Accessibility and the Allocation of Time: Changes in Travel Behavior 1990-2010

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Dedication

I would like to dedicate this thesis to my family, without whose love and support I never would have made it, and especially to my grandfather, Paul, who passed away while I was pursuing this degree.

Abstract

Using detailed travel surveys conducted by the Metropolitan Council of the Minneapolis/Saint Paul region for 1990, 2000-2001, and 2010-2011, this study analyzes journey-to-work times, activity allocation and accessibility. The analysis shows a decline in the time people spend outside of their homes as well as the time people spend in travel over the past decade. Although distances per trip are increasing, the willingness to make trips is declining, resulting in fewer kilometers traveled and less time allocated to travel. This study finds accessibility to be a significant factor in commute durations. Accessibility and commute duration have large affects on the amount of time spent at work therefore activity patterns are influenced by transportation and the urban environment.

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Chapter 1

Introduction

The word accessibility has many different meanings, but they all contain the same key idea. For example, in recent years, many people in the United States will think of the Americans with Disabilities Act when they hear the word "accessibility". This act was put into place to insure that people with limited physical mobility would still have adequate access to public infrastructure and built environments, for instance wheelchair ramps into buildings, low-floor public transportation, and auditory pedestrian traffic signals. This idea of accessibility as separate from mobility carries over to the transportation system.

In terms of a transportation network, mobility refers to a persons ability to get from point A to point B as economically as possible. In many cases that means as quickly as possible, or as cheaply. For most of human history, a person's mobility was directly dependent on their physical ability to walk or run (or swim or ride) to a certain place. While, most land on the planet was technically accessible given enough time, practically, accessibility was extremely limited and travel times were very high. Presently, mobility is very high. Technology allows for faster than sound air travel, and race cars routinely travel at over 200mph. However, a high mobility does not imply high accessibility. One could be in a race car in the center of the Sahara, and ignoring performance issues caused by dust, could easily travel at a very high rate of speed, but when asked to pick up a gallon of milk on the way home, it could take hours or even days to reach the nearest market.

Accessibility is thus the measure of the number of opportunities of a given time that are within certain parameters, usually distance or travel time. In other words it is the potential for interactions [Cao et al., 2010, Hansen, 1959, Haugen, 2011, Grengs, 2013, Tschopp et al., 2005, VanWee and Geurs, 2011, Yang and Ferreira, 2005]. It is inherently linked with mobility, but as the previous paragraph discussed, not always correlated. it depends on both mobility and density of destinations. Accessibility as a measure of a transportation system's value has been studied for half a century, and high accessibility is the main objective of transportation planning [Cheng et al., 2007]. This study examines how accessibility affects time spent traveling to and at work.

Previous research has found that commute trip durations remain relatively stable over time, despite the changing urban landscape [Levinson and Kumar, 1994b, Levinson and Kumar, 1995, Levinson and Kumar, 1997, Levinson, 1998], with people traveling on faster suburban roads rather than slower urban roads, and their destinations are becoming more decentralized with suburban jobs. [Mokhtarian and Chen, 2004] found in a detailed literature review that household structure, demographics, destination activity, and the characteristics of the region traveled in all have measurable effects on travel time budgets.

This study extends previous research by examining factors that affect travel and activity behavior. [Levinson, 1998] used a gravity based accessibility model for the Washington DC Metropolitan area and applied it to data from a 1988 household survey to test several hypotheses that analyze the relationship between accessibility and the commuting times of various individuals. Increased job accessibility in housing rich areas, and labor accessibility in employment rich areas were expected to decrease commute time.

Using detailed travel surveys conducted by the Metropolitan Council of the Minneapolis/Saint Paul (Twin Cities) Region in Minnesota for 1990, 2000-2001, and 2010-2011, this paper conducts a detailed analysis of journey-to-work times, activity allocation and accessibility. Given the data are collected every 10 years, it is also possible to observe changes in the travel behavior in the region, as well as any changes in the relationships important to the transportation network. This information is key in assessing the transportation landscape, and can be used to help develop policy going forward.

- Chapter 1 introduces the analytic goals pursued in this thesis.
- Chapter 2 briefly presents the theory behind the subjects presented in this thesis.
- Chapter 3 documents the data used in the thesis.
- Chapter 4 describes the methods used in the analysis.
- Chapter 5 provides a descriptive analysis of the data.
- Chapter 6 reports the results of the models developed.
- Chapter 7 discusses the implications of the thesis.

Chapter 2

Theory

The core hypotheses tested in this study are based on previous studies [Levinson and Kumar, 1994b, Levinson, 1998]. We expect the relationships between commute duration and accessibility in the Twin Cities to corroborate previous findings. In brief the core hypotheses for auto commuters are below:

- Individuals who live in areas that have high housing accessibility will have longer commutes due to competition for jobs.
- Individuals who work in areas that have high housing accessibility will have shorter commutes because they are more likely to live in said housing.
- Individuals working in areas with many competing jobs will have longer commutes because they will have to search for housing further from their work due to competition in the housing market.
- Individuals living in areas with high job accessibility will have shorter commutes because one of those jobs is more likely to be theirs.
- Distance to the center of a city is important in that accessibility to jobs is higher for those who live near the center, and therefore they should have shorter commutes than those who live further from the center where accessibility is lower.

We would anticipate the same relationships for transit commuters were transit service as uniform as road networks. But the relationship is confounded by significant positive externalities associated with transit service, as observed by the Mohring Effect [Mohring, 1972]) in thick transit markets, which will occur where either job accessibility is high (i.e. high density job centers) or housing accessibility is high. [Levinson, 1998] found that commute durations drop when employment is higher near either the origin (home) or destination (work) end for trips.

Extending the analysis from travel duration to activity duration, we posit that the relationship between accessibility and time spent at work resembles the relationship between accessibility and commute duration. While there is a finite amount of time and thus a budget [Levinson and Kanchi, 2002], so more time at one activity must reduce time available for other activities, there are also complementarities between travel activities and out-of-home activities (which cannot be engaged in but for travel). Thus we anticipate that longer work commutes and longer work durations are positively associated, and the factors affecting them are similar. There could be several reasons for this:

- Areas of high employment accessibility are associated with higher salaries. More productive employees (justifying the salary) work longer hours.
- Individuals who work near their place of employment are able to travel back and forth between home and work readily, and may more easily blend the two. A person who lives near their job will, due to the easier commute, have more flexibility in their hours (if the employer allows it), popping into the office as needed rather than needing to camp at their workplace in case something comes up. They may also be more likely to return home for lunch.
- Individuals with long commutes may work fewer days per week, but more hours per day, to compensate for the additional travel time.

Chapter 3

Data

The data for this study were collected by the Metropolitan Council for the Travel Behavior Inventories (TBI) conducted in 1990, 2000, and 2010. The TBI was designed in 1969 to update the information used for transportation planning in the Twin Cities Metropolitan region [TPP, 1974]. It consisted of 4 surveys, a home survey, a truck survey, a survey of travel to specific "special generators", and a survey of transit usage. The TBI collects data on a variety of factors; from information about household size and makeup, employment information, and specific information about trips.

Due to the changing nature of the surveys in each decade, the data needed to be harmonized in order to be compared on a decade-to-decade basis. Also, much of the data is self-reported by the individuals who participated, and therefore there are errors in the reporting.

Certain censoring thresholds were used to address this issue. Trips were excluded if:

- The calculated distance traveled was greater than 200 km (though not technically impossible, any trip greater than this seemed unlikely and out of the realm of the analysis).
- The calculated average speed was greater than 150 $km \cdot H^{-1}$ (again, not technically an impossibility, however an average speed that fast would be highly unlikely, and

some calculated speeds were impossibly high).

- Trip durations exceeded than 120 minutes. While durations greater than that may or may not be errors, it was determined that they fell beyond a reasonable application of this study. Or,
- Any of the fields were missing or unreported.

When a trip was omitted, so were all of the other trips made by that respondent, so as not to artificially affect the time allocations.

Table 3.1 shows the censoring filters and the sample size remaining after each filter. Errors in the data may also be due to respondent's tendency to round trip departure and arrival times to the nearest multiple of 5. This causes the data to be skewed towards those times. Figure 3.1 shows this for the 2010 reported trips. The x-axis shows the reported travel times in minutes, and the y-axis is the number of reported trips (after filtering). There are very clear spikes at the 5's that are much larger than the rest of the reported times, which show the anticipated exponential decay relationship. As many activities tend to be scheduled to begin on 5, 15, and 30 minute intervals as well, it is difficult to determine the extent to which the spikes around those times are artifacts of rounding, or actually present in practice, which may affect the precision of any models developed from the data. A check with the GPS study data from the 2010 survey could be done to find the error introduced by these 5-minute spikes.

Table 3.1 shows the filtering parameters and the remaining sample size for each year after the filters. Most of the filtering and analysis of the data in this study are the same as [Levinson and Wu, 2005], which analyzed TBI data from 1990 and 2000, however with a few definitional changes in order to directly compare 2000 with 2010. Only adult respondents of working age were used (between 18 and 65), as well as only respondents who had begun and ended the travel day at home. The latter parameter is needed to calculate the time spent at home. In [Levinson and Wu, 2005] the respondents were separated by gender and employment status, however telecommuting was not taken into account. Additionally, anyone who made a trip reported to be greater than 120 minutes was excluded. This is due to the assumption that they are making "unusual" trips, rather than a daily routine trip. Telecommuting is becoming a significant means of employment, which may have deep impacts on the transportation network, and is the subject of a separate study using the TBI, however for the purposes of comparison to [Levinson and Wu, 2005], it was decided to omit the work-at-home category for this study as well.

The trip purposes for each separate TBI were harmonized, as defined in Table 47 from [Owen et al., 2013]. A worker is defined as someone who made a work-trip on the travel day. A work-at-home respondent is defined as someone who did not have a work outside of home trip on the travel day but did have work-at-home listed as an activity.

One significant difference between this study and [Levinson and Wu, 2005] is the inclusion of "work-related" trips as work trips, and the inclusion of formerly "non-workers" who made work related trips into the worker category. This change was made due to the 2010 TBI lacking a "work-related trip" purpose. In the 2010 survey, a work trip included any trip made for work outside of the home, regardless of whether that trip was to the primary place of employment or not. This change slightly altered the 1990 and 2000 results, and as such were recalculated, as discussed later in this report. The sample size of each category can be seen in Figure 3.2.

The Metropolitan Council divides the region into small areas called Transportation Analysis Zones (TAZs). These TAZs allow for a higher resolution of data than just municipality level statistics, especially for the large cities of Minneapolis and Saint Paul. Different TAZ systems were in use for the different surveys. For this analysis the year 2000 TAZ system is used to be consistent with the accessibility calculations that are used..

For all years, accessibilities were calculated based on a cumulative opportunities model, where the number of opportunities from a TAZ given a certain travel time threshold (in minutes) is calculated. Additional population and employment data were

Table 3.1: Filtering

Description of Constraints	1990	2000	2010
Subtotal	24509	14671	30286
Reason for Dropping Records			
Gender not recorded	0	0	45
Age [18,65]	7513	6279	11992
Did not start travel day at home	975	237	700
Did not end travel day at home	385	209	1820
Trip Duration > 120	31	17	653
Travel+activity duration > 1440	63	5	91
Missing 1 or more trips	60	266	535
Work-at-home only	20	70	698
Total dropped	9047	7083	16534
Net total	15462	7588	13572

collected from the United States Census Bureau. Accessibility measures for 2010 for both auto and transit were calculated by [Owen and Levinson, 2012]. The Accessibilities for 1995 and 2000 were computed for auto [El-Geneidy et al., 2006] and transit [Iacono et al., 2008]. In order to find the number of opportunities available within a certain travel time, the travel times needed to be estimated for arterial links. This was done by comparing various models of travel time models to find the most accurate [Davis and Xiong, 2007]. Davis and Xiong recommended the Skarbardonis-Dowling model (shown below) [Skabardonis and Dowling, 1997], and this was the model used to estimate the travel costs for the accessibility measures.

$$TT = (\frac{L}{FFS} + 0.5NC(1 - \frac{g}{C})^2 PF)(1 + 0.05(\frac{v}{c})^{10})$$

where

TT = predicted mean travel time

FFS = free-flow travel speed

N = number of signals in the link

C = cycle length

g = effective green time

PF = progression adjustment factor

v = volume

c = capacity (adjusted by green time/cycle length ratio)

$PF = \frac{(1-P)f_{PA}}{1-\frac{g}{C}}$

where

PF = progression adjustment factor

P = proportion of vehicles arriving on green

g/C = proportion of green time available

f_{PA} = supplemental adjustment factor for platoon arriving during green (approximately =1)

When the link has only one signalized intersection at the downstream site, the model can be simplified to

$$TT \approx (\frac{L}{FFS} + 0.5(1-P)(C-g))(1+0.05(\frac{v}{c})^{10})$$

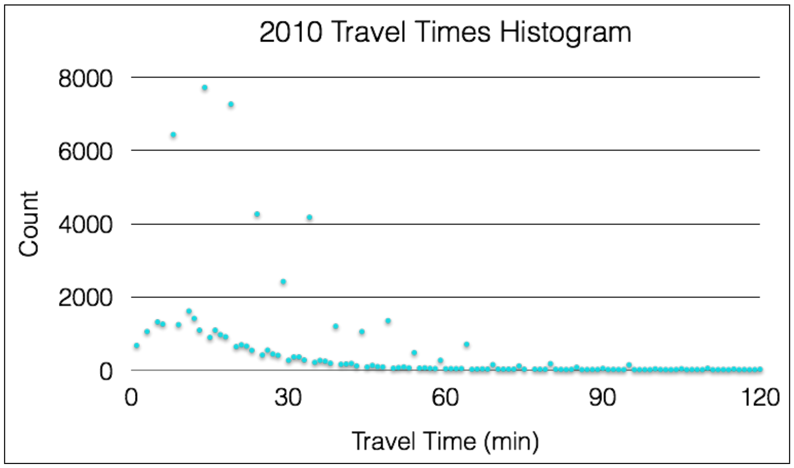

Figure 3.1: Travel Times Histogram

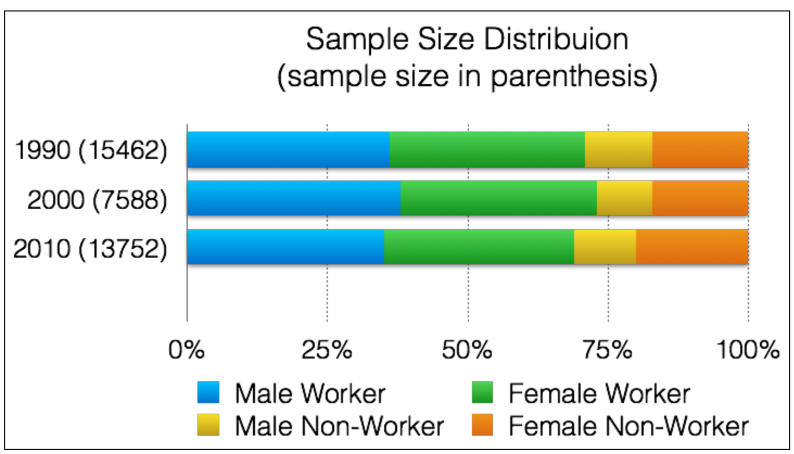

Figure 3.2: Sample Distribution

Chapter 4

Methods

The activity durations were calculated by linking the trips taken by each respondent and then subtracting the arrival time of the former trip from the departure time of the latter. The remaining time was calculated by adding the travel times for each trip to the calculated activity durations and subtracting the total from 1440 minutes. This time was cross-checked by subtracting the time of departure of the first trip from midnight and the last trips' arrival from midnight and adding the two. This remaining time was attributed to time at home due to the parameter that all respondents began and ended their travel days at home. Figure 4.1 illustrates this calculation process on an idealized data set.

Each activity's allocation of time was calculated by taking the mean of the activity durations for each gender/employment category, where the total sample size was the size of that gender/employment category. This equates to the average time that each respondent spent on that activity, including those who did not partake in that activity on the travel day. Thus, each gender/employment category represents a time budget of each activity to add to a total of 1440 minutes. The results from 2000 were compared to 1990 and 2010 were compared to both 1990 and 2000 using a t-test to determine if any changes were significant.

In order to analyze the effects of suburbanization in the region, the network distances to the central business district (CBD) were calculated. It is assumed that the density of development decreases, and the average velocities of vehicles increase as distance to the CBD increases. These factors are all intertwined with accessibility, but also looked at independently and in relation to accessibility. Due to the nature of the Minneapolis - Saint Paul region being the "Twin Cities" and essentially having two CBDs, the distances were calculated from both. All trips were then placed into categories based on their minimum distance to the CBDs (for example, if a trip origin was closer to Downtown Minneapolis than Downtown Saint Paul, its category was determined by its distance to Downtown Minneapolis.) Figure 4.2 shows the network distance map of the region illustrating this calculation.

While the analysis ideally would enter separate cumulative accessibility values for 10 minutes, 20 minutes, ..., 60 minutes, this faces the problem of autocorrelation. Thus, a composite weighted accessibility at each TAZ was calculated by using the equation

$$A_{TAZ} = \sum (A_x - A_{x-1}) e^{cx}$$

where

A_x = accessibility within x minute threshold

A_{x-1} = accessibility within the previous minute threshold.

c = coefficent

The factor c was estimated to be -0.08 using data from the Washington DC region [Levinson and Kumar, 1994a] for the first models tested. This weighted accessibility calculation combines the multiple cumulative opportunities accessibility measures (the exact number of opportunities available within a certain travel cost) into a gravity-like model of accessibility, and maintains comparability with [Levinson, 1998]. In order to test the validity of this model (specifically the coefficient of -0.08) for the Twin Cities region, the regression analysis was tested using a variety of coefficients for 2010. The results of these regressions as well as adjusted R^2 and F values for each can be found in the Appendix.

An OLS regression was performed for auto and transit users where the dependent variable was the commute duration. Using the same explanatory variables as previous studies allows for direct comparison to the DC results, with a few exceptions; the addition of workers aged 70+ to the age60 category, since there were none in 2010 and 1990, and very few in 2000, and the elimination of the "female head of household" variable, since the TBI survey did not record that and it would be difficult to determine from the questions asked to the same confidence as the DC study. Additionally, the same analysis was run with the dependent variable as the time allocated to work for auto commuters. For these regressions, the data was organized by worker (based on the previously stated criteria) and an additional explanatory variable of the number of work trips made that day was added. Income as an explanatory variable was initially found to be insignificant, but was removed from the regression due to the multitude of problems with the income records in the TBI; the income is recorded for the household, not at the person level, it is self reported, and more than half of the survey respondents declined to answer the question, which greatly reduced the sample size and accuracy of the regressions. Some studies have indicated a correlation between income and time allocation [Robert, 1970], however for the purposes of this study it was determined that there are enough overlapping explanatory variables to account for this.

Once the regressions most matching the DC study were conducted, several other models were tested on the 2010 auto commuter data; including using the accessibility from each TAZ as a separate model for both cumulative and non-cumulative measures, and using all non-cumulative TAZ accessibilities as explanatory variables (these regressions were done with the same independent variables as the non-collinear test). In addition, a log-linear GLM was tested for the weighted accessibility with a coefficient of -0.08, however the results were not very different from the OLS model and the Akaike information criterion suggested that the GLM was only slightly a better fit. The results of these regressions may be found in the Appendix (all regressions included the demographic variables, but due to their very similar results and relative unimportance to fit testing, their coefficients were omitted from some of these tables).

Regressions were also done for the work duration using only the accessibility variables (plus demographics), with commute duration substituting for accessibility, and with predicted commute duration from the best fit model as a substitute for accessibility.

In order to compare the models over the three surveys, the Z statistic was calculated using the following equation [Clogg et al., 1995]

$$Z = \frac{\beta_1 - \beta_2}{\sqrt{SE_{\beta_1} + SE_{\beta_2}}}$$

Where β_x = coefficient of year x SE_{β_x} = standard error of the variable for year x.

Person ID	Origin	Destination	Trip departure time	Trip arrival time	Travel time	Activity Duration (min)	Total
1	Home	Shop	8:30	8:45	15	30	45
1	Shop	Work	9:15	9:30	15	360	420
1	Work	Dining	15:30	15:45	15	105	540
1	Dining	Shop	17:30	17:40	10	20	570
1	Shop	Home	18:00	18:20	10	850	1440
2	Home	Work	8:00	8:20	20		360

Figure 4.1: Activity Duration Calculation

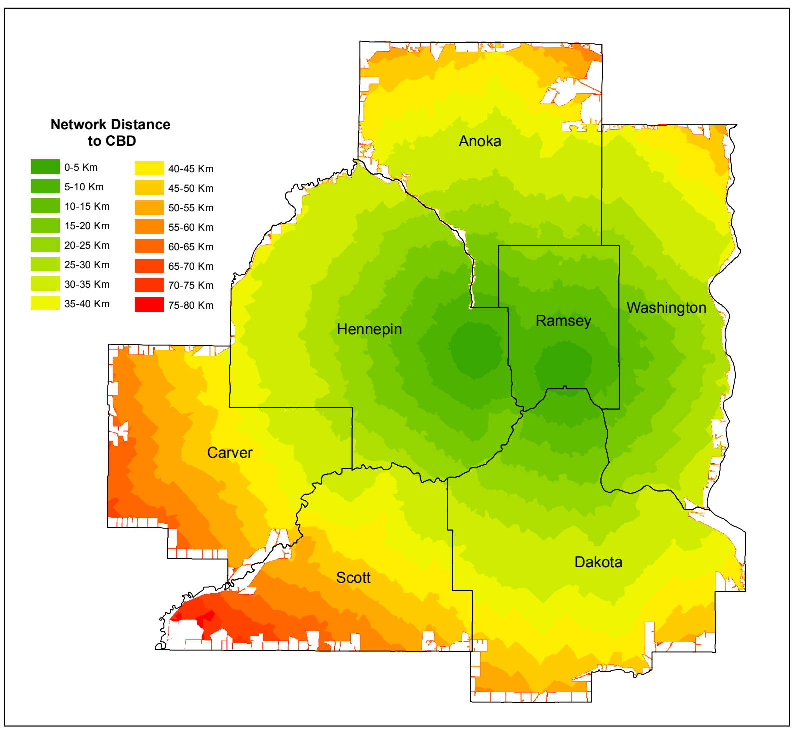

Figure 4.2: 2010 Network Distance to CBD

Chapter 5

Descriptive Analysis

Table 5.1 and 5.2 show the characteristics of trips taken in the region (speeds are in kph). Trip durations for workers has gone up for all activities from 2000 to 2010, but for non-workers it has gone down. This may be due to economic factors in that workers may have taken less desirable jobs based on distance from their homes, or caused people to move further from their workplace. The latter may have had an effect on non-work trips as well. The travel time for female workers increased; however for non-workers and overall travel time is down. This matches other research that shows that less time is being spent traveling, as evidenced by a decrease in the total vehicle travel in the United States [USD, 2013]. Interestingly, the average trip duration for 2000 and 2010 did not significantly change (18 minutes for 2000 and 19 minutes for 2010). This implies that the reductions are in the willingness to make a trip, but not based on the distance of said trip.

This decline in the amount of time spent traveling has been a topic recently in the transportation field. The rate of change in Total Vehicle Travel has been steadily decreasing, and the per capita total distance traveled has begun to decline. As technologies change, the attitude towards cars and car travel has also changed, with the car becoming a less desirable form of transportation to alternatives or simply not making a trip [Metz, 2010]. The term "Peak Travel" has been used to describe the idea that travel growth in the United States has ceased and may begin to decline [Millard-Ball and Schipper, 2011]. The results of this study indicate that, while trip times remain somewhat steady, total travel is declining in the Twin Cities region.

Table 5.3 and 5.4 summarize the allocation of time over these three surveys. The time spent working for both genders and both work from home and work outside of home have decreased by a large amount. This is in part due to the economic recession of 2008, which caused a rise in the number of part-time laborers [Cen, 2012]. However there has also been a decade-long decline in labor force participation rates beginning prior to the 2008 recession.

Total time spent shopping decreased for everyone except for non-working females, likely caused in part by an increase in online shopping. According to the United States Census Bureau, the percentage of households in the United States that had access to the Internet increased from 41.5% in 2000 to 71.7% in 2011 [File, 2013]. The Internet has provided electronic accessibility, much as the transportation network has in the material world. It helps to facilitate commerce, communication, education, and leisure. This may lead to a decreased need for people to travel, and account for more time spent at home. The recession of 2008 may have had an impact on shopping traveling habits as a reduction in the household budgets for luxuries such as eating out, shopping for unemployed persons, but also those nervous about the potential of unemployment. Further, all other activities also declined from 2000 to 2010. These decreases meant a proportional increase in the amount of time spent at home.

Table 5.1: Average travel times (minutes) and travel distances (km) auto

			Worker						Non-Worker					
Destination		Year	Male	S.D.		Female	S.D.		Male	S.D.		Female	S.D.	
Work	Time	1990	23.1	16.8		20.2	14.9		–	–		–	–	
	Distance	1990	11.0	15.2		8.4	12.1		–	–		–	–	
	Speed	1990	28.6	–		25.0	–		–	–		–	–	
	Time	2000	22.8	16.9	†	19.8	15.3	†	–	–		–	–	
	Distance	2000	12.1	16.9	†	9.8	13.7		–	–		–	–	
	Speed	2000	31.8	–		29.7	–		–	–		–	–	
	Time	2010	23.9	16.8	†††	21.6	15.3	†††	–	–		–	–	
	Distance	2010	14.2	15.6	†††	12.3	13.2	††	–	–		–	–	
	Speed	2010	35.6	–		34.2	–		–	–		–	–	
Shop	Time	1990	12.9	11.5		12.4	12.0		13.8	12.3		12.4	12.5	
	Distance	1990	7.2	6.4		6.3	6.4		7.3	11.2		7.2	10.9	
	Speed	1990	33.5	–		30.5	–		31.7	–		34.8	–	
	Time	2000	13.2	11.7		13.0	11.7		14.2	13.1	†	12.8	12.3	†
	Distance	2000	7.6	12.1	†	6.8	11.5	†	7.4	12.3		7.3	12.6	
	Speed	2000	34.5	–		31.4	–		31.3	–		34.2	–	
	Time	2010	15.4	13.7	†††	14.1	12.1	†††	13.6	12.7	†	12.4	11.0	†
	Distance	2010	8.4	11.0	†††	7.1	9.6	††	7.0	10.8		6.5	9.5	†††
	Speed	2010	32.7	–		30.2	–		30.9	–		31.5	–	
Other	Time	1990	16.4	14.2		13.4	12.9		18.4	16.4		15.6	15.2	
	Distance	1990	7.8	12.9		7.8	12.2		10.2	13.4		8.0	10.9	
	Speed	1990	28.5	–		34.9	–		33.3	–		30.8	–	
	Time	2000	16.6	15.5		14.6	13.3		18.2	16.8		15.3	14.6	†
	Distance	2000	8.2	15.4		7.2	12.3		9.8	15.3		8.1	12.4	
	Speed	2000	29.6	–		29.6	–		32.3	–		31.8	–	
	Time	2010	16.6	14.6		15.5	13.1	†††	17.8	15.7	††	15.8	13.6	†
	Distance	2010	8.9	7.6		8.1	10.3		9.2	13.1	††	7.9	9.5	
	Speed	2010	32.2	–		31.4	–		31.0	–		30.0	–	

† Indicates statistically different from previous year
†† Indicates 2010 statistically different from 1990
†††Indicates statistically different from both previous years
$P < 0.5$

Table 5.2: Average travel times (minutes) and travel distances (km) transit

			Worker						Non-Worker					
Destination		Year	Male	S.D.		Female	S.D.		Male	S.D.		Female	S.D.	
Work	Time	1990	24.4	18.1		21.5	16.2		–	–		–	–	
	Distance	1990	9.9	16.3		7.3	13.2		–	–		–	–	
	Speed	1990	24.3	–		20.4	–		–	–		–	–	
	Time	2000	23.6	17.7	†	20.6	16.1	†	–	–		–	–	
	Distance	2000	11.4	17.6	†	9.1	14.4	†	–	–		–	–	
	Speed	2000	29.0	–		26.5	–		–	–		–	–	
	Time	2010	25.4	18.3	†††	23.1	16.8	†††	–	–		–	–	
	Distance	2010	12.7	17.1	†††	10.8	14.7	†††	–	–		–	–	
	Speed	2010	30.0	–		28.1	–		–	–		–	–	
Shop	Time	1990	14.2	12.8		13.7	13.3		15.1	13.6		13.7	13.8	
	Distance	1990	6.7	6.9		5.8	6.9		6.8	11.7		6.7	11.4	
	Speed	1990	28.3	–		25.4	–		27.0	–		29.3	–	
	Time	2000	13.8	12.3	†	13.6	12.3		14.8	13.7	†	13.4	12.9	
	Distance	2000	6.2	13.5		5.4	12.9	†	6.0	13.7	†	5.9	14.0	†
	Speed	2000	27.0	–		23.8	–		24.3	–		26.4	–	
	Time	2010	15.9	14.2	†††	14.6	12.6	†††	14.1	13.2	†††	12.9	11.5	†††
	Distance	2010	7.5	11.9	†††	6.2	10.5	††	6.1	11.7	††	5.6	10.4	††
	Speed	2010	28.3	–		25.5	–		26.0	–		26.0	–	
Other	Time	1990	17.1	14.9		14.1	13.6		19.1	17.1		16.3	15.9	
	Distance	1990	7.1	13.6		7.1	12.9		9.5	14.1		7.3	11.6	
	Speed	1990	24.9	–		30.2	–		29.8	–		26.9	–	
	Time	2000	18.1	17.0	†	16.1	14.8	†	19.7	18.3	†	16.8	16.1	
	Distance	2000	7.6	16.0		6.6	12.9	†	9.2	15.9		7.5	13.0	
	Speed	2000	25.2	–		24.6	–		28.0	–		26.8	–	
	Time	2010	17.1	15.1	†	16.0	13.6	††	18.3	16.2	†††	16.3	4.1	†
	Distance	2010	7.7	8.8		6.9	11.5	††	8.0	14.3	†††	6.7	10.7	†††
	Speed	2010	27.0	–		25.9	–		26.2	–		24.7	–	

† Indicates statistically different from previous year
†† Indicates 2010 statistically different from 1990
†††Indicates statistically different from both previous years
$P < 0.5$

Table 5.3: Activity durations auto (minutes)

		Workers				Non-Workers			
Activity	Year	Male	S.D.	Female	S.D.	Male	S.D.	Female	S.D.
Home	1990	777	286	816	302	1101	453	1172	482
	2000	778	340	809	349	1082	482	1140	485
	2010	787	340	825	351	1175	494	1175	486
Work	1990	514	206	477	198	–	–	–	–
	2000	502	237	471	205	–	–	–	–
	2010	495	218	470	202	–	–	–	–
Shop	1990	7	22	15	32	21	43	41	61
	2000	8	38	14	31	21	43	41	61
	2010	5	64	9	44	32	74	41	53
Other	1990	52	85	55	79	143	167	132	144
	2000	59	78	62	67	243	192	177	128
	2010	65	72	55	64	171	134	161	115
Travel	1990	88	22	77	20	79	21	80	20
	2000	93	17	84	15	82	16	81	14
	2010	87	17	81	15	73	15	74	14

Table 5.4: Activity durations transit (minutes)

		Workers				Non-Workers			
Activity	Year	Male	S.D.	Female	S.D.	Male	S.D.	Female	S.D.
Home	1990	765	291	803	306	1084	455	1154	484
	2000	772	346	803	355	1074	487	1131	490
	2010	784	346	822	359	1171	501	1171	493
Work	1990	512	211	475	206	–	–	–	–
	2000	497	243	466	212	–	–	–	–
	2010	489	220	464	207	–	–	–	–
Shop	1990	8	34	17	43	24	55	47	76
	2000	8	48	14	37	21	49	41	67
	2010	4	59	7	41	26	65	33	48
Other	1990	58	100	61	96	160	194	147	169
	2000	62	89	65	78	255	210	186	143
	2010	71	88	60	77	187	153	176	133
Travel	1990	97	29	83	30	173	54	92	31
	2000	101	25	92	25	90	27	82	23
	2010	92	23	87	24	57	20	61	20

Chapter 6

Results

Table 6.1 and 6.6 show the results of the initial models tested. These models used the same parameters as the DC study (with a few modifications, see 4). This allows for a verification that the study methods are sound relative to the previous literature was well as a comparison between the different regions. For the most part, the relationships of the accessibility variables retain the same signs as the DC study (with the exception of resident accessibility in 2010 auto users). Additionally, in both transit and auto users, some of the other significant demographic variables differ in their signs. These differences may be related to different external factors that govern behavior for the different regions. Similarly, the magnitudes of the coefficients of the models are different due to both the slightly different parameters as well as the different urban structure between the two cities (amongst other factors such as culture and changing dynamics over time). However, these models are suspect due to a high degree of colinearity, especially amongst the accessibility variables. For instance, as one would expect due to the density of development, the distance to the CBD is highly correlated with employment accessibility, as shown in figure 6.1.

Tables 6.2 and 6.7 show the results of the final model to predict commute duration selected; adjusting the weighting coefficient to 0.04 rather than 0.08. This coefficient was selected due to it having the highest R^2 value of all of the coefficients tested. The 20 minute interval and 0.04 weight models are very similar both in their results as well as their respective fits. This is expected because the two methods of calculating the accessibility are very similar. The reason for the difference in coefficient for the weighting equation from the DC study warrants further analysis, but was beyond the scope of this project. Although this model did not have the exact parameters as the DC study's model, the accessibility variables retain the same relationships as found in that study. Tables 6.3 and 6.8 show the z and p values for the coefficients calculated from the commute duration models. The relationships between the independent and dependent variables do not seem to be changing much over time.

Tables 6.4, and 6.9 show the results of the regressions to predict the time spent at work for auto and transit respectively. The results for both auto and transit are similar in both magnitude and sign. Tables 6.5 and 6.10 show the statistical differences of the allocation models. The relationships appear to be relatively stable for auto users but are changing slightly for transit users time spent at work. This change may be due to the more rapid change of the transit system compared to the road network as well as economic changes that may affect transit users more heavily than auto users. Additionally, the high error rates of the data may account for the lack of statistical differences between the coefficients in the models.

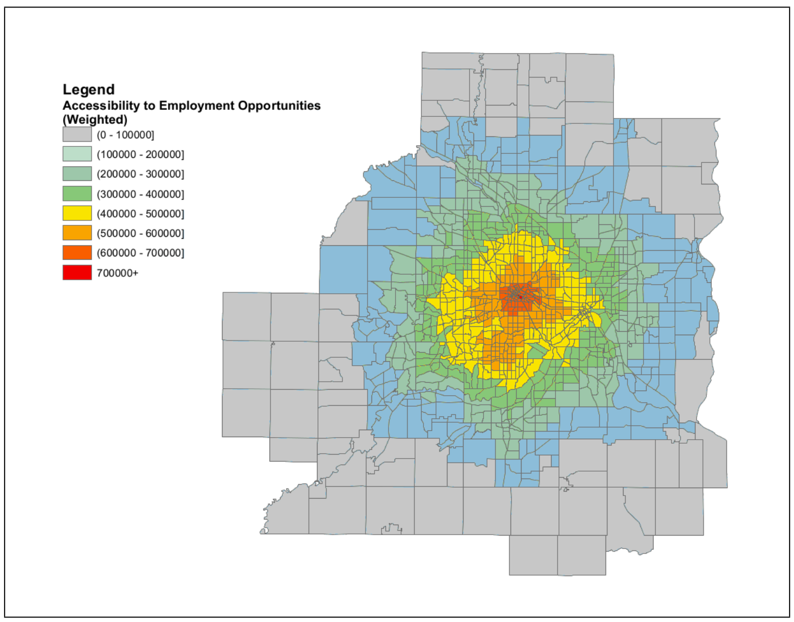

Figure 6.1: 2010 Employment Accessibility by Auto

Table 6.1: Regressions to predict commuting duration by auto DC study variables

Variable	DC		2010 MSP		2000 MSP		1990 MSP	
Age	Coefficient		Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)		(t-value)	
10	-5.85	***	-5.76	***	-6.92	***	-5.87	***
	(-2.75)		(-2.98)		(-3.26)		(-4.12)	
20	1.90	**	-1.38	**	-1.216	*	-0.28	***
	(1.96)		(-1.75)		(-1.42)		(-0.26)	
40	0.434		0.65		0.634		0.697	
	(0.50)		(1.12)		(2.31)		(1.25)	
50	-0.62		-1.04	**	-0.44		-0.35	
	(-0.62)		(-1.85)		(-0.61)		(-0.76)	
60	-0.77		-0.83		-0.52		-0.62	
	(-0.56)		(-1.19)		(-0.35)		(-0.42)	
Male	1.82	**	1.53	***	1.79	***	1.42	**
	(2.52)		(4.26)		(5.12)		(4.32)	
SFhome	0.16		-0.155		-0.78		-1.23	
	(0.18)		(-0.275)		(-0.41)		(-0.31)	
VPD	1.03		0.179	**	1.24	*	1.09	**
	(1.07)		(0.44)		(0.98)		(1.27)	
Children	0.936	*	-0.341		0.32		0.12	
	(1.72)		(-0.948)		(1.02)		(0.15)	
HHsize	0.0857		0.196		0.22		0.19	
	(0.24)		(0.909)		(1.05)		(1.03)	
A_{iEa}	-8.68E-05	***	-1.60E-05	**	-7.231E-06	***	-7.892E-06	***
	(-4.86)		(-1.97)		(-3.214)		(-2.923)	
A_{iRa}	1.18E-04	***	-1.14E-05		1.989E-05	***	2.003E-05	**
	(2.75)		(-0.869)		(2.43)		(2.63)	
A_{jEa}	7.13E-05	***	3.73E-05	***	3.68E-05	***	3.02E-05	***
	(4.21)		(5.04)		(4.29)		(5.02)	
A_{jRa}	-1.47E-04	***	-4.03E-05	***	-2.72E-05	***	-3.09E-05	***
	(-3.26)		(-3.17)		(-2.46)		(-3.02)	
D_{io}	0.63	***	2.75E-02	**	0.43	**	0.53	***
	(5.82)		(2.71)		(4.036)		(5.23)	
D_{jo}	-0.55	***	-5.21E-02	***	-0.32	**	-0.30	**
	(-3.77)		(-4.31)		(-2.29)		(-3.02)	
Constant	23.29	***	28.26	***	25.42	***	24.32	***
	(4.61)		(11.30)		(9.85)		(11.26)	
Sample Size	1950		5228		2978		6574	
Adj. R^2	0.17		0.1398		0.14		0.142	
F	22.79	***	52.94	***	42.21	***	44.26	

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.2: Regressions to predict commute duration for auto users weight coefficient -0.04

	2010				2000				1990			
	Employment		Resident		Employment		Resident		Employment		Resident	
Variable	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
age	(t-value)		(t-value)		(t-value)		(t-value)		(t-value)		(t-value)	
10	-5.682	***	-5.764	***	-7.214	***	-7.358	***	-6.490	***	-6.407	***
	(-2.935)		(-2.968)		(-3.252)		(3.317)		(-4.872)		(-5.018)	
20	-1.401	*	-1.529	*	-1.321	**	-1.281	*	-1.263	**	-1.250	*
	(-1.78)		(-1.936)		(-1.455)		(-1.348)		(-1.352)		(-1.338)	
40	0.6102		0.5815		0.6211		0.634		0.689		0.717	
	(1.052)		(1.000)		(2.269)		(2.018)		(2.004)		(2.084)	
50	-1.029	*	-1.075	*	-0.523	*	-0.507	*	-1.307	*	-1.137	*
	(-1.837)		(-1.915)		(-0.684)		(-6.234)		(-2.17)		(-1.888)	
60	-0.8348		-0.9055		-0.762		-0.732		-0.650		-0.728	
	(-1.196)		(-1.294)		(-0.484)		(-0.416)		(-1.211)		(-1.465)	
Male	1.477	***	1.452	***	1.629	***	1.662	***	1.924	***	1.520	***
	(4.105)		(4.021)		(4.981)		(5.022)		(7.04)		(5.562)	
SFhome	-0.2046		-0.2178		-0.822		-0.797		-0.969		-0.978	
	(-0.362)		(-0.385)		(-0.463)		(-0.411)		(-0.367)		(-0.364)	
VPD	0.1644		0.1437		1.31		1.258		0.314		0.323	
	(0.404)		(0.352)		(1.001)		(0.973)		(0.413)		(0.411)	
Children	-0.317		-0.3125		0.281		0.284		-0.651		-0.622	
	(-0.882)		(-0.867)		(0.988)		(1.002)		(-1.38)		(-1.03)	
HHsize	0.2083		0.2273		0.1975		0.199		0.216		0.182	
	(0.965)		(1.051)		(1.021)		(1.024)		(0.942)		(1.245)	
A_{iEa}, A_{iRa}	-1.095E-05	***	7.441E-06	***	-1.031E-06	***	1.05E-06	***	-1.15E-05	***	2.88E-05	***
	(-24.243)		(23.892)		(-22.41)		(23.02)		(-22.45)		(23.17)	
A_{jEa}, A_{jRa}	1.022E-05	***	-6.991E-06	***	2.013E-05	***	-1.93E-05	***	3.15E-05	***	-2.67E-05	***
	(21.233)		(-20.451)		(19.821)		(-19.224)		(25.31)		(-27.67)	
Constant	21.19	***	21.3	***	19.8	***	19.998	***	20.76	***	25.17	***
	(16.759)		(16.023)		(15.798)		(15.82)		(18.76)		(20.52)	
Sample Size	5228		5228		2978		2978		6574		6574	
Adj. R^2	0.1355		0.1303		0.1378		0.1325		0.1257		0.1231	
F	69.26	***	66.25	***	40.21	***	41.57	***	45.78	***	42.68	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.3: Statistical differences between years in predicted commute duration for auto users weight coefficent -0.04

	Employment			Resident		
Variable	2010-2000	2000-1990	2010-1990	2010-2000	2000-1990	2010-1990
age	Z-value p-value	Z-value p-value	Z-value p-value	Z-value p-value	Z-value p-value	Z-value p-value
10	-0.752	0.384	-0.447	-0.781	0.509	-0.358
	0.226	0.650	0.327	0.217	0.695	0.360
20	0.061	0.043	0.105	0.188	0.023	0.212
	0.524	0.517	0.542	0.575	0.509	0.584
40	-0.012	-0.086	-0.082	-0.055	-0.102	-0.141
	0.495	0.466	0.467	0.478	0.459	0.444
50	0.440	-0.671	-0.258	0.709	-0.762	-0.057
	0.670	0.251	0.398	0.761	0.223	0.477
60	0.048	0.077	0.166	0.111	0.003	0.162
	0.519	0.531	0.566	0.544	0.501	0.564
Male	-0.183	-0.381	-0.562	-0.252	0.183	-0.085
	0.427	0.352	0.287	0.400	0.572	0.466
SFhome	-0.404	-0.070	-0.427	-0.366	-0.084	-0.422
	0.343	0.472	0.335	0.357	0.466	0.337
VPD	-0.875	0.692	-0.138	-0.854	0.648	-0.164
	0.191	0.756	0.445	0.196	0.742	0.435
Children	0.045	-0.425	-0.366	0.036	-0.359	-0.315
	0.518	0.335	0.357	0.514	0.360	0.376
HHsize	0.017	-0.028	-0.012	0.044	0.029	0.075
	0.507	0.489	0.495	0.518	0.512	0.530
A_{iEa}, A_{iRa}	1.41E-02	-1.40E-02	-5.60E-04	1.07E-02	-2.44E-02	-1.71E-02
	0.506	0.494	0.500	0.504	0.490	0.493
A_{jEa}, A_{jRa}	-8.10E-03	-7.56E-03	-0.016	-1.06E-02	-5.27E-03	-1.72E-02
	0.497	0.497	0.494	0.496	0.498	0.493
Constant	0.876	-0.625	0.279	0.808	-3.277 ***	-2.421 ***
	0.809	0.266	0.610	0.791	0.001	0.008

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.4: Regressions to predict time at work for auto users using predicted travel times

Variable	2010		2000		1990	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-64.8 (-2.14)	**	-57.77 (-1.90)	**	-48.32 (-1.59)	**
20	-10.7 (-0.982)		-12.278 (-1.12)		-13.066 (-1.19)	
40	1.74 (0.252)		1.818 (0.26)		2.077 (0.3)	
50	14.8 (1.975)	**	13.745 (1.83)	**	13.523 (1.8)	**
60	-8.74 (-1.053)		-10.191 (-1.22)		-9.351 (-1.12)	
Male	25 (4.78)	***	4.184 (0.63)		4.284 (0.64)	
SFhome	-3.94 (-0.587)		-3.959 (-0.58)		-3.487 (-0.51)	
VPD	11.3 (2.367)	**	12.377 (2.59)	**	10.185 (2.13)	**
Children	-10.4 (-2.432)	**	-12.197 (-2.85)	**	-13.067 (-3.05)	**
HHsize	-0.455 (-0.178)		-0.38 (-0.14)		-0.41 (-0.16)	
Number of Work trips	-150 (-43.759)	***	-146.634 (-42.77)	***	-123.232 (-35.9)	***
PredictedCommute Duration	10.5 (3.001)	***	9.15 (2.61)	***	8.55 (2.44)	***
Constant	772 (21.43)	***	266.388 (2.13)	*	251.157 (2.01)	*
Sample size	5228		2978		6574	
Adj. R^2	0.274		0.2987		0.2964	
F	165.4	***	162.1	***	164.5	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.5: Statistical differences between years in predicted time spent at work for auto users weight coefficient -0.04

Variable	2010-2000	2000-1990	2010-1990
age	Z-value	Z-value	Z-value
	p-value	p-value	p-value
10	0.902	1.212	2.116
	0.817	0.887	0.983
20	-0.338	-0.168	-0.506
	0.368	0.433	0.306
40	-0.021	-0.069	-0.091
	0.492	0.472	0.464
50	0.272	0.057	0.330
	0.607	0.523	0.629
60	-0.356	0.206	-0.150
	0.361	0.581	0.440
Male	6.042	-0.027	5.999
	1.000	0.489	1.000
SFhome	-0.005	0.128	0.123
	0.498	0.551	0.549
VPD	-0.348	0.709	0.361
	0.364	0.761	0.641
Children	-0.614	-0.297	-0.912
	0.269	0.383	0.181
HHsize	0.033	-0.013	0.020
	0.513	0.495	0.508
A_{iEa}, A_{iRa}	1.285	8.934	10.220
	0.901	1.000	1.000
A_{jEa}, A_{jRa}	0.510	0.227	0.737
	0.695	0.590	0.769
Constant	39.837	0.963	41.051
	1.000	0.832	1.000

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.6: Regressions to predict commuting duration by Transit DC study variables

Variable	DC		2010 MSP		2000 MSP		1990 MSP	
Age	Coefficient		Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)		(t-value)	
10	-9.83	*	22.75	***	12.35	*	20.13	**
	(-1.82)		(2.91)		(1.23)		(2.68)	
20	0.58		-1.07		-0.63		-0.98	
	(0.28)		(-0.41)		(-0.32)		(-0.45)	
40	3.39		-2.22		1.06		-0.84	
	(1.82)		(-0.99)		(0.35)		(-0.84)	
50	-1.08		-3.733		-1.29		-2.42	
	(-0.40)		(-1.73)		(-0.93)		(-3.21)	
60	7.26	**	-2.084		5.06		-1.05	
	(2.04)		(-0.71)		(1.92)		(-2.34)	
70	16.96	*	-11.3		-9.84		-10.2	
	(1.79)		(-1.45)		(-1.94)		(-3.62)	
Male	-0.33		0.94		0.84		0.95	
	(-0.18)		(0.62)		(0.51)		(0.86)	
SFhome	-3.78	**	-0.86		-0.57		-0.92	
	(-2.04)		(-1.55)		(-0.84)		(1.24)	
VPD	-2.30		-2.01		-2.56		-2.87	
	(-1.13)		(-0.89)		(-1.43)		(-1.94)	
Children	-2.80	**	-1.88		-2.41		-2.81	
	(-2.09)		(-1.11)		(-1.58)		(-3.21)	
HHsize	1.83	**	1.88		1.94		2.02	
	(2.04)		(1.05)		(1.10)		(1.24)	
A_{iEt}	-1.15E-03	**	-4.314E-05	*	-4.105E-05	*	-4.204E-05	**
	(-2.27)		(-1.257)		(-1.426)		(-1.072)	
A_{iRt}	1.12E-03		3.79E-05		2.49E-05		2.21E-05	
	(0.85)		(0.59)		(0.92)		(1.46)	
A_{jEt}	-1.14E-03	**	-3.655E-05	**	-4.026E-05	*	-3.84E-05	*
	(-2.56)		(-1.301)		(-1.02)		(-1.24)	
A_{jRt}	1.05E-03		2.04E-06		9.842E-07		8.612E-07	
	(0.75)		(0.89)		(0.57)		(0.14)	
D_{io}	1.71	***	0.92	***	1.21	***	1.31	**
	(9.71)		(3.081)		(4.091)		(5.012)	
D_{jo}	-1.67	***	-1.57	**	-1.27	*	-1.02	*
	(-5.63)		(0.112)		(0.101)		(0.312)	
Constant	44.12	***	38.95	***	40.21	***	39.26	***
	(9.21)		(6.415)		(7.691)		(5.292)	
Sample Size	409		124		106		164	
Adj. R^2	0.038		0.114		0.095		0.137	
F	12.96	***	4.501	***	6.02	***	5.06	

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.7: Regressions to predict commute duration for transit users weight coefficient -0.04

	2010				2000				1990			
	Employment		Resident		Employment		Resident		Employment		Resident	
Variable	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
age	(t-value)		(t-value)		(t-value)		(t-value)		(t-value)		(t-value)	
10	21.74	**	18.70	***	13.89	**	13.276	**	19.24	**	16.747	**
	(2.780)		(2.391)		(1.383)		(1.322)		(2.562)		(2.229)	
20	-0.95		-0.82		-0.68		-0.564		-0.81		-0.670	
	(-0.362)		(-0.313)		(-0.345)		(-0.286)		(-0.373)		(-0.307)	
40	-2.65		-2.24		0.91		0.748		-0.69		-0.791	
	(-1.180)		(-0.999)		(0.299)		(0.247)		(-0.618)		(-0.706)	
50	-3.19		-2.91		-1.41		-1.210		-2.08		-1.911	
	(-1.480)		(-1.348)		(-1.016)		(-0.872)		(-2.755)		(-2.534)	
60	-2.11		-2.00		5.36		5.694		-1.12		-1.094	
	(-0.720)		(-0.682)		(2.032)		(2.160)		(-2.488)		(-2.437)	
Male	1.01		1.03		0.72		0.846		1.12		1.202	
	(0.669)		(0.681)		(0.436)		(0.513)		(1.012)		(1.088)	
SFhome	-0.90	*	-0.77	*	-0.48	*	-0.447	*	-0.85	**	-0.691	*
	(-1.627)		(-1.382)		(-0.712)		(-0.659)		(1.146)		(0.930)	
VPD	-1.76		-1.64		-2.40		-2.586		-3.09		-3.432	
	(-0.781)		(-0.724)		(-1.342)		(-1.444)		(-2.087)		(-2.319)	
Children	-1.99	**	-2.33	*	-2.77	**	-2.964	**	-3.00	**	-3.447	**
	(-1.176)		(-1.377)		(-1.817)		(-1.943)		(-3.432)		(-3.937)	
HHsize	1.75		1.64		2.24		2.370		2.14		2.308	
	(0.977)		(0.915)		(1.268)		(1.343)		(1.313)		(1.417)	
A_{iEt}, A_{iRt}	-4.22E-05	***	3.65E-05	***	-4.03E-05	**	3.89E-05	***	-4.12E-05	***	4.02E-05	***
	(-1.21)		(0.63)		(-1.01)		(0.85)		(-1.13)		(0.82)	
A_{jEt}, A_{jRt}	-3.24E-05	**	1.95E-06	**	-3.12E-05	*	2.03E-06	**	-2.86E-05	**	2.89E-06	**
	(-1.26)		(0.85)		(-1.13)		(0.89)		(-1.01)		(0.78)	
Constant	32.68		26.80		33.06		28.540		33.89		31.244	
	(5.382)		(4.413)		(6.323)		(5.458)		(4.568)		(4.211)	
Sample Size	124		124		106		106		164		164	
Adj. R^2	0.102		0.125		0.123		0.122		0.105		0.112	
F	5.23	***	4.32	***	4.52	***	4.44	***	4.25	***	5.02	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.8: Statistical differences between years in predicted commute duration for transit users weight coefficient -0.04

	Employment			Resident		
Variable	2010-2000	2000-1990	2010-1990	2010-2000	2000-1990	2010-1990
age	Z-value p-value	Z-value p-value	Z-value p-value	Z-value p-value	Z-value p-value	Z-value p-value
10	1.857 0.968	-1.277 0.101	0.639 0.738	1.283 0.900	-0.828 0.204	0.499 0.691
20	0.126 0.550	-0.064 0.475	0.064 0.525	0.119 0.548	-0.052 0.479	0.068 0.527
40	0.757 0.775	0.108 0.543	1.069 0.857	0.650 0.742	-0.021 0.492	0.790 0.785
50	0.946 0.828	-0.458 0.324	0.651 0.742	0.903 0.817	-0.479 0.316	0.585 0.721
60	-1.377 * 0.084	2.413 0.992	0.538 0.705	-1.565 * 0.059	2.619 0.996	0.493 0.689
Male	0.163 0.565	-0.241 0.405	-0.068 0.473	0.103 0.541	-0.215 0.415	-0.106 0.458
SFhome	0.379 0.648	-0.311 0.378	0.044 0.518	0.291 0.614	-0.205 0.419	0.069 0.528
VPD	-0.143 0.443	-0.157 0.438	-0.688 0.246	-0.470 0.319	-0.468 0.320	-0.926 0.177
Children	-0.435 0.332	-0.149 0.441	-0.630 0.264	-0.353 0.362	-0.312 0.378	-0.697 0.243
HHsize	-0.260 0.398	0.054 0.522	-0.211 0.417	-0.387 0.349	0.034 0.513	-0.361 0.359
A_{iEt}, A_{iRt}	2.20E-04 0.500	-1.03E-04 0.500	1.18E-04 0.500	-2.36E-04 0.500	-1.34E-04 0.500	-3.58E-04 0.500
A_{jEt}, A_{jRt}	1.64E-04 0.500	3.48E-04 0.500	0.001 0.500	-3.74E-05 0.500	-3.52E-04 0.500	-3.84E-04 0.500
Constant	-0.113 0.455	-0.233 0.408	-0.329 0.371	-0.518 0.302	-0.760 0.224	-1.210 0.113

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.9: Regressions to predict time at work for transit users using predicted travel times

Variable	2010		2000		1990	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-228.3 (-9.61)	***	-300.77 (-12.66)	***	-134.11 (-5.65)	***
20	-26.98 (-2.82)		-60.47 (-6.33)	**	-52.97 (-5.54)	**
40	0.74 (0.1)		1.24 (0.17)		0.68 (0.09)	
50	-1.7 (-0.25)		-2.03 (-0.3)		-1 (-0.15)	
60	-12.8 (-1.09)		-29.44 (-2.5)		-15.96 (-1.36)	
Male	4.05 (7.63)	*	3.79 (7.13)	**	5.58 (10.51)	**
SFhome	-7.54 (-1.12)		-8.78 (-1.3)		-6.85 (-1.02)	
VPD	7.6 (1.43)		13.74 (2.58)		8.87 (1.67)	
Children	-16.4 (-4.28)	**	-19.08 (-4.98)	**	-18.49 (-4.83)	**
HHsize	-0.6 (-0.21)		-1.11 (-0.39)		-1.25 (-0.44)	
Number of Work trips	-15.2 (-5.26)	**	-20 (-6.93)	**	-7.33 (-2.54)	**
Predicted/Reported Commute Duration	8.3 (2.4)	***	4.56 (1.32)	***	8.84 (2.56)	***
Constant	508.2 (31.534)	***	241.88 (15.008)	***	560.15 (34.76)	***
Sample size	124		106		164	
Adj. R^2	0.201		0.214		0.194	
F	146.3	***	162.3	***	162.3	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table 6.10: Statistical differences between years in predicted time spent at work for transit users weight coefficient -0.04

Variable	2010-2000		2000-1990		2010-1990	
age	Z-value p-value		Z-value p-value		Z-value p-value	
10	-10.514	***	24.183		13.668	
	3.74E-26		1.000		1.000	
20	-7.659	***	1.715		-5.942	***
	9.37E-15		0.957		1.40E-09	
40	-0.130		0.145		0.016	
	0.448		0.558		0.506	
50	-0.090		0.281		0.191	
	0.464		0.611		0.576	
60	-3.431	***	2.780		-0.652	
	3.00E-04		0.997		0.257	
Male	0.252		-1.737	**	-1.485	*
	0.600		0.041		0.069	
SFhome	-0.338		0.526		0.188	
	0.368		0.701		0.575	
VPD	-1.882	**	1.493		-0.390	
	0.030		0.932		0.348	
Children	-0.968		0.213		-0.755	
	0.166		0.584		0.225	
HHsize	-0.214		-0.059		-0.272	
	0.415		0.477		0.393	
A_{iEa}, A_{iRa}	-1.997	**	5.274		3.275	
	0.023		1.000		0.999	
A_{jEa}, A_{jRa}	1.422		-1.628	*	-0.205	
	0.923		0.052		0.419	
Constant	46.909		-56.060	***	-9.151	***
	1.000		0		2.83E-20	

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Chapter 7

Discussion

It is apparent that there are many factors that affect time budgets, as discussed previously and as found in the results. The results of this study show that accessibility is a significant factor in determining not only travel behavior, but overall time budgeting in general. However, simply looking at the coefficients of the models is somewhat uninformative.

Although the values of the coefficients of the models for the accessibility variables are very small, when multiplied up by the total accessibility indices and then across the entire region, the time saved/lost due to changes in accessibility are quite noticeable. For instance, in 2010, many TAZs in the suburbs had weighted employment accessibility indices for auto of around 200,000, while the indices in downtown Minneapolis were over 700,000, a difference of 500,000 (see figure 6.1). The commute duration coefficient for employment accessibility at the origin for the final weighted model is -1.095×10^{-5} (see Table 6.2), this means that if an individual moved from one of those outer suburbs to downtown Minneapolis, their commute duration, according to the model, would decrease by 5.475 minutes. See Table 7.1 for the results of this calculation for all years, modes, and accessibilities.

Table 7.1: Minute change in commute duration for every 500,000 additional jobs/ residences

		2010		2000		1990	
Auto	A_{iEa}, A_{iRa}	-5.475	3.7205	-0.5155	0.525	-5.75	14.4
	A_{jEa}, A_{jRa}	5.11	-3.495	10.065	-9.65	15.75	-13.35
Transit	A_{iEt}, A_{iRt}	-21.1	18.25	-20.15	19.45	-20.6	20.1
	A_{jEt}, A_{jRt}	-16.2	0.975	-15.6	1.015	-14.3	1.445

Additionally, if a TAZ that has 10,000 people living in it was able to increase its accessibility index through either transportation infrastructure improvements or through land use changes, even by a relatively small amount of 10000 for an individual commute cost savings of 0.1095 minutes, the total system savings for that TAZ would be 18 hours, 15 minutes a day.

The models here are also useful for planners or engineers as these methods can be easily adapted to other data from other cities or for other activities besides work. This gives a tool that can be used to gauge the impact of a transportation or other large project from an accessibility standpoint and how that project will translate into time allocation.

Chapter 8

Conclusion

The results of this analysis show a measurable decline in the time people spend outside of their homes as well as the amount of time people spend in travel over the past decade. The rise of the Internet and mobile telecommunications and changes in the economy between 2000 and 2010, along with changing demographics and new modes of work may be among the factors causing people to reconsider the necessity of travel. Although trip distances per trip are not getting any shorter, the willingness to make those trip is declining, and as a result fewer kilometers are being traveled and less time on average is being allocated to travel.

This indicates that unless and until there is a countervailing technical or cultural shift, urban transportation networks in the United States may be mature and further large-scale expansions unwarranted. We may begin to have discussions about rationalizing and reducing urban networks if these trends continue.

This study corroborates previous studies showing that accessibility is a significant factor in commute durations. Though commutes do not make the majority of travel, they are the most important and regular trips made by most working age people. This study shows that the structure of a city affects commute durations and time spent at work. Even as travel patterns change, the relationship between accessibility and commute duration remains relatively stable.

In addition, this study shows a correlation between commute duration and the amount of time spent at work. Further analysis into the cause of this may be warranted, though it is most likely due to a blending of the work and home environments when one lives very close to where one works. The main factors looked at that affect time spent at work are age, the number of work (destination) trips and commute duration. Age plays a large role, especially at the younger brackets due to younger workers being more likely to work part-time shifts, with people in their 20's to 40's spending the most time at work. The number of work trips was expected to have an effect because of the way the data were recorded, if a person left for a lunch break or on an errand during the work day on personal business, that would likely show up as multiple work trips, whereas someone who ate their lunch at their workplace would have that lunch time included in their time at work. Interestingly, the number of children one has, while a significant factor statistically, did not decrease the time spent at work by a large amount. The predicted commute durations resulted in very similar models both to each other and to the actual recorded commute durations for both auto and transit. This is further evidence to the validation of the commute time models. In addition, the relationships between demographics and accessibility and travel behavior appear to be relatively stable, especially for auto users, however there are a few changes amongst transit users. These changes may be due to the changing nature of the transit system in the Twin Cities (with an light rail system being constructed between 2000 and 2010), as well as changes in the economy which may have disproportionately affected transit users. There were some limitations to this study, such as the lack of a day-to-day comparison and the relative simplicity of the models. Using different data sources to analyze these relationships more in depth could be an area for future study. Despite the limitations, these findings shows that the transportation network and urban structure have significant impacts on day-to-day life beyond simply while traveling. It would follow that similar relationships would exists with other activities besides work as well.

Each person has to decide how they will use the time allotted to them each day, and many of those decisions are directly related to the transportation systems in place. It is important to understand how transportation and urban form effect social behavior so that informed decisions can be made regarding policy and design.

References

[TPP, 1974] (1974). A summary report of travel in the twin cities metropolitan area. Technical report, Metropolitan Council.

[Cen, 2012] (2012). Statistical abstract of the united states. Technical report, United States Census Bureau.

[USD, 2013] (2013). Annual vehicle miles traveled. Technical report, United States Department of Transportation, Federal Highway Administration.

[Cao et al., 2010] Cao, X., Mokhtarian, P. L., and Handy, S. L. (2010). Neighborhood design and the accessibility of the elderly: An empirical analysis in northern california. *International Journal of Sustainable Transportation*, 4(6):347–371.

[Cheng et al., 2007] Cheng, J., Bertolini, L., and leClercq, F. (2007). Measuring sustainable accessibility. *Journal of the Transportation Research Board*, 2017:16–25.

[Clogg et al., 1995] Clogg, C. C., Petkova, E., and Haritou, A. (1995). Statistical methods for comparing regression coefficients between models. *American Journal of Sociology*, 100(5):1261–1293.

[Davis and Xiong, 2007] Davis, G. and Xiong, H. (2007). Access to destinations: Travel time estimation on arterials.

[El-Geneidy et al., 2006] El-Geneidy, A. M., Levinson, D. M., and County, H. (2006). Access to destinations: Development of accessibility measures. Technical report, Minnesota Department of Transportation.

[File, 2013] File, T. (2013). Computer and internet use in the united states. Technical report, United States Census Bureau.

[Grengs, 2013] Grengs, J. (2013). Nonwork accessibility as a social equity indicator. *International Journal of Sustainable Transportation*.

[Hansen, 1959] Hansen, W. (1959). How accessibility shapes land use. *Journal of the American Institute of Planners*, XXV:73–76.

[Haugen, 2011] Haugen, K. (2011). The advantage of 'near': Which accessibilities matter to whom? *European Journal of Transport and Infrastructure Research*, 11(4):368–388.

[Iacono et al., 2008] Iacono, M., Krizek, K., and El-Geneidy, A. M. (2008). Access to destinations: How close is close enough? estimating accurate distance decay functions for multiple modes and different purposes.

[Levinson, 1998] Levinson, D. M. (1998). Accessibility and the journey to work. *Journal of Transport Geography*, 6(1):11–21.

[Levinson and Kanchi, 2002] Levinson, D. M. and Kanchi, S. (2002). Road capacity and the allocation of time. *Journal of Transportation and Statistics*, 5(1):25–46.

[Levinson and Kumar, 1994a] Levinson, D. M. and Kumar, A. (1994a). Multimodal trip distribution: Structure and application. *Transportation Research Record*, pages 124–124.

[Levinson and Kumar, 1994b] Levinson, D. M. and Kumar, A. (1994b). The rational locator: Why travel times have remained stable. *Journal of the American Planning Association*, 60(3):319–322.

[Levinson and Kumar, 1995] Levinson, D. M. and Kumar, A. (1995). Activity, travel, and the allocation of time. *Journal of the American Planning Association*, 61(4):458–470.

[Levinson and Kumar, 1997] Levinson, D. M. and Kumar, A. (1997). Density and the journey to work. *Growth and Change*, 28(2):147–172.

[Levinson and Wu, 2005] Levinson, D. M. and Wu, Y. (2005). The rational locator re-examined. *Transportation*, 32:187–202.

[Metz, 2010] Metz, D. (2010). Saturation of demand for daily travel. *Transport Reviews*, 30(5):659–674.

[Millard-Ball and Schipper, 2011] Millard-Ball, A. and Schipper, L. (2011). Are we reaching peak travel? trends in passenger transport in eight industrialized countries. *Transport Reviews*, 31(3):357–378.

[Mohring, 1972] Mohring, H. (1972). Optimization and scale economies in urban bus transportation. *The American Economic Review*, pages 591–604.

[Mokhtarian and Chen, 2004] Mokhtarian, P. L. and Chen, C. (2004). Ttb or not ttb, that is the question: a review and analysis of the empirical literature on travel time (and money) budgets. *Transportation Research Part A: Policy and Practice*, 38(9):643–675.

[Owen and Levinson, 2012] Owen, A. and Levinson, D. M. (2012). Access to destinations: Annual accessibility measure for the twin cities metropolitan area. Technical report, Minnesota Department of Transportation.

[Owen et al., 2013] Owen, A., Schoner, J., and Levinson, D. M. (2013). Travel behavior over time; task 2: Data collection and preperation. Unpublished.

[Robert, 1970] Robert, E. H. (1970). Wages, income and hours of work in the us labor force. *Inst. of Technology.*

[Skabardonis and Dowling, 1997] Skabardonis, A. and Dowling, R. (1997). Improved speed-flow relationship for planning applications. *Transportation Research Record: Journal of the Transportation Research Board*, (1572):18–23.

[Tschopp et al., 2005] Tschopp, M., Fröhlich, P., and Axhausen, K. W. (2005). Accessibility and spatial development in switzerland during the last 50 years: A multilevel regression approach. *Access to destinations*, pages 361–376.

[VanWee and Geurs, 2011] VanWee, B. and Geurs, K. (2011). Discussing equity and social exclusion in accessibility evaluations. *European Journal of Transport and Infrastructure Research*, 11(4):350–367.

[Yang and Ferreira, 2005] Yang, J. and Ferreira, J. R. (2005). Evaluating measures of job–housing proximity: Boston and atlanta, 1980–2000. *Access to Destinations*, 7:171–192.

Appendix A

Additional Tables and Figures

The results of the weighted employment accessibility measures by auto are shown in Figures A.1-6.1. The expected relationship of higher accessibility in the center of the region are apparent. The scale is the same for each of the maps, in order to show how accessibility is changing in the region.

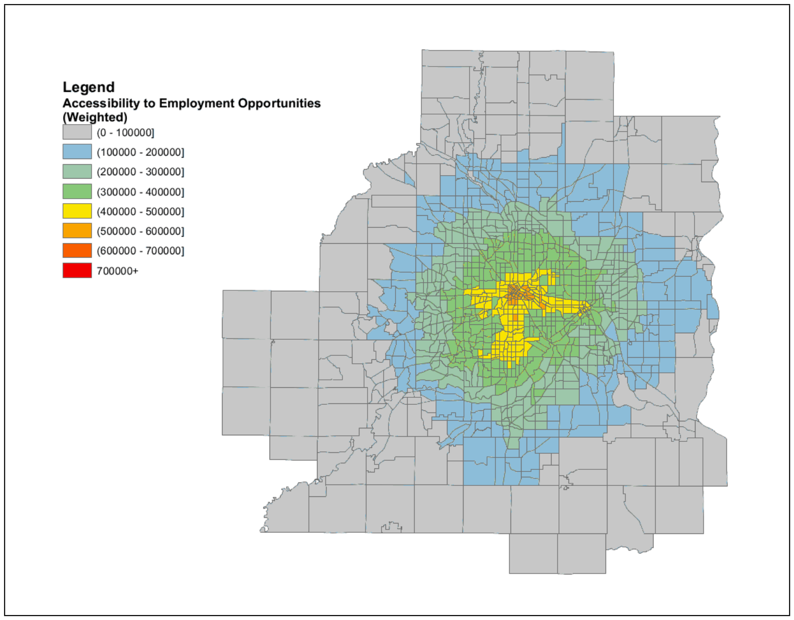

Figure A.1: 1995 Employment Accessibility by Auto

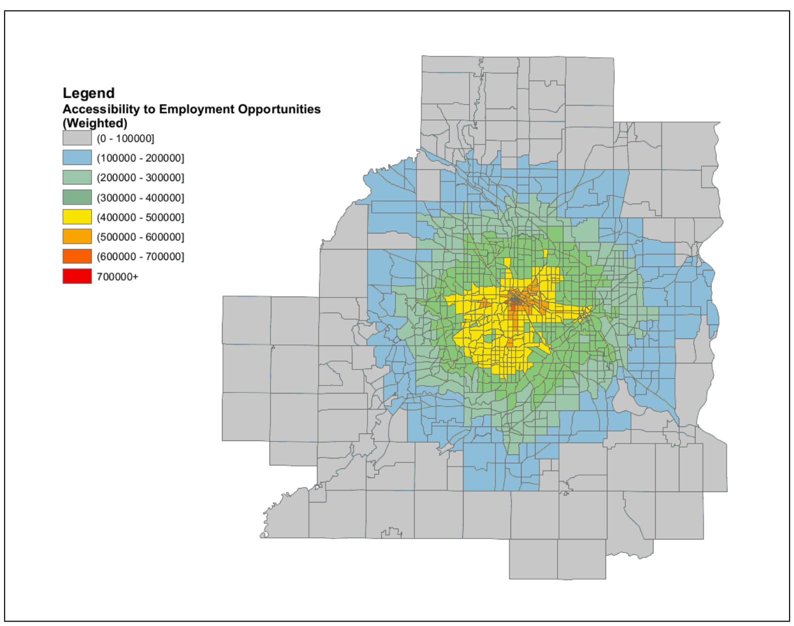

Figure A.2: 2000 Employment Accessibility by Auto

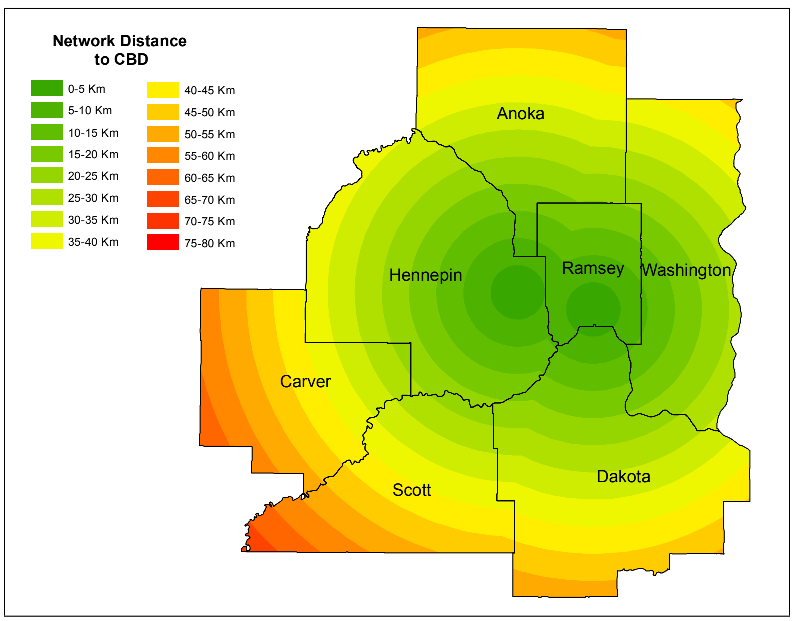

Figure A.3: Idealized Distance from CBD

Table A.1: 2010 Correlation Matrix for auto users 2010

WT	-0.07	1.00																
age10	-0.04	-0.03	1.00															
age20	-0.05	-0.02	-0.03	1.00														
age40	0.06	0.00	-0.06	-0.18	1.00													
age50	-0.03	0.03	-0.07	-0.21	-0.45	1.00												
age60	-0.02	-0.01	-0.04	-0.11	-0.24	-0.28	1.00											
Male	0.07	0.06	0.00	0.00	0.02	-0.03	0.00											
VPD	0.03	0.03	-0.03	-0.07	0.00	0.08	0.00	0.05	1.00									
HHsize	0.06	-0.01	0.08	0.07	0.27	-0.24	-0.28	0.11	-0.12	1.00								
SFhome	0.04	0.02	0.02	-0.08	0.08	0.04	-0.08	0.09	0.11	0.31	1.00							
Children	0.05	0.00	0.01	-0.12	0.44	-0.22	-0.22	0.07	-0.05	0.68	0.18	1.00						
D_{io}	0.20	0.01	0.04	-0.05	0.03	0.01	-0.02	0.04	0.15	0.13	0.10	0.08	1.00					
D_{jo}	-0.15	0.05	0.05	0.04	0.00	0.00	-0.02	0.01	0.09	0.05	0.04	0.02	0.48	1.00				
A_{iEa}	-0.22	0.00	-0.03	0.06	-0.02	-0.02	0.01	-0.04	-0.15	-0.14	-0.14	-0.10	-0.90	-0.40	1.00			
A_{jEa}	0.16	-0.05	-0.06	-0.04	0.01	0.00	0.00	0.00	-0.08	-0.05	-0.04	-0.01	-0.40	-0.91	0.40	1.00		
A_{iRa}	-0.23	-0.01	-0.03	0.05	-0.02	-0.02	0.01	-0.04	-0.15	-0.14	-0.13	-0.09	-0.90	-0.40	0.99	0.40	1.00	
A_{jRa}	0.15	-0.04	-0.06	-0.04	0.01	0.00	0.01	0.00	-0.09	-0.05	-0.04	-0.02	-0.41	-0.91	0.40	0.99	0.41	1.00
T_W	0.11	-0.51	-0.05	-0.03	0.00	0.02	0.00	0.02	0.02	-0.03	-0.01	-0.04	0.06	-0.03	-0.07	0.04	-0.07	0.04
	T_E	WT	10	20	40	50	60	Male	VPD	HHS	SFH	Child	D_{io}	D_{jo}	A_{iEa}	A_{jEa}	A_{iRa}	A_{jRa}

Table A.2: Regressions to predict commuting duration by auto without collinear variables 1

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	-5.72	***	-6.81	***	-6.24	***
	(-2.95)		(-3.15)		(-4.67)	
20	-1.42	*	-1.34	*	-1.25	*
	(-1.81)		(-1.48)		(-2.85)	
40	0.571		0.725		0.703	
	(0.98)		(2.54)		(1.064)	
50	-1.16	**	-0.361	**	-1.32	**
	(-2.06)		(-0.728)		(-2.21)	
60	-0.943		-0.524		-0.613	
	(-1.35)		(-0.353)		(-0.985)	
Male	1.55	***	1.795	**	1.924	**
	(4.30)		(6.25)		(7.04)	
SFhome	-0.272		-0.542		-0.941	
	(-0.481)		(-0.364)		(-0.321)	
VPD	0.236		0.345		0.327	
	(0.579)		(0.642)		(0.457)	
Children	-0.354		0.021		-0.645	
	(-0.983)		(1.35)		(-1.32)	
HHsize	0.198		0.572		0.243	
	(0.917)		(1.02)		(0.962)	
A_{iEa}	-2.45E-05	***	-9.865E-06	***	-1.023E-05	***
	(-23.58)		(-12.27)		(-21.367)	
A_{jEa}	2.123E-05	***	3.258E-05	***	3.21E-05	***
	(21.053)		(26.45)		(25.41)	
Constant	21.68	***	28.47	***	27.68	***
	(19.17)		(23.67)		(19.37)	
Sample Size	5228		2978		6574	
Adj. R^2	0.1347		0.1782		0.1245	
F	67.63	***	58.39	***	54.63	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.3: Regressions to predict commuting duration by auto without collinear variables 2

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	-5.78	***	-6.79	***	-6.22	***
	(-2.97)		(-3.14)		(-4.42)	
20	-1.56	**	-1.32	*	-1.53	
	(-1.97)		(-1.45)		(-2.82)	
40	0.543		0.723		0.713	
	(0.933)		(2.42)		(1.061)	
50	-1.19	**	-0.357	*	-1.27	**
	(-2.12)		(-0.734)		(-2.19)	
60	-1.03		-0.531		-0.619	
	(-1.463)		(-0.354)		(-0.979)	
Male	1.50	***	1.80	**	1.928	**
	(4.153)		(6.31)		(7.00)	
SFhome	-0.250		-0.548		-0.940	
	(-0.442)		(-0.342)		(-0.328)	
VPD	0.193		0.361		0.336	
	(0.473)		(0.679)		(0.424)	
Children	-0.347		0.027		-0.648	
	(-0.963)		(1.27)		(-1.27)	
HHsize	0.213		0.534		0.187	
	(0.985)		(1.07)		(1.342)	
A_{iRa}	1.857E-05	***	1.042E-05	***	2.624E-05	***
	(23.39)		(18.84)		(22.47)	
A_{jRa}	-1.645E-05	***	-2.031E-05	***	-2.89E-05	***
	(-20.283)		(-24.12)		(-28.02)	
Constant	21.71	***	27.64	***	24.92	***
	(18.02)		(24.52)		(20.37)	
Sample Size	5228		2978		6574	
Adj. R^2	0.1299		0.1706		0.1452	
F	64.85	***	54.23	***	53.47	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.4: Regressions to predict time spent at work for auto users without collinear variables 1

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	-118.1	***	-103.0	***	-115.3	***
	(-5.148)		(-3.81)		(-6.39)	
20	-22.2	**	-20.52	**	-21.2	**
	(-2.39)		(-3.14)		(-2.56)	
40	1.32		1.63		1.34	
	(0.193)		(0.23)		(0.34)	
50	4.01		4.52		4.37	
	(0.604)		(0.902)		(0.621)	
60	-1.03		-8.34		-10.26	
	(-1.25)		(-1.86)		(-1.69)	
Male	18.8	***	20.5	***	22.97	***
	(4.41)		(5.02)		(4.82)	
SFhome	-6.65		-5.87		-5.57	
	(-0.994)		(-0.27)		(-0.921)	
VPD	7.24		8.56		7.984	
	(1.51)		(1.71)		(1.62)	
Children	-10.1	**	-13.1	*	-11.2	*
	(-2.38)		(-4.02)		(-3.01)	
HHsize	-2.11		-2.18		-2.14	
	(-0.827)		(-0.80)		(-1.23)	
A_{iEa}	-8.613E-05	***	-1.241E-04	***	-2.078E-05	***
	(-5.49)		(-2.86)		(-3.45)	
A_{jEa}	3.994E-05	***	4.008E-05	***	4.357E-05	***
	(2.65)		(3.65)		(4.35)	
Commute Duration	0.628***	0.545	***	0.423	***	
	(3.83)		(4.23)		(3.37)	
Number of Work Trips	-148.5	***	-132.8	***	-134.2	***
	(-43.55)		(-32.56)		(-37.52)	
Constant	606.2	***	578.7	***	562.8	***
	(41.63)		(21.5)		(20.3)	
Sample Size	5228		2978		6574	
Adj. R^2	0.2815		0.1342		0.224	
F	147.2	***	110.5	***	141.1	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.5: Regressions to predict time spent at work for auto users without collinear variables 2

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	-118.1	***	-102.6	***	-116.2	***
	(-5.145)		(-3.83)		(-7.32)	
20	-22.6	**	-20.41	**	-20.31	
	(-2.42)		(-3.22)		(-2.45)	
40	1.34		1.62		1.26	
	(0.195)		(0.232)		(0.333)	
50	4.12		4.49		4.671	
	(0.621)		(0.82)		(0.574)	
60	-1.03		-8.39		-9.36	
	(-1.24)		(-1.82)		(-1.66)	
Male	18.7	***	20.26	***	22.37	***
	(4.37)		(5.28)		(6.17)	
SFhome	-6.47		-5.80		-5.62	
	(-0.967)		(-0.215)		(-0.824)	
VPD	7.13		8.52		7.69	
	(1.48)		(1.74)		(1.35)	
Children	-10.1	**	-12.2	*	-11.2	*
	(-2.38)		(-3.66)		(-3.02)	
HHsize	-2.03		-2.02		-2.41	
	(-0.794)		(-0.745)		(-1.02)	
A_{iRa}	-1.352E-04	***	-9.022E-05	***	-1.267E-05	***
	(-5.35)		(-6.32)		(-6.14)	
A_{jRa}	6.42E-05	**	4.332E-05	**	1.852E-05	***
	(2.48)		(2.02)		(2.31)	
Commute Duration	0.640***	0.526	***	0.815	***	
	(3.91)		(4.11)		(3.26)	
Number of Work Trips	-148.6	***	-125.0	***	-133.0	***
	(-43.57)		(-25.17)		(-31.5)	
Constant	608.6	***	575.2	***	502.1	***
	(39.64)		(22.0)		(12.3)	
Sample Size	5228		2978		6574	
Adj. R^2	0.2812		0.1255		0.1024	
F	147.1	***	100.2	***	104.1	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.6: Regressions to predict commuting duration by Transit without collinear variables 1

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	23.21	***	12.78	**	20.34	***
	(5.98)		(8.34)		(4.87)	
20	-1.04	*	-0.72		-0.84	
	(-1.73)		(-0.23)		(-0.17)	
40	-2.51		1.02		-1.64	
	(0.78)		(0.42)		(-1.24)	
50	-3.18		-1.35		-1.75	
	(-2.04)		(-1.02)		(-1.54)	
60	-2.15	**	4.87	*	-0.23	
	(-1.21)		(2.02)		(-1.47)	
Male	0.97		0.87		0.79	
	(0.71)		(0.54)		(0.27)	
SFhome	-0.94		-0.51		-0.75	
	(-1.32)		(-0.79)		(-0.84)	
VPD	-2.47		-2.30		-2.72	
	(-0.36)		(-0.97)		(-0.68)	
Children	-1.72		-3.02		-2.04	
	(-0.983)		(-1.24)		(-1.14)	
HHsize	1.92		2.06		1.87	
	(0.979)		(1.04)		(0.975)	
A_{iEt}	-4.215E-05	***	-4.026E-05	***	-4.521E-05	***
	(-21.42)		(-20.78)		(-19.87)	
A_{jEt}	-3.472E-05	***	-3.788E-05	***	-3.687E-05	***
	(-18.75)		(-21.54)		(-22.45)	
Constant	26.32	***	25.67	***	24.92	***
	(24.72)		(24.17)		(21.49)	
Sample Size	124		106		164	
Adj. R^2	0.123		0.098		0.1111	
F	56.37	***	52.47	***	57.21	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.7: Regressions to predict commuting duration by Transit without collinear variables 2

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	23.31	***	12.82	**	20.48	***
	(6.02)		(6.24)		(4.74)	
20	-1.08	*	-0.81		-0.87	
	(-1.68)		(-0.21)		(-0.12)	
40	-2.48		1.11		-1.49	
	(0.70)		(0.45)		(-1.34)	
50	-3.24		-1.36		-1.85	
	(-1.97)		(-1.05)		(-1.41)	
60	-2.23	**	4.91	*	-0.31	
	(-1.78)		(1.97)		(-1.42)	
Male	1.02		0.82		0.80	
	(0.78)		(0.51)		(0.15)	
SFhome	-0.89		-0.78		-0.63	
	(-1.18)		(-0.72)		(-0.82)	
VPD	-2.58		-2.19		-2.71	
	(-0.47)		(-1.87)		(-0.71)	
Children	-1.81		-3.13		-1.98	
	(-1.24)		(-1.28)		(-1.42)	
HHsize	1.89		1.97		1.92	
	(0.824)		(1.09)		(1.07)	
A_{iRt}	3.852E-05	***	3.741E-05	***	3.498E-05	***
	(20.47)		(20.89)		(20.47)	
A_{jRt}	3.241E-05	***	2.678E-05	***	2.395E-05	***
	(20.51)		(22.34)		(20.61)	
Constant	28.27	***	28.21	***	27.38	***
	(21.26)		(25.21)		(22.18)	
Sample Size	124		106		164	
Adj. R^2	0.114		0.096		0.1124	
F	54.00	***	51.23	***	56.37	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.8: Regressions to predict commute duration for auto users 2010 resident accessibility 5-30 min

Variable	5 min		10 min		15 min		20 min		25 min		30 min	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
Male	1.79E+00 (4.772)	***	1.70E+00 (4.635)	***	1.63E+00 (4.477)	***	1.54E+00 (4.257)	***	1.43E+00 (3.967)	***	1.36E+00 (3.759)	***
SFhome	-7.75E-01 (-1.293)		-2.37E-01 (-0.411)		-4.68E-02 (-0.082)		2.28E-02 (0.04)		7.27E-02 (0.128)		-5.38E-03 (-0.009)	
VPD	8.43E-01 (2.005)	**	4.94E-01 (1.197)		4.34E-01 (1.058)		3.55E-01 (0.87)		3.02E-01 (0.741)		2.43E-01 (0.594)	
Children	-4.44E-01 (-1.183)		-4.13E-01 (-1.127)		-3.72E-01 (-1.024)		-3.66E-01 (-1.013)		-3.34E-01 (-0.926)		-3.19E-01 (-0.882)	
HHsize	5.93E-01 (2.651)	***	2.73E-01 (1.241)		2.07E-01 (0.945)		1.99E-01 (0.916)		1.91E-01 (0.882)		2.48E-01 (1.144)	
A_{iRa}	6.98E-05 (11.119)	***	3.61E-05 (19.088)	***	1.80E-05 (21.206)	***	1.28E-05 (22.462)	***	1.15E-05 (23.594)	***	1.16E-05 (23.464)	***
A_{jRa}	-4.11E-05 (-12.812)	***	-2.71E-05 (-17.751)	***	-1.51E-05 (-19.039)	***	-1.16E-05 (-20.397)	***	-1.12E-05 (-20.666)	***	-1.18E-05 (-19.764)	***
Constant	2.06E+01 (20.688)		2.15E+01 (21.335)		2.13E+01 (20.805)		2.07E+01 (19.764)		2.03E+01 (18.387)		1.98E+01 (16.388)	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	5.88E-02		1.01E-01		1.14E-01		1.24E-01		1.30E-01		1.25E-01	
F	2.82E+01	***	5.00E+01	***	5.69E+01	***	6.28E+01	***	6.59E+01	***	6.32E+01	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.9: Regressions to predict commute duration for auto users 2010 resident accessibility 35-60 min

Variable	35 min		40 min		45 min		50 min		55 min		60 min	
Age	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)		(t-value)		(t-value)		(t-value)	
10	-6.11E+00	***	-6.30E+00	***	-6.63E+00	***	-6.87E+00	***	-6.95E+00	***	-6.73E+00	***
	(-3.114)		(-3.176)		(-3.306)		(-3.397)		(-3.42)		(-3.326)	
20	-1.79E+00	**	-2.02E+00	**	-2.24E+00	***	-2.45E+00	***	-2.60E+00	***	-2.41E+00	***
	(-2.249)		(-2.511)		(-2.742)		(-2.982)		(-3.145)		(-2.925)	
40	6.85E-01		6.64E-01		6.33E-01		5.56E-01		4.88E-01		5.37E-01	
	(1.165)		(1.116)		(1.052)		(0.917)		(0.801)		(0.885)	
50	-7.03E-01		-6.56E-01		-6.19E-01		-6.96E-01		-7.68E-01		-6.99E-01	
	(-1.238)		(-1.142)		(-1.066)		(-1.189)		(-1.304)		(-1.193)	
60	-5.97E-01		-5.16E-01		-4.26E-01		-4.36E-01		-4.92E-01		-4.44E-01	
	(-0.845)		(-0.722)		(-0.589)		(-0.598)		(-0.67)		(-0.608)	
Male	1.34E+00	***	1.36E+00	***	1.43E+00	***	1.52E+00	***	1.58E+00	***	1.55E+00	***
	(3.67)		(3.672)		(3.841)		(4.041)		(4.17)		(4.112)	
SFhome	-9.61E-02		-6.67E-02		-5.98E-02		3.57E-02		9.22E-02		7.35E-02	
	(-0.168)		(-0.115)		(-0.102)		(0.06)		(0.155)		(0.124)	
VPD	1.70E-01		2.02E-01		2.65E-01		3.24E-01		4.16E-01		3.59E-01	
	(0.412)		(0.484)		(0.627)		(0.76)		(0.969)		(0.841)	
Children	-2.84E-01		-2.09E-01		-1.58E-01		-1.41E-01		-1.42E-01		-1.28E-01	
	(-0.779)		(-0.566)		(-0.424)		(-0.376)		(-0.375)		(-0.341)	
HHsize	3.31E-01		4.00E-01	*	4.88E-01	**	5.27E-01	**	5.47E-01	**	5.21E-01	
	(1.515)		(1.817)		(2.192)		(2.349)		(2.427)		(2.32)	
A_{iRa}	1.25E-05	***	1.38E-05	***	1.57E-05	***	1.83E-05	***	2.28E-05	***	1.67E-05	***
	(22.085)		(19.836)		(16.969)		(14.417)		(12.619)		(14.15)	
A_{jRa}	-1.29E-05	***	-1.46E-05	***	-1.65E-05	***	-1.82E-05	***	-2.12E-05	***	-1.73E-05	***
	(-17.832)		(-14.989)		(-11.992)		(-9.245)		(-7.054)		(-9.109)	
Constant	1.97E+01		1.94E+01		1.93E+01		2.07E+01		2.31E+01		1.90E+01	***
	(14.241)		(11.355)		(8.458)		(6.453)		(4.724)		(3.411)	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	1.11E-01		9.13E-02		7.06E-02		5.45E-02		4.46E-02		0.05392	
F	5.54E+01	***	4.48E+01	***	3.41E+01	***	2.61E+01	***	2.14E+01	***	25.82	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.10: Regressions to predict commute duration for auto users 2010 employment accessibility interval 5-30 min

Variable	5 min		10 min		15 min		20 min		25 min		30 min	
	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa}	-6.98E-05	***	-4.12E-05	***	-2.47E-05	***	-2.01E-05	***	-1.96E-05	***	-1.84E-05	
	-11.119		-17.805		-20.067		-20.824		-22.101		-19.199	
A_{jEa}	4.11E-05	***	3.55E-05	***	1.96E-05	***	1.93E-05	***	1.82E-05	***	1.79E-05	
	12.812		15.346		17.924		18.593		18.409		15.005	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.05882		0.08587		0.1057		0.1102		0.115		0.09066	
F	28.22	***	41.19	***	52.47	***	54.92	***	57.56	***	44.42	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.11: Regressions to predict commute duration for auto users 2010 employment accessibility interval 35-60 min

Variable	35 min		40 min		45 min		50 min		55 min		60 min	
	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa}	-2.04E-05	***	-1.72E-05	***	-1.81E-05	***	-1.41E-05	***	-1.30E-05	***	-6.62E-06	
	-18.323		-13.049		-11.053		-7.263		-5.839		-2.693	
A_{jEa}	1.84E-05	***	1.23E-05	***	1.35E-05	***	2.74E-06	***	7.53E-06	***	-2.44E-06	
	13.671		6.97		6.795		1.193		3.112		-0.955	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.08199		0.04677		0.04108		0.0227		0.02045		0.01435	
F	39.89	***	22.37	***	18.61	***	11.11	***	10.09	***	7.342	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.12: Regressions to predict commute duration for auto users 2010 resident accessibility interval 5-30 min

Variable	5 min		10 min		15 min		20 min		25 min		30 min	
	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa}	1.18E-04	***	4.41E-05	***	2.47E-05	***	1.74E-05	***	1.46E-05	***	1.42E-05	***
	13.148		19.502		21.358		22.812		22.777		22.971	
A_{jEa}	-7.37E-05	***	-3.26E-05	***	-1.99E-05	***	-1.61E-05	***	-1.34E-05	***	-1.42E-05	***
	-11.809		-17.223		-18.449		-20.203		-19.294		-19.156	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.05834		0.1004		0.1126		0.1249		0.1206		0.1206	
F	27.98	***	49.63	***	56.24	***	63.16	***	60.74	***	60.73	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.13: Regressions to predict commute duration for auto users 2010 resident accessibility interval 35-60 min

Variable	35 min		40 min		45 min		50 min		55 min		60 min	
	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa}	1.51E-05	***	1.59E-05	***	1.77E-05	***	1.80E-05	***	1.98E-05	***	1.94E-05	***
	21.901		19.693		17.416		13.918		11.858		8.843	
A_{jEa}	-1.49E-05	***	-1.55E-05	***	-1.73E-05	***	-1.45E-05	***	-1.51E-05	***	-7.58E-06	***
	-17.633		-14.425		-12.685		-8.276		-6.991		-2.918	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.1103		0.09011		0.07517		0.05144		0.04238		0.02787	
F	54.99	***	44.13	***	36.4	***	24.62	***	20.27	***	13.48	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.14: Regressions to predict commute duration for auto users 2010 weighted different weights -0.01 - -0.3

Variable	-0.01		-0.01		-0.02		-0.02		-0.03		-0.03	
	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
	(t-value)		(t-value)		(t-value)		(t-value)		(t-value)		(t-value)	
A_{iEa}, A_{iRa}	-5.17E-06	***	3.20E-06	***	-6.76E-06	***	4.32E-06	***	-8.67E-06	***	5.72E-06	***
	(-24.186)		(23.811)		(-24.289)		(23.902)		(-24.302)		(23.925)	
A_{jEa}, A_{jRa}	5.10E-06	***	-3.15E-06	***	6.54E-06	***	-4.18E-06	***	8.24E-06	***	-2.67E-07	***
	(20.75)		(-20.075)		(21)		(-20.266)		(21.155)		(-20.388)	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.1328		0.1281		0.1344		0.1294		0.1353		0.1301	
F	67.67	***	64.96	***	68.62	***	65.71	***	69.12	***	66.12	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.15: Regressions to predict commute duration for auto users 2010 weighted different weights -0.04 - -0.06

Variable	-0.04		-0.04		-0.05		-0.05		-0.06		-0.06	
	Coefficient		Coefficient		Coefficient		Coefficient		Coefficient		Coefficient	
	(t-value)		(t-value)		(t-value)		(t-value)		(t-value)		(t-value)	
A_{iEa}, A_{iRa}	-1.10E-05	***	7.44E-06	***	-1.36E-05	***	9.54E-06	***	-1.68E-05	***	1.21E-05	***
	(-24.243)		(23.892)		(-24.13)		(23.814)		(-23.975)		(23.699)	
A_{jEa}, A_{jRa}	1.02E-05	***	-6.99E-06	***	1.25E-05	***	-8.83E-06	***	1.51E-05	***	-5.38E-07	***
	(21.233)		(-20.451)		(21.251)		(-20.463)		(21.22)		(-20.434)	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.1355		0.1303		0.1353		0.1301		0.1346		0.1296	
F	69.26	***	66.25	***	69.12	***	66.15	***	68.76	***	65.86	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.16: Regressions to predict commute duration for auto users 2010 weighted different weights -0.07 - -0.1

Variable	-0.07		-0.07		-0.09		-0.09		-0.1		-0.1	
	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa}, A_{iRa}	-2.04E-05	***	1.51E-05	***	-2.92E-05	***	2.27E-05	***	-3.45E-05	***	2.74E-05	***
	(-23.789)		(23.555)		(-23.354)		(23.207)		(-23.116)		(23.012)	
A_{jEa}, A_{jRa}	1.80E-05	***	-1.35E-05	***	2.48E-05	***	-1.98E-05	***	2.88E-05	***	-2.36E-05	***
	(21.151)		(-20.372)		(20.93)		(-20.171)		(20.789)		(-20.042)	
Sample Size	5228		5228		5228		5228		5228		5228	
Adj. R^2	0.1337		0.1288		0.1313		0.1267		0.1298		0.1254	
F	68.23	***	65.41	***	66.81	***	64.19	***	65.99	***	63.46	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.17: Regressions to predict commute duration for auto users 2010 non-cumulative

Variable	Employment			Resident		
Age (yr)	Coefficient	(t-value)		Coefficient	(t-value)	
10	-5.40E+00	(-2.783)	***	-5.53E+00	(-2.851)	***
20	-1.44E+00	(-1.829)	*	-1.57E+00	(-1.986)	**
40	6.35E-01	(1.096)		5.72E-01	(0.985)	
50	-8.66E-01	(-1.543)		-9.52E-01	(-1.687)	*
60	-6.70E-01	(-0.96)		-7.73E-01	(-1.101)	
Male	1.46E+00	(4.059)	***	1.43E+00	(3.96)	***
SFhome	-2.40E-01	(-0.415)		-1.71E-01	(-0.3)	
VPD	4.55E-02	(0.111)		9.60E-02	(0.234)	
Children	-3.17E-01	(-0.882)		-2.99E-01	(-0.828)	
HHsize	2.33E-01	(1.08)		2.41E-01	(1.111)	
A_{iEa5}, A_{iRa5}	-1.77E-05	(-2.163)	**	3.40E-05	(2.095)	**
A_{iEa10}, A_{iRa10}	-8.73E-06	(-1.544)		-1.21E-05	(-1.699)	*
A_{iEa15}, A_{iRa15}	2.56E-08	(0.006)		-4.81E-06	(-0.811)	
A_{iEa20}, A_{iRa20}	7.66E-07	(0.189)		-3.69E-06	(-0.798)	
A_{iEa25}, A_{iRa25}	-8.98E-06	(-1.984)	**	7.39E-07	(0.154)	
A_{iEa30}, A_{iRa30}	-7.98E-06	(-1.435)		-5.78E-06	(-1.192)	
A_{iEa35}, A_{iRa35}	-8.86E-06	(-1.273)		2.30E-06	(0.41)	
A_{iEa40}, A_{iRa40}	4.91E-06	(0.527)		-1.18E-05	(-1.777)	*
A_{iEa45}, A_{iRa45}	2.47E-05	(2.253)	**	4.44E-06	(0.529)	
A_{iEa50}, A_{iRa50}	-2.02E-05	(-1.167)		1.48E-05	(1.579)	
A_{iEa55}, A_{iRa55}	-2.89E-05	(-2.707)	***	-1.64E-05	(-2.322)	**
A_{iEa60}, A_{iRa60}	4.06E-06	(0.201)		-5.96E-06	(-0.612)	
A_{jEa5}, A_{jRa5}	3.11E-05	(5.187)	***	7.03E-06	(0.572)	
A_{jEa10}, A_{jRa10}	-7.14E-06	(-1.369)		7.95E-07	(0.13)	
A_{jEa15}, A_{jRa15}	-9.22E-06	(-2.209)	**	9.13E-07	(0.154)	
A_{jEa20}, A_{jRa20}	1.08E-05	(2.536)	**	1.25E-05	(2.766)	***
A_{jEa25}, A_{jRa25}	2.30E-05	(3.963)	***	-6.13E-06	(-1.121)	
A_{jEa30}, A_{jRa30}	5.86E-06	(0.9)		1.30E-05	(2.387)	*
A_{jEa35}, A_{jRa35}	-2.36E-05	(-2.288)	**	1.26E-06	(0.175)	
A_{jEa40}, A_{jRa40}	-4.44E-06	(-0.348)		-1.96E-05	(-2.362)	**
A_{jEa45}, A_{jRa45}	1.87E-05	(1.13)		2.55E-05	(2.277)	**
A_{jEa50}, A_{jRa50}	2.55E-05	(0.956)		-1.01E-05	(-0.819)	
A_{jEa55}, A_{jRa55}	-2.03E-05	(-1.21)		-1.76E-05	(-1.754)	*
A_{jEa60}, A_{jRa60}	-3.88E-05	(-1.079)		1.90E-05	(1.462)	
Constant	6.34E+01	(3.095)	***	3.21E+01	(2.799)	***
Sample Size	5228			5228		
Adj. R^2	0.1405			0.1341		
F	26.12 ***			24.8 ***		

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.18: Regressions to predict commute duration for auto users 2010 10 min intervals

Variable	Employment			Resident		
Age (yr)	Coefficient	(t-value)		Coefficient	(t-value)	
10	-5.73E+00	(-2.947)	***	-5.72E+00	(-2.947)	***
20	-1.61E+00	(-2.037)	**	-1.57E+00	(-1.987)	**
40	5.87E-01	(1.009)		5.90E-01	(1.014)	
50	-1.06E+00	(-1.875)	*	-1.03E+00	(-1.819)	*
60	-8.86E-01	(-1.263)		-8.42E-01	(-1.2)	
Male	1.43E+00	(3.944)	***	1.47E+00	(4.053)	***
SFhome	-1.99E-01	(-0.35)		-1.89E-01	(-0.333)	
VPD	1.24E-01	(0.303)		4.25E-02	(0.103)	
Children	-3.39E-01	(-0.938)		-2.86E-01	(-0.793)	
HHsize	2.57E-01	(1.187)		2.36E-01	(1.089)	
A_{iEa10}, A_{iRa10}	-8.85E-06	(-1.661)	*	-1.73E-06	(-0.364)	
A_{iEa20}, A_{iRa20}	-5.57E-06	(-1.536)		-3.98E-06	(-1.353)	
A_{iEa30}, A_{iRa30}	-3.03E-06	(-0.716)		-1.80E-06	(-0.632)	
A_{iEa40}, A_{iRa40}	-8.62E-06	(-1.557)		-4.82E-06	(-1.441)	
A_{iEa50}, A_{iRa50}	-1.37E-06	(-0.189)		6.01E-06	(1.297)	
A_{iEa60}, A_{iRa60}	9.79E-06	(1.602)		-9.14E-06	(-1.986)	**
A_{jEa10}, A_{jRa10}	3.12E-06	(0.742)		3.25E-06	(0.951)	
A_{jEa20}, A_{jRa20}	1.00E-05	(2.88)	***	4.52E-06	(1.626)	
A_{jEa30}, A_{jRa30}	9.09E-06	(2.008)	**	4.55E-06	(1.373)	
A_{jEa40}, A_{jRa40}	-9.02E-06	(-1.301)		-3.00E-06	(-0.689)	
A_{jEa50}, A_{jRa50}	8.23E-06	(0.863)		4.08E-06	(0.653)	
A_{jEa60}, A_{jRa60}	-8.33E-06	(-1.175)		-3.35E-06	(-0.491)	
Constant	2.32E+01	(4.249)	***	4.12E+01	(3.878)	***
Sample Size	5228			5228		
Adj. R^2	0.137			0.1311		
F	38.7 ***			36.83 ***		

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.19: Regressions to predict commute duration for auto users 20 min intervals

	2010				2000				1990			
	Employment		Resident		Employment		Resident		Employment		Resident	
Variable	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa20}, A_{iRa20}	-5.40E-06	***	3.78E-06	***	-5.95E-06	***	4.14E-06	***	-5.23E-06	***	4.11E-06	***
	(-6.032)		(3.407)		(-6.650)		(3.730)		(-5.840)		(3.704)	
A_{iEa40}, A_{iRa40}	-3.22E-06	***	2.08E-06	***	-2.52E-06	***	2.48E-06	**	-2.37E-06	**	2.03E-06	
	(-4.072)		(2.867)		(-3.182)		(3.409)		(-2.997)		(2.793)	
A_{iEa60}, A_{iRa60}	-2.78E-06	*	1.31E-06	*	-2.17E-06	*	1.55E-06	*	-2.21E-06	*	1.91E-06	*
	(-1.914)		(1.49)		(-1.450)		(1.771)		(-1.520)		(2.181)	
A_{jEa20}, A_{jRa20}	6.74E-06	***	-4.95E-06	***	5.26E-06	***	-5.88E-06	***	4.96E-06	***	-3.81E-06	***
	(8.366)		(-5.099)		(6.537)		(-6.062)		(6.157)		(-3.926)	
A_{jEa40}, A_{jRa40}	2.68E-06	***	-1.80E-06	**	2.10E-06	***	-2.14E-06	**	2.93E-06	**	-2.49E-06	***
	(2.767)		(-2.193)		(2.162)		(-2.607)		(3.025)		(-3.033)	
A_{jEa60}, A_{jRa60}	-2.11E-06		-7.23E-07		-1.65E-06	*	-8.60E-07		-2.79E-06		-5.49E-07	
	(-0.912)		(-0.56)		(-0.713)		(-0.665)		(-1.208)		(-0.425)	
Constant	35.4	***	31.29	***	15.672	***	20.765	***	19.212	***	21.946	***
	(5.64)		(5.606)		(12.504)		(16.426)		(17.360)		(17.891)	
Sample Size	5228		5228		2978		2978		6574		6574	
Adj. R^2	0.136		0.1312		0.1368		0.1327		0.1301		0.1262	
F	52.4	***	50.34	***	48.21	***	52.31	***	48.75	***	49.23	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.20: Regressions to predict commute duration for auto users 2010 30 min intervals

Variable	Employment			Resident		
Age (yr)	Coefficient	(t-value)		Coefficient	(t-value)	
10	-5.53E+00	(-2.857)	***	-5.69E+00	(-2.934)	***
20	-1.47E+00	(-1.862)	*	-1.56E+00	(-1.975)	**
40	6.39E-01	(1.102)		5.89E-01	(1.013)	
50	-9.30E-01	(-1.658)	*	-1.03E+00	(-1.831)	*
60	-7.63E-01	(-1.093)		-8.62E-01	(-1.231)	
Male	1.47E+00	(4.081)	***	1.46E+00	(4.033)	***
SFhome	-1.40E-01	(-0.247)		-1.97E-01	(-0.349)	
VPD	3.98E-02	(0.098)		6.09E-02	(0.149)	
Children	-3.10E-01	(-0.862)		-3.01E-01	(-0.836)	
HHsize	2.38E-01	(1.101)		2.47E-01	(1.14)	
A_{iEa30}, A_{iRa30}	-4.66E-06	(-14.118)	***	-3.13E-06	(-10.679)	***
A_{iEa60}, A_{iRa60}	-2.44E-06	(-4.459)	***	-1.39E-06	(-4.148)	***
A_{jEa30}, A_{jRa30}	5.73E-06	(16.317)	***	3.96E-06	(12.881)	***
A_{jEa60}, A_{jRa60}	-9.27E-07	(-1.159)		-2.28E-07	(-0.495)	
Constant	3.31E+01	(9.68)	***	3.06E+01	(9.36)	***
Sample Size	5228			5228		
Adj. R^2	0.1365			0.1317		
F	60.02 ***			57.62 ***		

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.21: Regressions to predict commute duration for auto users 2010 10 min intervals

Regression	Adjusted R^2	Regression	Adjusted R^2
DC	0.1398	Interval Resident 35	0.1103
Non-colinear Employment	0.1347	Interval Resident 40	0.0901
Non-colinear Resident	0.1299	Interval Resident 45	0.0752
Cumulative Resident 5	0.0588	Interval Resident 50	0.0514
Cumulative Resident 10	0.1010	Interval Resident 55	0.0424
Cumulative Resident 15	0.1140	Interval Resident 60	0.0279
Cumulative Resident 20	0.1240	Weights Employment -0.01	0.1328
Cumulative Resident 25	0.1300	Weights Employment -0.02	0.1344
Cumulative Resident 30	0.1250	Weights Employment -0.03	0.1353
Cumulative Resident 35	0.1110	Weights Employment -0.04	0.1355
Cumulative Resident 40	0.0913	Weights Employment -0.05	0.1353
Cumulative Resident 45	0.0706	Weights Employment -0.06	0.1346
Cumulative Resident 50	0.0545	Weights Employment -0.07	0.1337
Cumulative Resident 55	0.0446	Weights Employment -0.08	0.1347
Cumulative Resident 60	0.0539	Weights Employment -0.09	0.1313
Interval Employment 5	0.0588	Weights Employment -0.1	0.1298
Interval Employment 10	0.0859	Weights Resident -0.01	0.1281
Interval Employment 15	0.1057	Weights Resident -0.02	0.1294
Interval Employment 20	0.1102	Weights Resident -0.03	0.1301
Interval Employment 25	0.1150	Weights Resident -0.04	0.1303
Interval Employment 30	0.0907	Weights Resident -0.05	0.1301
Interval Employment 35	0.0820	Weights Resident -0.06	0.1296
Interval Employment 40	0.0468	Weights Resident -0.07	0.1288
Interval Employment 45	0.0411	Weights Resident -0.08	0.1299
Interval Employment 50	0.0227	Weights Resident -0.09	0.1267
Interval Employment 55	0.0205	Weights Resident -0.1	0.1254
Interval Employment 60	0.0144	Total Interval Employment	0.1405
Interval Resident 5	0.0583	Total Interval Resident	0.1341
Interval Resident 10	0.1004	10 min Interval Employment	0.1370
Interval Resident 15	0.1126	10 min Interval Resident	0.1311
Interval Resident 20	0.1249	20 min Interval Employment	0.1360
Interval Resident 25	0.1206	30 min Interval Employment	0.1365
Interval Resident 30	0.1206	30 min Interval Resident	0.1317

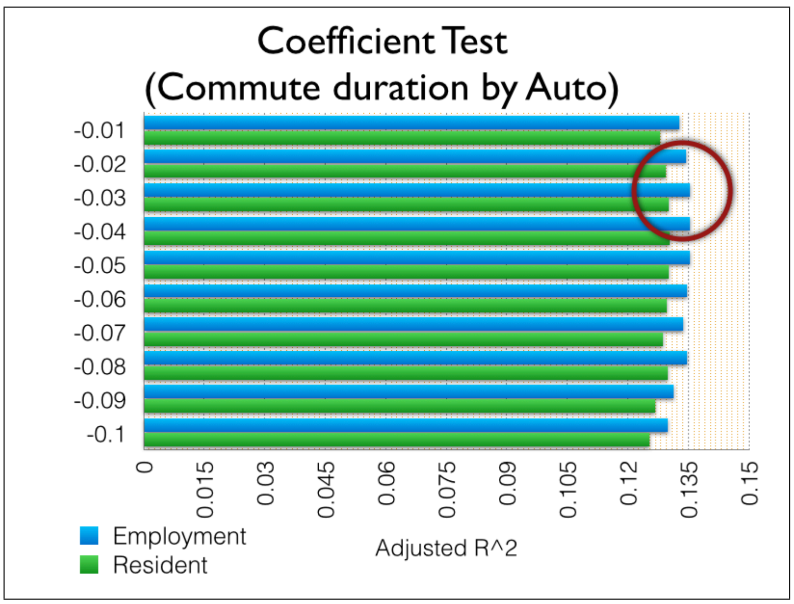

Figure A.4: Coefficient Test

Table A.22: Regressions to predict time spent at work for auto users

Variable	2010		2000		1990	
Age	Coefficient		Coefficient		Coefficient	
yr	(t-value)		(t-value)		(t-value)	
10	-118.3	***	-102.8	***	-115.6	***
	(-5.151)		(-3.83)		(-7.29)	
20	-21.96	**	-20.38	**	-20.24	**
	(-2.354)		(-3.214)		(-2.31)	
40	1.436		1.16		1.231	
	(0.209)		(0.215)		(0.312)	
50	4.359		4.514		4.621	
	(0.656)		(0.721)		(0.771)	
60	-9.73		-8.24		-9.21	
	(-1.174)		(-1.75)		(-1.54)	
Male	18.87	***	20.12	***	21.24	***
	(4.409)		(5.34)		(6.47)	
SFhome	-6.454		-5.791		-5.244	
	(-0.964)		(-0.214)		(-0.781)	
VPD	7.056		8.516		7.945	
	(1.464)		(1.742)		(1.24)	
Children	-10.06	*	-12.4	**	-11.54	*
	(-2.364)		(-3.64)		(-2.98)	
HHsize	-2.121		-2.021		-2.397	
	(-0.829)		(-0.744)		(-0.926)	
A_{iEa}	-1.085E-04		-8.952E-05		-1.463E-04	
	(-1.129)		(-1.541)		(-1.394)	
A_{iRa}	5.673E-05		4.287E-05		5.021E-05	
	(0.364)		(0.495)		(0.528)	
A_{jEa}	1.093E-04		2.157E-04		1.487E-04	
	(1.241)		(1.648)		(1.349)	
A_{jRa}	-9.7E-05		-1.512E-04		-1.021E-04	
	(-0.643)		(-0.785)		(-0.324)	
D_{io}	4.469E-02		4.384E-02		4.524	
	(0.371)		(0.215)		(0.202)	
D_{jo}	5.677E-02		5.894E-02		6.058	
	(0.395)		(0.541)		(0.247)	
Commute Duration	0.6264	***	0.5247	***	0.779	***
	(3.807)		(4.026)		(3.264)	
Number of Work Trips	-148.5	***	-124.3	***	-137.2	***
	(-43.503)		(-26.97)		(-34.67)	
Constant	592.5	***	534.7	***	499.6	***
	(19.57)		(21.13)		(18.54)	
Sample Size	5228		2978		6574	
Adj. R^2	0.2811		0.134		0.2671	
F	114.5	***	98.4	***	117.9	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.23: Regressions to predict time at work for auto users using predicted travel times 2010

Variable	20 min Interval		Weighted		Reported Trip Time	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-1.54E+02 (-6.363)	***	-6.48E+01 (-2.14)	**	-1.17E+02 (-5.091)	***
20	-3.47E+01 (-3.652)	***	-1.07E+01 (-0.982)		-2.46E+01 (-2.641)	***
40	1.20E+00 (0.174)		1.74E+00 (0.252)		1.12E+00 (0.163)	
50	-1.99E+00 (-0.291)		1.48E+01 (1.975)	**	5.39E+00 (0.812)	
60	-1.13E+01 (-1.359)		-8.74E+00 (-1.053)		-8.70E+00 (-1.051)	
Male	2.76E+01 (5.907)	***	2.50E+01 (4.78)	***	1.86E+01 (4.331)	***
SFhome	-4.45E+00 (-0.663)		-3.94E+00 (-0.587)		-4.45E+00 (-0.665)	
VPD	1.09E+01 (2.283)	**	1.13E+01 (2.367)	**	1.02E+01 (2.15)	**
Children	-1.09E+01 (-2.559)	**	-1.04E+01 (-2.432)	**	-1.01E+01 (-2.363)	**
HHsize	-1.05E+00 (-0.409)		-4.55E-01 (-0.178)		-7.64E-01 (-0.3)	
Number of Work Trips	-1.50E+02 (-44.017)	***	-1.50E+02 (-43.759)	***	-1.48E+02 (-43.457)	***
Predicted/Reported Commute Duration	5.06E+00 (3.99)	***	1.05E+01 (3.001)	***	9.12E+01 (5.915)	***
Constant	7.10E+02 (23.604)	***	7.72E+02 (23.43)	*	5.79E+02 (48.455)	***
Sample Size	5228		5228		5228	
Adj. R^2	0.275		0.274		0.2776	
F	166.1	***	165.4	***	168.3	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.24: Regressions to predict time at work for auto users using predicted travel times 2000

Variable	20 min Interval		Weighted		Reported Trip Time	
Age	Coefficient		Coefficient		Coefficient	
	(t-value)		(t-value)		(t-value)	
10	-180.72	***	-57.770	**	-97.861	***
	(-7.46)		(-1.90)		(-4.25)	
20	-36.96	***	-12.278		-26.178	**
	(-3.89)		(-1.12)		(-2.81)	
40	1.12		1.818		1.279	
	(0.16)		(0.26)		(0.18)	
50	-2.17		13.745	**	5.303	
	(-0.31)		(1.83)		(0.79)	
60	-9.79		-10.191		-7.983	
	(-1.17)		(-1.22)		(-0.96)	
Male	23.50	**	4.184		19.046	***
	(5.03)		(0.63)		(4.43)	
SFhome	-4.17		-3.959		-3.920	
	(-0.62')		(-0.58)		(-0.58)	
VPD	11.89	*	12.377	**	8.393	**
	(2.49)		(2.59)		(1.76)	
Children	-11.54	**	-12.197	*	-10.820	**
	(-2.71)		(-2.85)		(-2.53)	
HHsize	-1.03		-0.380		-0.824	
	(-0.40)		(-0.14)		(-0.32)	
Number of Work Trips	-169.18 (-49.64)	***	-146.634 (-42.77)	***	-124.380 (-36.52)	***
Predicted/Reported Commute Duration	5.99 (4.72)	***	9.15 (2.61)	***	8.85 (5.52)	***
Constant	828.84	***	266.388	*	545.894	***
	(27.55)		(2.13)		(45.68)	
Sample Size	2978		2978		2978	
Adj. R^2	0.3121		0.2987		0.2546	
F	158.7	***	162.1	***	163.7	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.25: Regressions to predict time at work for auto users using predicted travel times 1990

Variable	20 min Interval		Weighted		Reported Trip Time	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-166.88 (-6.89)	***	-48.320 (-1.59)	**	-114.839 (-4.99)	***
20	-38.76 (-4.07)	***	-13.066 (-1.19)		-27.885 (-2.99)	***
40	1.18 (0.17)		2.077 (0.30)		1.193 (0.17)	
50	-1.85 (-0.27)		13.523 (1.80)	*	5.770 (0.86)	
60	-10.91 (-1.31)		-9.351 (-1.12)		-6.920 (-0.83)	
Male	27.63 (5.91)	**	4.284 (0.64)		16.218 (3.77)	***
SFhome	-4.58 (-0.68)		-3.487 (-0.51)		-3.675 (-0.54)	
VPD	12.92 (2.70)	**	10.185 (2.13)	**	9.158 (1.93)	**
Children	-9.88 (-2.32)	**	-13.067 (-3.05)	**	-11.459 (-2.68)	**
HHsize	-0.96 (-0.37)		-0.410 (-0.16)		-0.806 (-0.31)	
Number of Work Trips	-143.785 (-42.19)	***	-123.232 (-35.9)	***	-140.284 (-41.19)	***
Predicted/Reported Commute Duration	6.34 (4.99)	***	8.55 (2.44)	***	10.1 (6.54)	***
Constant	773.86 (25.72)	***	251.157 (2.01)	*	637.266 (53.33)	***
Sample Size	6574		6574		6574	
Adj. R^2	0.2876		0.2964		0.3145	
F	159.3	***	164.5	***	162.3	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.26: Regressions to predict commute duration for transit users 20 min intervals

	2010				2000				1990			
	Employment		Resident		Employment		Resident		Employment		Resident	
Variable	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
A_{iEa20}, A_{iRa20}	-0.0000452	**	4.21E-05	**	-4.91E-05	**	3.92E-05	**	-4.58E-05	**	3.66E-05	***
	(-1.34)		(0.78)		(-1.455)		(0.727)		(-1.356)		(0.677)	
A_{iEa40}, A_{iRa40}	-0.0000421	**	2.16E-05	*	-3.60E-05	***	2.35E-05	**	-3.92E-05	**	2.56E-05	**
	(-1.13)		(0.59)		(-0.967)		(0.641)		(-1.052)		(0.698)	
A_{iEa60}, A_{iRa60}	-0.0000262		1.23E-05		-2.44E-05		1.07E-05		-2.11E-05		9.24E-06	
	(-0.86)		(1.23)		(-0.800)		(1.066)		(-0.693)		(0.924)	
A_{jEa20}, A_{jRa20}	-3.95E-05	*	3.68E-06	**	-3.36E-05	*	3.45E-06	**	-3.15E-05	***	3.23E-06	**
	(-0.63)		(0.92)		(-0.535)		(0.862)		(-0.501)		(0.808)	
A_{jEa40}, A_{jRa40}	-3.22E-05	*	1.22E-06		-3.41E-05	*	1.33E-06	*	-3.72E-05	*	1.45E-06	*
	(-0.61)		(0.84)		(-0.645)		(0.916)		(-0.703)		(0.89)	
A_{jEa60}, A_{jRa60}	-9.86E-06		9.78E-08		-9.24E-06		1.04E-07		-9.79E-06		1.10E-07	
	(-0.59)		(0.57)		(-0.553)		(0.6042)		(-0.586)		(0.639)	
Constant	46.14		48.79		35.04		32.74		36.683		43.456	
	(7.599)		(8.036)		(6.703)		(6.263)		(4.944)		(5.857)	
Sample Size	124		124		106		106		164		164	
Adj. R^2	0.114		0.132		0.125		0.146		0.134		0.142	
F	4.092	***	4.53	***	5.68	***	6.02	***	4.86	***	4.98	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.27: Regressions to predict time at work for transit users using predicted travel times 2010

Variable	20 min Interval		Weighted		Reported Trip Time	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-270.97 (-11.41)	***	-228.30 (-9.61)	***	-257.77 (-10.85)	***
20	-27.47 (-2.88)	**	-26.98 (-2.82)		-23.92 (-2.50)	***
40	0.83 (0.11)		0.74 (0.10)		0.74 (0.10)	
50	-1.57 (-0.23)		-1.70 (-0.25)		-1.58 (-0.23)	
60	-13.38 (-1.14)		-12.80 (-1.09)		-14.29 (-1.21)	
Male	4.41 (8.29)	**	4.05 (7.63)	*	4.18 (7.88)	*
SFhome	-7.39 (-1.10)		-7.54 (-1.12)		-8.05 (-1.19)	
VPD	7.83 (1.47)		7.60 (1.43)		6.35 (1.19)	
Children	-19.05 (-4.97)	**	-16.40 (-4.28)	**	-16.90 (-4.41)	*
HHsize	-0.61 (-0.22)		-0.60 (-0.21)		-0.56 (-0.20)	
Number of Work Trips	-15.83 (-5.48)	**	-15.2 (-5.26)	**	-17.0 (-5.89)	**
Predicted/Reported Commute Duration	7.66 (2.21	***	8.30 (2.40)	***	6.31 (1.83)	***
Constant	541.33 (33.59)	***	508.20 (31.534)	***	476.23 (29.55)	***
Sample Size	124		124		124	
Adj. R^2	0.187		0.201		0.192	
F	142.1	***	146.3	***	185.6	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.28: Regressions to predict time at work for transit users using predicted travel times 2000

Variable	20 min Interval		Weighted		Reported Trip Time	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-291.64 (-12.28)	***	-300.77 (-12.66)	***	-314.01 (-13.22)	***
20	-72.93 (-7.63)	*	-60.47 (-6.33)	**	-61.42 (-6.43)	**
40	1.14 (0.15)		1.24 (0.17)		0.98 (0.13)	
50	-2.18 (-0.32)		-2.03 (-0.30)		-1.82 (-0.27)	
60	-31.41 (-2.67)		-29.44 (-2.50)		-33.04 (-2.81)	
Male	3.60 (6.77)	*	3.79 (7.13)	**	3.23 (6.07)	**
SFhome	-8.21 (-1.22)		-8.78 (-1.30)		-7.59 (-1.13)	
VPD	16.78 (3.15)		13.74 (2.58)		18.23 (3.42)	
Children	-19.76 (-5.16)	***	-19.08 (-4.98)	**	-20.05 (-5.24)	***
HHsize	-1.17 (-0.41)		-1.11 (-0.39)		-1.20 (-0.42)	
Number of Work Trips	-20.30 (-7.03)	***	-20.0 (-6.93)	**	-17.6 -6.09	**
Predicted/Reported Commute Duration	4.18 (1.21	***	4.56 (1.32)	***	3.42 (0.99)	***
Constant	229.23 (14.22)	***	241.88 (15.008)	***	234.22 (14.53)	***
Sample Size	106		106		106	
Adj. R^2	0.195		0.214		0.187	
F	154.3	***	162.3	***	149.6	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Table A.29: Regressions to predict time at work for transit users using predicted travel times 1990

Variable	20 min Interval		Weighted		Reported Trip Time	
Age	Coefficient (t-value)		Coefficient (t-value)		Coefficient (t-value)	
10	-157.36 (-6.62)	***	-134.11 (-5.65)	***	-142.91 (-6.02)	***
20	-56.57 (-5.92)	**	-52.97 (-5.54)	**	-59.92 (-6.27)	*
40	0.72 (0.10)		0.68 (0.09)		0.76 (0.10)	
50	-0.94 (-0.14)		-1.00 (-0.15)		-0.78 (-0.12)	
60	-14.84 (-1.26)		-15.96 (-1.36)		-15.58 (-1.32)	
Male	5.23 (9.85)	*	5.58 (10.51)	**	5.59 (10.52)	*
SFhome	-7.95 (-1.18)		-6.85 (-1.02)		-6.82 (-1.01)	
VPD	9.28 (1.74)		8.87 (1.67)		8.78 (1.65)	
Children	-18.29 (-4.78)	***	-18.49 (-4.83)	**	-15.88 (-4.15)	**
HHsize	-1.55 (-0.55)		-1.25 (-0.44)		-1.55 (-0.55)	
Number of Work Trips	-7.34 (-2.54)	***	-7.33 (-2.54)	**	-6.70 (-2.32)	***
Predicted/Reported Commute Duration	9.17 (2.65	***	8.84 (2.56)	***	9.93 (2.87)	***
Constant	582.96 (36.17)	***	560.15 (34.76)	***	569.83 (35.36)	***
Sample Size	164		164		164	
Adj. R^2	0.199		0.194		0.203	
F	154.3	***	162.3	***	149.6	***

* indicates $P < 0.10$, ** indicates $P < 0.05$, *** indicates $P < 0.01$

Appendix B

Glossary and Acronyms

This appendix defines jargon terms in a glossary, and contains a table of variables and a table of acronyms and their meaning.

B.1 Glossary

- **Accessibility** – The ability to reach a destination within a certain cost parameter (typically travel time).
- **Auto** – Automobile
- **Commute** – A trip that had home as the origin and work or work-related as the destination and was the first of such of the travel day.
- **Destination** – The location that a trip ends.
- **Metropolitan Council** – Regional government agency responsible for transportation and planning policy in the Minneapolis/Saint Paul metropolitan region.
- **Origin** – The location that a trip begins.
- **Work Trip** – A trip where the destination was work or work-related, not necessarily the first of such of the travel day.

Table B.1: Variables used in regressions

Demographic and socio-economic variables	
Age 10[0,1]	1 if individual aged 10-20. 0 otherwise
Age 20[0,1]	1 if individual aged 20-30, 0 otherwise
Age 30[0,1]	1 if individual aged 30-40, 0 otherwise
Age 40[0,1]	1 if individual aged 40-50, 0 otherwise
Age 50[0,1]	1 if individual aged 50-60, 0 otherwise
Age 60[0,1]	1 if individual aged 60+, 0 otherwise
Children	Number of children 0 - I6 in the household
HHsize	Number of persons in household
Male[0,1]	1 if individual is male, 0 otherwise
SFhome[0,1]	1 if individual lives in single family home, 0 otherwise
VPD	Number of vehicles per licensed driver
Accessibility variables	
A_{iEa}, A_{iEt}	Origin (home-end) accessibility to employment, by auto, transit
A_{iRa}, A_{iRt}	Origin (home-end) accessibility to population (housing for DC), by auto, transit
A_{jEa}, A_{jEt}	Destination (work-end) accessibility to employment, by auto, transit
A_{jRa}, A_{jRt}	Destination (work-end) accessibility to population (housing for DC), by auto, transit
D_{io}	Distance (Km) between origin (home-end) and IDS Tower (miles, White House)
D_{jo}	Distance (Km) between destination (workplace) and IDS Tower (miles, White House)
T_W	Time spent at work
T_E	Travel time to work
WT	Number of work trips (a trip that had work or work-related as its destination)

B.2 Acronyms

Table B.2: Acronyms used

Acronym	**Meaning**
CBD	Central Business District
GLM	Generalized Linear Model
OLS	Ordinary Least-Squares Regression
TAZ	Transportation Analysis Zone
TBI	Travel Behavior Index