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The positive utility of the commute: modeling ideal commute time and relative desired commute amount

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Abstract. Two measures of commute time preferences – Ideal Commute Time and Relative Desired Commute amount (a variable indicating the desire to commute "much less" to "much more" than currently) – are modeled, using tobit and ordered probit, respectively. Ideal Commute Time was found to be positively related to Actual Commute Time and to a liking and utility for commuting, and negatively related to commute frequency and to a family/community-oriented lifestyle. Relative Desired Commute, on the other hand, was negatively related to amounts of actual commute and work-related travel, but positively related to travel liking and a measure of commute benefit. Overall, commute time is not unequivocally a source of disutility to be minimized, but rather offers some benefits (such as a transition between home and work). Most people have a non-zero optimum commute time, which can be violated in either direction – i.e. it is possible (although comparatively rare, occurring for only 7% of the sample) to commute too little. On the other hand, a large proportion of people (52% of the sample) are commuting longer than they would like, and hence would presumably be receptive to reducing (although usually not eliminating) that commute.

1. Introduction

According to the 1995 Nationwide Personal Transportation Survey (NPTS), the commute trip, generally the most scheduled and routine of all trip purposes, comprises 17.7% of all person-trips and 22.5% of all person-miles in the US (FHWA 1995).[1] In discussing personal travel, FHWA (1995) gives three reasons for what it calls "the deserved emphasis on travel to work". First, employed adults travel more miles per year than do those not working. Second, work trips place the largest strain on the transportation system because of the volumes of traffic concentrated in certain places and at specific points in the day. Finally, the commute is often the foundation around which other travel is scheduled. This temporal and geographic regularity, along with the commute's relative importance in trip planning, has made it the focus of numerous current and potential policies intended to reduce peak-period vehicle-trips and distances. Such policies attempt to provide financial or temporal incentives to carpool, take public transportation, walk or bike to work, change departure time, or reduce the number of days a commute trip is made (through compressed work weeks or telecommuting).

To improve our ability to forecast the impact of such policies – as well as the impact of congestion itself – on the commuter's travel decisions, it is important to understand the individual's commute preferences. While many dimensions are relevant to the commuter's preferred course of action (e.g. travel mode, departure time and route), we focus this paper on examining two aspects of a desired *amount* of commuting: the Ideal Commute Time (in minutes) and the Relative Desired Commute amount (on a five-point scale from "much less" to "much more" than currently).

In modeling travel behavior, it is universally assumed that travel is a source of disutility, and hence that individuals will seek to minimize their travel time and cost, subject to constraints. A number of researchers (reviewed in Salomon & Mokhtarian 1998; and Mokhtarian & Salomon, forthcoming), however, have noted that travel can offer a positive utility in its own right. Mokhtarian and Salomon (forthcoming) point out that the utility for travel has three components: the utility for the activity at the destination, the utility for activities that can be conducted while traveling, and an enjoyment of the act of travel itself. The first component represents the conventional "derived demand" justification for travel, while the latter two elements are typically ignored.

Specifically with respect to commuting, in terms of the three-way distinction drawn by Mokhtarian and Salomon, the source of a positive utility may be the social/professional interaction opportunities, the scenic location, or the shopping and other locational amenities of the workplace (the first, derived demand component); the ability to transition between home and work and to use the time productively (the second component); or, for example, the opportunity to experience the surrounding environment or drive a status-oriented automobile (the third component). Several researchers (e.g. Albertson 1977; Edmonson 1998; Mokhtarian & Salomon 1997; Richter 1990; Shamir 1991) have commented on the potential positive utility of commuting with respect to the second and third components.

Certainly, conventional wisdom holds that commuting is a hassle. There is ample anecdotal and quantitative evidence supporting that view, including polls that place congestion at or near the top of a list of problems facing residents of urban areas (Baldassare 1991; Cervero 1987/88) and studies that estimate the annual US-wide cost of congestion to be in the tens of billions of dollars (Arnott & Small 1994). On the other hand, there is evidence to support the opposite view as well. On the quantitative side, some studies (Gordon et al. 1991; Levinson & Kumar 1994) have shown that even as system-wide congestion has increased, commute times have changed relatively little across periods of several years, indicating that people may be making adjustments to reduce the personal impact of congestion. These adjustments sometimes take the form of relocating home or job or changing modes to physically shorten the commute time, but also include strategies that simply make the commute less stressful or more productive (*The Economist* 1998; Larson 1998; Salomon & Mokhtarian 1997) – arguably maintaining the benefits of the commute while reducing its costs.

On the anecdotal side, even the popular press has noted the benefits of commuting. In a *Washington Post* article (Sipress 1999), for example, a computer programmer with a congested commute of at least one hour each way remarked, "As strange as it sounds, I'd rather have an hour-plus commute than a five-minute commute. In the morning, it gives me a chance to work through what I'm going to do for the day. And it's my decompression time." A patent attorney "remembers fondly" his once-longer commute as a valued "transition period", and "wistfully" says about his current 3–6 minute drive, "I wouldn't mind it being a bit longer." The article further refers to the feeling of control people have during their (generally solo) commutes, to the customization of their cars for greater comfort (and utility), and to the ability to use the time for thinking, relaxing, making phone calls, even listening to books on tape. These are all examples of the second and third components of the utility for travel, namely the utilities of the activities that can be done while traveling and of the travel itself, that increase the desirability of the commute. Articles with a similar message (the first two prompted by earlier versions of this paper, but with supporting interviews of other commuters) have appeared in the *Los Angeles Times* (McNamara 1999), the *Sacramento Bee* (Lindelof 2000), and the *San Francisco Chronicle* (Taylor 2000).

Apparently, then, at least for some people the ideal commute time is something greater than zero. Understanding the circumstances in which the ideal commute time is greater than zero is important to our ability to predict travel behavior in general. What determines an individual's ideal commute time? Is it just a little less than one's current *actual* commute time? What is the relationship between ideal commute time and satisfaction with the current commute? Is ideal commute time a function of gender, or income?

Several previous studies have examined commute (time and distance) preferences. Wachs et al. (1993) mention the importance of the commute trip in current transportation policies and evaluate commute satisfaction over time (1984–1990) while examining the job/housing balance in one area of Southern California. This study of 1,557 health maintenance organization employees found that nearly all (94%) of those traveling 32 minutes or less to work were satisfied or very satisfied with their commute, whereas only about half (47%) of those traveling more than 32 minutes said the same. Young and Morris

(1981) analyzed commute satisfaction through 1,049 home interview surveys conducted in three suburban areas of Melbourne, Australia in 1978 and 1979. Their study considers the relationship between hypothetical commute length and satisfaction with commute. They find that while satisfaction appears to be negatively related to travel time, there is actually a compromise between "accessibility" and "proximity" thresholds (Young & Morris 1981, p. 52) – essentially, the desire to live close to work, but not too close. Satisfaction ratings were highest for (hypothetical) commute times of 10–20 minutes. Pazy et al. (1996) studied the willingness to commute of 162 female computer specialists in the Tel-Aviv metropolitan area. They found that those with a strong career orientation were willing to commute longer distances, while mothers of young children wanted shorter commutes. The longer the current commute, the less willing respondents were to extend it for a better job.

It is important to the present paper to note that, conceptually, we can distinguish a desired or ideal commute time from the amount a person is willing to commute. Workers may be *willing* to travel quite a bit longer than they would consider *ideal*, as part of a tradeoff for a desired job. In fact the "revealed preferences" of our sample show that about half (51.7%) of respondents travel longer than their ideal time (see Table 2). As discussed in greater detail in Section 2.2, we attempted to elicit an unconstrained response with the construction and placement of the Ideal Commute Time question. However, respondents are likely to confound somewhat the concept of ideal time with the time they are willing to spend, which would bias the reported ideal commute time upward. As Young and Morris (1981, pp. 57–58) comment: "An individual may go through a process of rationalization in which, in order to accept a certain decision, he or she must be convinced that the required travel distance is satisfactory." Similarly, in answering a question about her ideal commute time, the respondent may partly be considering what she thinks is realistic for her circumstances, which will again bias the ideal upwards. In particular, "zero" (or a very small number) may not be considered a "realistic ideal". We return to this point in Section 2.2.

The organization of this paper is as follows. The next section presents the empirical context of this study and describes the dependent and explanatory variables used in the models. The third section presents and describes the models for Ideal Commute Time and Relative Desired Commute amount. Finally, the fourth section offers conclusions and directions for further research.

2. Empirical context

2.1. *Geographic setting*

The data analyzed in this study comes from a fourteen-page self-administered survey mailed in May 1998 to 8,000 randomly-selected households in three neighborhoods of the San Francisco Bay Area. Half of the total surveys were sent to an urban neighborhood of North San Francisco and the other half were divided evenly between the suburban cities of Concord and Pleasant Hill. These areas were chosen to represent the diverse lifestyles, land use patterns, and mobility options in the Bay Area. Approximately 2,000 surveys were completed by an adult member of the household and returned, for a 25% response rate. The subset of 1,300 used in this analysis constitutes those respondents who worked either part- or full-time, and who completed the Ideal Commute Time and Actual Commute Time questions on the survey.[2] Table 1 lists some key demographic characteristics of this sample.

Our sample is relatively balanced in terms of representation by neighborhood and gender. Higher incomes are overrepresented compared to Census data. However, since the focus of this study is on examining the relationship of income (and other variables) to measures of commute preference, not on predicting the distribution of income, it is actually desirable to have sizable numbers of respondents in each income category. Because we limited this analysis only to respondents holding full- or part-time jobs, there are doubtless proportionally fewer older (retired) and younger (in school) respondents than in the population as a whole.[3] The average reported one-way commute time of about half an hour is somewhat higher than the 1995 NPTS average of 20.7 minutes. It is also higher than the most frequently reported commute range of 15–20 minutes for the southern California sample of Wachs et al. (1993). However, half an hour is a reasonable average for this heavily suburban sample, taken 3–5 years later than those previous studies.

2.2. *The dependent variables*

The models in Section 3 involve two dependent variables taken from our survey. The first variable (Ideal Commute Time) is intended to represent the respondent's desired commute time without regard to existing constraints. To encourage a well-considered response, this question immediately followed a section of attitudinal statements illustrating both positive and negative aspects of travel in general and commuting in particular (these are the "Attitudes" described in Section 2.3). In an attempt to minimize any rationalization bias on the part of the respondents, the Ideal Commute Time question was asked first, on p. 3 of the survey, and the Actual Commute Time question[4] was

Table 1. Key characteristics of sample (N = 1300).

Characteristic		Number (Percent)
Concord		300 (23.1)
Pleasant Hill		357 (27.5)
North San Francisco		643 (49.5)
Female[a]		674 (52.1)
Have a driver's license[b]		1281 (98.7)
Work full-time		1094 (84.2)
Personal income:[c]	< $15,000	90 (7.1)
	$15,000–34,999	269 (21.2)
	$35,000–54,999	395 (31.1)
	$55,000–74,999	230 (18.1)
	$75,000–94,999	127 (10.0)
	> $95,000	160 (12.6)
Age:[d]	18–23	42 (3.2)
	24–40	563 (43.3)
	41–64	655 (50.4)
	> 65	39 (3.0)

Characteristic	Mean (Std. Dev.)
Total people in household	2.41 (1.24)
Total children under 18 in HH[a]	0.47 (0.86)
Total workers in HH (full/part-time)[e]	1.78 (0.82)
Number of personal vehicles in HH[f]	1.88 (1.15)
Total short distance travel (miles/week)[d]	221.44 (192.79)
Ideal one-way commute (minutes)	15.80 (7.77)
Actual one-way commute (miles)[g]	13.92 (14.54)
Actual one-way commute (minutes)	29.57 (20.31)

[a] N = 1294; [b] N = 1298; [c] N = 1271; [d] N = 1299; [e] N = 1297; [f] N = 1296; [g] N = 1278.

asked much later (p. 14). The question itself was also worded to reduce response bias: "Some people may value their commute time as a transition between work and home, while others may feel it is stressful or a waste of time. For *you*, what would be the ideal *one-way* commute time?" The difference between Ideal and Actual Commute Times, then, represents one measure of commute satisfaction: the larger the difference (in either direction), the greater the dissatisfaction.

Figures 1 and 2 illustrate the relationship between Ideal and Actual Commute Times: Figure 1 portrays the marginal distribution of each, while Figure 2 plots the pair of values for each respondent. Figure 1 shows that the Ideal and Actual Commute Times have similar distributions, with (not surprisingly) the Ideal Times clustered around shorter times, on average, than the Actual. Ideal Commute Time most often fell into the 15–19 minutes

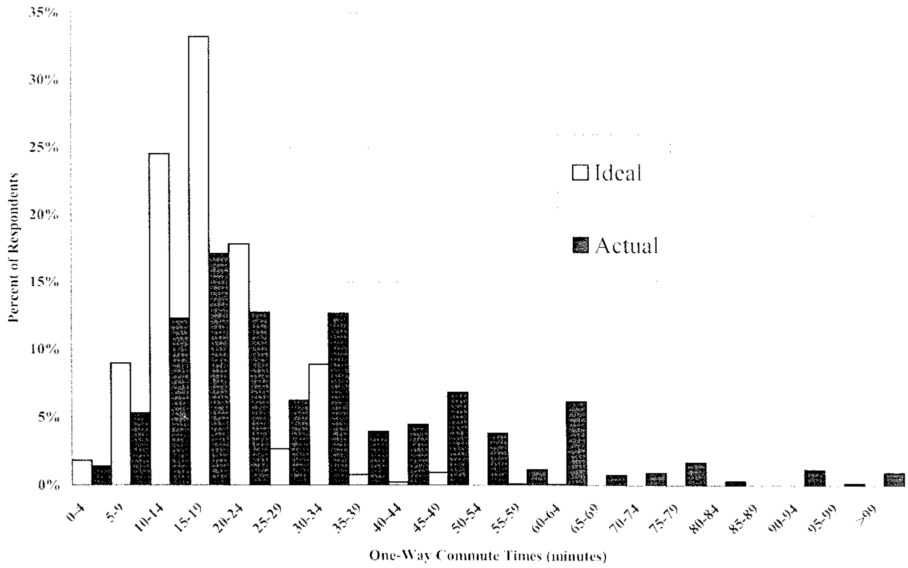

Figure 1. Distribution of Ideal and Actual Commute Times (N = 1300).

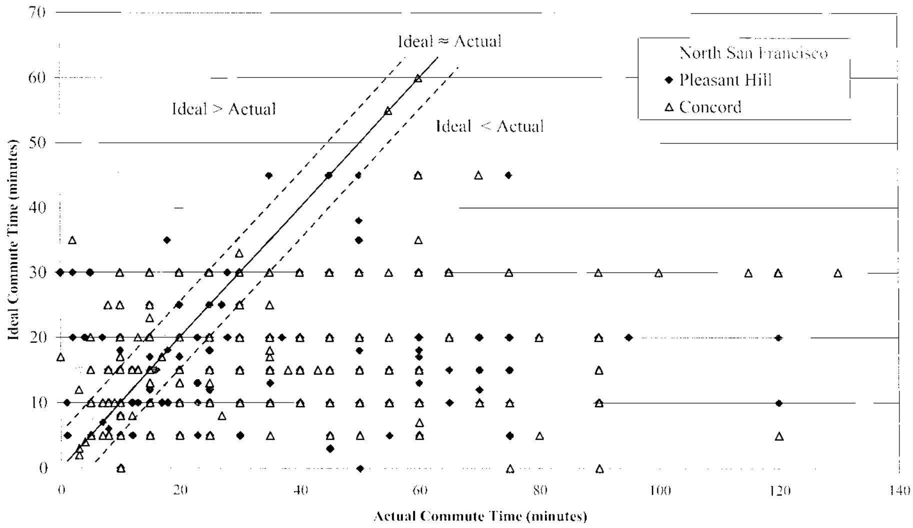

Figure 2. Scatter-plot of Ideal versus Actual Commute Times (N = 1300).

category (consistent with Young and Morris), with an average of 16 minutes, but nearly a third (31.5%) of the sample reported Ideal times of 20 minutes or more.

Only 1.2% of the sample reported an Ideal Commute Time of zero minutes; another 0.6% reported an Ideal from one to four minutes. Taken at face value, these results offer strong support of the concept of a positive utility for commuting. However, at least two issues should be considered: a potential self-selection or non-response bias on the part of those who rejected the survey, and a potential response bias on the part of those who did complete the survey (and this question in particular). We do not believe that these results are greatly biased downward due to self-selection, since those with extreme views (in this context, those who either hate traveling – and hence would have a small Ideal Commute Time – or love it) are *more* likely to respond to a survey related to those views. On the other hand, the potential response bias is of more concern: as mentioned earlier, it is likely that some people answered the question not in terms of an unconstrained ideal, but in terms of what they considered a "realistic ideal" for their circumstances. In other words, many respondents may not have considered "zero" to be a feasible answer.

We explored this latter issue further during two focus group sessions held in October 1999 with North San Francisco respondents to the survey. The focus group participants were again asked for their ideal commute time, and those who gave an answer other than zero were queried further. Some (but not all) of those confirmed that they didn't think zero was a possible answer, but when asked whether they would change their answer to zero, few did. Others (including one person who worked at home part-time and another who used to do so full-time) still preferred a positive commute time, for the kinds of reasons given in the Introduction. In fact, upon listening to the discussion, some who originally answered zero changed their response. Clearly, future studies of this nature should clarify the options to the respondents. However, we maintain that the conceptual arguments presented earlier are supported by the anecdotal evidence (from our sample and from the commuters' testimonies in the popular press articles previously cited), and that both of these considerations (conceptual and anecdotal) essentially corroborate the quantitative evidence from the sample as a whole.

Figure 2 illustrates the expected response bias toward rounding to the nearest five minutes. It also shows that the relationship between Ideal (I) and Actual (A) is not as powerful as might have been expected. The same Ideal Commute Time is reported by respondents with a large range of Actual Commute Times, suggesting that the reported Ideal is not simply something a little less than what commuters are currently doing, but rather a concept they can articulate in the abstract.

Further, consider the 45° line marking the points at which I = A (with dotted lines to represent an "approximately equal" band of 5 minutes in either direction). While most respondents fall below the line (meaning I < A, and they want a shorter commute than they currently have), a discernible minority lie above the line – and therefore want a *longer* commute time than they currently have. At least for those respondents, their reported Ideal is clearly not constrained (from below) by what they considered feasible. Not surprisingly, most of those who wish to travel more have relatively short (less than average) Actual Commute Times, illustrating again that it is possible for a commute to be too short.

The second dependent variable in our models measures the Relative Desired Commute (RDC) amount. On p. 9 of the survey, respondents were asked about their reaction to the amount they currently travel. Responses were obtained separately for short and long distance travel (the latter defined as a trip more than 100 miles one way), and within each of these categories, responses were obtained both "overall", and separately by selected purposes and modes. In each case, respondents indicated that "I'd like to travel ____ compared to what I do now" by selecting among the five responses: much less, less, about the same, more, or much more. The RDC variable is the response to the "commuting to work or school" purpose under short-distance travel. Thus, it also represents a measure of commute satisfaction.

The relationship between Relative Desired Commute amount and the difference between Ideal and Actual Commute Times (I-A) is shown in Table 2.[5] If a perfect relationship existed between these two measures of commute satisfaction, all of the responses would fall on the main diagonal of the table. For example, respondents whose Actual Commute Time exceeds their Ideal should logically want to commute less or much less (and fall into the upper-left cell). About 70% of the sample fall into the three cells on the main diagonal, a relatively high degree of consistency. However, this leaves almost a third of the sample with apparently inconsistent responses.

There are several possible sources of these observed discrepancies, aside from inevitable random fluctuations in responses and a definition of "about the same" that differed for some people from the one we adopted (namely, plus or minus 5 minutes). One obvious difference is that both the Ideal and Actual Commute Time questions related to work only, whereas the RDC question referred to work *or* school. Although all respondents analyzed in this study were employed either full-time or part-time, some could also have been going to school. To the extent that school considerations entered the response to the RDC question, and to the extent that desires for school differed from those for work, the RDC response could legitimately differ from the I-A response.

Second, although the RDC question and responses were balanced, there may still be a response bias downward: individuals may have felt it was socially unacceptable (or at least abnormal) to admit to wanting to commute more or much more. In this respect, obtaining Ideal and Actual Commute Times

Table 2. Comparison of two measures of commute satisfaction.

Relative Desired Commute amount		Difference between Ideal and Actual Commute Times				Median Actual Commute Time
		Ideal < Actual – 5	Ideal ≈ Actual (within ± 5 min)	Ideal > Actual + 5	Total	
Much less/Less	Count (% of total)	500 (38.5)	123 (9.5)	16 (1.2)	639	
	row %	78.2	19.2	2.5	100.0	35
	column %	74.4	22.7	18.4	49.2	
About the same	Count (% of total)	165 (12.7)	409 (31.5)	67 (5.2)	641	
	row %	25.7	63.8	10.5	100.0	15
	column %	24.6	75.6	77.0	49.3	
More/Much more	Count (% of total)	7 (0.5)	9 (0.7)	4 (0.3)	20	
	row %	35.0	45.0	20.0	100.0	20
	column %	1.0	1.7	4.6	1.5	
Total	Count	672	541	87	1300	
	row %	51.7	41.6	6.7	100.0	
	column %	100.0	100.0	100.0	100.0	
Median Actual Commute Time (minutes)		40	15	10	25	

separately and then examining the difference may provide a more objective measure of commute satisfaction. On the other hand, as we have mentioned earlier, ICT may be biased upward, which would produce a further discrepancy between I-A and RDC.

Finally, although we will occasionally, for convenience, refer to both the Ideal and the RDC variables together in the context of desired commute *time*, it is important to note that the RDC question did not mention a specific unit or dimension. Commuting "less" could refer to frequency, distance, or time. These three measures of commute amount are obviously related, but not perfectly. Thus, for example, the 165 respondents of Table 2 who want to commute "about the same", but have an Ideal less than their Actual Commute Time, may be indicating that the distance is fine, but that it takes too long due to congestion. Likewise, the 123 who want to commute "much less or less", but whose Actual and Ideal Commute Times are close, may like the commute time on the days they commute, but want to commute fewer days.

Turning to the margins of the table and first examining I-A, we see that nearly 42% of the respondents have an Actual Commute Time that falls within 5 minutes of their Ideal. This suggests either that they have succeeded in achieving their ideal, or (as Young and Morris propose) that they have rationalized their ideal to match their current circumstances. The median Actual Time for this group is 15 minutes. However, an even larger share of respondents – just over half – are commuting more than 5 minutes longer than their ideal time, consistent with the stereotype for metropolitan areas. Their median Actual Commute time is 40 minutes. Interestingly, 7% of the sample want to commute more than they currently are. As discussed in connection with Figure 2, this group tends to have short Actual Commutes, with a median time of 10 minutes.

When considering the Relative Desired Commute amount, a similar pattern with slightly different proportions emerges. In this case, less than 2% of the sample said they wanted to travel more (1.1%) or much more (0.5%), consistent with the social acceptability bias hypothesized above. The rest of the sample is divided evenly between those who want to travel about the same (about 49%) and those who want to travel less (about 34%) or much less (about 15%).

2.3. *The explanatory variables*

The potential explanatory variables for the models can be grouped into ten categories: Objective Mobility, Perceived Mobility, Relative Desired Mobility, Travel Liking, Attitudes, Personality, Lifestyle, Excess Travel, Travel Modifiers, and Demographics. Each category is described in general terms below; specific variables that are significant in the final models will be further explained in Section 3.

Objective Mobility:
These questions asked about distance and frequency of travel by mode and trip purpose, as well as travel time for the commute trip only (the Actual Commute Time variable discussed in Section 2.2). For the models presented here we included responses to general (overall) Objective Mobility questions and to those questions involving commute or work/school-related activities only.[6] We hypothesize that the greater the Objective Mobility, the more a person will want to reduce his commute.

Perceived Mobility:
We are interested not only in the Objective amount an individual travels, but also in how that amount of travel is perceived. One person may consider 100 miles a week to be a lot, while another considers it minimal. For each of the same overall, purpose, and mode categories for short and long distance, respondents were asked to rate the amount of their travel on a five-point semantic-differential scale anchored by “none” and “a lot”. Our hypothesis for Perceived Mobility variables is similar to that for Objective Mobility.

Relative Desired Mobility:
An individual may consider herself to travel “a lot”, but want to do even more. Thus Relative Desired Mobility refers to how much a person wants to travel compared to what she is doing now. The structure of this question was described in Section 2.2. The Relative Desired Commute dependent variable comes from this part of the survey, as do potential explanatory variables measuring “overall” satisfaction and satisfaction with “work/school-related activities” for both short- and long-distance travel.

Travel Liking:
Whether a respondent who already travels a lot wants to reduce it or do even more is likely to depend on how much he enjoys traveling. Respondents were asked to rate each of the same categories of travel on a five-point scale from strongly dislike to strongly like. We hypothesize a positive relationship between Travel Liking and desired commute time.

Attitudes:
The survey contained 32 attitudinal statements related to travel, land use, and the environment, to which individuals responded on the five-point Likert-type scale from strongly disagree to strongly agree. These 32 variables were

then distilled, through factor analysis (Redmond 2000), into six underlying dimensions: travel dislike, pro-environmental solutions, commute benefit, travel freedom, travel stress, and pro-high density. For several of these, the expected direction of impact on desired commute time is clear; for others no strong hypothesis presents itself.

Personality:
Respondents were asked to indicate how well (on a five-point scale from “hardly at all” to “almost completely”) each of 17 words and phrases described their personality. These 17 attributes reduced to four personality factors: adventure-seeker, organizer, loner, and the placid personality. Impacts on travel in general may be hypothesized for some of these traits, but their likely effect on commuting in particular is less apparent.

Lifestyle:
The survey contained 18 Likert-type scale statements relating to work, family, money, status and the value of time. These 18 questions comprised four lifestyle factors: status seeker, workaholic, family/community-oriented and a frustrated factor. We hypothesize that status seekers and workaholics are likely to want longer commutes, and that family-oriented and frustrated respondents may want shorter commutes.

Excess Travel:
Thirteen statements asked how often (on a three-point scale: never/seldom, sometimes, often) the respondent engaged in various activities that would be considered unnecessary or excess travel. Because these variables indicate a desire for travel generally, they may either be positively related to desired commute time, indicating a strong desire for all travel, or negatively related to desired commuting, indicating a desire for discretionary travel with which long commutes interfere. Both types of relationships are found in our final models.

Travel Modifiers:
One section of the survey asked respondents if they had made, or were considering, certain choices to ease or change their travel. For the purposes of these models, we considered whether respondents had bought a car stereo system or mobile phone, or switched to a better[7] or more fuel-efficient car. We can hypothesize that these changes would ease travel and/or make it more productive, and thus have a positive relationship to commute preferences.

Demographics:
Finally, the survey included an extensive list of demographic variables to allow for comparison to other surveys and to Census data. A number of relationships between these variables and commute satisfaction can be hypothesized; for example, women may want to commute less than men do. We were particularly interested in any significant differences between our survey neighborhoods, and included neighborhood dummy variables to capture the mean effects of any differences. However, none were significant in the final models, suggesting that any neighborhood-related differences were largely captured by the extensive set of attitudinal, lifestyle, personality and demographic variables available. One set of questions obtained the make, model and year of the vehicle driven most often by the respondent. These responses were categorized based largely on *Consumer Reports* standards with minor adjustments for changes in vehicle categories over time. Nine major vehicle groups were identified (small, compact, mid-sized, large, luxury, sport utility vehicle, minivan/van, pick-up truck, sport) and then dummy variables created for each (for more details, see Curry 2000).

3. Models

3.1. *General specification issues*

Models were developed for the two dependent variables discussed in Section 2.2: Ideal Commute Time (ICT) and Relative Desired Commute (RDC) amount. Altogether, 89 explanatory variables were considered for inclusion in the ICT model and 83 in the RDC model.[8] While these are large numbers, many of the variables represent alternate ways of measuring similar underlying constructs (such as actual mobility, whether Objective or Perceived). Many others represent variables not often measured for models of travel behavior (such as Personality, Lifestyle, and Attitudes), that are nevertheless expected to be potentially important to that behavior.

After considerable initial exploration using linear regression to identify subsets of variables likely to carry the most explanatory power, final models were estimated (after additional exploration) using tobit for ICT and ordered probit for RDC. The LIMDEP statistical package (Greene 1995) was used for these latter estimations. The use of linear regression as a heuristic screening mechanism is consistent with its use in LIMDEP and other econometric software to generate starting values for the parameters to be estimated in more complex models such as tobit and ordered response. The final specifications are generally consistent with expectation, as well as providing additional insight where prior expectation was either neutral or incorrect.

As mentioned in Section 2.2, both Relative Desired Commute amount and the difference between Ideal (I) and Actual (A) Commute Times represent alternate indicators of commute satisfaction. Here, however, we chose to take just I rather than I-A as the dependent variable in the first model. Using I-A as the dependent variable would be equivalent to including A as an explanatory variable in a model for I alone, but forcing its coefficient to equal 1. By including A as an explanatory variable for I but allowing its coefficient to be free, we do not prevent the coefficient from taking the value of 1 if that is the best value, but neither do we constrain it to be 1 if another value is better. Including A as an unconstrained explanatory variable also allowed us to test different transformations of I and A separately. After experimenting with natural log transformations of I and A we concluded that the best results were obtained using I in its original form and ln (A + 1). This represents a diminishing marginal impact of A on I, which is intuitively reasonable: an additional 5 minutes of Actual Commute Time will have a smaller effect on the Ideal Commute Time when the Actual Time is an hour than when it is 15 minutes. One minute was added to each value of A so that when A = 0, the ln function would return the value 0 rather than $-\infty$.

Two key differences should be kept in mind when interpreting the results of the two equations, then: the units of measurement and the point of reference. First, Ideal Commute Time is measured in minutes. While it is true that different people perceive objective time differently, the use of minutes does provide a concrete assessment of quantity. By contrast, with the RDC scale, the same quantitative amount of time considered “more” by one person may be “much more” to another and “about the same” to yet another. Second, Ideal Commute Time represents an “absolute”, whereas RDC is only measured relative to the current situation. Because of this difference, it is plausible for the same variable to enter the two models with opposite signs, as we will see below.

3.2. *Ideal Commute Time*

The Ideal Commute Time variable has the property that it is censored from below at zero; that is, values less than zero are not observed. Using ordinary least squares regression in this case (where the dependent variable is implicitly assumed to be able to take on any value) results in estimators that are inconsistent (usually biased toward zero), and predicted values that could be negative (Greene 1995). Since such a small proportion of our sample reported ICTs close to zero (as discussed in Section 2.2) these effects are not expected to be severe, and indeed our final model differs little from the one obtained through OLS. Nevertheless, to be rigorous, we estimated this model using the tobit formulation, which is the most appropriate way to handle left-censored dependent variables.

The tobit model is based on an unobserved (latent) continuous dependent variable y_i^* that can take on any value:

$$y_i^* = \beta' x_i + \varepsilon_i, \ \varepsilon_i \sim N[0, \sigma^2],$$

$$y_i = \begin{cases} 0 \text{ if } y_i^* \leq 0, \\ y_i^* \text{ if } y_i^* > 0, \end{cases}$$

where y_i is the observed variable (ICT in our case) for individual i. Maximum likelihood is then used to obtain estimators of the vector β and the scalar σ that are statistically consistent.

Table 3 summarizes the final tobit model for the Ideal Commute Time variable. Apparently there is no commonly-accepted goodness-of-fit (GOF) statistic for the tobit model.[9] However, Veall and Zimmermann (1994) test a

Table 3. Ideal Commute Time tobit model results (N = 1300).

Variable	Coefficient	*t*
Constant	–6.732	–3.051
Objective Mobility		
* Ln (Actual Commute Time + 1) [≥ 0]	5.862	17.008
Work/school commute trip frequency category (SD) [1, . . . , 6]	–1.120	–4.269
Perceived Mobility [1, . . . , 5]		
* For commuting to work or school (SD)	0.408	2.152
For work/school-related activities (SD)	0.373	2.227
Relative Desired Mobility [1, . . . , 5]		
For commuting to work or school (SD)	2.718	8.220
For work/school-related activities (LD)	–0.718	–3.219
Travel Liking [1, . . . , 5]		
* For commuting to work/school (SD)	0.686	2.686
Attitudes		
* Commute benefit factor score [–2.9, 2.6]	1.410	5.285
Personality		
Organizer factor score [–2.9, 2.6]	0.525	2.263
Lifestyle		
Family/community-oriented factor score [–3.9, 2.1]	–0.643	–2.490
Excess Travel [1, 2, 3]		
Frequency of travel to a more distant destination than necessary, partly for the fun of getting there	0.851	2.682
Sigma	6.749	50.511

* These variables entered into both models.
SD = Short Distance
LD = Long Distance
[ ] = range of possible or observed responses
Log-likelihood at convergence = –4294.285
R^2_{MZ} = 0.26

number of potential measures, using a simulation where the latent variable is generated by the normal distribution and then censored. They recommend using the measure that most closely replicated (under all their experimental conditions) the R^2 for an OLS regression on the latent variable. This measure is a modified McKelvey-Zavoina statistic, and is given by the following equation:

$$R^2_{\mathrm{MZ}} = \frac{\sum_{i=1}^{N} (\hat{y}_i^* - \hat{y}_\bullet^*)^2}{\sum_{i=1}^{N} (\hat{y}_i^* - \hat{y}_\bullet^*)^2 + N\hat{\sigma}^2}$$

where $\hat{y}_i^* = \hat{\beta}' x_i$ is the predicted value of the latent variable for the individual having characteristics x_i, $\hat{y}_\bullet^*$ is the mean of $\hat{y}_i^*$, and $\hat{\sigma}$ is the estimated standard deviation of ε_i. The numerator of R^2_{MZ} is a measure of explained variance, and the second term in the denominator is a measure of unexplained variance. The value of this statistic for our model is 0.26, indicating that about one-fourth of the total variance of y_i^* is explained.

Eleven explanatory variables plus the constant term are significant in the model. By far the most important explanatory variable (based on beta values for the standardized variables in the companion OLS model, not shown here) is ln(A + 1), which is positively related to the Ideal. That is, the longer one currently commutes, the higher one's Ideal Commute Time tends to be. This is another manifestation of the strong correlation between I and A seen in Table 2, and again indicates that many people either succeed in achieving their ideal or adjust their ideal to reflect reality. Young and Morris (1981) similarly found that reported satisfaction with given hypothetical commute times was related to actual commute times in that once the hypothetical commute exceeded 20 minutes, those people with longer actual commutes were more satisfied than those with shorter commutes.

As noted from Figure 2, however, I and A are not perfectly correlated, and a number of other variables contribute to explaining the remaining variation in I. Interestingly, another objective measure of commuting, frequency, is *negatively* related to Ideal time. However, this too is reasonable: the more frequently I need to make the trip, the shorter I will want that trip to be. Conversely, if I don't have to commute every day, my ideal may reflect a desire to live in a scenic exurban location. Such a tradeoff between commute length and frequency (with its potential decentralizing effect on urban form) has been directly and indirectly suggested by a number of telecommuting researchers (e.g. Mokhtarian 1998), but has not been strongly empirically supported to date. It is likely that many telecommuting episodes are too part-time and too short to justify a major relocation that would result in a substantially longer commute (Varma et al. 1998). Nevertheless, the existence of this tradeoff even as a preference (whether achieved or not) is an important indicator of potential demand for outlying residential locations.

The Perceived Mobility (PM) for commuting to work or school is also positively related to Ideal Commute Time. This is likely capturing an additional aspect of the basic relationship between ICT and current commute amounts that is not completely explained by ln(A + 1). The coefficient of perceived amount traveled (short distance) for work/school-related activities is positive as well, perhaps reflecting a relationship similar to that of ln(A + 1) and PM for commuting.

Two indicators of Relative Desired Mobility have opposite but logical signs and may represent a realistic time tradeoff. Not surprisingly, the more one wants to increase the commute, the longer the Ideal Commute Time. On the other hand, the more one wants to increase long distance travel for work/school-related activities, the shorter the Ideal Commute.

The Travel Liking and Attitude variables are unsurprising but important. As expected, my Ideal Commute is likely to be longer the more I like commuting. Similarly, the more I find benefits to commuting (represented by agreeing with statements such as “I use my commute time productively”, “My commute trip is a useful transition between home and work”, and disagreement with “My commute is a real hassle”), the longer my Ideal Commute.

The organizer factor represents self-identification with traits such as efficient, like a routine, on time, and like being in charge. The positive association of this Personality variable with Ideal Commute Time may reflect the expectations of a career-oriented individual, similar to the findings of Pazy et al. (1996) for commute willingness. Conversely, it is quite logical that the family/community-oriented person (represented by agreement with statements such as “my family and friends are more important to me than work”, “I’d like to spend more time on social or religious causes”, and “occasionally, I’d be willing to give up a day’s pay to get a day off work”) wants a shorter commute, to leave more time to spend with family and friends.

The more often a person travels to a more distant destination than necessary, the longer her Ideal Commute. The significance of this indicator of Excess Travel is intriguing, as it represents extending necessary travel out of an enjoyment of the trip. Finally, the negative constant term indicates that the unobserved variables, on average, work to temper the net positive effect of the variable coefficients. Overall, the model gives plausible results, and its explanatory variables are logical and satisfying. Collectively, they represent most types of variables on which data were collected.

3.3. *Relative Desired Commute amount*

The RDC dependent variable has the property that it is measured on a five-point ordinal scale rather than on a continuous scale with ratio properties. Using OLS regression on this variable assumes, for example, that the distance between "much less" and "less" is the same as the distance between "less" and "about the same", and can also result in predictions outside the range of values the variable can take on. Using multinomial logit or probit would treat all response alternatives as purely categorical, ignoring the ordinal relationship between them. Although it is common practice to estimate OLS models for such variables, it is preferable to take the discrete but ordered nature of the variable explicitly into account through an ordered response model such as ordered probit or ordered logit. Like the tobit model, ordered response models are also based on an underlying continuous latent variable, with the observed variable taking on its discrete values as the latent variable crosses certain thresholds. These thresholds are unknown parameters to be estimated.

More formally, the ordered probit model, in our context with five levels of the dependent variable, can be expressed as follows:

$$y_i^* = \beta' x_i + \varepsilon_i,\ \varepsilon_i \sim N[0, 1],$$

$$\begin{aligned} y_i &= 0 \text{ if } y_i^* \le \mu_0, \\ &= 1 \text{ if } \mu_0 < y_i^* \le \mu_1, \\ &= 2 \text{ if } \mu_1 < y_i^* \le \mu_2, \\ &= 3 \text{ if } \mu_2 < y_i^* \le \mu_3, \text{ and} \\ &= 4 \text{ if } \mu_3 < y_i^*, \end{aligned}$$

where y_i^* and y_i are the latent and observed dependent variables, respectively, and the μs are threshold parameters to be estimated. The μ parameters are only identifiable up to a linear shift (i.e. for any set of μs maximizing the likelihood function, adding a constant c to each μ_j will achieve the identical maximum), and in estimation, μ_0 is typically fixed at zero without loss of generality. In our context, y_i^* can be interpreted as respondent *i*'s true relative desired mobility, freely allowed to take on any value, whereas y_i represents the survey category into which that true response falls.

The final ordered probit model for Relative Desired Commute amount (or more precisely, RDC-1 to conform to the convention that the lowest level be zero) is shown in Table 4. Again, there are no universally-accepted measures of goodness of fit for the ordered probit model,[9] but it can be noted that the log-likelihood for the final model is –864.771, compared to a restricted log-likelihood (for the model containing only a constant term) of –1238.360.

Fourteen variables plus the constant term were significant in the final model.

Table 4. Relative Desired Commute amount ordered probit model results ($N = 1155$).

Variable	Coefficient	t
Constant	2.292	5.389
Objective Mobility [≥ 0]		
* Ln (Actual Commute Time + 1)	–0.242	–1.597
Actual Commute Time	–0.987	–1.776
Work/school commute miles/week (SD)	–0.313	–6.792
Total miles/week (SD)	0.131	4.469
Work/school-related activities miles/week (SD)	–0.167	–2.199
Perceived Mobility [1, . . . , 5]		
* For commuting to work or school (SD)	–0.163	–4.760
Travel Liking [1, . . . , 5]		
* For commuting to work or school (SD)	0.561	13.055
Overall (LD)	–0.143	–3.285
Attitudes		
* Commute benefit factor score [–2.9, 2.6]	0.267	4.898
Lifestyle		
Status seeker factor score [–1.7, 2.7]	0.132	3.010
Workaholic factor score [–2.1, 2.3]	0.109	2.278
Excess Travel [1, 2, 3]		
Frequency of travel by a longer route to experience more of the surroundings	–0.156	–2.463
Demographics		
Total number of adults in HH [1, 2, . . .]	0.204	4.300
Vehicle type: Minivan [0, 1]	–0.363	–2.371
Threshold parameters		
μ_1	1.689	23.582
μ_2	4.609	39.073
μ_3	5.197	19.219

* These variables appear in both models.
SD = Short Distance
LD = Long Distance
[ ] = range of possible or observed responses
Log-likelihood at convergence = –864.771
Restricted log-likelihood = –1238.360

Five of the significant variables are measures of Objective Mobility (OM). The first two of these, ln (Actual Commute Time + 1) and Actual Commute Time itself, are quite highly correlated (0.91), and have borderline p-values (0.11 and 0.08, respectively). However, deleting either one of them (which of course caused the other to become highly significant) slightly but significantly degraded the model according to the χ^2 test (e.g., deleting ACT gave a χ^2 statistic = 3.8232, with 1 d.f., $p = 0.05$). Under these circumstances, there are no hard and fast rules governing whether both variables should stay in the model or not; we chose to leave both variables in to reflect the fact that each of them is trying to add something to the explanatory power of the other, that basically the relationship between ACT and RDM is a rather complex nonlinear one that is not adequately explained by either ACT or its log alone.

Four of the five OM variables – ACT and its log, and distances traveled for commuting and other work/school activities – have negative coefficients: the more a person travels for work, the more he wants to reduce the commute (and the same is true for the Perceived Mobility commute variable in the model). This is certainly a natural relationship. However, total distance traveled for all (local) purposes has the opposite sign. Since all of these variables are collectively highly significant and have different coefficients, they are each important to the model. However, they are best understood by considering the net impact of all five working together. Inspection of the beta coefficients in the corresponding OLS model (not shown here) indicates that the net impact will nearly always be negative, with the positive weight of total distance traveled serving to partially moderate the negative effect of the other four variables. Only when work-related travel (both commute and other) is a relatively small proportion of total travel will the net effect be positive, which is a natural circumstance under which the Desired Commute may be longer than at present.

Similar to a result for the Ideal Commute Time model, two Travel Liking variables enter this model with opposite but natural signs. The more I like commuting, the more likely I am to want to increase the commute I currently have. Based on the OLS beta coefficient, this is the most important variable in the model. On the other hand, the more I like long-distance travel overall, the less I want to commute. Again, this suggests at least an informal tradeoff between travel categories, within an overall desired travel time budget.

The travel benefit factor (based on agreeing with statements such as, "getting stuck in traffic doesn't bother me too much", and disagreeing with statements such as, "travel time is generally wasted time" and "the traveling that I need to do interferes with doing other things I like") has the expected positive relationship to Relative Desired Commute. Two lifestyle traits are also positively associated: individuals who are status seekers (based on agreeing with statements such as "to me, the car is a status symbol", "a lot of the fun of having something nice is showing it off", and "the one who dies with the most toys wins") and those who are workaholics (based on agreeing with statements such as "I'm pretty much a workaholic", and "I'd like to spend more time on work") desire longer commutes. These traits represent an orientation toward a career and the financial and social rewards it brings, and affect one's view of the ideal commute. All else equal, the status car user will want to maximize the opportunity to enjoy and display her auto, while the workaholic has adjusted his preferences to reflect his willingness to commute longer distances for the sake of a desired job.

The Excess Travel indicator in the model, taking a longer route to experience one's surroundings, is associated with a desire to decrease the commute. Perhaps the longer the commute, the less time and inclination the traveler has to "take the scenic route" that is otherwise desired and enjoyed. Thus, this variable may reflect an aspect of a love for travel that is hindered by a long commute.

The number of adults in the household is positively associated with Relative Desired Commute. This may represent both a greater need for a transition between work and home for members of a larger household, and (conversely) the desire of single parents to minimize the time spent on commuting. The negative relationship between driving a minivan and Relative Desired Commute could be associated with family obligations as well. Gender was not significant in the model; however, the minivan variable is likely to be picking up some gender variability as the majority of minivan drivers in our sample are women, and women are more likely to be responsible for household duties such as taking kids to school. Finally, in this case, the positive value of the constant serves to increase the net positive value of the variable coefficients.

It is of interest to interpret the threshold parameters of the ordered probit model. Whereas the original five survey categories defining the observed dependent variable are not interval-scaled (i.e. the distance between responses 1 and 2 is not necessarily the same to the respondent as the distance between 3 and 4), the threshold parameters, by construction, do have that property. Although, as mentioned earlier, the unit of measurement of the Relative Desired Commute variable is unspecified (i.e. it is not necessarily referring to distance, or time), examining the spacing of the μs gives insight into how respondents collectively perceive the five response categories in this context.

From the estimated values of the μs provided in Table 4, we can see that the "width" of the "less" category is 1.69, the "about the same" category is 2.92, and the "more" category is 0.59. This suggests, first, that a sizable amount of variation from current conditions would still constitute "about the same" amount of travel for most respondents. Once outside that broad middle range, however, the threshold from "less" to "much less" is reached more quickly, and the threshold in the other direction, from "more" to "much more", is reached most quickly of all. That is, it takes quite a bit less commute travel for a respondent to feel like "much more" is being desired, than it does to feel like "much less" is desired. This asymmetric perception may reflect absorption of the societal stereotype that commuting is undesirable, and therefore that to want more of it must be somewhat extreme. We could therefore hypothesize that we would obtain different results with the analysis of Relative Desired Mobility for a more widely-favored category of travel such as long-distance entertainment/social/recreational.

4. Conclusions and directions for further research

This study attempts to better understand individual preferences regarding a basic and important travel indicator: commute time. Earlier work suggests that people may assign some positive utility to commuting for several reasons: the benefits associated with a typical work destination (such as opportunities for socializing, shopping and other activities), the benefits associated with activities that can be conducted while traveling (listening to music, making phone calls, reading, transitioning between work and home roles), and an intrinsic enjoyment of travel itself (Mokhtarian and Salomon, forthcoming).

Consistent with those conceptual considerations and with related empirical work, we found that for the most part, people want some commute time (although generally not long – our sample reported a mean of 16 minutes, but 8.9% indicated an Ideal Commute Time specifically of 30 minutes, and 2.1% indicated longer than 30 minutes). For a sizable minority (42% of our sample), people's Actual Commute Time falls within 5 minutes of their Ideal, indicating either that they have succeeded in achieving their ideal or that they have adjusted their ideal to fit reality. However, for more than half (52%) of the sample, the Actual Commute Time exceeds the Ideal by more than 5 minutes, indicating a large segment of commuters who would be receptive to reducing the mismatch between desired and actual commute times. On the other hand, for a much smaller but interesting minority (7%), the Actual Commute Time is more than 5 minutes *smaller* than the Ideal. This group would prefer to commute *more* than it is doing now.

Tobit and ordered probit equations were estimated to model two measures of commute time preferences: Ideal Commute Time and Relative Desired Commute amount (a variable indicating the desire to commute "much less" to "much more" than now), respectively. Both variables were found to be influenced in logical ways by objective and perceived measures of the amount of current travel, liking for travel in general and commuting in particular, attitudes regarding benefits and drawbacks of travel, personality or lifestyle traits, and demographic characteristics. For example, Ideal Commute Time was found to be positively related to Actual Commute Time, and negatively related to commute frequency and a family/community-oriented lifestyle. Relative Desired Commute, on the other hand, was negatively related to amounts of actual commute and work-related travel, but this difference between the two models is expected in view of the difference between the dependent variables (absolute versus relative to existing conditions). Variables measuring the liking for commute travel and benefits of commuting had positive coefficients in both models, an expected but important result confirming the existence and value of positive attitudes toward commuting in influencing commute-related desires.

It is of interest to mention some of the variables that were allowed to enter the models but were not found to be significant in the final specifications. These included the residential neighborhood dummy variables, income, speed (as a proxy for degree of congestion) , having bought a better car, having bought a cell phone, and having bought a car stereo (the latter three indicating a desire and ability to obtain some utility from commuting). The absence of these variables from the final models may not mean that their effects are insignificant, but rather that those effects are captured through variables that *are* included. For example, one's liking for commute travel is probably partly a function of commute speed. The perceived benefit of commuting may be heavily influenced by whether one has a cell phone, a nice car stereo, and so on. Potential similarities of residents in the same neighborhood are likely to be captured by the attitudinal, lifestyle, personality, and demographic variables that do appear in the models.

On the whole, these results support the contention that commute time is not unequivocally a disutility to be minimized, but rather that there is an optimum to be achieved which can be violated in either direction – i.e. it is possible (although comparatively rare) to commute too little as well as too much. For many people, commuting carries some positive benefits, and they would not want to eliminate it entirely. Further, many people consider their current commute time to be Ideal. On the other hand, large proportions of people are commuting longer than they would like, and hence would presumably be receptive to reducing (although usually not eliminating) that commute if circumstances permitted.

Future analysis of the same sample can refine and extend these results in at least two ways. First, it would be useful to explore various ways of segmenting the sample. For example, the variables potentially explaining Ideal Commute Time may be weighted differently depending on gender or presence of children. Another basis for segmentation is the individual's status regarding long-distance travel, specifically, amounts of long-distance travel for work and leisure. It can be hypothesized that Ideal Commute Time may be viewed differently by those who already travel extensively for long distance trips than by those who do not. A third basis is the predominant mode used: while mode indicators were not significant as dummy variables, the use of different modes may well be associated with different valuations of various explanatory factors. A final basis for segmentation is the relative weight an individual gives to each of the three components of an affinity for travel: the benefits obtained at the destination, the ability to conduct other activities while traveling, and the enjoyment of travel for its own sake.

Second, there are a variety of interrelationships among the variables used in this study that are not adequately captured by these single-equation models. Work is in progress to develop a conceptual model expressing those interrelationships more completely. That will be followed by the empirical estimation of that model using structural equations. Such a model will provide even greater insight into individuals' views of that most fundamental of human activities – travel.

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Notes

1. Much of our discussion includes "work or school-related" travel as well as "commute" travel. The 1995 NPTS distinguishes between "work-related" travel and "church & school" travel, which comprise 2.6% and 8.8% of all person-trips respectively, and 5.8% and 5.7% of all person-miles, respectively.
2. For the three respondents in this sample who did not complete the Relative Desired Commute question, a predicted value was derived from a regression model on the remaining 11 questions in the Relative Desired Mobility section (see Section 2.3), calibrated on the set of respondents who answered all 12 questions.
3. For a more complete discussion of the survey respondents' demographic characteristics, their representativeness as compared to the census, and expected sample bias see Redmond (2000) or Curry (2000).
4. "Actual" Commute Time is, of course, the respondent's reported perception of the Actual time. However, for a frequent and routine activity such as commuting, the respondent's perception is likely to be reasonably accurate. In any case, for this analysis, to the extent that Ideal time is a function of "Actual", it is in fact the respondent's perception of the Actual that is important to that relationship.
5. While Table 2 collapses RDC into three categories to compare it to I-A, the dependent variable modeled in Section 3.3 is the original 5-category version.
6. From the commute distance and time questions, we also created a variable for commute speed (as a proxy for degree of congestion). Further, we tested the effect of mode on commute preference through the inclusion of three dummy variables indicating the respondent's dominant mode, but none of these four variables was significant in the final models.
7. We did not specify what a better car was. This allowed respondents to answer with respect to a car that would be better for them, for whatever reasons they prioritize.
8. The 83 variables used for the RDC model were a subset of the 89 used for the ICT model. Six variables were not included in the RDC model (Ideal Commute Time and five other

explanatory variables) because their relationship to the dependent variable was too nearly tautological. The five variables were: Relative Desired Mobility (RDM) overall and for work- or school-related activities, for both long- and short-distance travel, and the travel dislike attitude. The dependent variable RDC is also an RDM variable, and strongly related to the other four. The travel dislike factor was removed because its presence in the model had counterintuitive effects. The I variable was removed after some debate by the authors. When this variable was included it consistently improved the model but overpowered the other variables, driving several of them into insignificance. We realized that when both I and A were included in the same model, RDC could be predicted with a high degree of accuracy (as Table 2 illustrates), but this was simply reflecting the nearly tautological relationship between RDC and I-A. On the other hand, including RDC in the model for ICT did not have the same disproportionate effect. To understand why, consider that if I-A is large and positive, the value of RDC is known with a high degree of certainty to be either "More" or "Much more". However, if RDC is known to be high and A is also known, we can predict only that I is greater than A, but I could take on any number of values that fulfills that condition.

9. Response from W. H. Greene to an inquiry from the second author, posted on the limdep-l@its.usyd.edu.au listserv, November 10, 2000.

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