

**AN ANALYSIS OF THE IMPACT OF
SPORT UTILITY VEHICLES IN THE UNITED STATES**

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ABSTRACT

During the 1990s, sport utility vehicles (SUVs) became the fastest growing segment of the auto industry, especially those in the medium-size category. In 1999, SUV sales reached almost 19% of the total light vehicle market and the mix of SUVs on the road, as measured by registration data, was about 8.7%. This immense popularity has been called by some a passing fad – vehicle purchases based on the SUV “image.” But the continued yearly increases in SUV sales seem to indicate a more permanent trend. Additional explanations for SUV popularity include the general economic wellbeing in the United States, a perception of safety, and “utility.”

Generally larger and heavier than the typical automobile, SUVs require more fuel per mile to operate and produce greater amounts of pollutants. They are also driven further annually than are automobiles of the same vintage, a fact that exacerbates the fuel-use and emission problems.

Although buyers believe that SUVs are safer than automobiles which they are in some cases, SUVs are more prone to roll-overs than are automobiles. In addition, SUVs, with their higher bumpers and greater weight, may be a threat to other vehicles on the highway, especially in side-impact crashes.

With sales projected to grow to over 3 million units per year beginning in 2001, SUVs show no sign of decreasing in popularity. These vehicles are used primarily for general mobility, rather than off-road activities. An emphasis on better fuel economy and improved emissions control could address environmental and oil dependency concerns. In fact, recently, two vehicle manufacturers announced intentions of improving the fuel economy of their SUVs in the next few years. Also, tests simulating crashes involving automobiles and SUVs could provide valuable data for identifying potential safety design issues. It is clear that automobiles and SUVs will be sharing the highways for years to come.

AN ANALYSIS OF THE IMPACT OF SPORT UTILITY VEHICLES IN THE UNITED STATES

It may be labeled sport utility vehicle, SUV, sport-ute, suburban assault vehicle, or a friend of OPEC (Organization for Petroleum Exporting Countries). It has been the subject of comics, the object of high-finance marketing ploys, and the theme of *Dateline*. Whatever the label or the occasion, this vehicle is in great demand. The popularity of sport utility vehicles (SUVs) has increased dramatically since the late 1970s, and SUVs are currently the fastest growing segment of the motor vehicle industry. Hoping to gain market share due to the popularity of the expanding SUV market, more and more manufacturers are adding SUVs to their vehicle lineup. One purpose of this study is to analyze the world of the SUV to determine why this vehicle has seen such a rapid increase in popularity. Another purpose is to examine the impact of SUVs on energy consumption, emissions,¹ and highway safety.

1. INTRODUCTION

To analyze the impact of the rising popularity of SUVs, we look at the historical market share of SUVs and compare it with the market share of other types of personal vehicles. This examination compares sales trends of the SUV with sales of other types of vehicles. We also look at general economic trends in the United States as well as increases in personal mobility across all age groups. We look at other concerns, such as energy use and emissions, and at public perceptions of environmental problems. We examine buyer and driver profiles and review public opinion polls for anecdotal evidence. Finally, we examine safety issues.

2. HISTORICAL GROWTH OF THE SUV MARKET

Passenger vehicles are usually described by size (e.g., “compact”) or price (e.g., “luxury”). The sport utility vehicle is available with engine sizes ranging from 1.6 to 6.5

¹ Including both criteria emissions and greenhouse gases (GHG).

liters, curb weights from about 2,700 pounds to over 5,500 pounds, and price ranges² from under \$14,000 to over \$65,000. It is, therefore, difficult to analyze SUVs without subdividing them into categories. Table 1 lists SUVs in three categories based on engine size. Other categories (e.g., price, weight, or wheelbase) would result in slightly different groupings. Throughout this report, unless otherwise noted, SUVs are described as being “small” (less than 3 liters), “medium” (3-5 liters), or “large” (greater than 5 liters) based on engine size. Some models have engine sizes in two categories; these models are placed in the category of the more popular engine size.

Figure 1 shows the sales of SUVs, in millions of vehicles per year, beginning in 1980. As shown in this figure, total sales climbed consistently beginning in the early 1980s and rose rapidly in the 1990s. The SUV market accounted for 7% of vehicle sales in 1990 and 19% in 1999.³ Figure 2 shows the distribution of total SUV sales among small, medium, and large SUVs since 1980. (A particular make-model could switch size categories from year to year if the engine size changed.) As shown in Figure 2, most SUV sales are for medium-sized vehicles, with engine displacements between 3.0 and 5.0 liters. Through the years, the large SUVs have maintained a small but consistent share of the SUV market. The medium and small SUVs have seen more fluctuation in their share of the SUV market; the majority of sales of small SUVs was between 1983 and 1987. In 1988, Consumers Union published reports indicating that small SUVs were less safe than other vehicles. Sales of small SUVs declined about that time, and sales of medium SUVs rose sharply.

When SUVs appeared to be increasing in popularity, many manufacturers added SUV models to their product listings. Figure 3 shows the growth in the number of SUV models since 1980. As a matter of clarification, many of these “different” models are actually the same basic vehicle with slightly different trim and a different name.⁴

² Price ranges represent 1999 model base price and are taken from Crain Communications, *Automotive News*, '99 Market Data Book, May 1999, pp. 75-81.

³ Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System, 1999.

⁴ Krebs, Michelle, “Vehicles So Much Alike They’re Actually the Same,” *The New York Times*, October 20, 1999.

Table 1. Currently Available SUVs by Size Category, Model Year 1999^a

NAMEPLATE	LITERS (low value)	LITERS (high value)	HEIGHT	LENGTH	WIDTH	WHEEL- BASE	CURB- WEIGHT	GROSS VEHICLE WEIGHT	MY 1999 SALES	MY 1998 SALES	LOW MPG ^b	HIGH MPG ^b	EST. GHG ^c (tons/yr)	LOW BASE PRICE ^d	HIGH BASE PRICE ^d
Small SUVs (engine < 3.0 liters)															
CHEVROLET TRACKER	1.6	2.0	66.5	148.8	66.7	86.6	2,717	3,100	32,569	21,672	22-25	25-28	11-12	\$14,000	\$16,300
HONDA CR-V	2.0	-	65.9	177.6	68.9	103.2	3,450	4,740	115,614	91,700	22-25	-	12	\$19,000	\$20,900
ISUZU AMIGO	2.4	3.2	66.6	167.8	70.4	96.9	3,466	4,650	9,972	4,146	17-21	21-24	12-15	\$16,300	\$20,745
KIA SPORTAGE	2.0	-	65.0	170.3	68.1	104.3	3,186	4,200	46,645	26,281	19-23	-	13-14	\$15,200	\$19,000
SUBARU FORESTER	2.5	-	65.0	175.2	68.3	99.4	3,020	4,110	50,582	36,521	21-26	21-27	12-13	\$19,200	\$22,700
SUZUKI SIDEKICK 2DOOR	1.7	-	65.1	143.7	65.2	86.6	2,756	3,307	669	18,248	23-26	-	11-12	\$13,500	\$19,800
SUZUKI GRAND VITARA	2.5	-	68.5	164.6	70.1	97.6	3,197	3,990	24,222	1,557	18-20	19-22	11-14	\$18,400	\$20,400
SUZUKI VITARA 2 DOOR	1.6	2.0	66.5	152.0	67.3	86.6	2,723	3,373	4,666	-	22-25	25-28	11-12	\$13,900	\$18,400
TOYOTA RAV4	2.0	-	64.8	147.2	66.7	86.6	2,500	3,649	61,942	65,260	22-26	24-29	7-12	\$16,100	\$18,200
SALES-WEIGHTED AVG.			65.7	168.7	68.7	98.3	3,238					26.4		\$17,833	
Medium SUVs (3.0 liters <= engine < 5.0 liters)															
ACURA SLX	3.5	-	72.2	181.3	72.2	108.7	4,615	4,740	689	1,722	15-19	-	17	\$36,800	-
CHEVROLET S10 BLAZER	4.3	-	64.5	176.8	67.8	100.5	3,848	4,850	220,197	225,044	15-18	17-23	14-16	\$19,000	\$33,300
FORD EXPLORER	4.0	4.9	67.9	178.6	70.2	101.7	3,919	4,811	439,250	415,362	14-19	18-23	15-18	\$20,600	\$35,100
GMC JIMMY	4.3	-	66.9	177.3	67.8	100.5	3,848	4,850	72,527	72,146	15-18	17-23	14-16	\$19,100	\$31,600
GMC ENVOY	4.3	-	64.2	183.8	67.8	107.0	4,049	5,350	-	-	15-18	-	n/a	\$34,125	-
HONDA PASSPORT	3.2	-	68.5	177.4	70.4	106.4	3,860	n/a	24,826	24,677	16-20	18-21	15	\$23,100	\$29,400
INFINITI QX4	3.3	-	70.7	183.9	72.4	106.3	4,275	5,150	21,194	17,818	15-19	-	17	\$36,000	-
ISUZU RODEO	2.2	3.2	66.1	176.7	70.4	106.4	4,700	4,850	61,997	59,306	16-20	21-24	13-15	\$18,700	\$31,100
ISUZU TROOPER	3.5	-	72.2	181.3	72.2	108.7	4,455	5,510	19,018	15,679	15-19	16-19	16-17	\$27,600	-
ISUZU VEHICROSS	3.5	-	66.9	162.6	70.5	91.8	3,955	4,652	889	-	15-19	-	15	\$29,400	-
JEEP CHEROKEE	2.5	4.0	64.0	167.5	69.4	101.4	3,360	4,900	162,430	143,786	16-21	21-25	12-15	\$16,600	\$23,200
JEEP WRANGLER	2.5	4.0	71.1	153.0	66.7	93.4	3,216	4,450	88,908	82,098	15-18	18-20	14-16	\$14,900	\$20,700
JEEP GRAND CHEROKEE	4.0	4.7	69.4	181.5	72.3	105.9	3,932	n/a	288,264	238,478	15-19	16-21	19	\$26,500	\$34,700
LAND ROVER DEFENDER	3.9	-	90.0	181.1	70.5	110.0	4,840	n/a	10	759	15-19	-	n/a	\$34,600	-
LAND ROVER DISCOVERY II	3.9	-	77.4	178.7	70.6	100.0	4,465	6,019	19,590	13,057	13-16	14-17	18-19	\$34,800	-
LAND ROVER RANGE ROVER	3.9	4.6	71.6	185.5	74.4	108.1	4,960	6,130	7,454	6,866	13-16	-	19	\$58,600	\$66,600
LEXUS RX300	3.0	-	65.7	180.1	71.5	103.0	4,037	4,950	66,734	27,581	18-22	-	n/a	\$32,500	\$33,900
LEXUS LX450/470	4.7	-	72.8	192.5	76.4	112.2	5,401	6,470	15,281	1,168	13-16	-	19	\$56,700	-

NAMEPLATE	LITERS (low value)	LITERS (high value)	HEIGHT	LENGTH	WIDTH	WHEEL- BASE	CURB- WEIGHT	GROSS VEHICLE WEIGHT	MY 1999 SALES	MY 1998 SALES	LOW MPG ^b	HIGH MPG ^b	EST. GHG ^c (tons/yr)	LOW BASE PRICE ^d	HIGH BASE PRICE ^d
MERCEDES-BENZ ML320	3.2	-	69.9	180.6	72.	111.0	4,387	6,000	36,474	42,923	17-21	-	15-16	\$35,500	-
MERCEDES-BENZ ML430	4.3	-	69.9	180.6	72.2	111.0	4,696	6,000	6,948	-	15-18	-	14-16	\$44,400	-
MERCURY MOUNTAINEER	4.0	4.9	70.3	190.1	70.2	111.6	4,113	5,050	48,114	47,697	14-19	15-20	16-18	\$27,800	\$30,200
MINI COOPER	2.3	3.5	74.8	186.6	69.9	107.3	4,431	5,730	4,691	4,289	16-18	22-24	16-17	\$31,800	-
MITSUBISHI MONTERO	3.0	3.5	65.6	178.3	66.7	107.3	3,995	5,350	46,161	36,603	15-18	17-20	12-15	\$18,800	\$33,100
MITSUBISHI MONTERO SPORT	3.0	3.5	65.6	178.3	66.7	107.3	3,995	5,350	46,161	36,603	15-18	17-20	12-15	\$18,800	\$33,100
NISSAN X-TERRA	2.4	3.3	69.4	178.0	70.4	104.3	3,858		26,940	-	15-19	19-24	15-19		
NISSAN PATHFINDER	3.3	-	67.1	178.3	68.7	106.3	3,960	5,150	68,526	67,832	15-19	17-19	15-17	\$24,700	\$33,500
OLDSMOBILE BRAVADA	4.3	-	63.2	183.7	67.8	107.0	4,049	5,300	28,330	28,652	16-20	-	16	\$31,700	-
TOYOTA LAND CRUISER WAGON	4.7	-	72.8	192.5	76.4	112.2	5,401	6,470	18,179	12,288	13-16	-	19	\$47,000	-
TOYOTA 4RUNNER	2.7	3.4	67.5	178.7	66.5	105.3	3,850	5,250	126,970	116,577	17-20	18-23	13-16	\$21,500	\$36,200
SALES-WEIGHTED AVG.			67.7	177.3	103.4	103.4	3,917				20.4			\$28,754	
Large SUVs (engine >= 5.0 liters)															
AM GENERAL HUMMER	6.5	-	75.0	184.5	86.5	130.0	6,750	10,300	n/a	4	n/a	-	n/a	\$69,200	\$86,500
CADILLAC ESCALADE	5.7	-	74.3	201.2	77.0	117.5	5,573	8,600	18,860	-	12-16	-	8-10	\$46,500	-
CHEVROLET C/K1500 AND C/K2500 SUBURBAN	5.7	6.5	72.3	219.5	76.7	131.5	5,297	6,800	135,160	107,708	14-18	-	18	\$26,400	\$30,500
CHEVROLET C/K1500 TAHOE	5.7	6.5	72.5	188.0	77.1	111.5	4,876	6,250	132,035	136,413	12-16	15-19	18-19	\$24,700	\$33,100
DODGE DURANGO	4.7	5.9	72.9	193.2	71.5	115.9	4,655	6,400	191,649	126,397	12-16	15-20	19-20	\$26,600	-
FORD EXPEDITION	4.6	5.4	76.6	204.6	78.6	119.1	5,212	6,750	242,711	216,777	12-16	13-18	16-19	\$30,000	\$39,600
GMC C/K1500 AND C/K2500 SUBURBAN	5.7	-	70.7	219.5	76.7	131.5	4,820	6,800	46,397	43,358	14-18	-	18	\$26,400	\$31,000
GMC C/K1500 YUKON	5.7	6.5	75.0	199.6	76.8	117.5	5,331	6,800	56,176	46,548	12-16	15-19	18	\$30,700	\$43,600
LINCOLN NAVIGATOR	5.4	-	76.7	204.8	79.9	119.0	5,350	7,000	40,987	43,342	12-16	13-17	16-17	\$41,400	\$45,000
SALES-WEIGHTED AVG.			74.0	202.3	76.3	119.7	5,052				17.1			\$30,538	

^aIn this table, "n/a" means not available, and "-" means there is no "high" value.

^bDifferences in miles -per-gallon (MPG) ranges are caused by factors such as two-wheel-drive (2WD) vs. four-wheel-drive (4WD), number of cylinders, and/or manual vs. automatic transmission.

^cGHG = green house gas.

^dDifferences in base price are based on factors such as 2WD vs. 4WD, convertible or not, and/or 2 -door vs. 4-door.

Sources: Base prices from Crain Communications, *Automotive News, '99 Market Data Book*, May 1999, pp. 91-104, Model Year 1999. Sales and specifications are from the Oak Ridge National Laboratory Light Vehicle MPG and Market Shares System. Greenhouse gas emissions estimates are from DiCicco and Martin, "Green Guide to Cars and Trucks," Model Year 1998 and 1999 editions, American Council for an Energy-Efficient Economy.

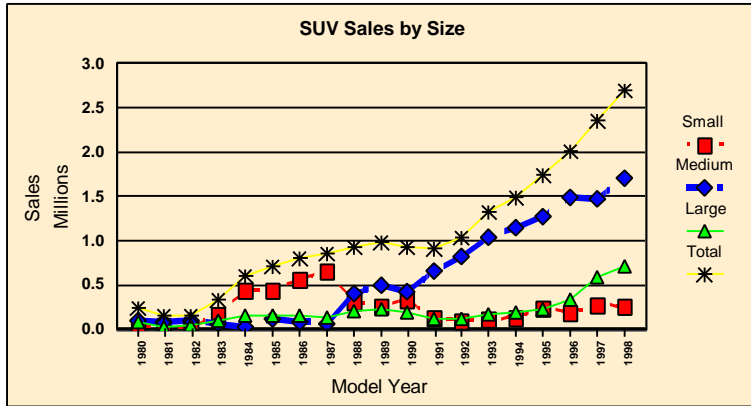


Figure 1. SUV Sales by Engine Size for Model Years 1980 through 1999. Source: Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

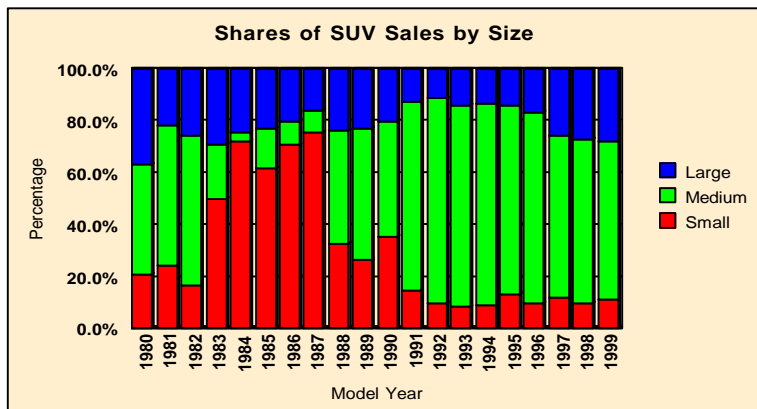


Figure 2. Shares of SUV Sales by Engine Size for Model Years 1980 through 1999. Source: Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

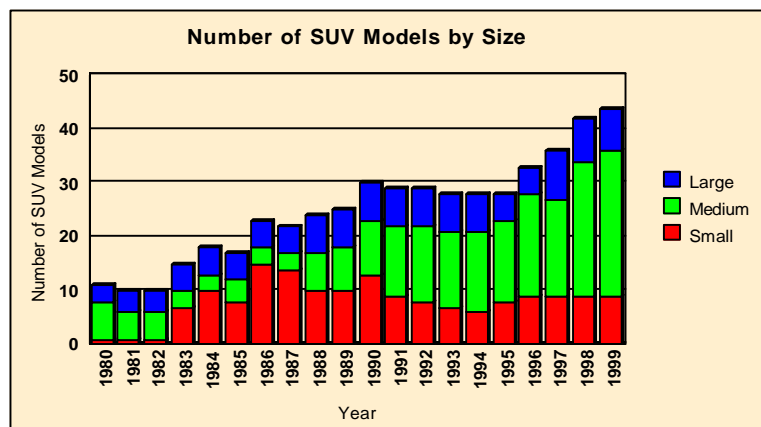


Figure 3. Number of SUV Models by Engine Size for Model Years 1980 through 1999. Source: Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

Sales of SUVs have grown from slightly over 243 thousand units in 1980 to over 3 million units in 1999. Figure 4 compares the market shares of sales of SUVs with sales of other new light vehicles from 1980 through 1999. Sales of minivans, pickups, and vans (including all vehicles with gross vehicle weight ratings less than 8,500 pounds) and SUVs (all sizes) grew from about 20% of the market in 1980 to almost half in 1999. In the 1990s, strong SUV sales, combined with an increase of minivan, pickup, and van sales, caused quite a decline in market share for cars.

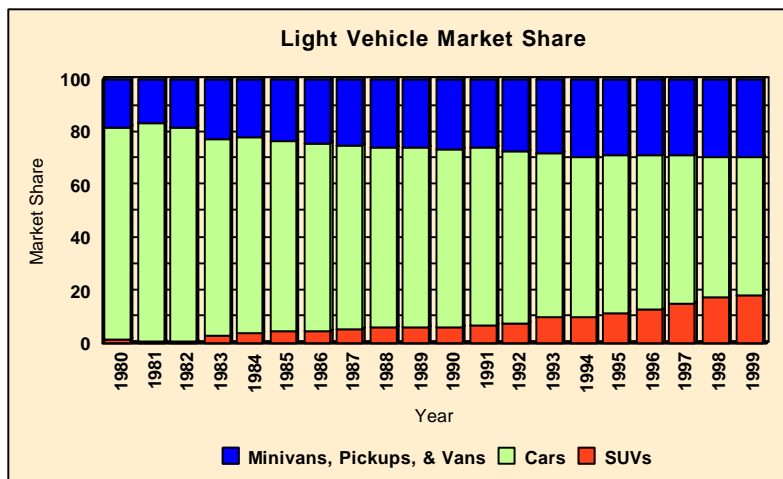


Figure 4. Market Shares of Sales of SUVs in Comparison with Sales of Other Light Vehicles, 1980-1999. Source: Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

Based on these charts, it would appear that SUV sales could be expected to increase dramatically in the next few years unless something occurs to change the market trend (e.g., a fuel shortage occurs). Polk estimates that SUV sales will be about 23% of the light vehicle market from 2001 -2005.⁵ According to AutoPacific’s *The US Car and Light Truck Market*, sales of SUVs are projected to be over 3 million units annually throughout the next decade with the fastest growing SUV category that of medium-sized SUVs.⁶ (See Table 1 for nameplates.)

Figure 5 compares projected sales of SUVs from 2000 through 2003 with other vehicle types. The entire market is forecast to rise about 4.5% during that time period. The small car (the most energy-efficient vehicle) market share is projected to decrease

⁵ The Polk Company, “Sport Utility Owners Keep Coming Back for More,” <http://www.polk.com/pressreleases/20000119.pdf>.

⁶ AutoPacific, *The US Car and Light Truck Market*, 1999, pp. 119-20.

slightly. While luxury cars, pickup trucks, and SUVs will all show gains in their market shares, the greatest gains will be for SUVs.⁷

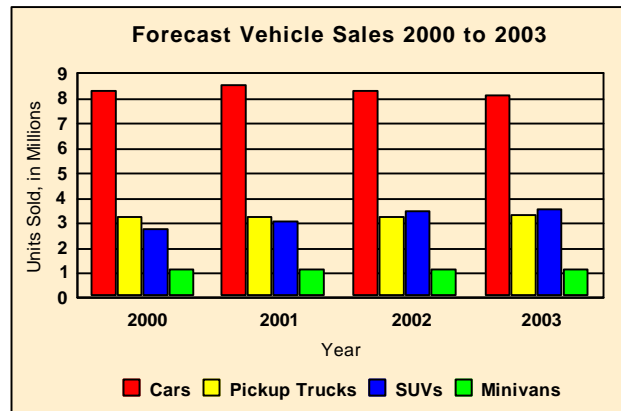


Figure 5. Forecast Sales of Light Vehicles Through the Year 2003 Source: AutoPacific, *The US Car and Light Truck Market*, 1999, pp. 24, 120, 121.

3. ECONOMIC FACTORS AND MOBILITY TRENDS

Many articles have been written about SUVs being road hog s and gas guzzlers. In addition, they are not budget-priced. Profits on automobiles are quite slim in comparison with profit margins on SUVs.⁸ When the economy is booming, however, the ticket price is not always the deciding factor.⁹

The gross domestic product since 1980 is shown in Figure 6 in constant 1996 dollars. As shown in this figure, the United States is producing more and continues a trend of slow but steady growth.

⁷ AutoPacific, *The US Car and Light Truck Market*, 1999, p. 119.

⁸ Office of Transportation Technologies, <http://www.ott.doe.gov/facts/archives/fotw111.html>, “Fact of the Week,” Fact #111, January 3, 2000. (Original source: J.D. Power and Associates.)

⁹ Bradsher, Keith, “The Unsung Comeback of the Large Car,” *The New York Times*, October 3, 1999.

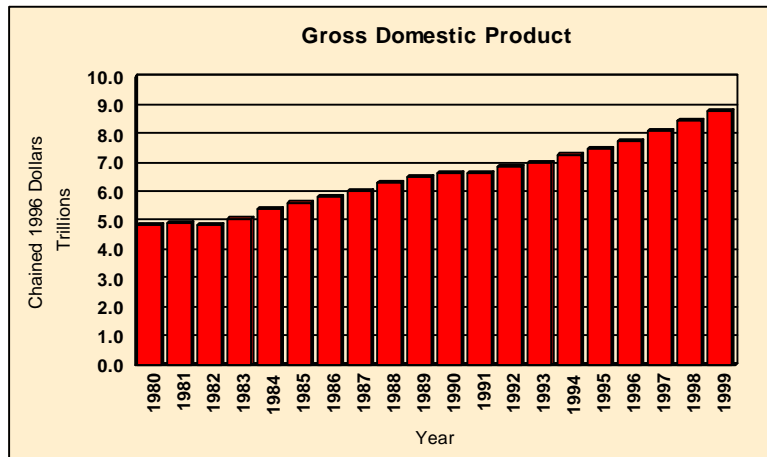


Figure 6. Gross Domestic Product (constant 1996 dollars) as a Measure of Economic Growth. Source: Bureau of Economic Analysis web site, “National Income and Product Accounts,” <http://www.bea.doc.gov/bea/dn/gdplev.htm>.

Figure 7 shows the economic condition in the United States as measured by the median household income in both current and constant dollars. Although household income has grown in terms of current dollars, the real growth has been cyclical and at a slow rate (in terms of constant dollars). In the 1990s, real growth of household income has shown a steady increase (from \$33,922 in 1993 to \$37,718 in 1998 in constant 1996 dollars).

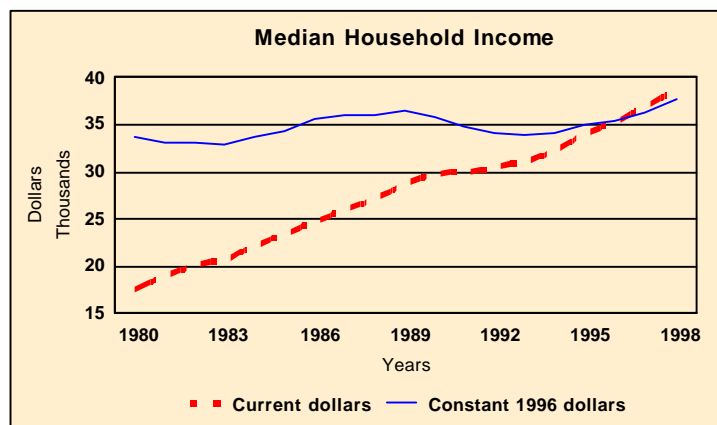


Figure 7. Median Household Income, in Current and Constant 1996 Dollars, since 1980. Source: U.S. Bureau of the Census, *Statistical Abstract of the United States*, Section 14, Table No. 739, <http://www.census.gov/prod/3/98pubs/98statab/sasec14.pdf>.

As shown in Figures 6 and 7, productivity and income have shown growth. In addition to steady real growth in household income during the 1990s, personal income per capita increased from \$20,652 in 1990 to \$22,713 in 1997 (in constant 1992 dollars).¹⁰

Since 1980, automotive technologies have improved and the passenger vehicle has become safer¹¹ and more comfortable. As highways were built, widened, and improved, fuel prices increased very little in comparison with the general economy. Figure 8 shows the average prices of fuel since 1980 in constant dollars. Fuel prices have been rather low in recent years compared to the early 80s. This graph, however, does not show the increase in fuel prices in early 2000. Since 1990, the percentages of average annual household expenditures which consumers spend on vehicle purchases and fuel have remained fairly constant at about 10 -11% of all consumer expenditures (7 -8% for vehicle purchases and 3 -3.5% for fuel costs).¹²

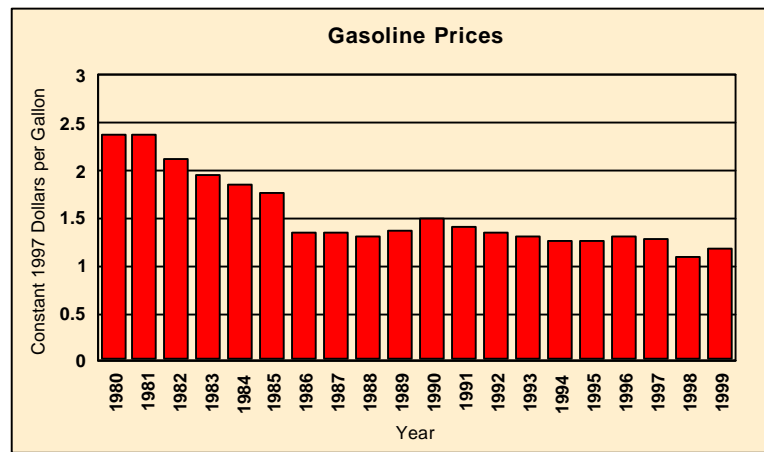


Figure 8. Average Gasoline Prices Per Gallon Since 1980 in Constant 1997 Dollars.

Source: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, February 2000, Table 9.4.

¹⁰ U.S. Bureau of the Census, *Statistical Abstract of the United States*, Section 14, Table No. 727, <http://www.census.gov/prod/3/98pubs/98statab/sasec14.pdf>.

¹¹ Just in the past decade, the fatality rate, as measured in fatalities per 100 million vehicle miles traveled, decreased from 2.3 (in 1988) to 1.6 (in 1998). Source: U.S. Department of Transportation, National Highway Traffic Safety Administration, <http://www.nhtsa.dot.gov/people/ncsa/pdf/Overview98.pdf>.

¹² Davis, Stacy C., *Transportation Energy Data Book*, Ed. 19, ORNL-6958, September 1999, Table 11.2; additional data of fuel and vehicle costs from *Transportation Energy Data Book*, Eds. 9-19.

A good economy, improved roads, and low fuel prices contributed to greater mobility of the average American citizen. Between 1983 and 1990, the average daily vehicle trips per household increased by almost 15%; between 1990 and 1995, the average daily vehicle trips per household increased by another 12%.¹³ The average annual person miles traveled (PMT) from 1983 to 1990 and from 1990 to 1995 increased by 9% and 14%, respectively.¹⁴ Each year, the total vehicle miles traveled (VMT) in the United States increases; these increases have been at a rate of around 3% annually throughout the 1990s. Higher population, more vehicles registered, increased PMT, and increased VMT indicate that transportation activity is continuing to grow. Figure 9 shows increases in VMT/vehicle since 1980. Although the average annual VMT/vehicle has not increased at the same rate as overall VMT, it has certainly not seen any decreases.

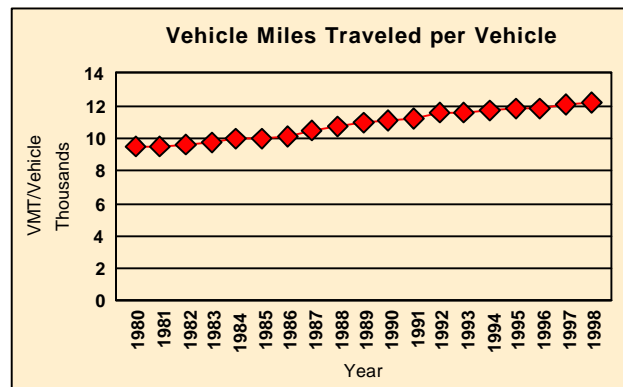


Figure 9. Average Annual Vehicle Distance Traveled per Vehicle Since 1980.

Source: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1995* (Table VM-201A), *Highway Statistics 1996* (Table VM-1); *Highway Statistics 1997* (Table VM-1) and *Highway Statistics 1998* (Table VM-1), <http://www.fhwa.dot.gov/ohim/ohimstat.htm>.

The economy is holding steady. Although U.S. citizens travel more and go further every year, expenditures for vehicles and fuel remain at approximately the same share of the household income as in the past.

¹³ Hu, P. S., and Young, J. R., *Summary of Travel Trends: 1995 Nationwide Personal Transportation Survey*. Table 2.

¹⁴ Davis, Stacy C., *Transportation Energy Data Book*. Ed. 19. Table 11.7.

4. SUVS AND THEIR BUYERS/DRIVERS

To understand the success of the SUV and to project the level of interest in SUVs in the near future, we examine typical profiles of both the vehicles and their owners.

4.1 VEHICLE CHARACTERISTICS

Generally speaking, SUVs are described as being large, sturdy, high -priced, appropriate for hauling/towing, safe (to the SUV occupants), and “trendy.” In terms of size, the small SUV category (dominated by the Honda CR -V and the Toyota RAV4) allows buyers to purchase the SUV image without paying a huge price. Base model prices range from almost \$14,000 to \$23,000 (see Table 1). The sales -weighted average price for a small SUV in 1999 was \$17,833.

The middle SUV category (led by the Ford Explorer, Jeep Grand Cherokee, Chevrolet Blazer, Jeep Cherokee, and Toyota 4Runner) has the largest number of nameplates as well as the greatest sales. Base model prices range from under \$15,000 to over \$66,000 (Table 1). The sales -weighted average price for a medium SUV in 1999 was \$28,754.

The large SUV category (including the Ford Expedition, Chevrolet Tahoe, Dodge Durango, and Chevrolet Suburban) has larger engines but not necessarily larger price tags than SUVs in the middle category. Base model prices for vehicles with significant sales range from under \$25,000 to almost \$46,500 (Table 1). The sales -weighted average price for a large SUV in 1999 was \$30,538.

Small SUVs have fuel economies similar to that of cars but the additional height, weight, and power requirements of the medium and large SUVs cause them to be less fuel efficient than cars. The sales -weighted fuel economies of new light vehicles in 1999 indicate that the large SUVs are, on average, the least fuel -efficient type of light vehicle (Figure 10).

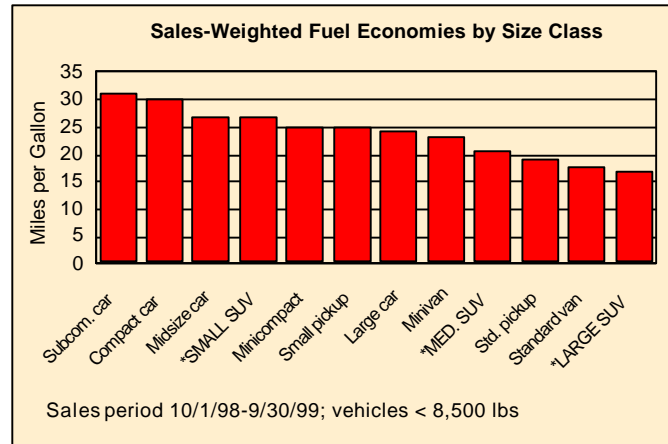


Figure 10. Sales-Weighted Fuel Economies by Vehicle Size Class, for Vehicles Weighing 8,500 Pounds or Less; Sales Period Covers 10/1/98 Through 9/30/99. Source: Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

Because SUVs are currently categorized as light trucks, they are required to meet Federal fuel economy and emissions standards for light trucks. Corporate Average Fuel Economy (CAFE) standards for light trucks are less stringent than for cars. For example, the CAFE standard for automobiles is currently 27.5 mpg, while it is only 20.7 mpg for light trucks.¹⁵ The purpose of these relaxed fuel economy requirements for light trucks is to benefit small businesses that use trucks in their businesses – for example, to haul materials or products.¹⁶ These days, however, most SUVs (84%) and pickup trucks (73%) are being used mainly for personal transportation.¹⁷

As more and more people switch from cars to less fuel-efficient SUVs, the United States as a whole will increase its oil demand to fuel these vehicles. Table 2 shows an average annual fuel use for each vehicle size class. Large SUVs, on average, use 65% more fuel than large cars use in one year. Currently, more than half of our oil is imported,¹⁸ leaving the U.S. dependent on oil-rich OPEC nations.

¹⁵ Davis, Stacy C., *Transportation Energy Data Book*, Ed. 19, Table 7.15.

¹⁶ Niemeier, Deb, et al., “Redefining Conventional Wisdom: An Exploration of Auto Ownership and Travel Behavior in the U.S.,” <http://www.fhwa.dot.gov/ohim/travelconf/niemeier.pdf>, p. 1.

¹⁷ U.S. Bureau of the Census, *1997 Economic Census, Vehicle Inventory and Use Survey*, Microdata File, CD-ED97-VIUS.

¹⁸ Davis, Stacy C., *Transportation Energy Data Book*, Ed. 19, Table 1.9.

Table 2. Estimated Annual Fuel Use (Gallons) by Size Class

Automobiles	Annual fuel use	Light trucks	Annual fuel use
Subcompact car	382	Small pickup	492
Compact car	389	Small SUV	507
Midsize car	446	Minivan	612
Minicompact	470	Std. pickup	632
Large car	487	Medium SUV	682
		Standard van	783
		Large SUV	801
Weighted average	428	Weighted average	645

^a Based on annual miles of 11,988 for all automobile classes; 14,256 for minivans and standard vans; 13,853 for all SUV classes; and 12,064 for all pickup classes.

Source: Average annual miles from Table 5 divided by fuel economies from Figure 10.

Because the cost of fuel in the United States has traditionally been fairly low, fuel economy is not as important to U.S. consumers as it is to consumers in Europe or Asia. In a survey conducted by AutoPacific in 1998, 30% of all new *car buyers* considered fuel economy to be “extremely important”; however, only 18% of *SUV buyers* considered fuel economy as “extremely important,” and only 10% rated the fuel economy of their new SUV as “excellent.” The same survey noted that SUV owners expected a fuel economy of only 19 mpg and that it would take a 70% increase in the price of fuel for them to change their vehicle type.¹⁹ Another national survey, which was not aimed specifically at new car buyers but the population in general, indicated that less than 5% of the survey respondents rated fuel economy as “most important in the choice of the next vehicle they purchased.”²⁰ Because of the rising fuel prices in early 2000, the number of people ranking fuel economy as important may increase in future surveys.²¹ Possibly in anticipation of this occurrence, Ford and General Motors recently announced intentions of improving SUV fuel economies in the next few years.

The 1999 *Green Guide to Cars and Trucks* assigned “green” scores to vehicles based on fuel economy and emissions of pollutants. The only SUV to receive a

¹⁹ AutoPacific, *The US Car and Light Truck Market*, 1999, pp. 167-174.

²⁰ Office of Transportation Technologies, <http://www.ott.doe.gov/facts/archives/fotw56.html>, “Fact of the Week,” Fact #56, February 26, 1998. (Original source: Opinion Research Corporation.)

²¹ Check the Office of Transportation Technologies Facts and Analysis website for future opinion surveys, <http://www.ott.doe.gov/facts.html>.

“superior” rating and be named as one of the 12 greenest vehicles in 1999 was the small Toyota RAV4 electric vehicle. Five SUVs (nine different nameplates) were named to the list of “12 Worst Vehicles for the Environment in 1999.” Although the Ford Expedition is on the “12 Worst” list, the two-wheel-drive, 4.6-liter Expedition was named a “Best of ‘99” choice as one of the greener large SUVs.²²

Federal emission standards for automobiles and light trucks have varied over the years; generally, standards for trucks have been less stringent. Since 1995, Federal emission standards have been the same for cars and the smallest light trucks [up to 6,000 pounds gross vehicle weight rating (GVWR) and 3,750 pounds loaded vehicle weight (LVW)].²³ Light trucks with a GVWR over 6,001 pounds or a LVW over 3,750 pounds have less stringent emission standards than the smaller vehicles.²⁴ All of the large SUVs, most of the medium SUVs, and a couple of the small SUVs fall in this category. So, from the start, most SUVs are allowed to emit more pollutants than cars. Then, as vehicles get older, the amount of pollution they produce increases.²⁵ According to the *Green Guide to Cars & Trucks*, the average new light truck pollutes 40% more than the new average car. Table 3 shows the difference between cars and light trucks in emissions of carbon dioxide (the most important greenhouse gas) and several criteria pollutants. This may change in the future because of the Environmental Protection Agency’s Tier 2 Federal Emission Standards, which are scheduled to be phased in from 2004–2007. “This regulation marks the first time that SUVs and other light-duty trucks—even the largest passenger vehicles—are subject to the same national pollution standards as cars.”²⁶

²² DeCicco, John, and Thomas, Martin, *Green Guide to Cars & Trucks, Model Year 1999*, pp. 26-27.

²³ See Table 1; LVW = curb weight plus 300 pounds.

²⁴ Davis, Stacy C., *Transportation Energy Data Book*, Ed. 19, Tables 4.16–4.20.

²⁵ U.S. Department of Energy, Fuel Economy Site, www.fueleconomy.gov.

²⁶ U.S. Environmental Protection Agency, Air and Radiation, Office of Transportation and Air Quality, *EPA's Program for Cleaner Vehicles and Cleaner Gasoline*, 1999.

**Table 3. Emissions from a Typical New Car and Light Truck
(pounds of pollutant per year)**

Pollutant	Pollutant type ^b	Average new car	Average new light truck	Percentage difference
Carbon dioxide	GHG	15,200	21,200	39.5%
Carbon monoxide	CP	420	547	30.2%
Hydrocarbons	CP	55	74	34.5%
Nitrogen oxides	CP	50	83	66.0%
Particulate matter	CP	2.7	3.3	22.2%

^aIncludes both tailpipe emissions and fuel-cycle emissions and assumes the vehicle is driven 15,000 miles per year.

^b GHG = greenhouse gas. CP = criteria pollutant.

Source: DeCicco, John, and Thomas, Martin, *Green Guide to Cars & Trucks, Model Year 1999*, p. 93.

Although the large SUV image implies superior towing capabilities, recent towing capacity ratings indicate that SUV towing capacities are representative of the particular engine size as well as the frame design, vehicle weight, and specific add-on tow packages.²⁷ For example, the smaller SUVs (Isuzu Amigo and Jeep Wrangler) have tow capacities similar to those of luxury cars. The larger SUVs have significantly higher tow ratings. Table 4 shows towing capacities for selected 1999 models.

Last, but not least, SUV advertisements (and even the vehicle names) suggest rugged, off-road, mountain-climbing capabilities as SUV characteristics. Bradsher, in an article in *The New York Times*, stated that few drivers actually take their SUVs off-road. “According to an internal memorandum, the Big Three found in a joint 1995 study that only 13% of sport utility vehicles were driven off-road.”²⁸

²⁷ *Trailer Life*, http://trailerlife.com/towratings/tr_index.cfm.

²⁸ Bradsher, Keith, “Deadly Crashes Increase Between Cars, Light Trucks,” *The New York Times*, September 24, 1997.

Table 4. Tow Ratings for Selected 1999 Models

Nameplate	Engine; transmission	Tow limit ^a
Cars		
Dodge Intrepid	All	2,000
Ford Crown Victoria	4.6, V-8	2,000
Lincoln Continental Mark III	4.6, V-8	2,000
Mercury Grand Marquis	4.6, V-8	2,000
Cadillac (all)	4.6, V-8	3,000
Volvo	All	3,300
Vans, Minivans		
Oldsmobile Silhouette	3.4, V-6	2,000
Nissan Quest	3.0, V-6	3,500
Dodge Caravan	3.3/3.8, V-6	3,500
Plymouth Voyager	3.3, V-6	3,500
Volkswagen Eurovan	All	4,400
Pickups		
Chevrolet Silverado	4.3, V-6, Manual	3,500
Toyota Tacoma	all I-4	3,500
Dodge Dakota	3.9, V-6, Manual	4,400
Ford F 150	4.2, V-6, Auto	5,800
Dodge Ram 1500	5.2/5.9, V-8, Auto	8,000
SUVs		
Isuzu Amigo	3.2, V-6	2,000
Jeep Wrangler	4.0, I-6	2,000
Oldsmobile Bravada	4.3, V-6, Auto	5,000
Chevrolet Blazer/GMC Jimmy	4.3, V-6, Auto	5,500
Mercury Mountaineer	4.0, V-6	5,860
Land Rover Range Rover	All	6,500
Suburban C1500	5.7, V-8, Auto	6,500
Ford Expedition (4WD)	5.4, V-8, Auto	6,800
Ford Expedition	5.4, V-8, Auto	8,300
Hummer (2 passenger)	Diesel	8,510

^aFor additional notes, requirements, and limitations, see specifications for each tow rating listed at *Trailer Life*, http://trailerlife.com/towratings/tr_index.cfm.

4.2 BUYER/DRIVER PROFILES

In the fall of 1998, AutoPacific surveyed 40,000 people to obtain information on the type of vehicle that purchasers/lesers were considering for their next purchase/lease. For those 30 years of age and under, 73% indicated that they were considering an SUV for their next purchase, as did 63% of survey participants in their 30s and 50% of those in their 40s. For those 65 and older, only 13% were considering buying an SUV. Overall

(i.e., all ages), 48% responded that they were considering an SUV.²⁹ It is interesting to note that consumers currently in their 30s and early 40s would have been children and teenagers during the oil crisis of 1973-74 when families were urged to conserve energy and people were lining up for hours at the gas station in some parts of the country. Yet, some in this group seem to have lost the “energy conservation” mindset, as they are now ardent fans of SUVs.

The average SUV customer is male (63.7%), married (76.4%), aged 45 years, in a household with an income of \$94,400, and at the head of the household (84%). SUV customers expect to drive 14,367 miles each year and 39% are prior owners of another SUV.³⁰ Because SUV owners are fairly affluent, the price of the vehicle and of fuel is not sufficiently important to cause them to consider changing the type of vehicle they drive.

Based on data from the 1995 Nationwide Personal Transportation Study (NPTS), Niemeier determined that 29.3% of total household vehicles (i.e., non-commercial vehicles) on the road are SUVs, vans, or trucks (most of these are pickup trucks), and only about a third of these vehicles are owned by persons with annual incomes under \$35,000.³¹

Although the primary SUV customer is male, women are beginning to enter the SUV market because of their perception that the SUV is safer and provides better visibility. This perception of safety is based on the size, shape, and rugged image of the vehicle, rather than published reports or statistics (see Section 5). In addition, soccer moms who drove minivans are changing their persona when they move from a minivan to a sport utility vehicle. It has been projected that 53.8% of future SUV buyers will be female. In the United States, women influence “as much as 80% of all vehicle buying decisions.”³²

In early 1999, an opinion poll queried 1,000 consumers to determine the single most important reason for purchasing a particular type of vehicle. Owners of small cars responded with reasons such as price/value and fuel economy; owners of large cars

²⁹ Office of Transportation Technologies, <http://www.ott.doe.gov/facts/archives/fotw92.html>, “Fact of the Week,” Fact #92, June 8, 1999. (Original source: AutoPacific Group.)

³⁰ AutoPacific, *The US Car and Light Truck Market*, 1999, pp. 143-144.

³¹ Niemeier, Deb, et al., “Redefining Conventional Wisdom: An Exploration of Auto Ownership and Travel Behavior in the U.S.,” <http://www.fhwa.dot.gov/ohim/travelconf/niemeier.pdf>, Table 1-2.

³² Maples, John D., et al., *Vehicle Consumer Characteristics and Trends Data Book*, pp. 54-55. (Original source: Dorhing National Survey.)

indicated price/value and safety; owners of minivans indicated size of family and more space/room; and owners of pickups indicated price/value and hauling (as well as work/business). SUV owners responded that the primary reason for their purchase was availability of four-wheel-drive. Additionally, 5% indicated hauling capabilities and another 5% noted towing as reasons for their purchase.³³

Opinion polls taken in December 1996 and in February 1998 asked questions concerning the characteristics most desired in vehicles. In both polls, the most important characteristics were dependability and safety, and both of these characteristics were listed as even more important to consumers in 1998 than in 1996. In both polls, fuel economy and low price were the least important attributes, and they were listed as of lesser importance in 1998 than in 1996.³⁴

Owners of minivans and SUVs are more likely to have children than owners of any other automotive category. In addition, SUV buyers list “Family Vehicle,” functionality, and reliability as the most desirable characteristics in a vehicle.³⁵

SUV purchasers have been categorized by J. D. Powers as either “Domestic Indulgents” (those who buy a vehicle based on size, status, and luxury equipment) or “Utility Seekers” (those who buy for functionality – hauling, towing, room for more passengers, and safety).³⁶

According to The Polk Company, the Babyboomer generation is leading the way in buying SUVs. The basic sedan was the vehicle of choice when the family only owned one car. The number of vehicles per household in the United States had grown to 1.9 in 1998, however, and now most households own one car and one truck.³⁷

³³ Office of Transportation Technologies, <http://www.ott.doe.gov/facts/archives/fotw83.html>, “Fact of the Week,” Fact #83, March 29, 1999. (Original source: Opinion Research Corporation.)

³⁴ Office of Transportation Technologies, <http://www.ott.doe.gov/facts/archives/fotw56.html>, “Fact of the Week,” Fact #56, February 26, 1998. (Original source: Opinion Research Corporation.)

³⁵ The Polk Company, “Goodbye Family Car ... Hello Family Light Truck,” <http://www.polk.com/pressreleases/20000120.pdf>.

³⁶ Maples, John D., et al., *Vehicle Consumer Characteristics and Trends Data Book*, p. 61. (Original source: J.D. Powers and Associates.)

³⁷ The Polk Company, “Do Current Truck Sales Predict the Death of the Car?” <http://www.polk.com/pressreleases/19990921.pdf>.

4.3 SUV USAGE AND TRAVEL

The 1995 NPTS shows that SUVs travel more than automobiles on an annual basis (Table 5). In fact, SUVs traveled more than cars for each vehicle age category in the 1995 NPTS except those automobiles with a vehicle age of 16 years or greater. SUVs (all ages) were driven 13% more than the average of all vehicles, and 16% more than automobiles, although they were driven 3% fewer miles than were vans.

Table 5. Average Annual Miles per Vehicle by Vehicle Type and Vehicle Age and Ratio of Vehicle Miles by Vehicle to Automobile Vehicle Miles

Vehicle age (years)	Vehicle type				All ^b
	Automobile Miles	Van ^a Miles (Ratio)	SUV Miles (Ratio)	Pickup Miles (Ratio)	
0-5	14,319	16,271 (1.14)	15,350 (1.07)	16,107 (1.12)	14,901
6-10	12,044	13,095 (1.09)	13,979 (1.16)	12,305 (1.02)	12,280
11-15	9,771	11,693 (1.20)	10,985 (1.12)	9,516 (0.97)	9,701
16+	6,407	8,392 (1.31)	5,919 (0.92)	6,604 (1.03)	6,381
Average (all ages)	11,988	14,256 (1.19)	13,853 (1.16)	12,064 (1.01)	12,226

^aIncludes minivans.

^bIncludes automobiles, vans, SUVs, pickup trucks, other personal trucks, motorcycles, recreational vehicles, and any other personal vehicle reported in NPTS.

Source: U.S. Department of Transportation, Federal Highway Administration, 1995 *Nationwide Personal Transportation Survey*, <http://www-cta.ornl.gov/npts>.

It has been suggested that driver characteristics could explain the high annual mileage of SUVs. The following observations were made using data from the 1995 NPTS. The information is based on data from the primary driver of the vehicle. If there was no primary driver of the vehicle or the primary driver of the vehicle was not interviewed, the data were not included in the analysis. It should be noted that *driver* data, as compiled by NPTS surveys, differs slightly from the *buyer* profiles provided by AutoPacific (Section 4.2).

- \$ Sixty percent of those driving SUVs are male, while only 44% of those driving cars are male. The annual VMT of males is approximately 4% more than that of females.
- \$ Thirty-eight percent of those driving SUVs have a family income of \$40,000 – \$79,999 as compared to 29% of car drivers. The annual VMT for drivers with a family income of \$40,000 – \$79,999 is approximately 13% higher than those drivers whose family income is less than \$40,000.

- \$ Fifty-two percent of those driving SUVs are in families which consist of more than one adult plus children; this compares to 38% of car drivers. The annual VMT for drivers with a family of more than one adult plus children is approximately 8% higher than the average for all families.
- \$ The average age of an SUV driver is 40.2 years. This is the lowest average driver age of all vehicle types. The average age of a car driver is 44.1 years. Drivers between the ages of 26 to 35 have the highest annual VMT. (Age categories in the 1995 NPTS are ten-year increments beginning with 16 years of age.)
- \$ Fifty percent of those driving SUVs have two vehicles in their household, while only 43% of those driving cars have two vehicles. The annual VMT for drivers with two vehicles in their household is approximately 4% higher than the average for all households with vehicles.
- \$ Twenty percent of SUV drivers live in rural areas whereas 18% of car drivers live in rural areas. The annual VMT for all drivers living in rural areas is approximately 6% higher than the national average.
- \$ Thirty-three percent of SUV drivers live in areas with a population density of 0 to 500 people per square mile as opposed to 27% of car drivers. The annual VMT for drivers in areas with a population density of 0 to 500 people is approximately 6% over the national average.

Using the NPTS, Niemeier et al. compared travel patterns in suburban/second city areas with those in urban areas. Suburban/second city households own 6.8% more passenger cars and 12.5% more vehicles in the SUV-van-truck category than do urban households. SUV-van-truck vehicles are used at about the same rate as automobiles for all trip purposes (i.e., work-related, shopping, family and household, social/recreational, etc.) and by both men and women. The NPTS is limited to households and does not include company fleet vehicles, which confirms that SUVs are being used for personal trips and are not being used exclusively in business endeavors. Because SUV emissions and fuel economy are regulated by truck standards, which are less stringent than automobile requirements, this apparent replacement of the family car with an SUV will have the effect of using more energy and emitting more tailpipe emissions than would have occurred with the typical automobile.³⁸

³⁸ Niemeier, Deb, et al., "Redefining Conventional Wisdom: An Exploration of Auto Ownership and Travel Behavior in the U.S.," 1999, <http://www.fhwa.dot.gov/ohim/travelconf/niemeier.pdf>.

4.4 WHY BUY A SPORT UTILITY VEHICLE?

As stated in earlier sections, the sales of SUVs have increased dramatically, especially during the past ten years. Many people are referring to the increase in SUV sales as a fad, based on the purchaser perception that they are fashionable and make a statement about an active or high-income lifestyle. (Actually, purchase costs vary widely from the economy versions to the luxury models, and the longevity of the SUV popularity makes it unlikely to be a fad.) Popularity of SUVs could also be encouraged by the relatively low fuel prices and good fuel availability in the U.S. and by the absence of public pressure to conserve energy or to control pollution. In addition, the United States economy is strong, and individuals have more money to spend on luxuries. Furthermore, because the SUV market is so good, almost every manufacturer offers at least one SUV option. Most recently the **luxury** sport utility hit the market, with sticker prices above \$45,000.

Advertising plays a major role in influencing purchasing decisions. In the Fall of 1999, Ford Motor Company started a new ad campaign for its suite of SUVs; the ads emphasize outdoor adventures, with “no boundaries.” The *image* is what sells; the implication is that one **could** go anywhere in the SUV, if one weren’t so busy commuting to work and running errands.³⁹

Although image is important when making a vehicle purchase, the height of the SUV is also a factor. Market surveys show that “visibility from the driver’s seat ties a vehicle’s driving performance and interior comfort as the most important attributes that buyers seek.”⁴⁰ Finally, SUV owners profess to feeling more protected and more in control of their safety in traffic when encased within an SUV. These perceptions and other safety issues are examined in the next section.

5. SUVS AND SAFETY

The public believes that SUVs are safer than cars because they are generally larger (considered a weight advantage in crashes with other vehicles), higher (improved

³⁹ Bradsher, Keith, “Advertising,” *The New York Times*, August 23, 1999, p. C12.

⁴⁰ Bradsher, Keith, “The Unsung Comeback of the Large Car,” *The New York Times*, October 3, 1999.

visibility), and more rugged (a vehicle that can climb mountains and cross streams of water will surely be more than adequate on a city street). Recently, however, the Insurance Institute for Highway Safety, Consumers Union, and the National Highway Traffic Safety Administration (NHTSA) published reports that indicate SUVs are not as safe as they might appear to be.

Table 6 shows the number of fatalities from 1980 through 1998 for SUV-involved crashes in small, medium, and large SUV categories and compares these numbers with total highway fatalities. The numbers of SUV fatalities in this table are the sum of SUV occupants, occupants of non-SUV vehicles (when the crash involved an SUV), and non-motorists. As shown in Table 6, the number of fatalities involving SUVs is increasing, as is the percentage of SUV-related fatalities over total fatalities. While the number of total highway fatalities fell from 51,091 in 1980 to 41,471 in 1998 (a reduction of 18.83%), SUV-involved fatalities rose from 991 to 4,607, during the same time period.

Table 6. Fatalities in SUV-Involved Crashes, 1980-1998, by SUV Size Category

Year	Total highway fatalities	Crash fatalities, including all vehicle occupants and non-motorists ^a							
		Small SUVs	Percent small	Medium SUVs	Percent medium	Large SUVs	Percent large	Total SUVs	Percent of total
1980	51,091	0	0.0%	586	1.1%	405	0.8%	991	1.9%
1981	49,301	38	0.1%	631	1.3%	431	0.9%	1,100	2.2%
1982	43,945	388	0.9%	174	0.4%	222	0.5%	784	1.8%
1983	42,589	366	0.9%	156	0.4%	235	0.6%	757	1.8%
1984	44,257	368	0.8%	207	0.5%	253	0.6%	828	1.9%
1985	43,825	425	1.0%	469	1.1%	357	0.8%	1,251	2.9%
1986	46,087	368	0.8%	907	2.0%	468	1.0%	1,743	3.8%
1987	46,390	312	0.7%	982	2.1%	453	1.0%	1,747	3.8%
1988	47,087	276	0.6%	1,176	2.5%	486	1.0%	1,938	4.1%
1989	45,582	250	0.5%	1,385	3.0%	520	1.1%	2,155	4.7%
1990	44,599	280	0.6%	1,448	3.2%	574	1.3%	2,302	5.2%
1991	41,058	373	0.9%	1,560	3.8%	510	1.2%	2,443	6.0%
1992	39,250	339	0.9%	1,602	4.1%	448	1.1%	2,389	6.1%
1993	40,150	414	1.0%	1,846	4.6%	456	1.1%	2,716	6.8%
1994	40,716	449	1.1%	2,160	5.3%	513	1.3%	3,122	7.7%
1995	41,817	426	1.0%	2,466	5.9%	567	1.4%	3,459	8.3%
1996	42,065	460	1.1%	2,830	6.7%	554	1.3%	3,844	9.1%
1997	42,013	506	1.2%	3,190	7.6%	614	1.5%	4,310	10.3%
1998	41,471	498	1.2%	3,457	8.3%	652	1.6%	4,607	11.1%

^aPercentages represent the percent of fatalities in a particular size category to total fatalities.

Source: National Highway Traffic Safety Administration, "Traffic Safety CD-ROM, Fatality Analysis Reporting System (FARS): 1975-1994, and General Estimates System (GES): 1988-1994," BTS-CD-10, Bureau of Transportation Statistics, U.S. Department of Transportation; also FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

While the total number of highway fatalities decreased by 7% between 1990 and 1998, the total SUV-related fatalities increased by almost 100%. Figure 11 compares total highway fatalities and SUV-involved fatalities.

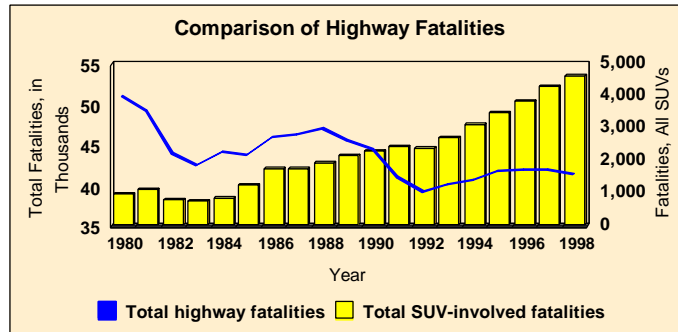


Figure 11. Comparison of Total Highway Fatalities (line; left axis) and SUV Involved Fatalities (bars; right axis). Source: National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

Though Figure 11 indicates that SUV-involved fatalities are increasing while overall fatalities are decreasing, it is important to note the change in the actual mix of vehicles on the road. There are many more SUVs on the roads today than there were in the 1980s, or even the early 1990s. Figure 12 compares the share of SUV registrations (over total registrations) and the share of SUV-involved fatalities (over all fatalities) between 1985 (the earliest registration data available to ORNL) and 1998 (the latest fatality data available from the Fatality Analysis Reporting System). As can be seen in this figure, the share of SUV fatalities is increasing but not faster than the increase in the share of SUVs on the road.

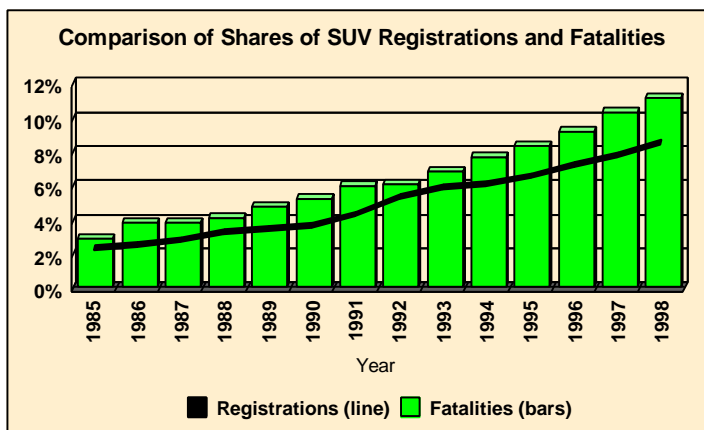


Figure 12. Comparison of the Share of SUV Registrations to Total Registrations (line) and the Share of SUV-Involved Fatalities to Total Fatalities (bars), 1985-1998. Source: The Polk Company, National Vehicle Population Profile 1985-1998, computer data files, and National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

Figure 13 compares overall vehicle registrations with overall highway fatalities between 1985 and 1998. As seen in this figure, overall fatalities are decreasing even while the total number of vehicles registered continues to increase.

Based on a comparison of fatality data for SUVs to other vehicles, the registered-vehicle-fatality rate (defined as number of fatalities per number of registered vehicles) for SUVs is higher than the registered-vehicle-fatality rate for other vehicles. Figure 14 shows the fatality rates for all vehicles and for SUVs since 1985.

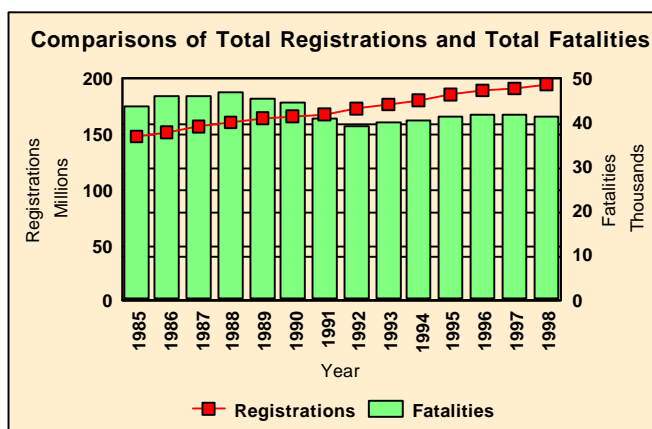


Figure 13. Comparison of the Number of Total Registrations of All Vehicle Stock (line) and the Number of Total Fatalities (bars), 1985-1998. Source: The Polk Company, National Vehicle Population Profile 1985-1998, computer data files, and National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

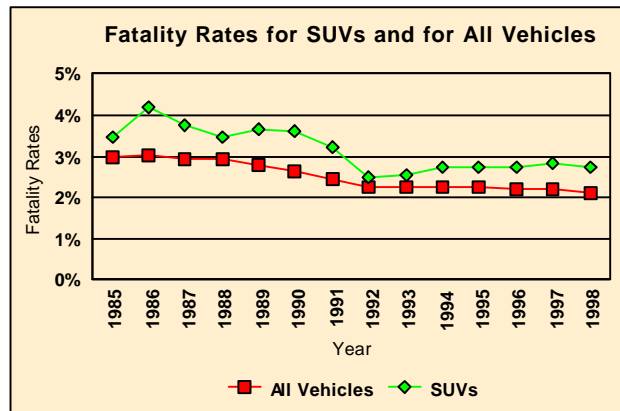


Figure 14. Fatality Rates for All Vehicles and for SUVs, Where Fatality Rate Is Defined as the Number of Fatalities per 100 Registered Vehicles.Source: The Polk Company, National Vehicle Population Profile 1985-1998, computer data files, and U.S. Department of Transportation, National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

The Insurance Institute of Highway Safety has published some fatality/exposure comparisons by vehicle type and size. Table 7 shows fatality rates, where fatality rate is defined as number of fatalities per million registered passenger vehicles 1-3 years old. As shown in Table 7, the fatality rate is highest for small and very small cars, medium-sized pickups, and small SUVs. The fatality rate is lowest for occupants of SUVs weighing over 5,000 pounds.

Table 7. Deaths per Million Passenger Vehicles 13 Years Old, 1998

Size ^a	Cars (including minivans)	Pickups (4WD only)	SUVs (4WD only)	Size explanations ^b
Very small	245	n/a	n/a	Car: WB ≤ 100; L ≤ 165
Small	166	n/a	186	Car: WB = 101-105; L = 166-180 SUV: weight < 3000 lbs
Medium	135	178	113	Car: WB = 106-110; L = 181-195 PU/SUV: weight 3,000-3,999 lbs
Large	106	130	131	Car: WB = 111-115; L = 196-210 PU/SUV: weight 4,000-4,999 lbs
Very large	107	154	93	Car: WB ≥ 115; L ≥ 210 PU/SUV: weight ≥ 5,000 lbs

^a It should be noted that the definitions of “size” are not the same for the different types of vehicles in these categories. Size is defined in terms of wheelbase and length for cars and in terms of weight for pickups and SUVs. The designations into size categories are approximate and, for SUVs, are not precisely as defined in Table 1. “n/a” indicates that there are no vehicles in a category.

^bIn these size explanations, “WB” = wheelbase in inches, and “L” = length of vehicle in inches; PU stands for pickup.

Source: Insurance Institute for Highway Safety, “Fatality Facts,” http://www.highwaysafety.org/safety_facts/fatality_facts/passveh.htm.

It would be interesting to compare fatality rates over time for small, medium, and large SUVs. This comparison is not possible due to the lack of historical registration data by SUV category. However, historical SUV *sales* data are available for small, medium, and large SUVs. Appendix A shows that the growth in SUV registrations for all size categories closely parallels the growth in total SUV sales over time. After noting this similarity, Appendix A then compares sales and fatalities between 1980 and 1998 for small, medium, and large SUV size categories.

An overall “safety” factor, when defined as vehicle crashworthiness (occupant protection in a crash), is difficult to compute. There are various crash tests for head-on, frontal offset, side impact, and rollover tests, but there is no comprehensive scale to weight results from different types of tests. Although crash statistics indicate that large vehicles provide more protection than small vehicles in crashes, there is no methodology to compare crash test results across vehicle models in different size categories.⁴¹

⁴¹ Wald, Matthew L. “Crash Test Statistics a Mystery to Buyers,” *The New York Times*, February 21, 1997.

Actually, crash test results are followed by a caution that the ratings are valid only for vehicles of approximately the same weight.

Safety concerns related to SUVs fall into two categories: (1) occupants of the SUV and (2) non-occupants of the SUV in multiple-vehicle and non-motorist crashes involving an SUV. Appendix B is a tabular listing of the number of fatalities from 1980 through 1998 for SUV-involved crashes of certain types. This appendix contains the total number of fatalities for both single-vehicle and multiple-vehicle crashes and lists the number of fatalities of SUV occupants and occupants of the other vehicle in multiple-vehicle crashes. Appendix B also provides specific data for SUVs involved in rollover crashes that result in fatalities.

Occupants of SUVs are in greater danger of rollover crashes than are automobile occupants. SUVs tend to roll over more easily than automobiles or minivans because of their high centers of gravity, greater weight, and offroad tires, all of which hinder maneuverability.⁴² Figure 15 shows the proportion of rollover/non-rollover fatalities for small, medium, and large SUVs involved in single-vehicle crashes from 1980-1998. Fatalities from rollover crashes were 22% of all fatalities from 1980-1998.⁴³ Single-vehicle crashes made up 56% of total fatal crashes in 1998.⁴⁴

Small SUVs are more likely to roll over than are medium and large SUVs.⁴⁵ As shown in Figure 15 (see also Appendix B), almost 81% of all small SUV, single-vehicle fatalities result from rollover crashes. “The single-vehicle rollover death rate in these vehicles in 1998 was more than 5 times as high as the rate in the largest cars (110 deaths per million registered vehicles compared with 22).”⁴⁶ Not only are SUVs more likely to

⁴² Bradsher, Keith, “The Unsung Comeback of the Large Car,” *The New York Times*, October 3, 1999.

⁴³ U.S. Department of Transportation, National Highway Traffic Safety Administration, “Traffic Safety CD-ROM”

⁴⁴ U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety Facts 1998*, October 1999, p. 49.

⁴⁵ Consumers Union. “The Risk of Rollover in Some Sport-Utility Vehicles and Consumer Union’s Testing for Such Risks,” <http://www.consumer.org/products/SUV/index.html>.

⁴⁶ Insurance Institute for Highway Safety, “Fatality Facts,” http://www.highwaysafety.org/safety_facts/fatality/facts/passveh.htm.

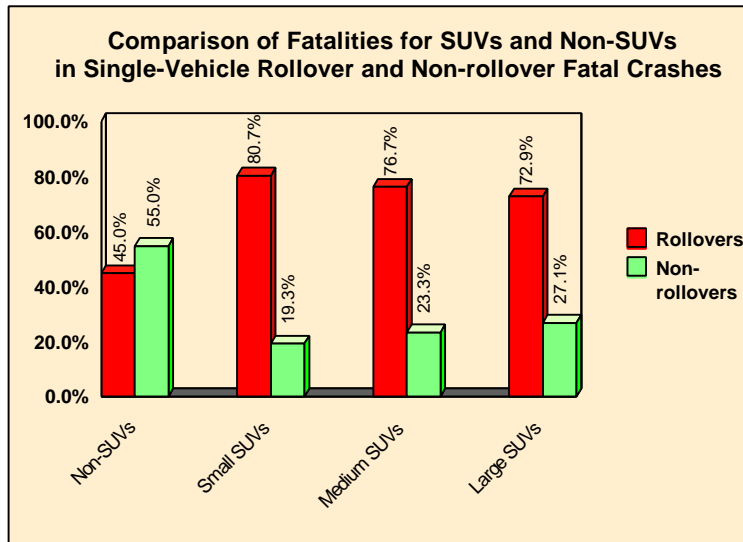


Figure 15. Comparison of Fatalities for SUVs and Non-SUVs in Single-Vehicle Rollover and Non-rollover Fatal Crashes. Source: U.S. Department of Transportation, National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

tip and to roll over than are non-SUVs, their construction does not provide the same protection as does that of automobiles.⁴⁷ The proportion of rollover fatalities for occupants of non-SUV vehicles involved in single-vehicle crashes from 1980 through 1998 is much lower (only about 45%) than that of small SUVs.

Receiving its support from various automobile insurance companies, the Insurance Institute for Highway Safety evaluates crashworthiness (i.e., how well a vehicle protects occupants in a crash). Table 8 lists the results of crash tests for various makes and models within several categories. According to the Insurance Institute of America, frontal offset crash tests are the principal component for judging crashworthiness. In this type of crash test, the medium SUV has better ratings than the mid-sized car.

⁴⁷ “The SUV Info Link,” <http://www.suv.org/safety.html>.

Table 8. Crashworthiness Evaluations: Frontal Offset Crash Test Performance

Category	Number tested ^a	Overall evaluation			
		Good	Acceptable	Marginal	Poor
Small cars	16	1	11	2	2
Small SUVs	10	1	4	4	1
Small pickups	8	0	3	3	2
Passenger vans	13	3	0	3	7
Midsize 4-door cars	15	3	5	0	7
Medium SUVs	15	3	5	3	4
Large family cars	11	4	3	2	2
Large luxury cars	8	5	2	1	0

^aTests of earlier designs are not included in the count of vehicle models tested.

Source: Insurance Institute for Highway Safety, “Vehicle Ratings,”

http://www.highwaysafety.org/vehicle_ratings/ratings.htm.

Figure 16 compares the number of fatalities of SUV occupants to the number of fatalities of occupants of the other vehicle in multiple-vehicle crashes involving SUVs (see also Appendix B). In multiple-vehicle crashes involving small SUVs, more SUV occupants are fatally injured than occupants of the other vehicle. For multiple-vehicle crashes of medium and large SUVs, the non-SUV occupants are more often fatalities. To see the numbers of non-motorists fatally injured in encounters with SUVs, see the tabular listing in Appendix B.

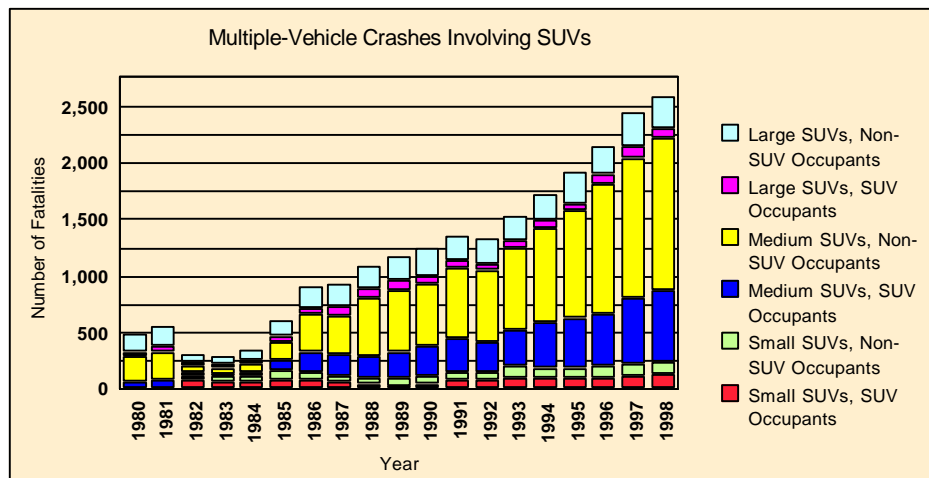


Figure 16. Number of Fatalities for Multiple Vehicle Crashes Involving SUVs, 1980-1998, by SUV Size and by SUV Occupant/Nonoccupant Status. Source: U.S. Department of Transportation, National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.

As shown in Figure 16, medium and large SUVs pose a potential threat to occupants of other vehicles in crashes, just as any other heavy vehicle would. As the size of the SUV increases, the danger to occupants of the “other” vehicle increases. In collisions with medium-sized SUVs, occupants of the non-SUV suffer twice as many fatalities; in collisions with large SUVs, occupants of the non-SUV suffer three times as many fatalities.

Because the bumper and frame on medium and large SUVs are higher than on cars, the SUV may override the bumpers on a car in a collision, causing more intrusion into the automobile. Side impacts are even more hazardous for the automobile occupants than are frontal crashes. In multi-vehicle crashes, when a car is struck by an SUV in a side-impact collision, the occupants of the car are “27 times more likely to die.”⁴⁸ These dangers are brought on by the SUV’s added weight, height, and rigid frame design.

In 1997, some insurance companies raised their rates for *liability* insurance covering SUVs to account for the excessive damage SUVs caused to cars in collisions. (It should be noted that *collision* rates for insuring SUVs are generally lower than automobile rates, which implies that the overall cost to insure an SUV could be less than the cost to insure a similar-priced automobile with insurance companies that do not adjust the liability premiums.)⁴⁹

6. CONCLUSIONS

This study analyzed the growth in popularity of SUVs and examined the impact of SUVs on energy consumption, air quality, and highway safety. The SUV market in the 1990s has seen an increase in the number of available models as well as expanding sales. Since 1990, growth has been greatest for the medium-sized SUV category. It should be noted that while the market for SUVs has grown rapidly, so has the entire light-truck market share. In addition, sales of SUVs, as well as light trucks, are projected to continue to increase between 2000 and 2003.

⁴⁸ “The SUV Info Link,” <http://www.suv.org/safety.html>.

⁴⁹ Bradsher, Keith. “Some Insurers to Increase Rates for Large Vehicles,” *The New York Times*, October 17, 1997.

Several possible reasons have been suggested to explain the popularity of SUVs:

- a sign of economic wellbeing – the percentage of total household expenditures for vehicle purchases and fuel costs has remained almost constant, as the available income has increased in the 1990s,
- a perception of safety – the size of the vehicle and its greater visibility give a perception of safety, and
- “utility” – the average U.S. citizen is more mobile than ever; the SUV combines the hauling/towing power of a pickup truck with the roominess and seating capacity of a minivan.

Though many have called the rising popularity of SUVs a “fad,” with over 16 million registered SUVs (over 3 million sold in 1999 alone – 19% of all light vehicle sales), the SUV is going to be very visible on our highways for years. If the economy takes a down swing or fuel prices increase substantially, sales may begin to stabilize or decline. The popularity of SUVs, however, is not based on vehicle price or fuel economy but on the sporty, rugged image of the vehicle and a perception of safety when encased within its sturdy frame. These reasons for purchasing an SUV are not likely to change. Therefore, SUV popularity will almost certainly continue at the forecast rate (over 3 million units annually after 2000).

Except for those in the small-size category, SUVs generally use more fuel (see Figure 10) and emit more pollutants (see Table 3) than automobiles. In addition, because SUV owners drive more miles per year than the average automobile owner, these additional fuel uses and pollutant emissions are compounded. As shown in Table 2, small SUVs use more fuel annually than large cars; therefore, the popularity of SUVs increases the nation’s dependency on imported oil and comes at a cost to the environment.

As the number of SUVs on the highways grows, the fatal crashes involving SUVs also increases, particularly the medium SUVs, which are the best sellers. In 1998, Polk data indicated that 8.7% of light vehicles were SUVs. During this same year, 11.1% of all fatalities were in crashes that involved SUVs. The fatality rate for SUVs is higher than that of non-SUVs. Does this mean that SUVs are dangerous? No one can say for sure. Usually, larger, heavier vehicles protect their passengers in crashes better than smaller, lighter vehicles. Therefore, larger, heavier SUVs may have safety advantages (for their occupants) when compared to smaller, lighter vehicles. Smaller SUVs would

not have the same advantage. And there are certainly concerns about SUV rollovers. Small SUVs are involved in more single-vehicle rollover fatalities than non-SUVs. Purchasing decisions, however, will most often be made by whether the buyer *feels* safe in the vehicle, instead of using hard facts and crash test data which are difficult to interpret. The safety of these vehicles, therefore, may simply be in the eye of the beholder.

What does the future hold? As new models are developed, their fuel economy may improve, as may their emissions controls. Manufacturers of small, economy cars will develop marketing strategies that will emphasize the advantages of smaller vehicles to a particular market. Some may realize that 4-wheel-drive is not a necessity on city streets. But the SUV will continue as a significant player in the personal vehicle industry and will continue to be useful as a station wagon/minivan/pickup truck/all-terrain vehicle — rolled into one.

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Appendix A

Comparison of Fatality and Sales Data for SUVs

The Polk Company collects registration data on light vehicles. The SUV share of light vehicle registrations as determined by data from Polk is given in Figure A-1. Figure A-1 also shows the percentage of market share of SUV sales. The number of SUV registrations by size category as defined in this paper is not available. As demonstrated in Figure A-1, the percentage of registered vehicles that are SUVs has steadily increased since 1985, reaching 8.6% of total registrations in 1998, a year in which 17.7% of all light vehicles sold were SUVs. The growth of the number of SUVs on the highway, as represented by vehicle registrations, follows fairly closely the slope of the graph of the total sales of SUVs. From 1985 to 1998, the average annual growth in SUV registrations was 12.6% and in SUV sales was 10.8%.

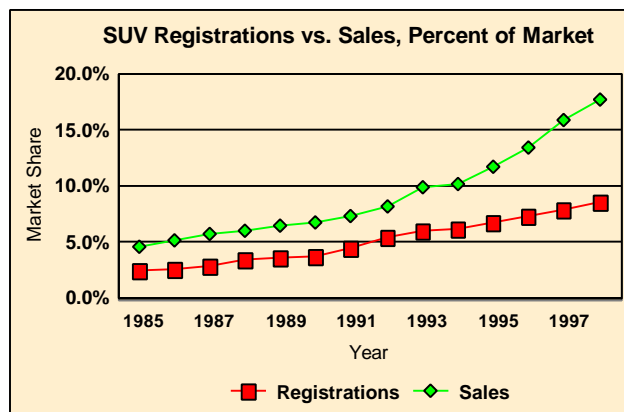


Figure A-1. Comparison of SUV Registrations with SUV Sales, 1985-1998, as a Percentage of Market Share. Source: The Polk Company, National Vehicle Population Profile 1985-1998, computer data files, and Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

Figure A-2 compares total SUV sales (all size categories) to SUV-involved fatalities from 1980 through 1998. This graph shows that fatalities increase as overall sales increase.

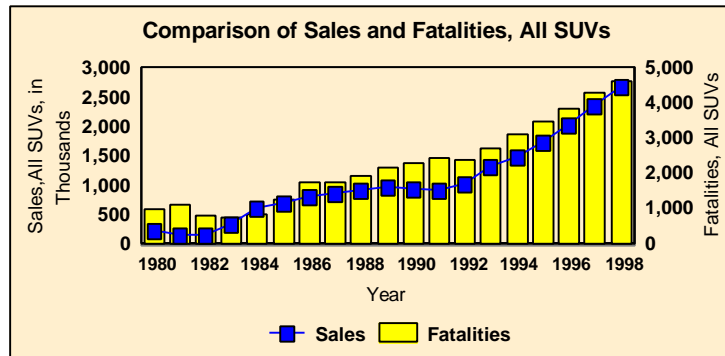


Figure A-2. Comparison of Sales of All SUVs (line; left axis) and SUV-Involved Fatalities (bars; right axis) for All SUV Size Categories. Source: National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html> ; also Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

Using sales data as a measure of actual highway exposure is not completely legitimate because a single year of sales does not represent the total mix of vehicles on the highways. Using annual vehicle registration numbers would be a more accurate representation; however, data specifically showing SUV registrations over time **by size categories** are difficult to derive.

Because of the data limitations for obtaining registration data by size category and because overall market-share sales data are comparable to overall market-share registration data (Figure A-1), the next three charts use sales data, which are available by size categories, as a surrogate for registration data. These charts compare sales and fatalities since 1980 for SUVs by size category.

Figure A-3 compares sales of small SUVs and fatalities involving small SUVs. While the sales of small SUVs have fluctuated widely over the years, the total fatalities involving small SUVs have not followed the sales pattern. In the 1990s, the number of highway fatalities involving small SUVs has risen but has remained at around 1% of total highway fatalities.

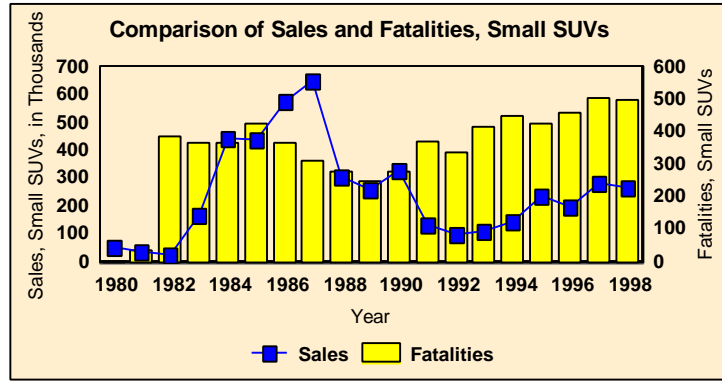


Figure A-3. Comparison of Sales of Small SUVs (line; left axis) and Fatalities Involving Small SUVs (bars; right axis) from 1980 through 1998. Sources: National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>; also Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

There was a dramatic increase in SUV occupant deaths (including both single-vehicle and multiple-vehicle crashes) between 1990 and 1998 for small and medium SUVs. Although the number of SUV occupant fatalities for large SUVs increased only 13% between these years, occupant fatalities for small and medium SUVs increased by 96% and 130%, respectively. The greatest increase in number of fatalities was in the medium-sized SUV category. These increases in the number of SUV-involved fatalities followed increases in sales. When the sales of medium-sized SUVs increased dramatically, so did their highway exposure and their potential for being involved in crashes (Figure A-4).

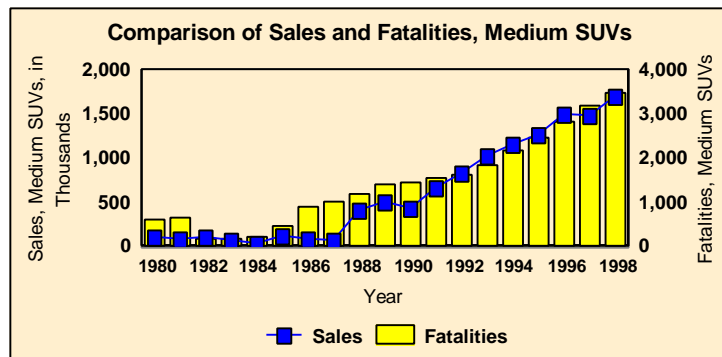


Figure A-4. Comparison of Sales of Medium SUVs (line; left axis) and Fatalities Involving Medium SUVs (bars; right axis) from 1980 through 1998. Sources: National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>; also Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System.

Large SUVs have maintained a fairly constant popularity, as measured in sales volume, since the mid-1980s. As shown in Figure A-5, sales of large SUVs increased dramatically in the mid- to late-1990s. Fatalities involving large SUVs remained at around 1% of total highway fatalities until the mid-1990s; they rose to 1.6% in 1998.

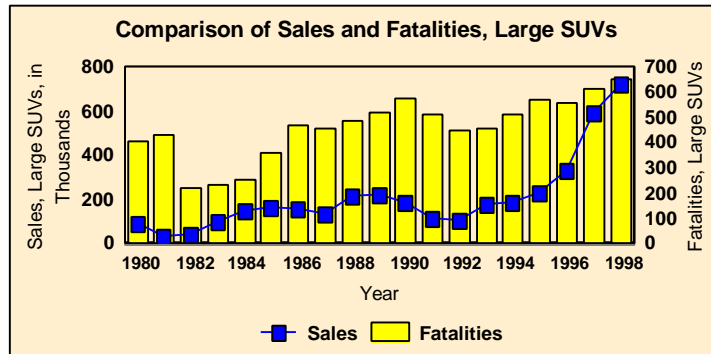


Figure A-5. Comparison of Sales of Large SUVs (line; left axis) and Fatalities (bars; right axis) from 1980 through 1998. Sources: National Highway Traffic Safety Administration, “Traffic Safety CD-ROM” and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>; also Oak Ridge National Laboratory, Light Vehicle MPG and Market Shares System

It must be noted that the charts contained in this appendix are based on sales data, not the actual numbers of SUVs on the road.

Appendix B
Number of Fatalities, by Year and Type of Accident,
in Crashes Involving SUVs, by Size Category

Year	Single-vehicle crash, SUV occupants	Multiple- vehicle crash, SUV occupants	Rollover crashes: Single-vehicle crash, SUV occupants	Rollover crashes: Multiple- vehicles, SUV occupants	Multiple- vehicle crash, occupants of non-SUV vehicle	Non-motorist fatalities involving SUV and non- motorist
Small SUVs						
1980	0	0	0	0	0	0
1981	28	3	25	0	5	2
1982	248	74	210	42	45	21
1983	243	67	199	25	40	16
1984	219	66	179	22	53	30
1985	233	81	194	26	83	28
1986	192	79	155	24	72	25
1987	169	58	136	26	65	20
1988	160	39	126	16	59	18
1989	137	33	118	10	64	16
1990	129	49	110	14	74	28
1991	191	86	151	31	67	29
1992	159	80	124	37	72	28
1993	168	103	135	29	96	47
1994	215	90	166	37	103	41
1995	205	103	155	36	83	35
1996	222	97	187	38	100	41
1997	232	110	172	38	119	45
1998	218	131	175	42	110	39
Medium SUVs						
1980	246	61	181	18	228	51
1981	252	70	191	23	245	64
1982	63	29	44	5	60	22
1983	59	24	46	5	55	18
1984	91	36	76	7	62	18
1985	181	87	144	26	162	39
1986	320	167	247	61	342	78
1987	363	189	290	62	339	91
1988	357	201	265	61	506	112
1989	467	233	360	65	550	135
1990	523	263	400	92	533	129
1991	513	293	384	98	612	142
1992	544	259	415	89	635	164
1993	621	316	480	109	720	189
1994	717	406	520	137	817	220
1995	837	435	632	151	948	246
1996	946	468	746	153	1,149	267
1997	1,023	568	810	199	1,242	357
1998	1,173	635	895	240	1,334	315

Year	Single-vehicle crash, SUV occupants	Multiple-vehicle crash, SUV occupants	Rollover crashes: Single-vehicle crash, SUV occupants	Rollover crashes: Multiple-vehicles, SUV occupants	Multiple-vehicle crash, occupants of non-SUV vehicle	Non-motorist fatalities involving SUV and non-motorist
Large SUVs						
1980	166	45	114	16	156	38
1981	164	60	117	14	164	43
1982	93	24	72	8	80	25
1983	111	33	83	18	72	19
1984	98	38	77	10	97	20
1985	128	49	101	15	149	31
1986	168	60	128	20	194	46
1987	146	76	117	20	190	41
1988	155	80	111	25	202	49
1989	164	76	115	24	219	61
1990	185	83	127	21	249	57
1991	165	83	116	22	204	58
1992	117	57	92	21	222	52
1993	122	74	88	21	211	49
1994	148	76	92	31	229	60
1995	152	63	118	23	289	63
1996	141	80	98	33	256	77
1997	145	96	106	28	312	61
1998	203	99	147	27	282	68
Total SUVs						
1980	412	106	295	34	384	89
1981	444	133	333	37	414	109
1982	404	127	326	55	185	68
1983	413	124	328	48	167	53
1984	408	140	332	39	212	68
1985	542	217	439	67	394	98
1986	680	306	530	105	608	149
1987	678	323	543	108	594	152
1988	672	320	502	102	767	179
1989	768	342	593	99	833	212
1990	837	395	637	127	856	214
1991	869	462	651	151	883	229
1992	820	396	631	147	929	244
1993	911	493	703	159	1,027	285
1994	1,080	572	778	205	1,149	321
1995	1,194	601	905	210	1,320	344
1996	1,309	645	1,031	224	1,505	385
1997	1,400	774	1,088	265	1,673	463
1998	1,594	865	1,217	309	1,726	422

Source: National Highway Traffic Safety Administration, "Traffic Safety CD-ROM" and FARS On-Line Query System at <http://www-fars.nhtsa.dot.gov/www/query.html>.