An Assessment of Demand for Rural Intercity Transportation Services in a Changing Environment

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UGPTI Transportation Seminar Series
January 28, 2010

Overview

- Changing environment
- Rural intercity travel
- Factors affecting mode choice
- Survey
  - Stated preference
- Multinomial logit model
- Traveler attitudes
- Conclusions

Changing Environment

- Volatile gas prices
- Increase in air fares in 2008
- Recession
- Government policy
- Aging population
- VMT has declined
- Transit ridership is up

Objective

- Determine the attitude of would-be passengers in their choice of mode and the factors determining their choice in rural and small urban areas.

Factors Affecting Mode Choice

- Mode characteristics
- Individual characteristics
- Trip characteristics

Factors Affecting Mode Choice

- Mode characteristics
  - Cost
  - Travel time
  - Service frequency
  - Transfer
  - Access
  - Comfort and convenience

Elasticities of Travel Demand with respect to Fuel Price

Study	Fuel Demand		Vehicle Miles Traveled		Time Frame
	Short-run	Long-run	Short-run	Long-run	
Goodwin (1992)	-0.27	-0.71	-0.16	-0.33	1972-1987
Espey (1998)	-0.26	-0.58			1966-1997
Graham and Glaister (2002)	-0.25	-0.77	-0.15	-0.31	1966-2000
Goodwin (2004)	-0.25	-0.64	-0.1	-0.29	1929-1998
Brons et al. (2006)		-0.53		-0.39	1974-1999
Hughes et al. (2006)	-0.21 to -0.34				1975-1980
Hughes et al. (2006)	-0.0034 to -0.077				2001-2006

Elasticities of Transit Demand with respect to Gasoline Price

Study	Elasticity	Study Area
Agthe & Billings (1978)	0.42	Tucson, AZ city bus system
Doi & Allen (1986)	0.11	New Jersey rail line
Luk & Hepburn (1993)	0.07	Australia
Hensher (1997)	0.02 – 0.12	Newcastle, Australia buses
TRACE (1999)	0.16 short-run 0.12 long-run	Review of European studies
Storchmann (2001)	0.07	Germany
Currie & Phung (2007)	0.04 (bus) 0.12 (all transit)	United States
Litman (2007)	0.05 – 0.15 short-run 0.2 – 0.4 long-run	Review of literature
Mattson (2008)	0.1 – 0.2 long-run	United States

Factors Affecting Mode Choice

- Individual characteristics
  - Income
  - Age
  - Gender
  - Habits
  - Attitudes

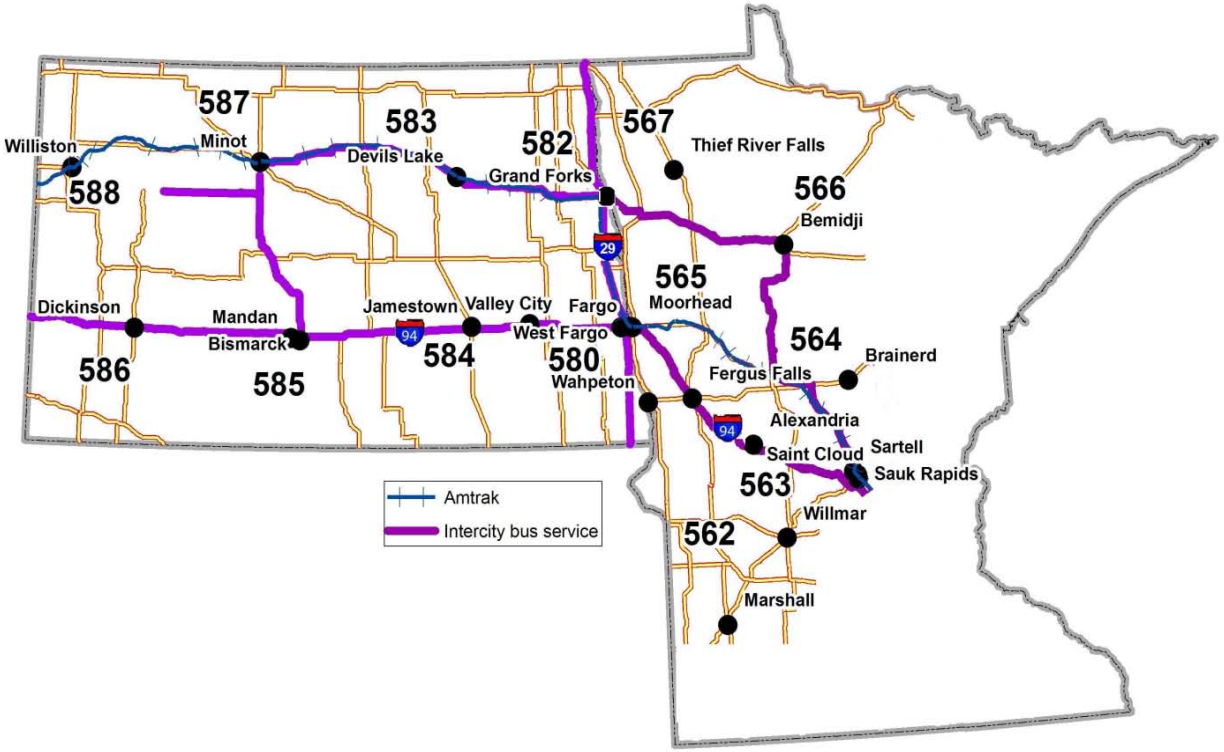
Factors Affecting Mode Choice

- Trip characteristics
  - Trip purpose
    - Business or personal
  - Trip distance
  - Size of travel party

Survey

- Focus on regional, intercity travel
- North Dakota and NW/West Central Minnesota
- Age 18+
- Mail survey
  - 2,000 sent
  - 237 responses received (12.5% response rate)
- 4 Sections
  - Current travel
  - Stated preference
  - Attitudes
  - Demographics

Survey Area


587
583
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567
Williston
Minot
Devils Lake
Grand Forks
Thief River Falls
588
566
Bemidji
29
565
Dickinson
Mandan
Bismarck
Jamestown
Valley City
Fargo
Moorhead
West Fargo
94
564
Brainerd
586
585
584
580
Wahpeton
Fergus Falls
Alexandria
94
Saint Cloud
Sartell
Sauk Rapids
563
Willmar
562
Marshall
Amtrak
Intercity bus service

Demographics of Survey Respondents

		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

Stated Preference (SP) Survey

- Choice set
  - Trip characteristics
    - Trip distance
    - Personal or business
    - Alone or group
  - Five alternatives
    - Automobile
    - Air
    - Bus
    - Train
    - Van
  - Mode attributes
    - Travel time
    - Price
    - Service frequency
    - Transfer requirement

Mode Alternatives

- **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.

Mode Attributes

Factor	Modes	Levels
Price	Bus, train, van	Low ($0.16/mile), high ($0.2083/mile)
	Air	Low ($250/trip), high ($500/trip)
	Automobile	Low ($2/gal), medium ($4/gal), high ($6/gal)
Speed	Bus, train, van	Slow (48 mph), fast (60 mph)
	Air	Slow, fast
	Automobile	All travel at 60 mph
Transfer	Air, bus, train, van	Yes, no
Frequency	Air, bus, train, van	Once per day, every eight hours, every two hours

Example Stated Preference Survey Question

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
	O	O	O	O	O

Stated Preference Survey

- Each survey respondent given 6 choice sets.
- 1,359 SP responses received.
- Mode of choice
  - 80.4% Automobile
  - 6.7% Van
  - 5.4% Rail
  - 4.0% Air
  - 3.5% Bus
- Results vary by cost, distance, income, trip purpose, age, gender.

Survey Results: Mode Share Data from the Stated Preference Survey, Overall and for Differing Levels of Gasoline Price and Income

	Auto (%)	Air (%)	Bus (%)	Train (%)	Van (%)
Total	80	4	3	5	7
Price of Gasoline					
$2/gallon	87	5	1	3	3
$4/gallon	83	4	3	5	5
$6/gallon	70	2	7	8	12
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

Survey Results: Mode Choice Results from Stated Preference Survey, by Distance and 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

Survey Results: Mode Choice Results from Stated Preference Survey, by Income and 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

Multinomial Logit Model

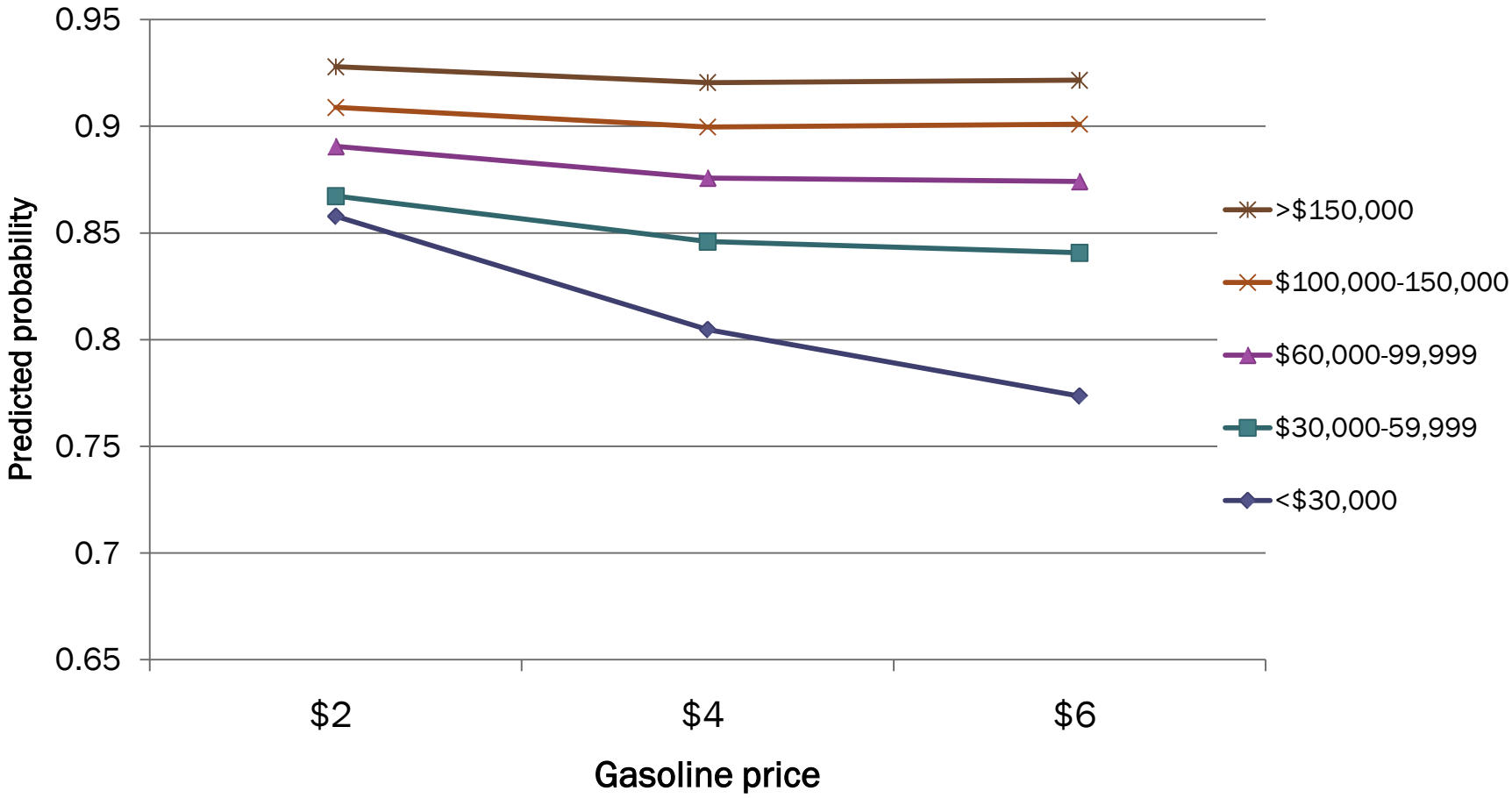
- Dependent variable: Mode of choice
- Explanatory variables:
  - Individual characteristics
    - Age, gender, income, transit experience
  - Trip characteristics
    - Trip purpose, party size
  - Mode characteristics
    - Travel time, cost, service frequency, transfer
  - Interaction
    - Income*cost
  - Mode dummy variables

Results from Multinomial Logit Model

Independent variable	Parameter estimate	Odds ratio
Auto	1.40**	4.05
Age*Air	-0.38**	0.69
Male*Auto	0.557**	1.74
Income*Auto	0.255*	1.29
Alone*Air	0.950**	2.58
Personal*Auto	0.465*	1.59
Personal*Air	-0.862**	0.42
Transit Exp*Auto	-0.652**	0.52
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	Not significant	
Frequency	Not significant	

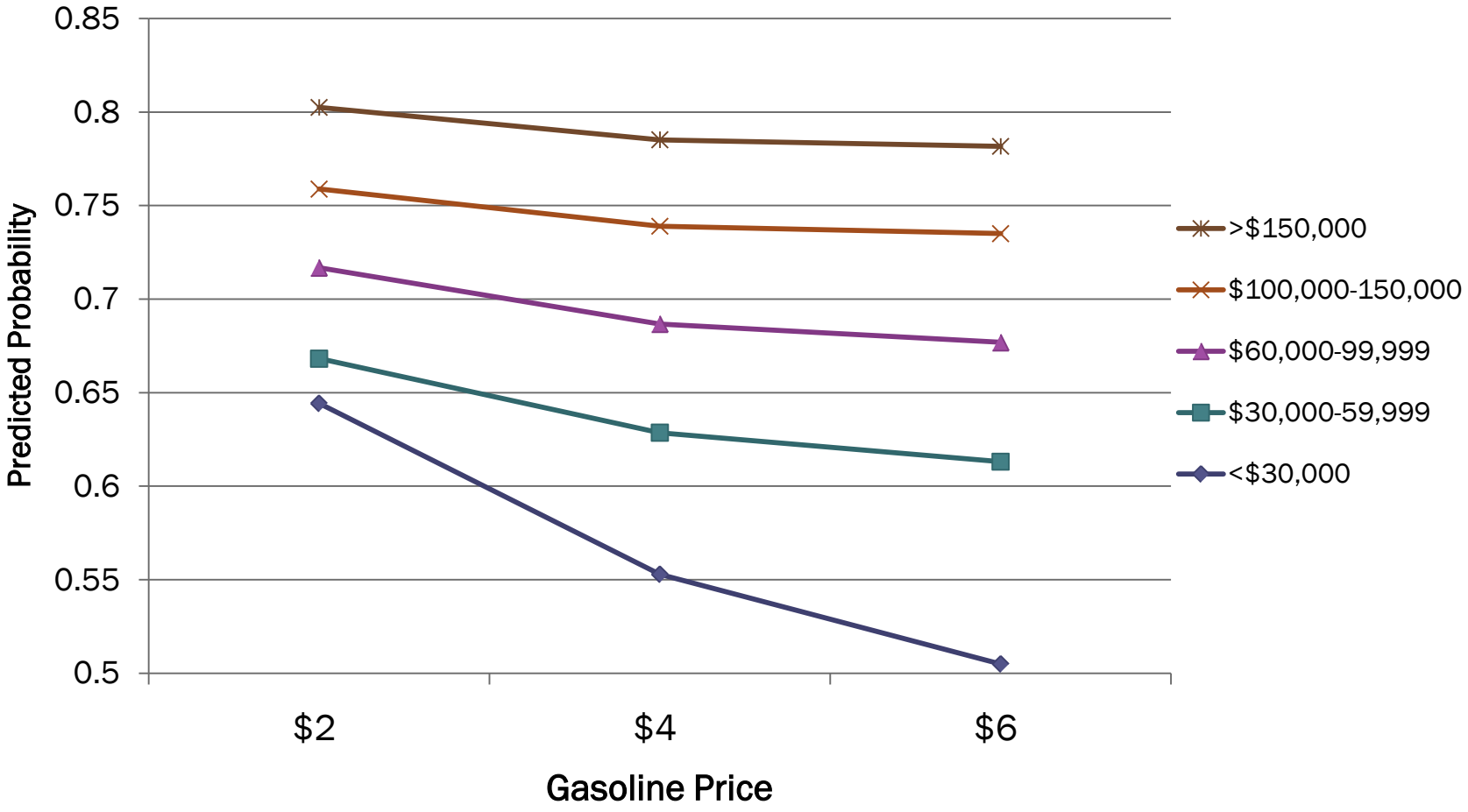
*, ** denote significance at 10% and 5% levels, respectively

Predicted Probability of Choosing Automobile with Varying Gasoline Prices and Income*



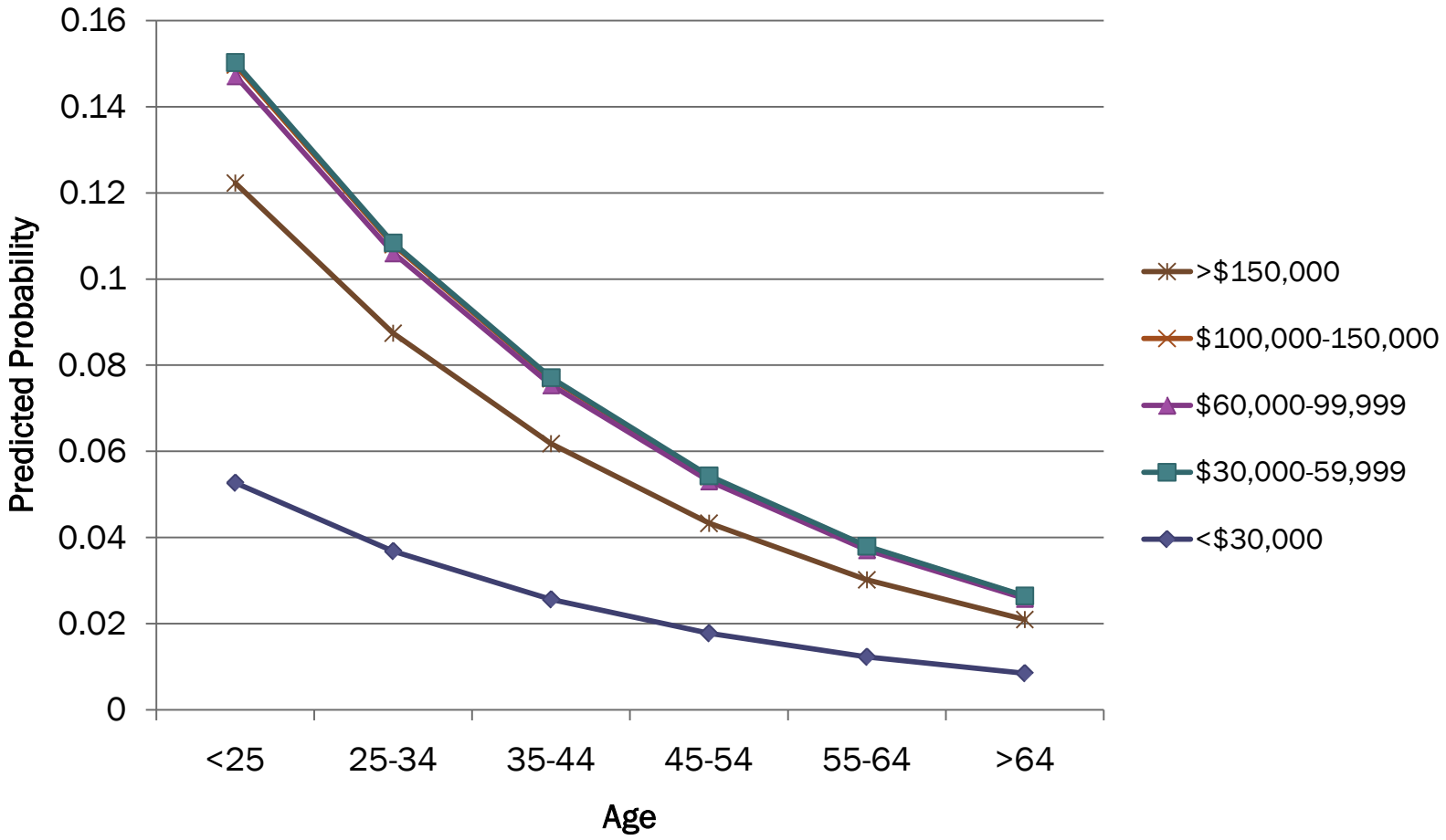
*Assumed for 45-54 year-old male who is traveling 240 miles alone for personal reasons and has never previously traveled by bus, train, or van.

Predicted Probability of Choosing Automobile with Varying Gasoline Prices and Income*



* Assumed for 65+ year-old female who is traveling 240 miles alone for personal reasons and has previously traveled by bus, train, or van.

Predicted Probability of Choosing Air Travel with Varying Age and Income*



*Assumed for male traveling alone for personal reasons, low air fare.

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.

Response to Opinion Questions

Average Score*	Statement
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.

Analysis of Attitudes and Mode Choice

Statement	Mode Preference
Productive use of time.	More likely to choose air.
Prefer predictable travel time.	Less likely to choose air.
Willingness to travel with strangers.	More likely to alternatives to auto.
Concerned about being able to change travel plans at a moment's notice.	More likely to choose auto. Much less likely to choose air.
Concerned about having comfortable seats	Much less likely to choose air.
More concerned about having a stress-free trip than with reaching destination quickly.	Less likely to choose auto. More likely to choose van.
Concerned with cleanliness of vehicles.	More likely to choose auto.
People who ride a given mode are like me.	More likely to choose that given mode.

Vans in Intercity Travel

- Some indication for demand for more intercity van services.
- Potential advantages of van travel.
  - Convenience factor
  - Frequency of schedules
  - Reliability of timekeeping
  - Relative economy
  - Safety
  - Weather and traffic conditions
- More research on demand for vans needed.

Concluding Remarks

- At higher gas prices, there is an increase in demand for alternative modes, especially among those of lower income.
- An aging population is more likely to choose intercity train, van, or bus service than air for regional travel.
- Previous transit experience increases likelihood of choosing intercity train, bus, or van.

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