Are SUVs Used to Match their Utility? SUV Use in New Zealand from 1989 to 2006

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ABSTRACT

This study analysed New Zealand Household Travel Survey data from 1989 to 2006 to assess changes in SUV use over time. SUVs were identified using vehicle make and model information and compared to a sample of cars matched on owner age, gender, and income to control for confounding influences on use. The proportion of SUVs to cars in the New Zealand vehicle fleet increased 7.3% from 1989 to 2006. The additional utility SUVs provide did not differentiate their pattern of use from cars. Privately owned SUVs were used as a substitute for cars, with lower vehicle occupancy and similar proportions of recreational trips compared with cars. The extra utility SUVs provide appears to be utilized by a sub-group of traditional SUVs which continue to be used for commercial purposes.

INTRODUCTION

There is a growing body of research on the characteristics of sport utility vehicle (SUV) drivers' attitudes (Hamilton & Barbato, 2005), driving behaviours (Wasietewski & Evans, 1985), perceptions of risk (Davis & Truett, 2000; Thomas & Walton, 2007), and reasons for purchasing SUVs (Choo & Mokhtarian, 2004). The larger size and general unsuitability of SUVs to high density areas (e.g. Raimond, 2005) is well-documented in the research literature. However, there is relatively less research examining their characteristics and use. In the United States, over 50 percent of all new personal vehicles purchased are SUVs (Kockelman & Zhao, 2000; Niemeier et al., 2001), compared with around 18 percent in some states in Australia (Raimond, 2005). SUVs elicit concern because of their danger to other road users (Thomas & Frampton, 1999; ATSB, 2002; Wood & Simms, 2002; AAMI, 2004, 2005) and higher levels of CO2 emissions relative to other vehicles (Davis & Truett, 2000; Graham, 2001; Raimond, 2005). New Zealand has a unique vehicle fleet because of a high proportion of used imported vehicles (Ministry of Economic Development, 2007). Many countries such as Australia do not allow these vehicles to be imported (Ministry of Transport, 2007), however, in New Zealand SUVs can be purchased for a similar price to cars. Therefore the major constraint on SUV usage is the cost of fuel, not the purchase price. This study uses New Zealand Household Travel Survey (NZHTS) from 1989 to 2006 to examine changing patterns of SUV use over time and how this compares to changing patterns of car use over the same period.

SUV Definition

There is no unequivocal definition of sport utility vehicle. The term is thought to have first been used by the media in the mid 1980s (Traffic Safety Center, 2005a), despite the fact that a number of vehicles in production since the mid-1930s could fit most SUV descriptions. The term "sport utility vehicle" does not appear in the research literature until the mid-1990s, although the term "sport/utility" is sometimes used to describe four wheel drives (4WDs) in research from the late 1970s. Raimond (2005) suggests defining characteristics include four-wheel drive or off-road capability, high ground clearance, wagon body type, and passenger capacity. Thomas & Walton (2007, 2008) relied on visual criteria to determine vehicle category. While the term "SUV" is common for vehicles of this description, some studies (mostly from the United States) include them in the category 'light truck' which also includes minivans, passenger vans and pick-up trucks (Sayer, Mefford & Huang, 2000). The lack of a consistent definition makes study comparisons difficult; a problem exacerbated by data sources such as travel surveys often changing their category definitions across survey years (Traffic Safety Center, 2005a).

Popularity

SUVs have become increasingly popular in recent years as they are perceived to provide increased safety, utility (predominantly increased passenger and luggage capacity) and an elevated driving position compared to other passenger vehicles (Raimond, 2005). However, research has indicated that SUVs are often not used for their intended purpose (e.g. Thomas & Walton, 2007). In the United States, SUVs also have reduced costs due to classification in a category subject to less-stringent fuel economy restrictions (Davis & Truett, 2000; Kockelman & Zhao, 2000; Graham,

2001; Niemeier et al., 2001). Along with other models of light truck, they are marketed to create a rugged outdoor image (Davis & Truett, 2000), in particular, focussing on their off-road ability, increased passenger capacity, improved towing ability and overall greater utility over cars (Plaut, 2004). The most common reason given for owning an SUV is its 4WD ability (Davis & Truett, 2000; AAMI, 2004), however a number of studies suggest a very small proportion of owners actually make use of this ability. For example, Thomas and Walton (2007) found that while SUV owners are more likely than car drivers to take their vehicles off road, two thirds do so either never or infrequently (i.e. once or twice a year). Studies suggest that use and ownership of these vehicles over recent years has shifted towards personal use in urban areas, rather than for commercial or off-road purposes (e.g. Hu, Davis & Schmoyer, 1998; Davis & Truett, 2000; Niemeier et al., 2001; Raimond, 2005).

Driver characteristics and Vehicle Use

The typical SUV driver is male, over 40, and earning a high income (Niemeier et al., 2001; Hamilton & Barbato, 2005), although an increasing number of women are joining the SUV market (Davis & Truett, 2000). Thomas and Walton (2007) found SUV drivers are also likely to have more years of driving experience and higher yearly motor vehicle travel. SUV drivers are also more likely to live in households with a couple and children, with larger families than those that only have cars (Niemeier et al., 2001). Some studies have found that people living in high density urban areas are more likely to drive SUVs (Choo & Mokhtarian, 2004), with as many as 60 percent of SUV drivers living in city areas (AAMI, 2004), while others suggest that SUVs are used more outside urban areas, at least when studying commuter samples (Plaut, 2004).

The likelihood that SUVs will be used for commuting purposes decreases with the number of vehicles in the household overall (Plaut, 2004), possibly because of they are used for specific purposes associated with the utility afforded by the vehicle. SUVs are on average driven further than other cars (Kockelman & Zhao, 2000), especially on weekend days, despite making fewer weekend trips overall (Raimond, 2005). One suggestion previously put forward is that SUVs have become a replacement for people movers with a larger proportion of trip purposes recorded as being for ‘ferrying passengers’, while other uses are reported at similar levels as cars (Raimond, 2005). In contrast, Kockelman and Zhao (2000) found no significant differences in usage when directly comparing SUVs and cars, as well as no difference in the number of passengers on each trip. This remained the case even when focussing on recreational trips, despite this type being generally considered the most appropriate for the vehicle class (Kockelman & Zhao, 2000). A few small differences have been found between SUV and car trips. SUVs are slightly more likely to be used for work trips (Niemeier, et al., 2001), and more likely to be used for recreational trips when multiple vehicles are available (Kockelman & Zhao, 2000). Three-quarters of households that have an SUV have multiple vehicles, a quarter of which have 3 or more (Raimond, 2005).

Overall, the average engine size in the New Zealand light vehicle fleet is increasing (Ministry of Transport, 2007). In 2006 the greatest proportional increase was in the larger engine category (3000-3999cc). The majority of SUVs (over 90%) in one US study had an engine size over 2 litres, while almost 40% of cars had an engine size

smaller than this (Raimond, 2005). This suggests SUVs are at least partly responsible for this overall increase in average engine size. This trend exacerbates concerns over vehicle emissions outlined in the New Zealand Energy Strategy to 2050 (Ministry of Economic Development, 2007). This report states that New Zealand currently has a high number of imported older large vehicles and a slow rate of replacement relying predominantly on used vehicles. Sport Utility Vehicles are important to consider in meeting these future targets due to their large size and fuel inefficiency.

Hypothesis

This study examines how vehicle use differs between cars and SUVs and how use has changed from 1989 to 2006 using the New Zealand Household Travel Survey (NZHTS). The use of SUVs in New Zealand was expected to become more 'car-like' over time, with a reduction in the use of their unique characteristics and intended functions such as their use for social / recreational purposes.

METHOD

Travel Survey

The primary data source was the New Zealand Household Travel Survey (NZHTS), conducted in 1989/1990 and 1997/1998, and is now ongoing from 2003 (for simplicity referred to here as 1990, 1998 and 2006 respectively). A description of the methodology can be found in The Travel Survey Report 1997/1998 (Land Transport Safety Authority, 2000). For each selected household, data was available relating to characteristics of the household, people in the household and the trips they undertake.

SUV Definition and Sample Selection

A complete list of vehicles included in the NZHTS based on make and model was created. From this list SUVs were identified using vehicle information and images obtained from various websites. Vehicles were categorised as SUVs that displayed characteristic visual SUV properties, such as high ground clearance and wagon-type bodies (Raimond, 2005; Thomas & Walton, 2007, 2008). Vehicles with an engine size of less than 1.3L (the smallest SUV engine in production) were excluded, because they were believed to be a result of erroneous data. Four-wheel drives manufactured in a double-cab model were included in this sample as they have similar utility and physical characteristics to SUVs. This inclusion also allows for more direct comparison to overseas studies that include light trucks.

A total sample of 118 SUVs from the 1990, 656 from the 1998, and 1070 from the 2006 surveys was identified based on these criteria. Age, gender, and income have been shown to affect the travel patterns of individuals in past research, especially in the case of optional travel such as recreational trips (Mallet & McGuckin, 2000). To control for these variables, a matched sample was selected at random from a group of drivers matched to the SUV sample on age, gender, and income. The resulting two groups did not differ on age, χ^2 (7, N = 3686) = .01, *n.s.,* gender, χ^2 (1, N = 3688) = .001, *n.s.,* or income, χ^2 (7, N = 3084) = .01, *n.s.*

All analyses were conducted using t-tests, Analysis of Variance (ANOVA), two-way chi-square contingency tables or Logistic Regression. Passenger trips were included in the analysis, as they reflect vehicle characteristics and use in the same way as driver trips. Each vehicle was included as either a driver or a passenger, never both, to avoid any potential double-counting. SUV use was compared to cars using a factorial design: Vehicle type (SUV vs Car), Time (Survey year: 1990, 1998, 2006).

RESULTS

SUVs were compared to the matched sample of cars unless indicated otherwise. The main analyses are shown in Table 1.

Fleet Characteristics

The proportion of SUVs to cars in the New Zealand vehicle fleet increased over time, rising 7.3% from 1990 to 2006, χ^2 (2, N = 36 846) = 621.74, $p < .001$. SUVs had significantly larger average engines than cars across all years, $F(1, 33\ 082) = 362.33$, $p < .001$, and both SUVs and cars showed an increase in average engine size across years, $F(2, 33\ 093) = 38.8$, $p < .001$. A significant interaction was observed, $F(2, 33\ 093) = 3.35$, $p < .05$, where the average increase in engine size was greater for SUVs ($M = .33$ L) than cars ($M = .21$ L). SUVs were on average newer than cars, $F(1, 33\ 871) = 47.19$, $p < .001$, although both vehicle types aged over time, $F(2, 33\ 871) = 181.44$, $p < .001$, and at a similar rate, $F(2, 33\ 871) = 1.85$, *n.s.*

Driver and Household Characteristics

Households with SUVs, on average, had significantly more vehicles than car-only households, across all years, $F(1,3682) = 23.32$, $p < .001$. While several significant differences were observed over time, only the small increase in the average number of cars per household was of note. Cars had a higher average number of vehicle occupants than SUVs, $F(1,18\ 061) = 17.27$, $p < .001$, although the only significant post-hoc difference was in 2006. Average vehicle occupancy decreased for both vehicle types by an average of .1 people per vehicle from 1998 to 2006, $F(1,18\ 061) = 45.16$, $p < .001$. SUVs were also significantly more likely to have a single occupant (70.2%) than cars (65.1%) in 1998, χ^2 (2, N = 6598) = 35.47, $p < .001$, and 2006, χ^2 (2, N = 11467) = 50.45, $p < .001$ (SUVs = 74.2%, cars = 67.8%).

A logistic regression of vehicle type by vehicle owner and survey year revealed that the rate of private ownership of vehicles increased over time, Wald (1, $\beta = .88$) = 5.49, $p < .05$, with SUVs increasing at a faster rate than cars, Wald (1, $\beta = -.39$) = 1.35, $p < .05$. In all years cars were more likely to be privately owned than SUVs but the difference between them decreased from 16.6% to 5.9% from 1990 to 2006. A logistic regression on area type showed that a higher proportion of SUVs were owned in rural locations than cars, and the opposite trend was found for urban areas, Wald (1, $\beta = -.43$) = 67.32, $p < .001$. This trend did not change over time, Wald (1, $\beta = -.02$) =.11, *n.s*.

The proportion of female SUV drivers increased by 20.3% from 1990 to 2006, which was significantly greater than the 5.4% increase in female car drivers, Wald (1, β = -.39) = 1.35, $p < .05$. Females were 19.2 times more likely to drive SUVs than cars in 2006 than 1990, Mantel-Haenszel (1, N = 5035) = 143.16, p < .001 (95% CI from 9.9 to 37.0).

Table 1.
Fleet Characteristics, Driver and Household Characteristics, and Trip Characteristics of Cars and SUVs in New Zealand from 1990 to 2006

			1990		1998		2006	
			Car	SUV	Car	SUV	Car	SUV
		Fleet Characteristics						
Proportion of the vehicle fleet (All cars were included)		%	98.6%	1.4%	95.9%	4.1%	91.3%	8.7%
Engine size (Litres) (All cars were included)		*M* *SD*	1865 (767.3)	2342 (876.3)	1993 (699.4)	2493 (619.5)	2077 (726.9)	2669 (708.3)
Vehicle age (All vehicles less than 30 years old were included)		*M* *SD*	9.15 (5.91)	7.37 (6.22)	9.84 (5.31)	8.39 (5.03)	12.07 (5.26)	11.07 (5.40)
		Driver and Household Characteristics						
Average number of household vehicles		*M* *SD*	2.01 (1.15)	2.36 (1.19)	2.03 (1.01)	2.22 (.94)	2.18 (1.08)	2.44 (1.28)
Average number of Vehicle occupants		*M* *SD*	-	-	1.56 (.99)	1.52 (.96)	1.48 (.82)	1.40 (.82)
Ownership	Privately owned	%	68.4%	51.8%	71.5%	56.3%	80.1%	74.2%
	Company owned / leased	%	12.8%	28.9%	9.2%	22.7%	6.7%	15.0%
	Other	%	18.8%	19.3%	19.3%	21.0%	13.2%	10.8%
Owner area type	Main urban area (Area population: Over 30,000)	%	-	-	64.5%	43.0%	62.3%	45.2%
	Secondary urban area (Area population: 10-30,000)	%	-	-	7.9%	8.5%	10.4%	9.0%
	Rural (Area population: less than 10,000)	%	-	-	27.6%	48.5%	27.3%	45.8%
Gender (Only drivers were included)	Male	%	56.5%	90.4%	52.4%	76.4%	51.1%	70.1%
	Female	%	43.5%	9.6%	47.6%	23.6%	48.9%	29.9%
		Trip Characteristics						
Average trip Distance (km)		*M* *SD*	7.39 (15.46)	12.12 (26.99)	10.18 (22.05)	12.62 (29.45)	9.95 (22.76)	11.91 (24.17)
Trip type	Home	%	32.7%	29.1%	32.4%	30.6%	32.8%	32.1%
	Work	%	14.9%	17.4%	15.6%	15.7%	18.3%	21.3%
	Work – Employer's business	%	5.8%	17.3%	6.8%	13.2%	2.7%	3.5%
	Shopping	%	13.4%	10.7%	11.9%	8.8%	14.8%	13.4%

Personal business / services	%	5.2%	4.4%	6.7%	7.1%	7.4%	7.8%
Accompany someone else	%	8.5%	5.1%	10.2%	7.3%	6.7%	5.3%
Social Recreational	%	19.0%	15.2%	15.7%	16.5%	15.9%	15.3%
Other	%	.5%	.7%	.7%	.7%	1.3%	1.0%

Note: All data derived from the NZHTS

Trip Characteristics

SUVs were driven significantly further on average than cars across all years, $F(1, 21896) = 660.58$, $p < .001$. SUV average trip distance stayed constant across time, SUV, $F(2, 11\ 178) = .89$, *n.s*., whereas average trip distance increased for cars from 1990 to 1998 and then remained constant, $F(2, 11\ 318) = 5.17$, $p < .01$. No significant interaction was observed.

A logistic regression revealed that trips for employers business significantly predicted an interaction of SUV vs car use over time, Wald $(1, \beta = .42) = 15.7$, $p < .001$, where SUV drivers, compared to car drivers, were 2.3 times less likely to use their vehicle for work purposes in 2006 compared with 1990, Mantel-Haenszel $(1, N = 582) = 17.35$, $p < .001$ (95% CI from 1.5 to 3.4), which reflects the decrease in the proportion of commercial ownership. Shopping trips, Wald $(1, \beta = .44) = 4.13$, $p < .05$) and trips to accompany someone else, Wald $(1, \beta = .52) = 4.3$, $p < .05$) were also significant predictors with these trip types being more likely to be observed in cars across all years.

SUVs were no more likely to be used for social or recreational purposes than cars between 1990 and 2006, whether commercially owned vehicles were included or excluded, indicating SUVs are not used particularly for social / recreational purposes. Social and recreational trips comprised one category in the 1990 and 1998 travel surveys, but recognising that they were potentially quite different types of trip, were separated in 2006. For the purposes of the above analysis they were collapsed for 2006. When SUV and car use was compared using separate social and recreational trip types, no significant differences were found, χ^2 $(8, N = 10\ 799) = 47.29$, $p < .001$. People were significantly more likely to accompany others in cars than SUVs across all years, likely a reflection of the higher vehicle occupancy of cars.

Comparison of Traditional and Contemporary SUV Types

The declining use of SUVs for work purposes across time indicates that perhaps the specific types of SUVs that were used for work purposes in 1990 continued to be used for these purposes, and that the increase in private ownership of SUVs and the introduction of many new models over time masked this trend. In 1990 there were 29 different models of SUV, which increased to 57 in 1998 and 72 in 2006. The original 29 models were categorised as ‘Traditional’ SUVs with all additional models in later years categorised as ‘Contemporary’.

Traditional SUVs were significantly older than contemporary SUVs, $F(1, 1630) = 21.74$, $p < .001$, significantly more likely to be commercially owned in 2006, χ^2 $(2, N =$

1054) = 18.4, $p < .001$, and significantly more likely to be owned in rural areas in both 1998, χ^2 (2, N = 656) = 18.29, $p < .001$, and 2006, χ^2 (2, N = 1070) = 14.89, $p < .01$. These SUV sub-types did not differ in average engine size in 1998 or 2006, F(1, 1649) = 2.11, *n.s*. Significant trip differences were observed in 2006, χ^2 (7, N = 6,478) = 150.51, $p < .001$, but not 1998, χ^2 (7, N = 3,957) = 14.07, *n.s*. In 2006 traditional SUVs were more likely to be used to travel to work (26.3%, 16.3%, respectively), and for work purposes (4.4%, 2.4%) than contemporary SUVs, and contemporary SUVs were more likely to be used for shopping (16.3%, 10.9%), accompanying other people (6.3%, 4.4%), and for social / recreational (16.9%, 13.9%) than traditional SUVs.

DISCUSSION

SUVs were shown to be used as substitutes for cars in New Zealand. The additional utility SUVs are perceived to provide, including increased passenger, luggage, and towing capacity (Raimond, 2005) and 4WD ability (Davis & Truett, 2000; AAMI, 2004), did not differentiate the use of privately owned SUVs from that of cars.

While privately owned SUVs may be purchased primarily for recreational use, which is indicated by the higher average number of household vehicles for SUV owners, no evidence was found to show that SUVs are more likely to be used for recreational use than cars. The simple availability of an SUV may lead to it being preferred over a car due to perceptions of increased safety, improved visibility or the relative newness compared to the alternative car. Lower vehicle occupancy combined with a lower proportion of shopping trips in SUVs runs counter to expectation due to SUVs' extra carrying space. This cannot be attributed to single occupant work trips which decreased over time, while private ownership increased. The reason for the high rate of single vehicle occupancy for SUVs is unclear.

The increase in private ownership of SUVs is most likely due to the favourable economic conditions over the observed period. Rising average household income in the early 2000s onwards (Statistics New Zealand, 2009b), the comparable purchase price of SUVs to cars and the lower real petrol prices made SUVs an affordable alternative (Statistics New Zealand, 2009c). To elaborate on changes in petrol prices, in the period 1981 to 2006 the Consumer Price Index (CPI) increased 254.4%, while the price of petrol only increased 168.5%. The price of fuel remained relatively constant through the 1990s, then began a fluctuating upward trend from the 2000s on, increasing more in line with the CPI (Statistics New Zealand, 2009c). SUVs' increasing engine size relative to cars over time suggests that petrol was not an impediment to their use.

NZ has a large primary sector comprising 18% of the country's Gross Domestic Product (Statistics New Zealand, 2009a) which relies on high utility vehicles, especially in agriculture. Traditional SUVs (those that have been in production since 1990) have maintained a clear purpose as work vehicles over time, particularly in rural areas. Commercial vehicles were more likely to be run on diesel than petrol, presumably to lower running costs. The NZ Transport Strategy (Ministry of Transport, 2007) aims to halve greenhouse gas emissions from privately owned vehicles by 2040, reduce single occupant weekday travel in urban areas, and reduce the emissions from new vehicles entering the fleet, all without adversely affecting

economic growth. A policy design to unilaterally decrease the use of SUVs will likely have a negative impact on businesses that rely on them. However, a large proportion of personal trips are made in commercially owned SUVs, so exemptions for businesses will only address part of the problem.

Limitations

While categories of responses in travel surveys need to be kept to a manageable number, the often broad categories can mask differences in vehicle use. Social / recreational trips, even separated as they are now, do not allow for the analysis of low frequency trips such as off-road trips. Travel survey data extending back to the 1970s would have provided additional insight into changing SUV trends, and may have shown larger differences between cars and SUVs than was observed here.

Conclusions

Privately owned SUVs are typically used as a substitute for cars in New Zealand. The additional utility of SUVs does not clearly distinguish their use from that of cars. A sub-group of traditional SUVs retained their high utility purpose as work vehicles over time.

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