	93.6	-3.5
Vehicle Travel per HH	91.4	0
New MV Sales per HH	64.1	-3.0
Unit Price of New Car (72\$)	107.9	+4.4
MV Ownership per HH	107.8	-0.4
Scrappage 6-11 yrs	NYA	
Scrappage 11-15 yrs	NYA	

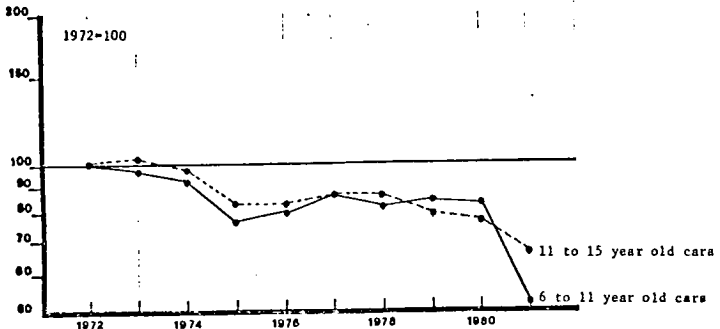
NYA = not yet available

Figure 6: Motor Vehicle Ownership per Household



Source: (2), (10)

Figure 7: Scrappage Rate of Passenger Cars



Source: (13)

For cars six to eleven years old, the scrappage rate in 1981 was roughly half of what it had been in 1972. For the even older cars (twelve years old and older), it was down by 35 percent.(13). Because of these low scrappage rates, motor vehicle sales could decline in six of the last nine years, at rates ranging from 9 to 34 percent, without substantial erosion in ownership rates and none in the registered vehicle fleet.(10).

It is a well-documented fact that in the aggregate older motor vehicles are driven less than newer ones.(14). Obviously, one can attribute much of the decline in driving in 1980-81 to the fact that people owned older vehicles. But are people content with older vehicles because they need to drive less, or do they drive less because they cannot afford newer vehicles?

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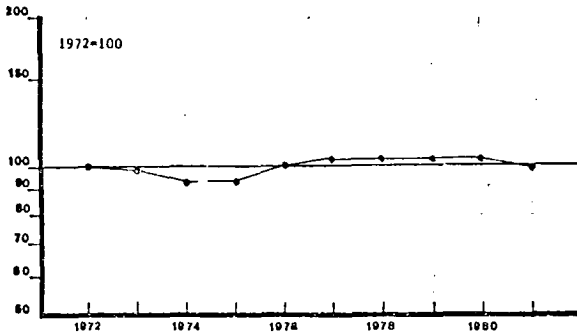
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Much evidence suggests the former. With five of six households owning a motor vehicle, the ownership of a vehicle is hardly a status symbol. Likewise, it is not a status symbol to drive more rather than less, to commute twenty and more miles rather than five or fewer, to shop at a distant mall rather than an equivalent local mall. U.S. Government surveys from 1972-73 (15) and 1977 (14) show that there is a decline in motor vehicle usage at the upper income levels. In the American society of the 1980s, there are better ways to spend one's time than behind the wheel. The proverbial Sunday drive of the 1920-1950 era is as dead as the hoola hoop!

A functional vehicle and the ability to drive are necessities, but only in very limited and shrinking circles must the vehicle be new or expensive. The vast majority of people appear to be satisfied if the vehicle gives reliable, simple, and comfortable private transportation. This, naturally, makes good workmanship, rust proofing, automatic transmission, power steering, power brakes, air conditioning, good suspension, bucket seats, and FM radio still highly desirable features.

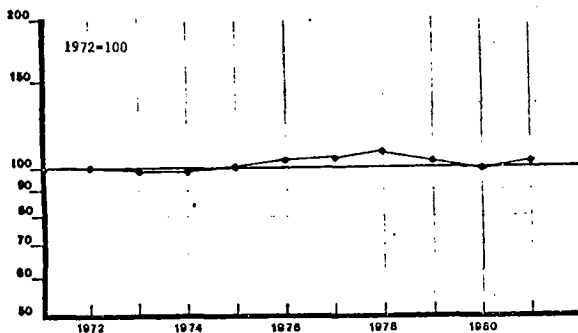
That necessity is the prevalent attitude toward motor vehicle transportation is also apparent from overall consumer spending patterns. Since 1972, there has been a general decline in the share of personal consumption expenditures that is devoted to motor vehicle travel. (Figure 8). Again the only exceptions were 1976 and 1977 when, as already noted, there was an unusual expansion in employment. Particularly significant is the 1981 decline of 4 percent, which occurred in the face of real (but minor) increases in the price of gasoline and new passenger cars. (Figure 9).

Figure 8: Motor Vehicle Transportation Expenditures as Share of Total Expenditures



Source: (9)

Figure 9: Average Unit Prices of New Passenger Cars in Constant Dollars



Source: (9)

THE OUTLOOK.

As of this writing only fragmentary data are available for 1982, but these data strongly suggest that the 1980-81 trends are continuing. There has been a further decline in new motor vehicle sales. Current sales are running nearly 10 percent below last year's depressed sales level. The share of personal consumption expenditures devoted to motor vehicle transportation has declined from 1981. Gasoline consumption is slightly down, and vehicle miles traveled on a per household basis is roughly constant. These data indicate that the general public in 1982 is continuing to disinvest in the luxury aspects of motor vehicle transportation. Though vehicle manufacturers and dealers are ever ready to point out that the sales fraction of larger and luxury cars is increasing, this means little since the overall sales of these vehicles are at best holding their own.(16).

What is the long-term outlook for motor vehicle sales if real gasoline prices increase, decline or stay steady? I, for one, do not believe that gasoline prices will greatly impact the motor vehicle market during the next five to ten years. This assumes that there will not be a steep (50 percent plus) increase in the real price of gasoline. The decline in motor vehicle sales continued even as gasoline prices declined. The decline, even if it is arrested, lasted longer than the downward sales trends of the Great Depression and World War II. However, those declines were steeper and had substantial impacts on the size of the registered fleet. Finally, even if the decline is over, this does not imply that the steep cyclical upturn of past recessions will reoccur.

The United States registered motor vehicle fleet of the 1970s and 1980s has proven to be far more durable than anyone assumed. In 1980, I overestimated the sales outlook for 1982 by 20 percent.(17). At that time, this was by far the lowest 1982 estimate I knew of. The ancient vehicles that ply the roads in the developing countries might make one believe that the downward sales decline can continue for many years without a major decline in the

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ratio of motor vehicles to households. However, from the fact that this ratio declined in 1981 (Figure 6), and undoubtedly is declining in 1982, one would assume that at least a minor pent up demand may be developing. But it will take an upturn in the economy before this demand can materialize. With the utilitarian behavior toward motor vehicle ownership and travel that developed during the past decade, future vehicle sales are more likely to lag than to lead an economic recovery.

The American public has adapted to higher gasoline prices by driving older cars. The rise in gasoline prices thus contributed to a more functional attitude toward motor vehicles. This functional attitude in turn has led to a decline in motor vehicle travel. In the United States we appear to be, at the household level, in a downward trend with respect to both driving and motor vehicle ownership. The trend has set in. An upturn in the economy is not likely to fully negate this trend and give us the prevailing attitudes of the 1950s and 1960s. New times bring new opportunities and not a rerun of yesterday's news.

ACKNOWLEDGEMENT.

I wish to thank Anna Wang for her assistance in assembling the data, Frank Schaeffer for preparing the figures, Nancy Westenberg for the typing of the several versions of the text and David Westenberg for his critical review of the paper.

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APPENDIX
THE INDEX VALUES

	Median HH Income (72\$)	Per Capita Income (72\$)	Gasoline Price (72\$)	Gasoline Consumption per HH	Gasoline Ex- penditures per HH (72\$)	HV Expen- ditures (72\$)	Share of HV Expen- ditures
1972	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1973	102.1	104.6	103.4	100.3	103.7	100.2	98.9
1974	97.9	102.7	126.0	92.5	116.5	90.0	92.3
1975	94.6	101.0	123.4	93.8	115.7	89.2	92.4
1976	96.1	104.3	121.5	95.7	116.3	99.1	100.2
1977	96.6	107.4	120.6	97.7	117.8	105.5	104.0
1978	99.6	110.8	116.9	99.9	116.8	106.1	103.1
1979	98.4	111.5	142.7	93.8	133.9	104.6	102.7
1980	92.7	105.8	174.0	86.1	149.9	98.2	101.1
1980R	--	--	--	84.3	146.7	96.2	--
1981	89.5	105.6	175.7	79.0	138.8	91.3	97.3

	Vehicle Travel per HH	New Motor Vehicle Sale per HH	Unit Price of New Car (72\$)	HV Owner- ship per HH	Scrapage 6-11 years	Scrapage 11-15 years
1972	100.0	100.0	100.0	100.0	100.0	100.0
1973	107.7	105.8	98.4	102.3	98.7	100.9
1974	95.9	81.4	97.1	104.1	93.4	96.5
1975	97.9	77.7	99.1	106.0	76.2	83.7
1976	99.9	90.8	102.6	107.2	80.8	83.0
1977	101.9	99.9	103.7	108.6	87.2	86.8
1978	104.9	100.8	105.5	110.4	81.1	86.0
1979	99.7	91.2	102.0	111.5	84.6	76.8
1980	95.0	72.4	99.4	111.0	83.7	76.7
1980R	93.6	70.9	--	108.7	--	--
1981	91.4	66.1	103.3	108.2	51.4	65.9