Assessing Demand for Rural Intercity Transportation in a Changing Environment

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Disclaimer

ABSTRACT

With higher fuel costs and changing economic conditions, travel behavior and the level and allocation of resources in highways, rail, air, and transit service in rural areas, may be changing. The objective of this study is to determine the attitude of would-be passengers in their choice of mode and the factors determining their choice in rural and small urban areas. A stated preference survey was developed and administered to residents of North Dakota and northwest and west central Minnesota. The survey asked respondents to identify their mode of choice in different hypothetical situations where there were five modes available – automobile, air, bus, train, and van – under differing mode and trip characteristics. A multinomial logit model was used to estimate the likelihood that an individual would choose a given mode based on the characteristics of the mode, the characteristics of the individual, and the characteristics of the trip. Results show that travelers, especially those of lower income, respond to higher gasoline prices by choosing alternative modes in greater numbers, suggesting rural intercity bus, van, and rail ridership would increase if gasoline prices rose. Results also show that age, gender, income, transit experience, traveler attitudes, travel time, trip purpose, and party size affect mode choice.

EXECUTIVE SUMMARY

Higher fuel costs have caused many Americans to revisit when and how they travel. U.S. vehicle miles traveled declined in 2008 on both urban and rural highways while public transportation ridership was at its highest level in over 50 years. The volatility in fuel prices and possible changes in transportation policy have created uncertainty regarding the future cost of intercity automobile travel. Given changes in travel behavior, the optimum level and allocation of resources in highways, rail, air, and transit service in rural areas may be changing as well.

The objective of this study is to determine the attitude of would-be passengers in their choice of mode and the factors determining their choice in rural and small urban areas. To that end, a survey instrument was developed to measure public attitude toward intercity transportation. The survey was administered to residents of North Dakota and northwest and west central Minnesota. A stated preference (SP) survey was used that asked respondents to identify their mode of choice in different hypothetical situations where there are five modes available under differing mode and trip characteristics.

Previous research shows there is some response by motorists to changes in fuel costs. A review of the literature suggests that the price elasticity of demand for fuel is between -0.2 and -0.3 in the short run and between -0.6 and -0.8 in the long run. When individuals reduce their fuel consumption in response to higher prices, they can do so either by reducing vehicle miles traveled or by increasing fuel efficiency. Research shows that both are affected. The weight of the evidence indicates that a 10% increase in the real price of fuel leads to a long-run decrease in vehicle miles traveled of 3%. The price of gasoline could also have an important effect on mode choice. Some research indicates that increases in gasoline prices do lead to increases in public transportation ridership. These cross price elasticities tend to be inelastic, but they vary by mode, city, travel type, and travel distance.

The price of gasoline is one factor that can impact mode choice, but there are others as well. Factors affecting mode choice can be organized into three categories: the characteristics of the different transportation modes, the characteristics of the individual making the trip, and the characteristics of the trip itself. The mode characteristics include cost, travel time, waiting time, comfort and convenience, frequency, and access; the trip-maker characteristics include income, age, gender, car-ownership, ability to drive, and preferences and attitudes; and the trip characteristics include trip purpose, trip length, and party size. The survey, which includes four sections, attempts to include each of these areas.
A main component of the survey is an SP section. SP surveys, also referred to as stated choice experiments, are widely used in areas such as marketing and transportation. In such a survey, the respondent is shown a number of choice sets. Each choice set consists of two or more options, or alternatives, that are described by a set of attributes with varying levels. The survey respondent is asked to choose his or her preferred option.

Our SP survey includes five modes to choose from: air, automobile, bus, train, and van. Environmental characteristics, generic trip attributes that do not depend on the mode, include trip distance, trip type, and party type. Trip distances of 30, 60, 240, and 480 miles were used. Trip type is categorized as either personal or business, and the party type indicates if the individual is traveling alone or with a group of either family and friends or co-workers. Mode-specific factors include price (the explicit financial cost), travel time, transfer requirements, and frequency of service.

Of the 2,000 surveys mailed, 106 were returned undeliverable due to the address being out of date. This leaves 1,894 individuals who (presumably) received the survey. Of these, 237 completed and returned the survey, resulting in a response rate of 12.5%. With each survey respondent given six different SP questions to answer, there were a total of 1,359 SP responses received. The automobile was the mode of choice in 80.4% of these responses, while air, bus, rail, and van accounted for 4.0%, 3.5%, 5.4%, and 6.7% of the responses, respectively.

Only a small percentage of respondents currently use modes other than automobile for regional travel (less than 500 miles). When added together, 14% of survey respondents indicated at least some use of intercity bus, rail, or van for these trips.

The SP survey results show that increases in the price of gasoline lead to decreases in automobile travel with corresponding increases in bus, train, and van travel. As the per gallon price of gasoline increases from $2 to $6, the automobile mode share decreases from 87% to 70%, while the mode shares increase from 1% to 7% for bus, 3% to 8% for train, and 3% to 12% for van.

There are also differences in responses based on age, gender, and income of survey participants as well as trip type and party size.

While a higher gasoline price reduces automobile mode share, this effect is clearly more prominent among those with lower incomes. With the price of gasoline at $2 per gallon, there is little difference in automobile mode share between income groups (85%-87%). However, when the gasoline price climbs to $6, the mode share drops to just over half for those in the lowest income group, while declining only slightly in the highest income group.

In response to the questions on travel attitudes, respondents showed the most interest in timeliness, comfort, cleanliness, and predictability. Environmental issues were not found to be a primary concern for survey respondents, though there was a high degree of variation in response to the environmental items. Safety was also found to not be a major concern regarding intercity travel.

The SP survey data are analyzed using a multinomial logit model, a discrete choice modeling technique. It models the probability that an individual would choose a given mode as a function of the individual, trip, and mode characteristics. In our model, the individual characteristics include age, gender, income, and transit experience. The trip characteristics include trip purpose and party size. The mode characteristics include travel time, cost, service frequency, and need for transfer.

These results show that the odds of choosing air travel decreases for older individuals; men are more likely than women to choose automobile; people of higher income have a greater odds of choosing automobile than those with lower income; the odds of choosing air travel are greater for business travelers and those traveling alone; individuals are more likely to choose automobile if they are traveling for personal reasons rather than business; and people are more likely to choose alternative modes if they have used them in the past. As expected, the odds of choosing a mode are found to decrease as travel time increases and as travel cost increases, and lower income individuals are found to be more sensitive to changes in travel cost. The results suggest that much of the demand shift to bus, train, and van under higher gasoline prices would be from those with lower incomes.

While future fuel costs will impact demand for intercity services, changing demographics may also impact demand. Our findings indicate that an aging population is more likely to choose intercity train, van, or bus service rather than air for regional travel.

One of the unexpected results from this survey is the relative popularity of van service. Van service was chosen roughly twice as often as intercity bus and also more often than rail. The results from the study could provide support for additional intercity van service, but more research is necessary as this study is not conclusive enough regarding this issue.

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1. INTRODUCTION

Higher fuel costs are causing many Americans to revisit when and how they travel. In light of the unprecedented rise in the price of gasoline in 2008, the cutback in airline capacity and the increased prices of air travel in 2008, and an economic recession, an increasing number of individuals may be reducing discretionary travel or considering shifts among modes. U.S. vehicle miles traveled declined in 2008 on both urban and rural highways while public transportation ridership was at its highest level in over 50 years (Federal Highway Administration 2009 and American Public Transportation Association 2009). Gasoline prices have since declined in 2009, but the volatility in fuel costs has created uncertainty regarding the future cost of intercity automobile travel. Government policy has contributed to this uncertainty as federal cap and trade legislation for greenhouse gas emissions being considered by Congress would increase fossil fuel costs by an unknown amount, while the possibility of future increases in the gasoline tax or the implementation of new funding mechanisms for transportation further complicates the situation. Given current changes in travel behavior, the optimum level and allocation of resources in highways, rail, air, and transit service in rural areas may be changing. The study will measure rural, intercity travel behavior and investigate its implications for public policy.

There exists extensive literature on intercity travel demand and mode choice, but there is little research when it comes to intercity travel between small cities and rural areas. It is particularly sparse in discussing the role of shuttle vans. Intercity vans now provide the only public highway transportation between some cities in rural areas. Most of the literature concerning intercity buses deals with long-distance travel between major cities.

The objective of this study is to determine the attitude of would-be passengers in their choice of mode and the factors determining their choice in rural and small urban areas. To that end, a survey instrument was developed to measure public attitude toward intercity transportation. The survey was administered to residents of North Dakota and northwest and west central Minnesota. A stated preference survey was used that asked respondents to identify their mode of choice in different hypothetical situations where there are five modes available under differing mode and trip characteristics.

The paper is organized as follows. Section two provides a description of the geographic area studied and the intercity transportation services available. One of the forces that could impact the demand for these intercity services is changing fuel costs. A number of studies have examined the impacts of fuel cost on traveler behavior. These studies are reviewed in section three. Other factors also influence the choice of mode. Section four identifies the possible factors that could affect mode choice. These factors are included in the survey and empirical model. A description of the survey is then provided in section five, with the results summarized in the following section. A multinomial logit model is used to analyze the survey data. The development of this model and the results are presented in sections seven and eight. The results from a binary logit model that estimates the impacts of individual attitudes on mode choice are discussed in section nine. Section ten provides a discussion of the use of vans for intercity travel. The last section of the paper provides concluding remarks.

2. STUDY AREA

The research area for this study includes all of North Dakota and northwest and west central Minnesota, as shown in Figure 2.1. Geographic boundaries of the survey are defined by zip code, with all North Dakota zip codes and Minnesota zip codes 562XX-567XX being included. The northwest and west central areas of Minnesota are similar to North Dakota in terms of geography, demographics, and travel behavior. This region is largely rural with a few small urban centers but no large urban areas. The area is served by intercity train, bus, and van services.

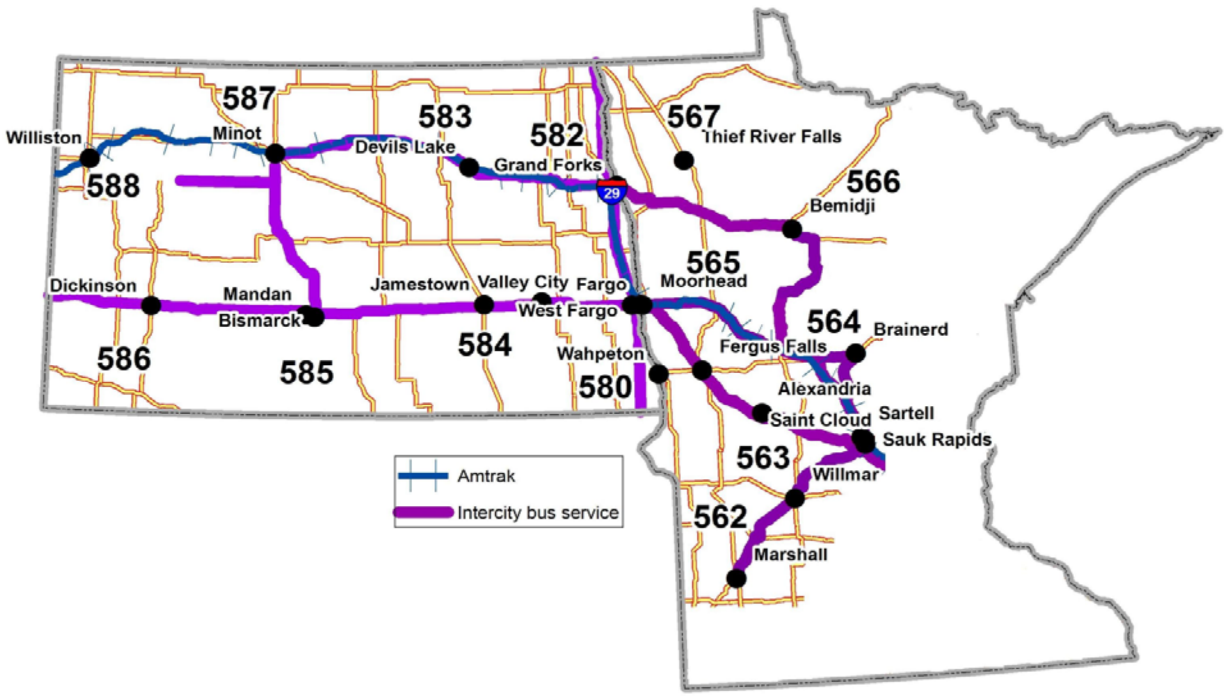

Figure 2.1 Survey Area

Amtrak's "Empire Builder" route operates within this region between St. Cloud, Minnesota, and Williston, North Dakota, over the tracks of the Burlington Northern Santa Fe (BNSF) Railway. Cities served along this route include St. Cloud, Staples, and Detroit Lakes in Minnesota and Fargo, Grand Forks, Devils Lake, Rugby, Minot, Stanley, and Williston in North Dakota. This route is part of a Chicago-Portland/Seattle daily transcontinental run and is the only rail passenger service serving the northern Great Plains in the United States.

In addition to the Amtrak service, intercity bus service is provided between St. Cloud and Fargo via Interstate highway 94 and U.S. Highway 10. Jefferson Lines also provides service to Grand Forks and Winnipeg via Interstate Highway 29, and a route connects St. Cloud to Sioux Falls, South Dakota, through southwestern Minnesota, including the towns of Willmar and Marshall. St. Cloud, Fargo, Grand Forks, Devils Lake, Minot, and Williston have scheduled airline service through connections at the hubs of Minneapolis and Denver. Finally, intercity van service carries passengers between Grand Forks and Minot and between Brainerd and the Minneapolis airport, with stops in Little Falls and St. Cloud.

See Appendix A for a discussion of the history of intercity transportation for both the study area and nationwide.

3. TRAVELER RESPONSE TO RISING GASOLINE PRICES

The increasing cost to travel, due to rising fuel costs, could be a driving force leading to significant changes in travel behavior. These changes could include reduced travel demand or a mode shift from automobile to public transportation. As shown in Figure 3.1, the Midwest average price of gasoline roughly tripled from 1998 to 2008. Even in inflation-adjusted terms, the price increased by 107% over that time period. This section will discuss the implications that higher gasoline prices could have on automobile travel and travel by other modes and review studies that have estimated own-price and cross-price elasticities.

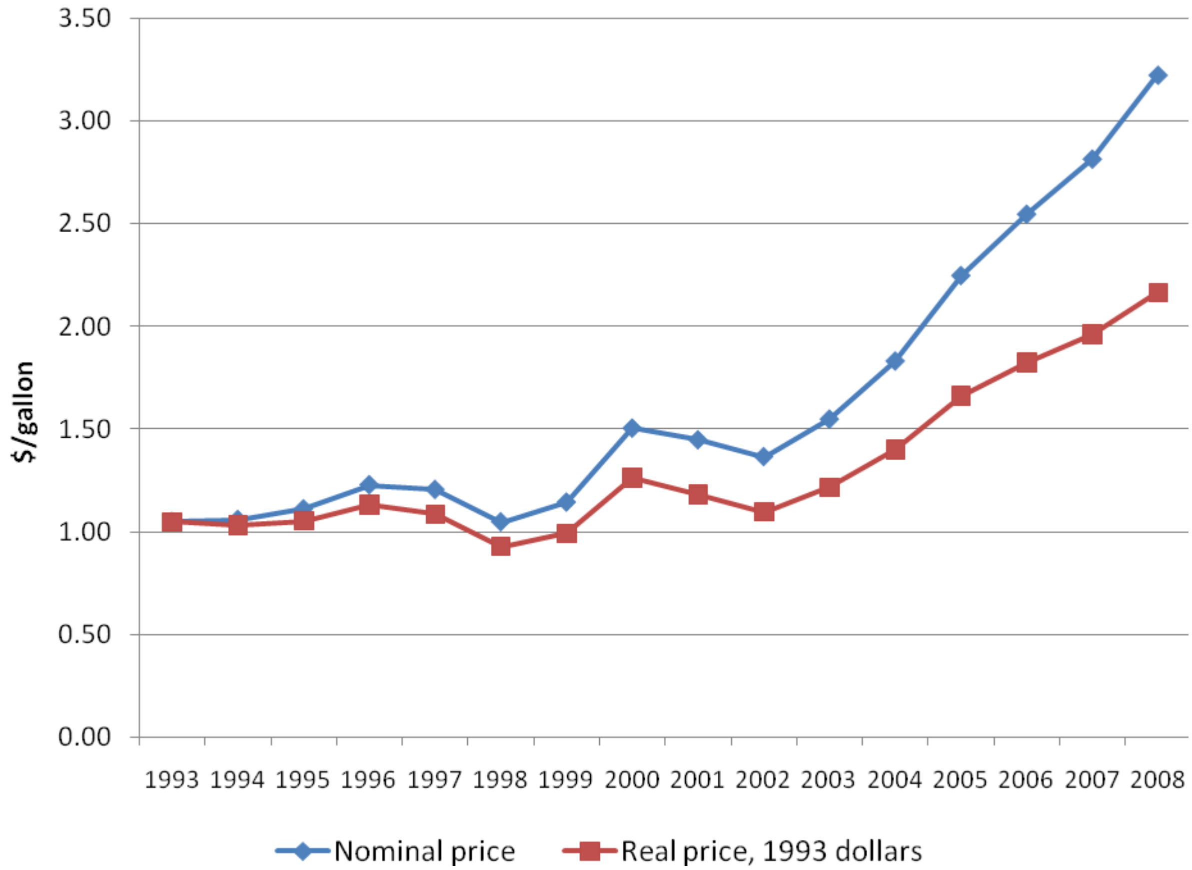

Figure 3.1 U.S. Midwest Average Gasoline Price, 1993-2008

3.1 Impacts on Fuel Consumption

There exists a large body of literature that has analyzed the impacts of fuel price on fuel consumption and vehicle travel. Literature reviews and meta-analyses have been conducted by Espey (1998), Graham and Glaister (2002), Goodwin et al. (2004), and Brons et al. (2006) (see Table 1). Espey (1998) reviewed articles published between 1966 and 1997 covering the time period from 1929 to 1993. This review yielded 277 estimates of long-run price elasticities and 363 estimates of short- or medium-run price elasticities. Goodwin et al. (2004) provided a literature review of papers published since 1990 on the effects of price on fuel consumption, traffic levels, and other variables such as fuel efficiency and car ownership. Their research reviewed 69 studies covering mostly the United States, Europe, and Canada with data periods ranging from 1929 to 1998. Graham and Glaister (2002) analyzed fuel demand elasticities by conducting a literature survey covering 113 studies over the 1966-2000 period. Brons et al. (2006) reviewed 43 studies with 158 different price elasticities of gasoline demand.

Table 3.1 Estimates from the Literature of Elasticities of Fuel Demand and Vehicle Miles Traveled with Respect to Fuel Price

	Fuel Demand		Vehicle Miles Traveled		
Study	Short-run	Long-run	Short-run	Long-run	Notes
Goodwin (1992)	-0.27	-0.71	-0.16	-0.33	Lit review of studies published from 1972 to 1987
Espey (1998)	-0.26	-0.58			Lit review with data periods from 1966 to 1997
Graham and Glaister (2002)	-0.25	-0.77	-0.15	-0.31	Lit review of studies published from 1966 to 2000
Goodwin (2004)	-0.25	-0.64	-0.1	-0.29	Lit review with data periods from 1929 to 1998
Brons et al. (2006)		-0.53*		-0.32*	Meta analysis of studies published from 1974 to 1999
Hughes et al. (2006)	-0.21 to -0.34				U.S. data for 1975-1980
Hughes et al. (2006)	-.0034 to -0.077				U.S. data for 2001-2006

*Not defined as short-run or long-run.

The findings of these studies are quite similar. According to Graham and Glaister (2002), the weight of evidence in the literature suggests that the price elasticity of demand for fuel is between -0.2 and -0.3 in the short run and between -0.6 and -0.8 in the long run. Long-run responses tend to be greater than short-run responses because, over time, consumers have more options available to them. Espey (1998) found short-run price elasticities for gasoline demand averaging -0.26, with a median of -0.23, and long-run price elasticities averaging -0.58, with a median of -0.43. Goodwin et al. (2004) found a mean price elasticity for fuel consumption of -0.25 in the short term and -0.64 in the long term, with standard deviations of 0.15 and 0.44, respectively. Graham and Glaister (2002) found short-run price elasticities averaging -0.25, with a median value of -0.21, and long-run elasticities averaging -0.77, with a median value of -0.55. Brons et al. (2006) found a mean price elasticity of -0.53, though they did not differentiate between short- and long-run effects. In an earlier literature review, Goodwin (1992) found elasticities of fuel consumption with respect to fuel price of -0.27 in the short run and -0.71 in the long run.

These results tended to be fairly robust, though there were some differences based on geographic area or time period. Brons et al. (2006) found a lower sensitivity to price, with respect to total gasoline demand, in the United States, Canada, and Australia. Goodwin et al. (2004) also found that the United States has lower fuel consumption elasticities than Europe. Espey (1998) found that that price elasticities in the United States may be smaller in the short run, but there was no evidence that the long-run elasticities were any different.

Perhaps more importantly, the elasticities could be changing over time. Espey (1998) found that the short-run gasoline demand price responsiveness appears to have declined over time. This finding was corroborated by more recent work by Hughes et al. (2006). As Espey and Hughes et al. noted, many of the studies of gasoline demand were conducted during the 1970s and the early 1980s. Fuel prices were high at the time and there were many concerns about energy conservation and security. Hughes et al. argue that demand elasticities may have changed since then. In their study, they compare price elasticities for two different time periods: 1975-1980 and 2001-2006. Both of these periods had high gas prices, with real prices that were fairly similar. They estimated that the short-run price elasticities of gasoline demand ranged from -0.21 to -0.34 during the 1975-1980 period and from -0.0034 to -0.077 during the 2001-2006 period. The results from the earlier period are consistent with other results from the literature, but the more recent estimates are much lower. The authors concluded that consumers have become significantly less responsive to gasoline price increases in the short run.

Hughes et al. (2006) provided a number of reasons to explain why consumers may have become less responsive to the price of gasoline. First, U.S. consumers may be more dependent on automobiles than they were in the past. An increase in suburban development, for example, has led to greater travel distances, and they hypothesize that this could mean that drivers have less ability to respond to price changes because greater distances decrease the viability of other modes of travel such as walking, biking, or public transportation. Further, when the distance between home and the workplace increases, a greater share of travel is fixed. They also hypothesize that consumers have become less sensitive to price increases due to increasing incomes that have made gasoline consumption account for a smaller share of the budget. However, they did not find evidence to support this hypothesis. Finally, increases in U.S. average fuel economy since the late 1970s may also contribute to the decrease in responsiveness. If a motorist decreases vehicles miles traveled by a certain amount, it would have a greater impact on fuel consumption if he or she is driving a less fuel efficient vehicle; so as more fuel efficient vehicles are being driven, fuel consumption will not decrease as much. Perhaps more importantly, in the late 1970s and early 1980s, there was a significant difference in fuel economy between old and new vehicles, so when someone traded in an old car for a new one, there was a sizable increase in fuel economy and a corresponding decrease in fuel consumption. Today, however, there is not as much of a difference in fuel economy between old and new vehicles, so the potential for consumers to decrease fuel consumption by purchasing a more fuel efficient vehicle is not as great.

The Hughes et al. (2006) study provides some evidence that motorists are not as responsive to fuel prices as previously estimated, but even though they used fairly recent data, there have been considerable increases in fuel prices since their study was published, and it is possible that another structural change in consumer demand could have occurred. Further, their study just examined short-run elasticities, and as they noted, long-run responses are the most important when devising policies. While Espey (1998) had previously noted that short-run elasticities appeared to be decreasing, her study also found that long-run elasticities may have been increasing. The evidence on this is inconclusive.

3.2 Impacts on Vehicle Miles Traveled

While fuel consumption decreases in response to higher price, vehicle miles traveled will not necessarily decrease by the same amount. As shown in Table 1, studies have found that consumers reduce their fuel consumption more than their mileage (Goodwin et al. 2004). When individuals reduce their fuel consumption in response to higher prices, they can do so either by reducing vehicle miles traveled or by increasing fuel efficiency. Research shows that both are affected. Fuel efficiency can be increased by changing driving styles (e.g., more fuel economical speeds, less heavy acceleration and braking) or by driving more fuel efficient vehicles.

Goodwin et al.'s (2004) review of the literature found elasticities for vehicle miles traveled with respect to fuel prices of -0.10 in the short run and -0.29 in the long run. Previously, Goodwin (1992) found estimates of -0.16 in the short run and -0.32 in the long run. Graham and Glaister (2002) found similar estimates of -0.15 in the short run and -0.31 in the long run. Brons et al. (2006) decomposed their estimated value for price elasticity of gasoline demand (-0.53) and estimated price elasticities of -0.22 for fuel efficiency, -0.10 for mileage per car, and -0.22 for car ownership.

The weight of the evidence indicates that a 10% increase in the real price of fuel leads to a long-run decrease in vehicle miles traveled of 3%.

3.3 Cross Price Elasticities

While it is apparent that higher fuel prices lead to some reductions in fuel consumption and travel, the use of alternative modes of travel such as public transportation would allow individuals to reduce fuel consumption without making drastic cuts in travel. The price of gasoline could have an important effect on mode choice. Some research exists which indicates that increases in gasoline prices do lead to increases in public transportation ridership. These cross price elasticities, however, tend to be quite inelastic. Mattson (2008) provides a review of some of these studies, which are shown in Table 2.

Table 3.2 Previous Estimates of Public Transit Demand Elasticities With Respect to Gasoline Prices

Study	Short-run	Long-run	Not defined	Notes
Agthe and Billings (1978)			0.42	Tucson city bus system, 1973-1976
Currie and Phung (2007)			0.04	0.12 for all transit
Doi and Allen (1986)			0.11	New Jersey rail line, probably short-run
Haire and Machemehl (2007)			0.24	For all transit, not just bus
Hensher (1997)			0.02 - 0.12	With respect to car operating costs; based on a survey of residents of Newcastle, Australia; as cited in Litman 2007
Litman (2004)	0.05 - 0.15	0.2 - 0.4		With respect to car operating costs
Luk and Hepburn (1993)	0.07			Australia, as cited in Litman (2004)
Storchmann (2001)	0.07			Germany
TRACE (1999)	0.16	0.12		As cited in Litman (2004)

Research in the 1970s through 1990s in the United States and Australia estimated elasticities of transit demand with respect to gasoline costs or automobile operating costs ranging from 0.02 to 0.42, with the most common estimates being around 0.1 (Agthe and Billings 1978, Doi and Allen 1986, Luk and Hepburn 1993, and Hensher 1997). More recently, studies have estimated elasticities of public transit demand with respect to fuel price of 0.07 in Germany (Storchmann 2001) and 0.07 to 0.30 in Australia (Wallis and Schmidt 2003 and Currie and Phung 2006). A recent study by Currie and Phung (2007) estimated an aggregate elasticity of 0.12 in the United States, but they found that it varies by mode, ranging from just 0.04 for bus ridership to a range of 0.27 to 0.38 for light rail. Other studies have also shown that the elasticities vary between modes and also between cities (Doi and Allen 1986 and Haire and Machemehl 2007). The elasticities can also vary by travel type (Storchmann 2001, Wallis and Schmidt 2003, and Currie and Phung 2008) and can change over time (Currie and Phung 2007). Currie and Phung (2008) calculated higher elasticities in Australia than the United States, and they suggested these results may be due to higher gas prices in Australia, implying that elasticities could increase as the price of gas increases.

Storchmann (2001) provided some evidence that elasticities can vary based on travel type. He found that the elasticity of public transit demand with respect to fuel price is highest for work (0.202) and school (0.121) and lowest for leisure (0.045), shopping (0.031), and holiday (0.016). These results indicate that those who drive for leisure purposes almost never switch to public transportation. Storchmann (2001) concluded that there is almost no substitution between the automobile and public transportation for leisure travel, and that there is much greater substitution between the two modes for work and school travel.

Much of this research is on shorter-distance travel, rather than long-distance intercity travel, but a few studies have shown that demand for longer-distance trips on public transportation is affected by gas prices more so than that for shorter-distance trips. Currie and Phung (2008) found that in Melbourne, Australia, the gas price elasticity for bus demand is 0.32 for routes over 25 km and 0.07 for routes under 7 km. Similarly, they found that the effects of gas prices upon rail transit are almost three times as large for longer-distance trips. Wallis and Schmidt (2003) also found that as higher gas prices deter people from driving, the longer-distance trips are more likely to be replaced by transit than the short-distance ones.

4. FACTORS AFFECTING MODE CHOICE

The price of gasoline is one factor that can impact mode choice, but there are others as well. There exists extensive literature on intercity travel demand and mode choice, and most studies find that cost and time are important determinants of intercity mode choice. Other studies consider service frequency, comfort, habit, information, access and egress, socioeconomic factors, and other variables that could impact mode choice. A number of factors could influence mode choice, but Miller (2004) noted, while reviewing the literature, that most studies use a fairly limited set of explanatory variables, usually travel time, cost, and service frequency, with a few socioeconomic attributes. He noted that a wide set of explanatory variables is needed for modeling mode choice. This section reviews the factors that could influence choice of mode for intercity travel and the research that has been conducted for each. Factors affecting mode choice can be organized into three categories: the characteristics of the different transportation modes, the characteristics of the individual making the trip, and the characteristics of the trip itself. The mode characteristics include cost, travel time, waiting time, comfort and convenience, frequency, and access; the trip-maker characteristics include income, age, gender, car-ownership, ability to drive, and preferences and attitudes; and the trip characteristics include trip purpose, trip length, and party size.

4.1 Mode Characteristics

4.1.1 Cost

Cost is commonly regarded as one of the main factors affecting mode choice. The cost of traveling by automobile consists largely of the price of fuel, while the cost of traveling by bus, rail, or air is represented by the fares paid for each. The previous section discussed research on how fuel costs influence automobile travel as well as travel by bus or rail. There is also extensive literature on the effects of fare changes on transit ridership. Litman (2004), Hanly and Dargay (1999), and Goodwin (1992) provided a review of these studies. These studies tend to focus more on municipal transit systems rather than intercity travel. An increase in fares, naturally, has a negative impact on ridership, but the response is generally found to be somewhat inelastic. Elasticity estimates have ranged from -0.2 to -1.0. Litman (2004) noted that no single transit elasticity value can be applied in all situations and that various factors affect price sensitivities, including user type, trip type, geography, type of price change, direction of price change, time period, and transit type. Studies show that commuters tend to be less responsive to changes in travel costs than leisure travelers.

4.1.2 Travel Time

The tradeoff between cost and travel time has been one of the main themes in transportation demand research over the last several decades (Hensher 2001). Among the earlier work was a study published by Beesley in 1965 (as cited by Hensher 2001). Beesley studied the choice among public transportation modes through the evaluation of two attributes: time and cost. The result of his research was a graphical illustration known as the Beesley Graph, which shows the points where time savings are exactly offset by cost loses (or vice versa). Numerous studies have built upon this work in attempts to estimate the value of travel time savings.

A variety of intercity and mode choice studies over the last several years have demonstrated the importance of travel time. Kumar et al. (2004) studied rural intercity bus service in India, with the objective of understanding users' perceptions for different attributes of service. They analyzed attributes such as in-vehicle travel time, headway, discomfort, and fare. As expected, in-vehicle travel time had a negative effect on rider utility. While headway and discomfort levels were also important, they found in-vehicle travel time to be substantially more important. In the United States, Ashiabor et al. (2007)

developed a nationwide intercity travel demand model, and, as expected, they found that as travel time increased for a given mode, traveler preference for that mode decreased. Proussaloglou et al. (2007) developed an intercity model choice model for long distance travel in the state of Wisconsin, which included in-vehicle travel time and access and egress travel times as explanatory variables. Andrade et al. (2006) studied the travel of shoppers in the Japanese city of Sapporo and found that whenever the travel time on the subway increased, there was a mode shift away from the subway towards both bus and automobile.

A number of studies have attempted to estimate the value of time savings (VTTS) for travel, and Zamparini and Reggiani (2007) conducted a meta-analysis of several such studies that have been conducted in North America, Europe, and Australia. They analyzed 53 studies, which included 90 VTTS estimations, and they found significant variation in the estimates, ranging from 13% to 342% of the hourly wage rate. The mean and median estimates, as a percentage of the wage rate, were 83% and 60%, respectively. The estimates varied by geographic area, trip purpose, and mode. The average estimated VTTS was lower in North America (68%) and highest in Center-South Europe (101%). They did not find estimates of VTTS to change significantly over time, but there was substantial variation in VTTS due to trip purpose, with the value of time being much higher (146% of wage rate) for business trips than for other trips (59%). They found average VTTS estimates for travelers by mode to be 146% for air, 82% for automobile, 77% for train, and 57% for bus. This clearly shows that those who choose air place a much higher value on time savings, while those choosing bus are valuing time at the lowest rate. The results of their meta-analysis confirm this, showing that those who choose rail and bus have a lower willingness to pay to reduce travel time, and that those who choose air pay the higher fares to save time. In studies cited above, Proussaloglou et al. (2007) estimated implied values of time ranging from $10 per hour for personal trips to $31 per hour for business trips (in 2001 dollars) for inter-city travel in Wisconsin, and Kumar et al. (2004) found an estimated value of in-vehicle time of 33 paise per minute in rural India.

Kumar et al., like Zamparini and Reggiani (2007), also concluded that there is a wide variation of the values associated with travel time. Their study suggests that additional factors could influence the value of time beyond those analyzed by Zamparini and Reggiani. Zamparini and Reggiani could not discern any significant effect from income on VTTS and did not analyze any other socioeconomic factors, but Kumar et al. concluded that the values of travel time are affected by socioeconomic characteristics of the user. In their study of rural India, the users were predominantly low-income people with negligible car ownerships. Prasetyo et al. (2003) also found that the value of time varies based on individual needs and values of activity time.

The value of travel time may also vary based on the overall length of the trip. Pinjari et al. (2006) studied commuter travel in Austin, Texas, and they found that in the first 15 minutes, commuters placed little value on travel time but a high value on travel time reliability. After 15 minutes, this reverses rapidly as commuters placed more value on time and less on reliability.

Other studies have specifically estimated the tradeoff between time and cost or time and some other variable. Richardson (2006), for example, studied the willingness of drivers to pay tolls to reduce travel time. Srinivasan et al. (2006) analyzed the trade-off between improved security levels and increased travel times for intercity business trips for travelers in New York City. They found that while positive impressions about security measures increased the likelihood of flying, the increased inspection and boarding time had a negative impact on choosing the air mode.

4.1.3 Others

In addition to travel time, some models will include waiting time, the need for a transfer, and time associated with access and egress. A measure of service frequency is often included as an explanatory variable as well.

Liu and Li (2004) noted that other factors may affect mode choice such as comfort/convenience, security/safety, and reliability, but that few studies have analyzed these factors due to data limitations and modeling difficulties. Liu and Li developed a mode choice model that includes safety and reliability. Kumar et al. included comfort in their model.

4.2 Individual Characteristics

Most studies include some socioeconomic variables as predictors of mode choice. For example, Ashaibor et al., Kumar et al., and Proussaloglou included income in their models. Kumar et al. also included age, gender, education, and profession. Socioeconomic factors can affect how sensitive travelers are to travel time and cost. Ashiabor et al. (2007), for example, found that high-income travelers are less sensitive to travel cost.

The habits and attitudes of individuals can also be important determinants of mode choice. Aarts et al. (1997) found that habit affected the decision making process. Those with strong habits considered fewer attributes of the modes and were more selective in processing information, while those with weak habits used a more complex and cognitively demanding process for choosing the mode of travel. Verplanken et al. (1997) noted that those who had a strong habit towards choosing a particular mode acquired less information about the mode choices. Garvill et al. (2003) similarly found that habit plays a large role in choice of mode.

While habit can have a significant impact on choice of mode, there is some evidence that an intervention can lessen the impact of habit. Bamberg et al. (2003a) studied the impact of the introduction of a prepaid bus ticket on bus use for college students. Before this intervention, student disposition to ride and actual bus use was relatively low, but the free bus pass combined with an informational campaign changed student disposition toward riding the bus. Bamberg et al. (2003b) conducted a similar study in Germany and found, again, that the intervention led to a significant increase in transit ridership. These studies and others by Fujii et al. (2003a and 2003b) have concluded that an intervention, such as a free bus pass or a forced change, can influence traveler attitudes and impact mode choice, not just during the intervention, but even after the intervention. As a result, the previous habits were no longer a strong predictor of mode choice.

Other studies have asked respondents a series of attitudinal questions and analyzed how different attitudes influenced choice of mode. Gilbert and Foerster (1977) found that some attitudes are important while others are not. Golob and Recker (1977) surveyed travelers on their attitudes toward mode choice alternatives, segmented respondents based on their attitudes, and estimated choice models for each segment. Outwater et al. (2003) conducted a similar study more recently. In their study, which analyzed the San Francisco bay area ferry-riding market, travelers were partitioned into eight segments based on their attitudes, and these market segments were used to estimate mode choice models. The attitudinal factors used to segment the market included desire to help the environment, need for time savings, need for flexibility, sensitivity to travel stress, insensitivity to transport cost, and sensitivity to personal travel experience.

4.3 Trip Characteristics

Finally, the characteristics of the trip itself can influence the choice of mode. Research has shown that transit is a closer substitute to the automobile for commuter or business trips than for leisure travel (Storchmann 2001). Business travelers may be motivated differently than those traveling for personal reasons. As the trip distance increases, the substitutability among the different modes may also change. For example, motorists may be more likely to switch to bus or rail in response to higher gas prices as the length of the trip increases (Wallace and Schmidt 2003 and Currie and Phung 2008), which could be due to an increase in the cost difference at greater trip distances. The size of the travel party could also be an important variable that is commonly ignored in mode choice studies (Miller 2004). As the size of the travel party increases, the automobile becomes more cost effective.

5. SURVEY DEVELOPMENT

Our study utilizes a survey to estimate the determinants of intercity mode choice. As discussed in Section 2 and shown in Figure 1, the geographic area studied is North Dakota and northwest and west central Minnesota, with the boundaries of the survey determined by zip codes 562XX-567XX for Minnesota and all zip codes for North Dakota. A random list of 2,000 names and addresses of individuals age 18 or older for this region were obtained from AccuData.

The survey obtains information on regional intercity travel for five different transportation modes. Since the focus is on regional travel, trips longer than 500 miles were not considered. The five modes are defined in the survey as follows:

- Automobile: Personal car, sport-utility vehicle, light-duty truck, van, or other vehicle that is driven by you or a member of your party.
- Air: Commercial or private airplane.
- Bus: Bus that provides passenger service between cities, such as Greyhound or Jefferson Lines.
- Train: Passenger train such as Amtrak.
- Van: Passenger van service operated by a private company or public agency, requiring payment to ride.

As the literature indicates, the choice of mode is influenced by the mode characteristics, trip characteristics, and individual characteristics, including demographic attributes and habits and attitudes. The survey, which includes four sections, attempts to include each of these components. Part A asks questions on how the respondent currently travels. Part B, titled Hypothetical Situations, is a stated preference survey. Part C, titled Your Opinions on Travel, asks a number of attitudinal questions. Part D obtains socioeconomic and demographic information about the respondents. These parts of the survey are described in more detail in the following sections. The entire survey can be found in Appendix B.

5.1 Current Travel Behavior

The purpose of the first section is to understand the travel behavior choices that respondents are and have been making. Four different trip distances are analyzed: 30-100 miles, 101-200 miles, 201-300 miles, and 301-500 miles. For each distance, the respondent is asked to indicate approximately how many trips he or she makes with each of the five modes of travel. The purpose of this question is to understand how often the respondent makes regional intercity trips and the frequency with which he or she chooses each mode given the existing conditions. The answers to this question will provide information regarding habit. The question also asks if trips are taken for business or personal reasons, or both. As discussed previously, trip purpose could influence mode choice, and information regarding whether or not the respondent is a frequent business traveler may be useful in explaining how he or she responds to questions later in the survey.

5.2 Stated Preference Survey

Part B of the survey is a stated preference (SP) survey. SP surveys, also referred to as stated choice experiments, are widely used in areas such as marketing and transportation. In such a survey, the respondent is shown a number of choice sets. Each choice set consists of two or more options, or alternatives, that are described by a set of attributes with varying levels. The survey respondent is asked to choose his or her preferred option. The revealed preference survey, alternatively, is used to observe actual behavior rather than ask respondents how they would behave in a hypothetical situation. SP surveys have gained popularity for use in travel behavior research due to their ability to accommodate hypothetical alternatives and identify behavioral responses to choice situations that are not revealed in the market (Hensher 1994 and Kumar et al. 2004). In our study, an SP survey is useful because it allows us to vary attributes, such as the price of gasoline, to levels not yet observed in the market, which makes it possible to analyze the impact of such a change, and it allows us to survey individuals who do not currently have access to each of the modes of travel. Furthermore, real-world collection of all the necessary variables could prove to be difficult. Because of these advantages, a number of transportation studies have utilized an SP survey to analyze transportation alternatives (Andrade et al. 2006, Dehghani et al. 2002, Kumar et al. 2004, Mehndiratta et al. 1997, Pinjari et al. 2006, Richardson 2002, Richardson 2006, and Srinivasan et al. 2006).

Methods from the field of experimental design were used to develop the stated preference section of the survey (Kuhfeld 2009). Experimental design is a field of statistics concerned with the proper construction of experiments to ensure the preservation of necessary properties. Experimental design is often used in marketing research studies such as this one to assist in the investigation of consumer choices. This is done by providing decision makers two or more alternatives with varying attributes that are presented as scenarios or choice sets. For our study, experimental design methods assisted in the identification of the minimum number of choice sets needed and the construction of individual choice sets. It also guided the assignment of choice sets to individual surveys.

Before applying methods from experimental design, the modes, environmental factors, and mode-specific factors hypothesized to impact rural travel behavior were identified. Five modes were identified: air, automobile, bus, train, and van. Environmental characteristics, generic trip attributes that do not depend on the mode, include trip distance, trip type, and party type. Trip distances of 30, 60, 240, and 480 miles were used. Trip type is categorized as either personal or business, and the party type indicates if the individual is traveling alone or with a group of either family and friends or co-workers.

Mode-specific factors include price (the explicit financial cost), travel time, transfer requirements, and frequency of service. The factors and their relative levels are presented in Table 5.1. These relative factor levels were later mapped into alternative-specific attributes that are presented in the survey as described next.

Table 5.1. Factors, Modes, and Levels for Stated Preference Questions

Factor	Modes	Levels
Price	Air, bus, train, van	Low, high
	Automobile	Low, medium, high
Speed	Air, bus, train, van	Slow, fast
Transfer	Air, bus, train, van	Yes, no
Frequency	Air, bus, train, van	Once per day, every eight hours, every four hours, every two hours

All modes except for automobile travel had two relative price levels: high and low. Automobile trips had a third price level: medium. The per-distance price of travel by level and mode are presented in Table 5.2. This information, combined with each choice set's generic distance attribute, was used to calculate the total cost of travel, a mode-specific factor.

Table 5.2 Price Levels by Mode

	Low	Medium	High
Air	$250/trip		$500/trip
Bus	$0.16/mile		$0.2083/mile
Train	$0.16/mile		$0.2083/mile
Van	$0.16/mile		$0.2083/mile
Automobile	$0.10/mile ($2/gallon)	$0.20/mile ($4/gallon)	$0.30/mile ($6/gallon)

Air, bus, train, and van modes each had two speed levels: slow and fast. For bus, train, and van, slow travel is defined as 48 miles per hour, while fast travel is at 60 miles per hour. All automobile travel is assumed to occur at a speed of 60 miles per hour. Like trip cost, speed, combined with each choice set's generic distance attribute, provides the basis for calculation of the total travel time for the trip. Table 5.3 presents travel time of air travel as a function of trip distance.

Table 5.3 Travel Time by Air

Miles	Slow	Fast
30	25 minutes	20 minutes
60	40 minutes	30 minutes
120	1 hour	45 minutes
240	90 minutes	1 hour
480	3 hours	90 minutes

Given its role in decision making, the price of fuel, a mode-specific factor for automobile travel, was presented with environmental factors in each question's introductory narrative. An example stated preference survey question is presented in Figure 5.1.

You are making a 60-mile personal trip with family and friends. The price of gas at the pump is $2 per gallon. Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Train**	**Air**	**Bus**	**Automobile**	**Van**
Travel Time	75 minutes	30 minutes	1 hour	1 hour	75 minutes
Transfer	No	No	Yes	No	No
Price	$12.50/person	$500/person	$10/person	$6	$10/person
Frequency	Every 2 hours	Once per day	Every 8 hours	-	Every 2 hours

Figure 5.1 Example Stated Preference Survey Question

A full factorial design, where all potential combinations of factor levels are included in the experiment, would have resulted in millions of unique choice sets, far too many for a single participant to complete. SAS software Version 9.1 was used to identify a fractional factorial design, a carefully chosen subset of those in the full factorial design. SAS software determined that 48 choice sets was the minimum number necessary to preserve necessary statistical properties. SAS software also assisted in the construction of the choice sets by randomizing the assignment of factor levels among the 48 choice sets. Although much smaller than the full factorial design, 48 choice sets was still considered to be too many questions for an individual to evaluate. Consequently, the choice sets were randomly assigned to eight blocks. Each survey included a single block of six stated preference questions.

5.3 Attitudinal Questions

The third section of the survey presents a number of statements about travel, and the respondent is asked to respond on a Likert-type scale the degree to which he or she agrees or disagrees with the statement. These statements, which are derived from those used by Outwater et al. (2004), include a number of attitudes regarding one's sensitivity to the environment, time, flexibility, safety, stress, comfort, reliability, privacy, convenience, and other elements of the travel experience.

5.4 Demographic Characteristics

The last section of the survey obtains demographic information about the respondents. Questions are asked about gender, age, education level, household size, income, automobile ownership, ability to operate an automobile, marriage status, employment status, and area of residence as defined by their five-digit zip code.

6. SURVEY RESULTS

Of the 2,000 surveys mailed, 106 were returned undeliverable due to the address being out of date. This leaves 1,894 individuals who (presumably) received the survey. Of these, 237 completed and returned the survey, resulting in a response rate of 12.5%.

6.1 Demographics

Table 6.1 provides demographic characteristics of the respondents, as well as the population characteristics of the study area. Older individuals were more likely to complete the survey, as were men. Among respondents, 58% were male and 57% were 55 or older, including 31% who were 65 or older, while just 9% were under age 35. The respondents cover a range of education and income levels, though compared to the general population, a greater percentage have an advanced education and higher income levels. (The population data are from the 2000 U.S. Census. Given these data are dated, comparisons can be difficult, especially with regard to income.) Two-thirds of the respondents are currently employed. Nearly all of the respondents own (98%) and operate (99%) an automobile, compared to 93% of the population that owns a vehicle. The geographic distribution of the survey respondents closely resembles that of the population.

Table 6.1 Demographics of Survey Respondents and Population

	Survey Respondents		Adult Population*
	Number	%	(%)
Gender			
Male	137	58	50
Female	98	42	50
Age			
18-25	2	1	14
25-34	20	8	15
35-44	29	12	20
45-54	50	21	18
55-64	62	26	12
>64	74	31	21
Education			
High school or less	48	20	47
Some college	82	35	27
College graduate	72	31	21
Post graduate	34	14	5
Income			
<30,000	38	17	41
30,000 - 59,999	79	36	36
60,000 - 99,999	70	32	18
100,000 - 150,000	23	11	4
>150,000	9	4	2
Own Automobile			
Yes	233	98	93
No	4	2	7
Able to Operate Automobile			
Yes	234	99	
No	3	1	
Currently Employed			
Yes	151	65	
No	80	35	

*Source: 2000 U.S. Census.

6.2 Current Travel

Reponses to Part A of the survey show that only a small percentage of respondents use modes other than automobile for regional travel. This part of the survey had a large number of non responses, which in most cases could be interpreted the same as “never.” That is, if survey respondents were not users of a certain mode of travel, it is likely that many of them left the survey question blank. Air travel is more common even for these regional trips (less than 500 miles) than bus, rail, or van travel. Van travel has fewer users overall than air, but it has some more frequent users at the shorter distances. Although the numbers for bus, rail, and van use in Table 6.2 are low, when added together, 14% of survey respondents indicated at least some use of one of these three modes of travel.

Table 6.2 Current Travel Frequency by Mode and Trip Purpose

	Number of trips by mode							Business		Personal	
Mode	5 or more trips per month	1-4 trips per month	6-10 trips per year	1-5 trips per year	Less than once per year	Never	No response	Yes	No	Yes	No
Distance: 30-100 miles											
Automobile	119	61	24	19	4	3	7	102	34	203	4
Air	0	0	0	14	17	95	111	6	17	32	8
Train	0	0	1	0	3	113	120	2	12	5	9
Bus	0	0	1	3	3	110	120	3	13	9	10
Van	5	3	1	1	3	107	117	7	13	9	11
Distance: 101-200 miles											
Automobile	27	55	48	73	10	7	17	62	36	189	1
Air	0	1	0	8	12	98	118	5	14	15	7
Train	0	0	0	1	1	113	122	1	12	3	7
Bus	0	0	0	0	6	110	121	2	11	4	7
Van	1	3	2	3	2	109	117	5	11	7	7
Distance: 201-300 miles											
Automobile	8	17	27	108	33	25	19	46	33	175	3
Air	0	1	0	8	16	95	117	10	11	18	7
Train	0	1	0	0	2	111	123	1	10	3	7
Bus	0	0	0	2	2	109	124	0	9	4	7
Van	1	1	1	3	1	108	122	3	10	5	7
Distance: 301-500 miles											
Automobile	2	9	11	93	58	38	26	31	31	154	3
Air	0	1	2	33	33	72	96	24	12	54	5
Train	1	0	0	2	7	107	120	1	9	9	7
Bus	0	0	0	2	1	110	124	1	8	3	8
Van	0	1	1	2	2	107	124	3	8	5	7

6.3 Stated Preference Response

With each survey respondent given six different SP questions to answer, there were a total of 1,359 SP responses received. The automobile was the mode of choice in 80.4% of these responses, while air, bus, rail, and van accounted for 4.0%, 3.5%, 5.4%, and 6.7% of the responses, respectively (Table 6.3).

Table 6.3 Mode Share Data from the Stated Preference Survey, Overall and for Differing Levels of Gasoline Price and Individual and Trip Characteristics

	Auto (%)	Air (%)	Bus (%)	Train (%)	Van (%)
Total	80	4	3	5	7
Price of Gasoline					
$2/gal	87	5	1	3	3
$4/gal	83	4	3	5	5
$6/gal	70	2	7	8	12
Age					
<35	82	10	2	2	3
35-44	77	5	1	7	10
45-54	83	4	3	5	5
55-64	84	2	4	4	6
>64	77	4	5	7	8
Gender					
Male	84	4	3	4	5
Female	75	4	4	7	9
Income					
<30,000	71	2	7	9	11
30,000-59,999	81	4	4	5	7
60,000-99,999	81	5	3	5	7
>100,000	85	5	1	5	4
Trip Distance					
30 miles	88	0	4	3	5
60 miles	85	0	1	5	8
240 miles	82	1	4	6	8
480 miles	66	16	4	8	6
Trip Purpose					
Business	75	6	5	7	8
Personal	86	2	2	4	6
Group Size					
Alone	80	5	4	6	6
Group	81	3	3	5	8

The SP survey results show that increases in the price of gasoline lead to decreases in automobile travel with corresponding increases in bus, train, and van travel. As the per gallon price of gasoline increases from $2 to $6, the automobile mode share decreases from 87% to 70%, while the mode shares increase from 1% to 7% for bus, 3% to 8% for train, and 3% to 12% for van.

There are also differences in responses based on age, gender, and income of survey participants. Mode share for automobile did not vary significantly with differences in age, but the youngest respondents were more likely than others to choose air travel. Men were found to be more likely than women to choose automobile. With respect to income, the percentage of respondents choosing automobile declined from 85% for those in the highest income group to 71% for those in the lowest income group. On the other hand, mode shares do not appear to change significantly for those of different education levels. Since the survey over-represents men, older individuals, and those with higher income levels, the mode shares expected in the general population may be lower for automobile and air and higher for the other modes.

The results also show that a higher percentage of business travelers choose air, bus, train, or van than those traveling for personal reasons, and those traveling alone were slightly more likely to choose air travel. Mode share for bus and van do not differ significantly with distance, but mode share increases slightly for train and significantly for air travel with increase in distance while declining for automobile travel.

Table 6.4 shows how these percentages change at each distance with changes in gasoline price. At each distance, mode share decreases for the automobile and increases for bus, train, and van as the price of gasoline rises. For 30-mile trips, the automobile has 96% mode share at $2 per gallon, decreasing to 77% at $6 per gallon. The least favorable trip for the automobile is the 480-mile trip with $6 per gallon gasoline, which resulted in a 61% mode share. An unexpected result in this table is that for 480-mile trips, the mode share for air travel decreases from about 20% at lower gas prices to 7% at $6 gasoline. This result may be explained by the income effect. Even though the cost of air travel is not directly affected by the price of gasoline, an increase in fuel cost reduces disposable income, which may result in individuals reducing expenditures on higher-priced goods and services such as air travel.

Table 6.4 Mode Choice Results from Stated Preference Survey, by Distance and Price of Gasoline

Distance/price of gasoline	Auto (%)	Air (%)	Bus (%)	Train (%)	Van (%)
30 miles					
$2/gallon	96	0	1	0	4
$4/gallon	89	0	5	3	3
$6/gallon	77	0	7	8	9
60 miles					
$2/gallon	91	0	1	3	5
$4/gallon	90	0	0	2	8
$6/gallon	74	1	3	9	14
240 miles					
$2/gallon	90	1	0	6	4
$4/gallon	85	0	3	5	7
$6/gallon	72	1	9	6	12
480 miles					
$2/gallon	73	20	2	4	2
$4/gallon	62	21	4	9	4
$6/gallon	61	7	7	11	14

While higher gasoline price reduces automobile mode share, this effect is clearly more prominent among those with lower incomes, as seen in Table 6.5. With the price of gasoline at $2 per gallon, there is little difference in automobile mode share among income groups (85%-87%). However, when the gasoline price climbs to $6, the mode share drops to just over half for those in the lowest income group, while declining only slightly in the highest income group.

Table 6.5 Mode Choice Results from Stated Preference Survey, by Income and Price of Gasoline

Income/price of gasoline	Auto (%)	Air (%)	Bus (%)	Train (%)	Van (%)
<30,000					
$2/gallon	85	1	3	4	7
$4/gallon	74	2	3	8	13
$6/gallon	51	2	17	17	14
30,000-59,999					
$2/gallon	87	5	2	3	4
$4/gallon	83	3	4	5	5
$6/gallon	72	3	5	8	12
60,000-99,999					
$2/gallon	86	7	0	3	3
$4/gallon	83	6	3	5	3
$6/gallon	73	2	5	6	15
>100,000					
$2/gallon	86	7	0	4	3
$4/gallon	88	5	0	3	3
$6/gallon	81	3	2	9	5

One of the unexpected results from this survey is the relative popularity of van service. Van service was chosen roughly twice as often as intercity bus and also more often than rail. One concern is that survey respondents may have misinterpreted the meaning of van, but the results may be explained by the success of intercity van service in areas of central Minnesota covered by this survey. In fact, Minnesota residents with access to these van services were more likely than others to choose van.

6.4 Opinions on Travel

The average responses to the opinion questions from Part C of the survey are shown in Table 6.6. The highest rated items regarded timeliness, comfort, cleanliness, and predictability. The highest rated statement was, “If my travel options are delayed, I want to know the cause and length of the delay.” In fact, a third of respondents responded with a 10 on this statement. The next most highly rated items were having comfortable seats, keeping as close as possible to departure and arrival schedules, having a clean vehicle, and having a predictable travel time. Although comfort is shown to be important, timeliness and predictability may be more important. One of the lower-rated statements was, “I don’t mind delays as long as I’m comfortable,” which had a median response of 4.

Table 6.6 Response to Opinion Questions

Average Score*	Statement
8.2	If my travel options are delayed, I want to know the cause and length of the delay.
8.1	It is important to have comfortable seats when I travel.
7.9	When traveling, I like to keep as close as possible to my departure and arrival schedules.
7.7	A clean vehicle is important to me.
7.6	I prefer a travel option that has a predictable travel time.
6.7	Having a stress-free trip is more important than reaching my destination quickly.
6.5	I would like to make productive use of my time when traveling.
6.3	I would change my form of travel if it would save me some time.
6.0	Having privacy is important to me when I travel.
6.0	I avoid traveling at certain times because it is too stressful.
5.8	I would rather do something else with the time that I spend traveling.
5.7	It's important to be able to change my travel plans at a moment's notice.
5.6	When traveling, I like to talk and visit with other people.
5.4	I prefer to make trips alone, because I like the time to myself.
5.4	I need to make trips according to a fixed schedule.
5.2	I use the most convenient form of transportation regardless of cost.
5.2	I'm willing to pay more for a ticket if allows me to rebook my trip later for free.
5.0	I always take the fastest route to my destination even if I have a cheaper alternative.
5.0	The people who fly are like me.
4.9	I don't mind traveling with strangers.
4.4	I would switch to a different form of transportation if it would help the environment.
4.4	The people who use shuttle vans are like me.
4.3	I don't mind long delays as long as I'm comfortable.
4.1	I would be willing to pay more when I travel if it would help the environment.
4.1	The people who use intercity rail service are like me.
4.0	I worry about getting in an accident when I travel.
3.8	The people who ride intercity bus are like me.
3.1	People who travel alone should pay more to help improve the environment.

*Measured on a 1-10 scale with higher number indicating greater agreement.

Environmental issues are not a primary concern for survey respondents. The lowest-rated statement was, "People who travel alone should pay more to help improve the environment," which had a median response of 2. In fact, 47% gave a response of 1 to this statement. Statements regarding willingness to pay more and switching to a different form of transportation if it would help the environment received median scores of 4 and 5, respectively.

Other statements that were poorly rated regarded concern for safety and opinions that users of intercity buses, rail service, and shuttle vans are "like me." The average response to the statements that people who fly, use shuttle vans, use intercity rail service, and ride intercity buses are "like me" are 5.0, 4.4, 4.1, and 3.8, respectively. These responses indicate that individuals generally feel that users of these alternative modes are different than them. This attitude is the weakest regarding air travel and the strongest regarding intercity bus travel.

Finally, safety is not a major concern regarding intercity travel. The statement, "I worry about getting in an accident when I travel," received a median response of 3.

The statement receiving the greatest variation in response was, "I use the most convenient form of transportation regardless of cost." The average response to this statement was 5.2, but the responses were distributed somewhat uniformly across the 1-10 scale, with 15% answering with a 1 and 10% responding with a 10. The environmental items also had some high variation. Even though the average responses were low, 20% and 25% of respondents, respectively, answered with a 7 or higher regarding willingness to pay more or switch to a different mode of travel if it would help the environment. The response to the statement on comfortable seats had the lowest amount of deviation.

7. THE MULTINOMIAL LOGIT MODEL

The SP survey data are analyzed using a multinomial logit model, a discrete choice modeling technique. Discrete choice modeling is popular in transportation and marketing research for understanding an individual's stated choice among alternatives (Kuhfeld 2009). The multinomial logit model, which is a type of random utility choice model, has been traditionally used to model the choice among alternative modes in intercity travel demand modeling (Koppelman and Sethi 2005).

The basic assumption in such a model is that decision makers are utility maximizers. Therefore, given a set of alternatives, the decision maker will select the one that maximizes his or her utility, U_{jk}. The utility of an alternative k for decision maker j is assumed to consist of a deterministic part that can be estimated, V_{jk}, and a random portion called the error term, ε_{jk}, as follows:

$$U_{jk} = V_{jk} + \varepsilon_{jk} \tag{1}$$

The deterministic part of the utility function includes characteristics of the decision maker, environmental characteristics, and characteristics of the alternatives. Different assumptions about the distribution of the error component result in different choice models. The simplest and most widely used among the multinomial discrete choice models is the conditional logit, which is often what is being referred to as the multinomial logit model (Koppelman and Sethi 2005).

A problem with the conditional logit model is that it suffers from the Independence from Irrelevant Alternatives (IIA) property, which makes the model inappropriate for situations where some pairs of alternatives are more substitutable than others (Koppelman and Sethi 2005). A variety of models have been developed to overcome this problem. One such model is the mixed logit model, which is used in this analysis and is considered a state of the art discrete choice model (Hensher and Greene 2003).

The deterministic portion of the utility from Equation 1 can be written as follows:

$$V_{jk} = \beta' X_j + \gamma' Y_j + \theta' Z_{jk} \tag{2}$$

where X_j are the characteristics of individual j; Y_j are the environmental, or trip, characteristics for individual j; Z_{jk} are the attributes of alternative k for individual j; and β', γ', and θ' are the parameter vectors associated with the vectors X_j, Y_j, and Z_{jk}, respectively. The probability that individual j would choose mode k among m alternatives is as follows:

$$P_{jk} = \frac{\exp(\beta'_k X_j + \gamma'_k Y_j + \theta' Z_{jk})}{\sum_{l=1}^{m} \exp(\beta'_l X_j + \gamma'_l Y_j + \theta' Z_{jl})}. \tag{3}$$

In our model, the individual characteristics include age, gender, income, and transit experience. The trip characteristics include trip purpose and party size. The mode characteristics include travel time, cost, service frequency, and need for transfer.

Age is measured on a scale of 1 to 6: 1) <25, 2) 25-34, 3) 35-44, 4) 45-54, 5) 55-64, and 6) >64. Income is measured on a scale of 1 to 5: 1) <$30,000, 2) $30,000-$59,999, 3) $60,000-$99,999, 4) $100,000-$150,000, and 5) >$150,000. Transit experience is a dummy variable equal to 1 if the individual has any experience using intercity bus, rail, or van, and 0 otherwise. Data for this variable were obtained from the first section of the survey. As previous research has shown that habit plays a role in mode choice, it is expected that previous transit experience may have a positive impact on choosing these alternative modes, everything else being equal. Travel time is measured in hours and cost in dollars. It is expected that an increase in cost will decrease the likelihood of choosing a given mode. The impact of price on mode choice, however, is likely to be affected by income. To account for this effect, an interaction between income and travel price is included. Dummy variables are included for different income groups, with the lowest income group being the base. It is hypothesized that the effect of price on mode choice will diminish as income increases.

The transfer variable is a dummy variable equal to 1 if a transfer is needed and 0 otherwise. Service frequency is measured on a scale of 1 to 4: 1) once per day, 2) once every 8 hours, 3) once every 2 hours, and 4) highest frequency category for automobile. Party size is a dummy variable equal to 1 if traveling alone and 0 if in a group, and trip purpose is a dummy variable equal to 1 if a personal trip and 0 if business. It is hypothesized that individuals are less likely to choose a mode with a transfer and more likely to choose a mode with greater frequency.

The individual and trip characteristics interact with mode dummy variables to estimate the effects of these factors on choice of individual modes. Dummy variables are used for each of the modes except van, so van is the base. Intercept dummy variables for the modes are also included.

8. MODEL RESULTS

The results are shown in Table 8.1, with the independent variables shown in the first column, parameter estimates in the second, and odds ratios for the statistically significant variables in the last column. Many variables are statistically significant, all of which have the expected signs.

8.1 Odds Ratios

The automobile intercept dummy variable shows that the odds of choosing automobile, everything else being equal, is 4.05 times greater than that for other modes. The individual characteristics – age, gender, income, and transit experience – are all found to affect mode choice. Age is found to have a significant negative impact on choice of air travel. As one moves to an older age group, the odds of choosing air decreases by 31%. Gender and income impact the probability of choosing automobile. The odds of choosing automobile increase by a factor of 1.74 if you are a man and 1.29 if you move into the next highest income group.

Table 8.1 Results from Multinomial Logit Model

Independent variable	Parameter estimate	Odds ratio
Auto	1.400**	4.05
Air	1.023	
Bus	-0.841	
Rail	-1.109	
Age*Auto	-0.056	
Age*Air	-0.375**	0.69
Age*Bus	0.163	
Age*Rail	0.096	
Male*Auto	0.557**	1.74
Male*Air	0.551	
Male*Bus	0.038	
Male*Rail	0.171	
Income*Auto	0.255*	1.29
Income*Air	-0.047	
Income*Bus	-0.287	
Income*Rail	0.088	
Alone*Auto	0.241	
Alone*Air	0.950**	2.58
Alone*Bus	0.479	
Alone*Rail	0.507	
Personal*Auto	0.465*	1.59
Personal*Air	-0.862**	0.42
Personal*Bus	-0.7	
Personal*Rail	-0.101	
Transit Exp*Auto	-0.652**	0.52
Transit Exp*Air	0.233	
Transit Exp*Bus	-0.098	
Transit Exp*Rail	0.186	
Travel Time	-0.426**	0.65
Travel Price	-0.0160**	0.984
Travel Price*Inc2	0.00866**	1.009
Travel Price*Inc3	0.00991**	1.010
Travel Price*Inc4	0.0115**	1.012
Transfer	-0.141	
Frequency	0.026	
Goodness of Fit		
Adjusted Estrella = 0.927		
McFadden's LRI = 0.5725		

*denotes significance at the 10% level

**denotes significance at the 5% level

Income also affects how individuals respond to changes in travel costs, as those of higher income levels are less sensitive to changes in the price of travel. One might expect that income would directly impact the odds of choosing air travel, which this study does not find, but it is the interaction between income and cost that is important. Higher income individuals are more likely to choose air travel because they are less sensitive to increases in travel costs. Income still impacts choice of automobile beyond the interaction effect possibly because there are many costs involved in owning an automobile beyond the gasoline price, which is the only cost included in this study.

For individuals who have previously used intercity transit services, their odds of choosing automobile decreases by 48%, meaning that they are more likely to choose alternative modes of travel than those who have never used these services, everything else being equal. Interpreting this result may be difficult. It could be that habit and lack of familiarity make it less likely for those who have never used transit to choose it. Alternatively, the transit experience variable may be endogenous since it may be affected by other variables in the equation. That is, the reasons someone used transit in the past may be the same as those explaining why the same person chooses transit in a hypothetical situation. Removing the transit experience variable from the model has little effect on the parameter estimates for the other variables, suggesting that the model is robust and endogeneity may not be a problem.

The characteristics of the trip (trip purpose and party size) impact mode choice. People traveling in a group or for personal reasons are less likely to choose air travel. If someone is traveling alone, the results show that the odds of choosing air increases by a factor of 2.58. Business travelers are more likely than others to choose air, and those traveling for personal reasons are more likely to choose automobile. The odds of choosing air travel decreases by 58% if the trip is for personal reasons rather than business.

Finally, some of the characteristics of the modes themselves are also important. Travel time and travel price for the modes are highly significant statistically. The estimated odds ratios show that a 1-hour increase in travel time decreases the odds of choosing a mode by 35%. A $1 increase in travel price decreases the odds of choosing a mode by 1.6% for those in the lowest income group. A $1 change in the cost of an intercity trip is rather small, so a small percentage change is not unexpected. Adding the odds ratio from the travel price variable to those income interaction variables shows that the impact of travel price on mode choice decreases as income level increases.

Transfers and service frequency were somewhat unexpectedly not found to have any significant impact on mode choice. The main factors that individuals appear to consider are cost, travel time, and the inherent characteristics of the mode itself, while transfers and service frequency are not considered. This may indicate that these characteristics are less important, or not important, but the survey may also fail to capture the degree to which individuals consider these factors. In the real world, individuals may consider a wide range of variables, but in an SP survey, if the choice sets become too complex, respondents may focus on a few attributes and ignore others. Research has shown that if too many alternatives or attributes are included in a stated choice experiment, the cognitive burden on survey respondents will become too great and they will ignore some of the information (Caussade et al. 2005 and Hensher 2006). This may explain why transfer and frequency were not found to affect mode choice in this study.

8.2 Predicted Probabilities

To better understand these results, the model is used to predict the probabilities that random individuals of differing characteristics would choose each mode under varying circumstances. Table 8.2 shows the predicted probabilities for 15 examples with a random assortment of individual, mode, and trip characteristics. While an extremely large number of such examples exist, these 15 were randomly chosen.

For example, as shown by example 11, a 25-34 year-old male with income over $150,000 who is traveling 60 miles with a group for personal reasons with the price of gasoline at $2 per gallon is highly likely (93%) to choose automobile. The probability of choosing automobile drops and of choosing transit increases with $6 per gallon gasoline, as shown in examples 2, 4, 5, and 7, and with income below $30,000, as shown in examples 9 and 10. The probability of choosing air is high (44%) in example 14 for a female below age 25, with an income of $60-100 thousand, who is traveling 480 miles alone for business purposes.

Figure 8.1 illustrates the impact of gasoline price and income on predicted probabilities. The graph shows the predicted probabilities of choosing automobile for a 45-54 year-old male who is traveling 240 miles alone for personal reasons and has never previously traveled by bus, train, or van. The speed of bus, train, and van is assumed to be the same as automobile, while the air speed is fast. Each curve shows the predicted probability of choosing automobile with varying gasoline prices at a given income level. Since there may be some correlation between gasoline price and fares for the alternative modes, all fare levels are set to high when gasoline price is $6 per gallon and low otherwise. The graph shows that the predicted probability of choosing automobile declines with decreases in income and increases in gasoline price and that those of lower incomes are more sensitive to changes in fuel costs. For those in the two highest income groups, the probability of choosing automobile drops by less than 1% when the gasoline price increases from $2 to $6, while this probability declines by more than 8% for those in the lowest income group. Even the response by the second-lowest income group (3% for those making $30-60,000) is small compared to that for those earning less than $30,000. The results suggest that much of the demand shift to bus, train, and van would be from those with lower incomes. In this example, the predicted non-automobile travel is evenly divided among bus, train, and van, with less than 1% going to air travel.

Table 8.2 Predicted Probabilities of Choosing Each Mode for a Random Sample of Individual, Trip, and Mode Characteristics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age	35-44	25-34	25-34	55-64	35-44	>64	35-44	45-54	55-64	55-64	25-34	>64	<25	<25	25-34
Gender	Female	Male	Female	Female	Female	Male	Female	Female	Male	Male	Male	Male	Male	Female	Male
Income (thousand $)	30-60	60-100	30-60	60-100	60-100	<30	60-100	>150	<30	<30	>150	<30	100-150	60-100	>150
Alone/Group	Alone	Group	Alone	Group	Alone	Alone	Alone	Alone	Alone	Group	Group	Group	Alone	Alone	Alone
Trip Purpose	Business	Business	Business	Business	Personal	Personal	Personal	Personal	Business	Business	Personal	Business	Business	Business	Business
Transit Experience	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Distance	240	480	30	60	240	60	240	30	30	30	60	60	30	480	60
Gas Price ($/gallon)	2	6	2	6	6	2	6	6	4	2	2	4	6	4	2
Air fare	Low	Low	High	High	High	High	High	Low	High	Low	High	High	Low	Low	Low
Bus fare	Low	High	Low	High	Low	High	Low	Low	High	Low	Low	Low	Low	High	Low
Train fare	High	High	High	High	High	High	Low	Low	High	Low	Low	High	High	Low	High
Van fare	Low	High	Low	High	Low	Low	Low	High	Low	Low	Low	High	High	High	High
Air speed	Slow	Slow	Slow	Fast	Slow	Slow	Fast	Slow	Fast	Slow	Slow	Slow	Slow	Slow	Fast
Bus speed	Fast	Fast	Fast	Slow	Slow	Fast	Fast	Slow	Slow	Fast	Fast	Fast	Fast	Fast	Slow
Train speed	Fast	Slow	Fast	Slow	Slow	Fast	Slow	Slow	Slow	Fast	Fast	Fast	Fast	Fast	Fast
Van speed	Fast	Fast	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Fast	Fast	Fast	Slow
Predicted Probabilities															
Auto (%)	68.5	60.1	69.7	61.9	74.9	84.6	71.3	80.2	62.5	62.6	93.3	74.8	73.6	33.5	80.3
Air (%)	4.8	16.0	0.4	0.1	0.8	0	1.0	0.6	0	0	0.1	0	4.6	43.9	3.1
Bus (%)	9.1	9.9	10.2	12.7	8.3	5.3	12.0	6.4	12.4	12.8	2.3	8.5	7.3	7.2	5.4
Train (%)	8.4	4.2	10.1	12.7	7.7	5.3	7.9	6.4	12.4	12.5	2.3	8.5	7.3	8.3	5.9
Van (%)	9.1	9.9	9.7	12.7	8.3	4.9	7.9	6.4	12.7	12.1	2.0	8.1	7.3	7.2	5.3

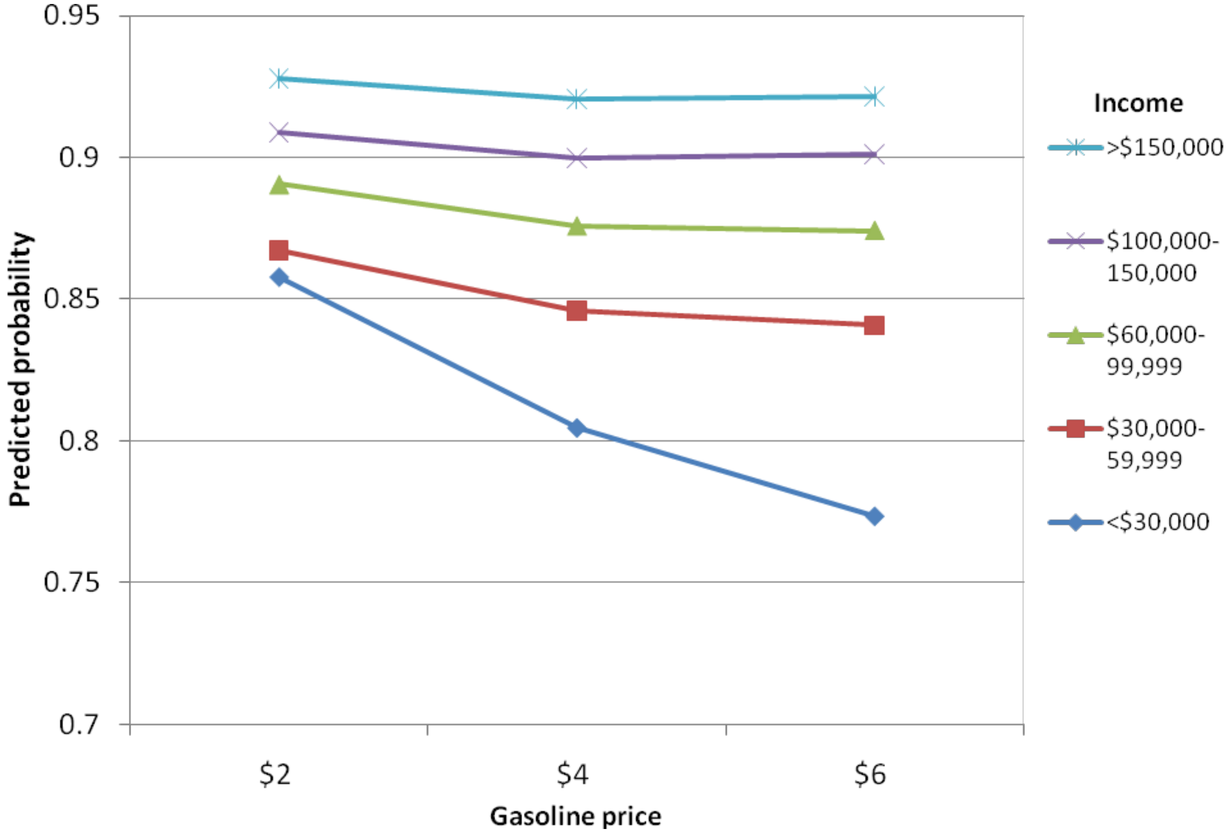

Figure 8.1 Predicted Probability of Choosing Automobile with Varying Gasoline Prices and Income (Assumed for 45-54 year-old male who is traveling 240 miles alone for personal reasons and has never previously traveled by bus, train, or van.)

9. IMPACT OF ATTITUDES ON MODE CHOICE

One aspect that the multinomial model does not address is the impact of attitudes on choice of mode. Including the respondent answers to the attitude questions from Part C of the survey in the model was attempted, but doing so required adding numerous variables; and the algorithm failed to converge with the addition of these variables, causing the estimates to be unreliable. To estimate the impact of attitudes on mode choice, separate binary logit models were estimated for each of the five modes. In these models, the dependent variable is equal to 1 if the mode is chosen and 0 if not. The individual, mode, and trip characteristics are all included as independent variables with the addition of the 28 attitude responses given by the individual. These variables range from 1 to 10, with a higher number indicating greater agreement with the attitude statement.

Table 9.1 shows the estimated odds ratios for each of the attitudes. An odds ratio greater than 1 indicates an increased probability of choosing that mode if the respondent rated a higher agreement with the statement, and an odds ratio less than 1 indicates a decreased probability. The full results are not shown here, as the estimates for the other variables are somewhat similar to what was found with the multinomial model, and the multinomial logit is more appropriate for estimating these effects. The point of showing the estimates in Table 9.1 is to give some indication as to whether attitudes impact mode choice.

Table 9.1 Impacts of Attitudes on Mode Choice, Results from Binary Logit Models

Opinion Statement	Auto	Air	Bus	Rail	Van
	----------------Odds Ratios----------------				
People who travel alone should pay more to help improve the environment.	1.00	1.11	0.87	1.00	1.01
I would be willing to pay more when I travel if it would help the environment.	0.95	0.75	1.14	1.09	1.08
I would switch to a different form of transportation if it would help the environment.	0.93	**1.70****	1.02	1.05	1.01
I would rather do something else with the time that I spend traveling.	**1.17****	**0.72***	0.99	0.87	**0.86***
I would like to make productive use of my time when traveling.	0.98	**1.44***	0.97	0.94	1.05
I prefer a travel option that has a predictable travel time.	0.90	**0.65****	1.28	1.09	1.18
When traveling, I like to keep as close as possible to my departure and arrival schedules.	**0.83****	**2.28****	1.02	1.24	1.01
If my travel options are delayed, I want to know the cause and length of the delay.	**1.21****	1.01	0.87	1.05	**0.68****
I would change my form of travel if it would save me some time.	**0.82****	1.22	1.19	1.14	**1.41****
I always take the fastest route to my destination even if I have a cheaper alternative.	1.06	**1.36***	0.80	**0.78****	0.94
I don't mind traveling with strangers.	**0.89****	1.19	1.05	**1.14***	**1.15****
When traveling, I like to talk and visit with other people.	1.04	0.84	0.95	0.98	0.89
I prefer to make trips alone, because I like the time to myself.	0.98	0.87	1.08	1.05	0.96
I worry about getting in an accident when I travel.	1.02	0.91	1.09	0.96	0.97
Having privacy is important to me when I travel.	1.06	1.11	1.09	0.94	0.88
I need to make trips according to a fixed schedule.	0.99	0.82	1.06	0.94	1.06
It's important to be able to change my travel plans at a moment's notice.	**1.14****	**0.61****	**0.83***	1.04	0.93
Having a stress-free trip is more important than reaching my destination quickly.	**0.84****	1.07	1.01	0.93	**1.43****
I don't mind long delays as long as I'm comfortable.	1.07	1.10	0.95	1.14	**0.78****
It is important to have comfortable seats when I travel.	0.97	**0.35****	**1.53***	0.89	**1.24***
I avoid traveling at certain times because it is too stressful.	1.05	**0.80***	0.92	**1.25****	**0.89***
A clean vehicle is important to me.	**1.12****	1.13	0.92	1.07	**0.78****
I use the most convenient form of transportation regardless of cost.	0.98	1.04	1.12	0.98	0.98
The people who ride intercity bus are like me.	0.95	**1.88****	1.02	0.92	1.07
The people who fly are like me.	1.07	**1.79****	0.95	**0.79****	1.01
The people who use intercity rail service are like me.	0.93	0.83	1.05	**1.42****	0.89
The people who use shuttle vans are like me.	1.01	0.77	1.16	0.84	**1.22***
I'm willing to pay more for a ticket if allows me to rebook my trip later for free.	0.98	**0.80***	0.95	**1.21****	0.94

** denotes significance at 5% level, * at 10% level

The first three attitude questions regard the environment. It was expected that those with greater concern for the environment would be more likely to choose modes other than the automobile, but no statistically significant relationship was found, with the exception being an increased probability of choosing air if they rated question 3 highly.

Those who would rather do something else with their time spent traveling are more likely than others to choose auto and less likely to choose air or van. This result seems counter-intuitive because people who are driving cannot do something else while driving, but it is not known what the something else is of which they are thinking. The next result, on the other hand, shows that people who would like to make productive use of their time when traveling are more likely than others to choose air. This result is more intuitive as air is quicker and, unlike driving, allows the individual to engage in other activities, such as reading, while traveling.

The probability of choosing air decreases among those who prefer a predictable travel time. This result suggests air travel is perceived as being less predictable, whether it is accurate or not. Those who want to keep as close as possible to departure and arrival schedules, on the other hand, are much more likely to choose air. This result, however, could be misleading. It could be the case that those who frequently travel by air are more concerned about staying close to their schedules due to being on a tighter schedule.

One attitude that could influence choice of mode is the willingness to travel with strangers. The results show that those who are more willing to travel with strangers are more likely than others to choose rail or van and less likely to choose automobile.

Flexibility is an advantage of the automobile. Unlike the other modes of travel, one can change travel plans at a moment’s notice when traveling by auto. The results from this model show that this is an influencing factor. Those who are more concerned about being able to change travel plans at a moment’s notice are more likely to choose auto and much less likely to choose air or, to a lesser extent, bus.

The results seem to support the notion that air travel is not comfortable, while indicating that respondents may view bus and van travel as comfortable. Those who are more concerned about having comfortable seats are much less likely to choose air and also more likely to choose bus or van. The magnitude and significance of this effect for air travel is great. Those who are more concerned about having a stress-free trip than with reaching their destination quickly are also more likely to choose van, while being less likely to choose auto. This suggests that the automobile is preferred for its speed but is more stressful for some, and those more concerned about the stress are more likely to choose other modes. The results may also support the notion that people have negative opinions about the cleanliness of transit vehicles (whether warranted or not). Those who are more concerned with the cleanliness of the vehicle were more likely to choose automobile.

Finally, there is some indication that individuals are more likely to choose a mode if they feel that the people who ride that mode are similar to them. This effect was found to exist for intercity rail and van and for air, but not intercity bus. Further research may be needed to better estimate the impacts of these attitudes on mode choice.

10. SHUTTLE VANS IN INTERCITY TRANSIT

One unexpected result of our survey is a possible preference for shuttle vans for travel between cities in our study area. Most of these are vehicles with room for no more than 14 passengers and a driver. Unlike parking and hotel schedules, these vans operate on a regular schedule on fixed routes.

Intercity vans are an overlooked factor in intercity passenger service and the literature. See Appendix C for a historical overview of intercity vans. Fourteen-passenger vans began to take on an intercity role with the consolidation of airlines and the routing of major traffic to hubs. Rather than being a local service for surrounding communities, airline vans began to expand to the nearby cities, especially those with colleges or resort destinations.

The largest reliance on van transportation is found in two similarly-sized destination cities. In 1994, Denver abandoned Stapleton Airport in favor of distant Denver International Airport. Minneapolis-St. Paul International Airport expanded facilities with a new Humphrey Terminal, mostly serving discount airlines.

In Colorado, the proximity to ski resort areas is somewhat hampered by the fact that most of the scenery and resorts are on the opposite side of the Continental Divide from the airport. In Minnesota, there are a number of cities at some distance, but one major airport serving the capital and the state's largest city. In both states, the van lines cover substantial distances, but with smaller and economical vehicles.

These vans are operated into rural areas and smaller cities. They differ from the shuttle vans which take passengers to city centers. Each city has a different approach with suburban carriers serving the airline passenger. Minneapolis relies on its light rail system direct to the airport. A unique feature of the airport is that the only direct connection between the Lindbergh and the Humphrey terminals is the light rail line. (Inter-terminal passengers are carried free.) Denver's Regional Transit district relies on large intercity-type buses to bring airport passengers to various transit hubs throughout the seven-county area.

With the dropping of the incident-to-air restriction, van carriers were not limited to single purposes and are now intercity carriers in their own right.

One of our researchers lives in Little Falls, Minnesota, which is served by Lakes Express, an intercity van company that provides scheduled passenger service between the Minneapolis-St. Paul International Airport and north-central Minnesota. See Appendix D for more information about Lakes Express. From his travel experience and from informal conversations with Little Falls residents, advantages of van travel include the following:

Convenience factor. In Little Falls, the vans leave from the 24-hour Perkins restaurant, where food and comfort are important parts of the travel experience.

Frequency of schedules. The bus runs once a day in each direction. The vans run all day and night.

Reliability of timekeeping. The bus has a poor reputation for being on time. The vans are not only reliable, but ask for passengers' cell phones, so that they may inform customers if the vans are delayed.

Relative economy. The vans charge $95 round trip, which is about $30 more than the bus. However, the handling of baggage, lack of transfer requirements in Minneapolis, and convenience of terminals to most passengers is worth the extra money.

Safety. While the bus comes and goes from a parking lot near McDonald's, passengers waiting for the van have a warm and convenient station at Perkins. Unlike the bus, which can occasionally depart early and leave someone at the bus stop, the van driver checks for passengers.

Weather and traffic conditions. People who otherwise would drive are frustrated by the traffic and construction problems approaching the Minneapolis airport. In addition, adverse weather in Minnesota dissuades people from driving to the airport. Furthermore, parking costs are an additional expense which may be avoided by taking the van.

While this is anecdotal information, it may well be that these stated reasons contribute to a favorable response toward intercity van transportation.

11. CONCLUSIONS

These results show that the odds of choosing air travel decreases for older individuals; men are more likely than women to choose automobile; people of higher income have greater odds of choosing automobile than those with lower income; the odds of choosing air travel are greater for business travelers and those traveling alone; individuals are more likely to choose automobile if they are traveling for personal reasons rather than business; and people are more likely to choose alternative modes if they have used them in the past. As expected, the odds of choosing a mode are found to decrease as travel time increases and as travel cost increases, and lower income individuals are found to be more sensitive to changes in travel cost.

The study considers a hypothetical situation with the price of gasoline at $6 per gallon. The results indicate that in such a scenario, there is clearly an increased demand for alternative modes of transportation, especially among those of lower income. With increased volatility in fuel prices the past few years, there is uncertainty regarding how high gasoline prices could rise over the near-to-medium-term future, but the Energy Information Administration (2009) is projecting long-term increases in the inflation-adjusted price of gasoline. Potential governmental policies, such as a cap and trade program for greenhouse gas emissions, a carbon tax, increases in the gasoline tax, or the implementation of new funding mechanisms for transportation, would have the effect of increasing the cost of automobile travel as well as the demand for intercity bus, rail, and van services. Higher fuel costs could also decrease demand for regional air travel because such price increases would effectively reduce disposable income, causing increased sensitivity to the higher cost of air travel.

Changing demographics may also impact future demand. Our findings indicate that an aging population is more likely to choose intercity train, van, or bus service rather than air for regional travel.

One of the unexpected results from this survey is the relative popularity of van service. Van service was chosen roughly twice as often as intercity bus and also more often than rail. The results from the study could provide support for additional intercity van service, but more research is necessary as this study is not conclusive enough regarding this issue.

The effect of previous transit experience on choice of mode found in this study is also interesting in that it suggests that once a person has become familiar with traveling by an alternative mode, he or she is more likely to choose that mode than a similar person who has never used intercity transit. The implication is that long-term demand for a service may increase if more people are introduced to the alternative mode of travel. More research may be needed to confirm this finding, but it is consistent with other studies that have researched habit and mode choice.

One issue that this study does not address is the travel time to the closest modal start node in relation to the respondent's location. In other words, how far does the respondent need to travel to the closest bus station or rail station, etc? The level of access to a given mode is likely to influence use of that mode. The intent of this study, though, was to investigate preferences for each mode in hypothetical situations where respondents do have access to each mode. Some analysis was conducted to examine if responses varied significantly based on the location of the respondent, but no significant results were found. Further research could examine how the distance to a bus, train, or van stop affects use of those modes. One possible explanation for the preference for van service could have been that some were thinking of a curb-to-curb or door-to-door service, rather than a scheduled service with fixed pick-up points. This difference in level of access would help explain traveler behavior.

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APPENDIX A. HISTORY OF INTERCITY TRANSPORTATION

In 44 B.C., when Julius Caesar rode to the Senate for that fatal session, he had the choice of walking, riding a horse, or riding in a carriage pulled by horses. If he would travel by water, he would have the choice of oars or sails for propulsion. In 1789, when George Washington was inaugurated in Federal Hall in New York City, he had the same means of transportation at his disposal.

But in 1861, when Abraham Lincoln left Springfield for his inaugural in Washington, he boarded his train in the Illinois capital and rode all the way to D.C. in the same coach. When he got there, his speech was instantly sent to the newspapers by telegraph, and Matthew Brady took a photograph of the event. In those 72 years, more changes occurred in transportation and communication than in the previous 1800.

Up until May 9, 1869, someone about to move from New York to California would sell all his possessions and say goodbye to all his friends, whom he would never see again. He could embark on a month-long trip around Cape Horn, or he could take a train to St. Louis, where he would buy what possessions he might need and a wagon, and walk alongside the wagon train to Sacramento for several months.

From May 10 forward, he could buy a ticket at Vanderbilt's first Grand Central Station and head for Sacramento, arriving there by the end of the week. From then on, a whole continent has been at the American traveler's disposal.

Railroads in the East, built mostly between 1840 and 1870, were constructed to link ports to major cities, which already were in place for one hundred years. Railroads in the West, built between 1870 and 1900, were constructed before towns were in place. The Northern Pacific and Great Northern built between towns in the Dakota Territory, hoping that people would settle along their lines to provide traffic before they were completed to Puget Sound. In the East, the towns came first, but in the West, the rails came first, with stagecoach lines (like the Marquis de Mores' route between Medora and Deadwood) filling in the gaps between railheads. Railroads were built primarily for passenger traffic, but by 1920 they found their true profit center in hauling low-value bulk cargo. Only barge lines would haul freight at such reasonable prices, even though the rails operated on the maxim, "All the traffic would bear."

In 1887, our first independent regulatory agency, the Interstate Commerce Commission (ICC), was established to regulate the rates and services of the railroads. In 1935, the ICC's jurisdiction was extended to encompass motor carriers of passengers and property. The ICC lumbered on for over a century, to face sunset in the Clinton Administration. What passenger service remained on the rails (it had been declining since World War II) was turned over to Amtrak by the Rail Passenger Service Act of 1970. (Commuter trains far outnumber Amtrak trains, and they are subject to state regulation.) Except for the Rio Grande Ski Train and some tourist railroads, all passenger rail is run by government agencies, either state or federal. Intercity buses were regulated from 1935 to 1982, when the Bus Regulatory Reform Act was signed into law. Neither the states nor the federal government have any jurisdiction over rates and routes of motor carriers.

The intercity motor bus industry began with motor coach service between Alice and Hibbing, Minnesota. This was the birth of the nationwide Greyhound System, and the upper Midwest is the cradle of the intercity bus lines. Triangle Transportation, which until 2000 was a daily carrier between Grand Forks, Duluth, and Winnipeg (a subsidiary, Star Bus Lines, handled the traffic between Grand Forks and Minot), is almost as old as Greyhound. Although Greyhound drastically cut back its system in 2004, it still is the largest bus line in the country, with Massachusetts-based Peter Pan, operating in the Northeast Corridor, a distant second. In Minnesota and the Dakotas, Minneapolis-based Jefferson Lines is a principal intercity carrier. Prior to the development of intercity bus lines in the Great Plains states, a system of interurban railways (really glorified trolley lines linking one city to another) sprung up in Iowa, Illinois, Indiana, and Ohio. The last of these is the Iowa Traction Co., operating a few miles of electrified track for freight only in and around Mason City, Iowa.

Originally, intercity buses were considered to be complementary to, or feeders for, the railroads. Often they replaced branch line trains which had fewer than 40 passengers per trip. Sometimes the railroads owned bus lines, like the New England Transportation Company, owned by the New York, New Haven & Hartford Railroad, and substituted for passenger train service on New England's many branches. Greyhound emerged as the principal intercity carrier of passengers, and in second place came Trailways, which was not a unified system but a brand name for a number of cooperative independent bus lines and railroad subsidiaries. With the passage of the Transportation Act of 1958, regulation of train discontinuances was transferred to the Interstate Commerce Commission, and the passenger train began to disappear as fast as the passenger pigeon. Often the railroads would use the excuse of paralleling intercity bus lines to show that the public convenience and necessity was served, and that the railroad service was redundant and no longer needed. This decimation of passenger trains continued until the Amtrak takeover in 1971. The discontinuance of private rail passenger service accompanying Amtrak's inception left intercity buses as the only form of public conveyance between small cities and rural areas in most markets.

A nationwide system of paved roads made bus travel possible. Most bus lines such as Greyhound followed the U.S. highways, like famed Route 66. Since they operated with a crew of one, a driver, who also unloaded baggage, and never went for such amenities as serving meals en route, buses were generally the low-cost, and slowest, route. The buses had the advantage of serving downtowns and of making flag stops at unmanned intersections along the highways. The Interstate Commerce Commission prescribed that the buses serve regular routes and follow detailed schedules. The ICC also regulated rates charged by interstate carriers. These rates had to be just and reasonable and not burden interstate commerce. If a state-approved tariff discouraged interstate travel it could be set aside by the ICC. (For example, if the rate between Moorhead and Minneapolis was significantly lower than the bus fare between Fargo and Minneapolis, it would discourage people from boarding the bus in North Dakota and crossing the state line in the bus.) Incident to regular routes was authority to offer charter service from any point on the route to anywhere in the United States. ICC and state authority over rates and routes ended with the Bus Regulatory Reform Act of 1982, but our route structure dates from the days of motor carrier regulation by federal and state commissions.

The coming of the Interstate highway system changed fundamentally the structure of bus routes. Small towns that were on conventional highways lost service, as the buses stayed on the limited-access expressways. Furthermore, buses on Interstate highways or toll roads could now match the speed of passenger trains, or even beat the railroad's time in markets like Hartford-Boston and Philadelphia-Pittsburgh. In the 21^{st} century, bus terminals lost the advantage of a central location and moved to gain easier access to highways. Such inner-city terminals as Chicago, Detroit, and Kansas City moved away from their central city locations to more remote locations near an on-off ramp.

Even towns that are not bypassed have lost service, as buses now only pick up and leave passengers at scheduled stops. Jefferson Lines, which operates between Minneapolis and Fargo on U.S. 10 (formerly operated by Greyhound, which now uses I-94) only stops at stations that have Amtrak service, as well as at Monticello, Little Falls, Brainerd, and Wadena. People from bypassed towns have to get to a city that has scheduled passenger service. Even then, there may be no ticket agent, and passengers have to buy a ticket from an open station en route.

The 2004 cutback in Greyhound service left many more towns without service or with devious routes. For example, there is no eastbound service out of Wyoming, and a trip from the capital city of Cheyenne to the state university at Laramie requires a circuitous run with a change of buses in Fort Collins, Colorado. The old 3-B's transcontinental route (Bismarck, Billings, and Bozeman) along I-94 and paralleling the old Northern Pacific lines now is operated with Greyhound coaches but drivers from Rimrock Stages. The sharp increase in air fares in 2004 was followed by more modest but still significant bus fare hikes, along with charges for checking baggage. Nonetheless, the intercity bus network remains intact, although connections and interline ticketing may cause problems.

In addition to scheduled intercity bus service, an informal network of passenger vans has developed in the Midwest. Most of these have evolved to the point that they offer scheduled service throughout the day, usually from a hub airport. In particular, Denver has a large number of vans from the airport to ski resorts and other mountain communities, and Minneapolis-St. Paul has van service to the lake country and for medical travel to the Mayo Clinic in Rochester. What they lack in comfort (bench sets, no restroom, or checked baggage) they make up with more frequent departures. Minneapolis-Brainerd has one round trip daily on Jefferson Lines; Lakes Express runs its vans every four hours, although the cost is about double the bus fare. The former route of Star Bus Lines between Grand Forks and Minot and on to Bismarck is now handled by a scheduled van service hauling a trailer for baggage.

APPENDIX B. SURVEY

The following is the survey used in the study. Eight different versions of the survey were distributed. Parts A, C, and D were identical in each survey, but the stated preference questions in part B differed. This is one of the eight versions.

Mode Descriptions

This survey references five different modes of transportation, which are defined as follows.

Automobile Personal car, sport-utility vehicle, light-duty truck, van or other vehicle that is driven by you or a member of your party.

Air Commercial or private airplane.

Bus Bus that provides passenger service between cities, such as Greyhound or Jefferson Lines.

Train Passenger train such as Amtrak.

Van Passenger van service operated by a private company or public agency, requiring payment to ride.

Part A. How You Travel

In this section, we ask how often you make trips of varying distance and by which mode of travel you use. There are four different distance categories presented: 30-100 miles, 100-200 miles, 200-300 miles, and 300-500 miles. For each, indicate how often you travel by each mode, and then indicate if any of those trips are business or personal. Consider a round trip as two separate trips.

1. DISTANCE: 30 TO 100 MILES ONE WAY

	Number of trips by mode						**Business**		**Personal**	
Mode	**5 or more trips per month**	**1-4 trips per month**	**6-10 trips per year**	**1-5 trips per year**	**Less than once per year**	**Never**	**Yes**	**No**	**Yes**	**No**
Automobile										
Air										
Train										
Bus										
Van										

2. DISTANCE: 101 TO 200 MILES ONE WAY

	Number of trips by mode						**Business**		**Personal**	
Mode	**5 or more trips per month**	**1-4 trips per month**	**6-10 trips per year**	**1-5 trips per year**	**Less than once per year**	**Never**	**Yes**	**No**	**Yes**	**No**
Automobile										
Air										
Train										
Bus										
Van										

3. DISTANCE: 201 TO 300 MILES ONE WAY

	Number of trips by mode						Business		Personal	
Mode	**5 or more trips per month**	**1-4 trips per month**	**6-10 trips per year**	**1-5 trips per year**	**Less than once per year**	**Never**	**Yes**	**No**	**Yes**	**No**
Automobile										
Air										
Train										
Bus										
Van										

4. DISTANCE: 301 TO 500 MILES ONE WAY

	Number of trips by mode						Business		Personal	
Mode	**5 or more trips per month**	**1-4 trips per month**	**6-10 trips per year**	**1-5 trips per year**	**Less than once per year**	**Never**	**Yes**	**No**	**Yes**	**No**
Automobile										
Air										
Train										
Bus										
Van										

Part B. Hypothetical Situations

In this section, you are provided with a number of hypothetical situations. In each situation, you are taking a trip and are asked to choose which mode of travel you would use given the circumstances. Factors that you will consider include the travel distance, time, price, frequency of service and need for a transfer (for non-automobile modes of travel), whether it is a personal or business trip, and whether you are traveling alone or in a group. The price refers to the fares for air, bus, train, and van travel and to the cost of fuel for automobile travel. The travel time and price are calculated based on a **one-way** trip. Take your time and consider each situation carefully.

You are making a 480-mile business trip. The price of gas at the pump is $4 per gallon.

Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Air**	**Automobile**	**Van**	**Train**	**Bus**
Travel Time	90 minutes	8 hours	10 hours	8 hours	10 hours
Transfer Required	Yes	No	No	No	No
Price	$500	$100	$80	$80	$100
Frequency	Every 2 hours	—	Every 2 hours	Every 2 hours	Once per day
	☐	☐	☐	☐	☐

You are making a 30-mile personal trip. The price of gas at the pump is $2 per gallon.

Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Automobile**	**Van**	**Bus**	**Train**	**Air**
Travel Time	30 minutes	30 minutes	30 minutes	40 minutes	20 minutes
Transfer Required	No	Yes	No	No	No
Price	$5	$6.25	$5	$5	$250
Frequency	—	Every 2 hours	Every 2 hours	Every 2 hours	Once per day
	☐	☐	☐	☐	☐

You are making a 480-mile personal trip with family and friends. The price of gas at the pump is $6 per gallon.

Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Van**	**Train**	**Bus**	**Air**	**Automobile**
Travel Time	8 hours	10 hours	8 hours	90 minutes	8 hours
Transfer Required	No	Yes	No	No	No
Price	$80/person	$80/person	$100/person	$250/person	$150
Frequency	Once per day	Every 8 hours	Every 8 hours	Every 8 hours	—
	☐	☐	☐	☐	☐

You are making a 480-mile personal trip. The price of gas at the pump is $6 per gallon.

Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Bus**	**Van**	**Train**	**Air**	**Automobile**
Travel Time	8 hours	8 hours	10 hours	3 hours	8 hours
Transfer Required	Yes	No	No	Yes	No
Price	$80	$80	$100	$500	$150
Frequency	Every 2 hours	Every 2 hours	Once per day	Every 8 hours	—
	☐	☐	☐	☐	☐

You are making a 60-mile business trip with co-workers. The price of gas at the pump is $2 per gallon.

Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Automobile**	**Van**	**Air**	**Bus**	**Train**
Travel Time	1 hour	1 hour	40 minutes	75 minutes	75 minutes
Transfer Required	No	No	No	Yes	Yes
Price	$6	$10/person	$250/person	$10/person	$15/person
Frequency	—	Every 2 hours	Every 2 hours	Every 2 hours	Once per day
	☐	☐	☐	☐	☐

You are making a 240-mile business trip with co-workers. The price of gas at the pump is $6 per gallon.

Please consider the following alternatives and select the one that you would use to make the trip.

Mode	**Train**	**Air**	**Bus**	**Automobile**	**Van**
Travel Time	4 hours	90 minutes	4 hours	4 hours	5 hours
Transfer	No	No	No	No	Yes
Required	$50/person	$250/person	$40/person	$75	$40/person
Price					
Frequency	Every 2 hours	Every 2 hours	Every 2 hours	—	Once per day
	☐	☐	☐	☐	☐

Part C. Your Opinion about Travel

For each of the following statements, circle the number on the scale indicating how much you agree or disagree.

	Statement	Strongly Disagree ←									→ Strongly Agree
1.	People who travel alone should pay more to help improve the environment.	1	2	3	4	5	6	7	8	9	10
2.	I would be willing to pay more when I travel if it would help the environment.	1	2	3	4	5	6	7	8	9	10
3.	I would switch to a different form of transportation if it would help the environment.	1	2	3	4	5	6	7	8	9	10
4.	I would rather do something else with the time that I spend traveling.	1	2	3	4	5	6	7	8	9	10
5.	I would like to make productive use of my time when traveling.	1	2	3	4	5	6	7	8	9	10
6.	I prefer a travel option that has a predictable travel time.	1	2	3	4	5	6	7	8	9	10
7.	When traveling, I like to keep as close as possible to my departure and arrival schedules.	1	2	3	4	5	6	7	8	9	10
8.	If my travel options are delayed, I want to know the cause and length of the delay.	1	2	3	4	5	6	7	8	9	10
9.	I would change my form of travel if it would save me some time.	1	2	3	4	5	6	7	8	9	10
10.	I always take the fastest route to my destination even if I have a cheaper alternative.	1	2	3	4	5	6	7	8	9	10
11.	I don’t mind traveling with strangers.	1	2	3	4	5	6	7	8	9	10
12.	When traveling, I like to talk and visit with other people.	1	2	3	4	5	6	7	8	9	10
13.	I prefer to make trips alone, because I like the time to myself.	1	2	3	4	5	6	7	8	9	10
14.	I worry about getting in an accident when I travel.	1	2	3	4	5	6	7	8	9	10
15.	Having privacy is important to me when I travel.	1	2	3	4	5	6	7	8	9	10
16.	I need to make trips according to a fixed schedule.	1	2	3	4	5	6	7	8	9	10
17.	It’s important to be able to change my travel plans at a moment’s notice.	1	2	3	4	5	6	7	8	9	10
18.	Having a stress-free trip is more important than reaching my destination quickly.	1	2	3	4	5	6	7	8	9	10
19.	I don’t mind long delays as long as I’m comfortable.	1	2	3	4	5	6	7	8	9	10
20.	It is important to have comfortable seats when I travel.	1	2	3	4	5	6	7	8	9	10
21.	I avoid traveling at certain times because it is too stressful.	1	2	3	4	5	6	7	8	9	10
22.	A clean vehicle is important to me.	1	2	3	4	5	6	7	8	9	10
23.	I use the most convenient form of transportation regardless of cost.	1	2	3	4	5	6	7	8	9	10
24.	The people who ride intercity bus are like me.	1	2	3	4	5	6	7	8	9	10
25.	The people who fly are like me.	1	2	3	4	5	6	7	8	9	10
26.	The people who use intercity rail service are like me.	1	2	3	4	5	6	7	8	9	10
27.	The people who use shuttle vans are like me.	1	2	3	4	5	6	7	8	9	10
28.	I’m willing to pay more for a ticket if it allows me to rebook my trip later for free.	1	2	3	4	5	6	7	8	9	10

Part D. General Information

Finally, please provide some general information about yourself. Your responses in this section enable us to project the results from this small sample to the population as a whole. Your answers will be kept entirely confidential.

- GENDER: ☐ Male ☐ Female

- AGE: ☐ <25 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ >64

- EDUCATION:

  ☐ High school or less ☐ Some college ☐ College Graduate ☐ Post Graduate

- How many people reside in your household? ______

- How many children under the age of 18 reside in your household? ______

- Income (Household)

  ☐ Less than $30,000 ☐ $30,000-59,999 ☐ $60,000-99,999

  ☐ $100,000-150,000 ☐ >$150,000

- Do you own an automobile? ☐ Yes ☐ No

- Are you able to operate an automobile (legally, physically, mentally)? ☐ Yes ☐ No

- Are you married? ☐ Yes ☐ No

- Are you currently employed? ☐ Yes ☐ No

- Are you self-employed? ☐ Yes ☐ No

- If no, are you currently looking for work? ☐ Yes ☐ No

- What is your 5-digit Zip Code? (Write in your ZIP CODE) __ __ __ __ __

THANK YOU FOR YOUR HELP!

APPENDIX C. BACKGROUND ON INTERCITY VAN SERVICE

Vans are the successors to the station wagons that met passenger trains to take travelers to local inns or resorts. Up until 1925, motor carriers, if they were regulated at all, were totally under state control. This system was dramatically changed by the decision of the U.S. Supreme Court in Buck v. Kuykendall, 267 U.S. 307 (1925). The Supreme Court, on appeal, held that a denial of interstate transportation (Seattle to Portland) was beyond the scope of the state of Washington. The effect of this case was to wipe out state barriers to entry of motor carriers. Power abhors a vacuum, and there was pressure on Congress to regulate the bus business.

The obvious agency to take over this regulation was the Interstate Commerce Commission, which had been in charge of regulating entry, exit, and rates of the railroads since 1887. The oldest federal agency was the natural choice to regulate the operation of motor carriers.   Buses came under the act, and they were generally limited to regular routes on regular schedules. As a cross-subsidy, they were allowed to offer charter service throughout the United States from all points on regular routes. The ICC kept jurisdiction over motor coach lines until the Bus Regulatory Reform Act of 1982. The regulatory scheme followed by the ICC largely followed the map of motor carriers grandfathered in by the Commission. The result was a protective regime which led to the duopoly of Greyhound and Trailways, with a few local carriers connecting with the Big Two or taking over branch line service abandoned by the railroads. As a matter of fact, the existence of paralleling bus service was cited by railroad companies as a rationale for discontinuing local trains following the Transportation Act of 1958.

One category of limited service found in ICC certificates was transportation “incident to air.” This category had to do with carriers hauling to and from airports with passengers or parcels intended for immediate transfer to airlines. From these certificates the airline connection carriers grew. For a while Greyhound attempted to serve the airports with their intercity buses, but they have withdrawn from the field. Over-the-road van service sprung up to meet the demand of passengers arriving at or leaving from principal international airports wishing to make a connection to smaller cities within the state.

Two changes occurred that substantially edited the map and practices of motor carriers. The Rail Passenger Service Act of 1970 greatly reduced the number of passenger trains. With some minor modifications, the 1971 Amtrak map defines rail passenger service today. Amtrak operates intensive train service in the Northeast and in some lines around Chicago and within California. Otherwise, Amtrak operates what is basically a once-a-day train system. Many of the discontinued rail routes were taken over by buses. In 1982, the Bus Regulatory Reform Act ended the ICC's jurisdiction over the bus business. Later, in 2004, Greyhound cut back on intercity and transcontinental service. Many of those lines were taken over by local carriers, but far more were simply abandoned.

APPENDIX D. A CASE STUDY: LAKES EXPRESS

Lakes Express is a Brainerd-based company that provides scheduled passenger service via shuttle vans between both terminals of the Minneapolis-St. Paul International Airport and north-central Minnesota. The company currently runs around-the-clock service at approximately three-hour intervals between the airport and St. Cloud, Little Falls, and Brainerd. In addition, Lakes Express offers non-scheduled on demand service through the Brainerd Lakes area and as far north as Bemidji.

In most instances, Lakes Express operates like a scheduled bus line. However, for a small sum ($10 within the city of Little Falls), the carrier will operate like a taxi and deliver passengers and baggage to private homes or hotels. The vans are equipped with regular bench seats, and are not handicapped accessible except for a Pullman step which the driver will use to help disabled people get into the van.

Lakes Express competes with Executive Express on the Minneapolis-St. Cloud portion. Jefferson Lines has three daily schedules between Minneapolis and St. Cloud, but only one serves Little Falls and Brainerd. Amtrak serves Minneapolis and St. Cloud in the midnight hours, and runs through Little Falls but does not stop. Commuter airlines link Brainerd and St. Cloud with Minneapolis, but schedules have been drastically reduced.