P1: Determinants of CO$_2$ Emissions from Daily Travel:
A Comparison of Germany and the United States

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ABSTRACT:

Federal, state, and local governments in the USA and Germany have the goal to reduce petroleum use and associated Greenhouse Gas (GHG) emissions from ground passenger transport. This poster compares determinants of CO2 emissions from daily travel in Germany and the USA using the two latest national household travel surveys: NHTS 2009 and MiD 2008/2009. The surveys are similar in their design and timing in almost every respect and thus offer a unique opportunity for comparison of the two countries. In fact, NHTS and MID have similar data structure, rely on comparable data collection methods, and contain similar variables.

Daily CO2 emissions were estimated following a method used for the calculation of this variable in the German MID dataset. Estimations are based on vehicle-level fuel efficiency information from the vehicle file, as well as trip distance and mode and vehicle choice information from the trip file. The analysis includes CO2 emissions for passenger car and public transport trips. Data were aggregated to the person level for analysis.

Results show 2.3 times greater travel-related CO2 emissions per day per trip maker in the USA than in Germany. In both countries CO2 emissions from daily travel are greater for men than for women, employed individuals than those unemployed or not in the workforce, and persons with easier car access in their household. Daily travel related CO2 emissions per person are lower in both countries for individuals living in larger metropolitan areas, in urban areas, and at higher population densities. However, regression analysis show that even controlling for dissimilarities in socio-economic factors, demographics, and land-use, transport related CO2 emissions per capita are much higher in the USA than in Germany.

MULTI-MODAL TRANSPORTATION CHOICES AND HEALTH:
AN EXPLORATORY ANALYSIS USING DATA FUSION TECHNIQUES

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In this study, we demonstrate the feasibility of using data fusion in the context of large-scale travel (NHTS) and health (ATUS-EH Module) surveys, and subsequently use the new comprehensive dataset generated to model the relationship between health and multi-modal (walking, biking, transit, and vehicle usage) long-term (weekly/monthly/yearly) travel choices. Two measures of health are fused from a health survey on to a travel survey at the disaggregate (individual) level. The probabilistic record linage software Link Plus was used for the data fusion purposes. The methodology was validated using the EH module of the American Time Use Surveys (ATUS). Subsequently, the algorithm was used to match the health information from the ATUS to the NHTS and the resulting master dataset was used to develop models for multi-modal travel choices and health. The statistical analysis indicates that while incrasing walking and transit use is associated with better health (relative to non users of the mode), those with the highest levels of walking and transit use are also in poor health relative to moderate users of the mode. Similarly, those at the two ends of the driving spectrum (first and fourth quartiles) have higher BMI compared to those in the middle of the spectrum. There were no statistically significant effects of weekly bike trips on health measures. Overall this study is envisioned as a proof of concept of how data fusion techniques may be used to integrate multiple datasets to facilitate a comprehensive study of multi-modal travel choices and health.

P3: **Exploring Travel Behavior of Millennials in Cell Phone only Households**

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This poster explores data from the 2009 NHTS Cell Phone Only (CPO) households. Since 1990, the NHTS had relied on landline households to provide information about household travel. As the first national CPO household travel survey of its kind in the U.S., the 2009 NHTS conducted a small CPO subsample of 1,254 households fielded concurrently with the landline sample. Since 2006, the annual National Health Interview Survey (NHIS) conducted by the CDC has tracked the changes occurring between land line and cell phone only households. The 2009 NHIS data showed that 24.5% of households (and 23% of adults) had no landline service and only cell phone service. This substantial growth in CPO households begged the question of how CPO households travel differently from landline households.

The NHTS CPO revealed many demographic correlations with the CPO portion of the 2009 National Health Interview Survey. The NHTS CPO sample encompassed all 50 states and DC and included 2,298 completed screener interviews with an overall response rate of 13.6%. This test sample was designed to gain a better understanding of how CPO households travel differently from land line households. The largest prevalence of cell phone only households by age group was with the millennial generation. This younger cohort showed the lowest rate of trips by POV and the highest rate of trips by walk and public transit. As the CPO proportion of households in the U.S. steadily increases over time, it is important to explore potential non-coverage bias on key travel behavior trends.

<mark>P4:</mark> Fusing Passive Data for Transportation Planning: Studies in Atlanta and Seattle

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Abstract

To date, the collection of comprehensive household travel data through surveys has been a challenge due mainly to high costs and nonresponse. This challenge exists at the regional level as well as at the national level. Many have investigated other options including GPS, WiFi positioning, Bluetooth, and triangulated signal data. However, these types of location data typically lack information about the people that make each trip in the data. Meanwhile, consumer data firms have been compiling information about individuals and households for decades, typically selling the inexpensive, up-to-date data for marketing. These readily available data contain the majority of household and individual demographic and socioeconomic fields that are used in travel demand applications. Having said that, consumer data generally lack trip-making behavior.

By combining these types of passive data using statistical, simulation, and data fusion techniques, their respective shortcomings for use in travel demand modeling applications may be overcome. We are investigating a data fusion technique that combines different types of passive data with the NHTS to create localized, synthetic household travel data. This poster will report on the findings of prototype studies in Atlanta and Seattle. *Specifically, we will emphasize how the NHTS was used in the data fusion and synthesis process.*

Weather, Traffic Accidents, and Climate Change

Benjamin Leard and Kevin Roth

August 31, 2015

Abstract

We exploit random daily variation in weather to document the relationship of temperature, rainfall, and snowfall with traffic accidents and travel demand. Using information on 46.5 million accidents from the State Data System of police reported accidents for 20 states and travel demand for 207,455 households included in the National Household Travel Survey, we find unanticipated effects of weather on accidents and their severity. Our estimates suggest that while warmer temperatures and reduced snowfall are associated with a moderate decline in non-fatal accidents, they are also associated with a significant increase in fatal accidents. This increase in fatalities is due to a robust positive relationship between fatalities and temperature. Half of the estimated effeect of temperature on fatalities is due to changes in the exposure to pedestrians, bicyclists, and motorcyclists as temperatures increase. The application of these results to middle-of-the-road climate predictions suggests that weather patterns for the end of the century would lead to 603 additional fatalities per year. Between 2010-2099, the present value social cost of all types of accidents caused by climate change is $58 billion.

Key Words: Traffic Accidents, Traffic Fatalities, Climate Change

JEL Classification Numbers: Q58, Q52, H23, R41

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P6: National calibration of the Integrated Transport and Health Impact Modeling tool using the National Household Travel Survey

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Background

Assessing the net public health impacts of active transportation (e.g. walking and bicycling) may identify opportunities for reducing health costs and improving wellbeing. Comprehensive health impact models, such as the Integrated Transport and Health Impact Modeling (ITHIM) Tool may help. We present the methods and preliminary results of a national ITHIM calibration using NHTS and other federal data.

Methods

ITHIM uses population-attributable risk functions to predict changes in disease burdens for a hypothesized change in transportation-related health exposures, including physical activity participation, air pollution concentration, and collision patterns. Fifteen ITHIM calibration data points provide baseline information on travel and physical activity habits, vehicle emissions, collision prevalence, population characteristics, and disease burdens. We sourced 7 calibration inputs related to travel volume and mode choices (including active transportation) from the 2009 NHTS, supplementing this with physical activity data from the 2011-2012 National Health and Nutrition Examination Survey and US Census population characteristics. Calibration of emissions and collisions is ongoing.

Results

At baseline, the average NHTS respondent walked 2.2 miles/week, bicycled 0.7 mile/week, and drove or rode in automobiles 186 miles/week.   When 2% of baseline automobile miles were reallocated to walking and bicycling (hypothesized values of 5.0 and 1.6 miles/week, respectively), the ITHIM-estimated benefits from increased physical activity were 33,370 deaths averted and $24.5 billion saved through healthcare costs and worker productivity. This estimate did not yet account for altered air pollution or collision health impacts.

Conclusions

NHTS provided essential data for this national transportation health impact modeling pilot effort. Additional analyses for collisions and emissions will estimate the net impact of shifting mode share from vehicles to active transportation, but preliminary results suggest substantial health gains and cost savings are possible with small population-level travel behavior changes. Once complete, these results may inform policy and planning efforts regarding active travel.

<mark>P7:</mark> Influence of employment density on gender travel: A case study of California and New York based on 2009 NHTS

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Abstract:
It has been long argued that suburban development could lead women to have limited travel and activity opportunities, compared to men. Although some evidence suggests that elements of compact design are associated with a lower gender gap in chauffeuring trips, to our knowledge research on how the built environment influences gendered travel remains limited.

This study uses empirical data from 2009 NHTS to investigate the association between the built environment and gender differences in daily travel patterns of paired household heads. Given our previous analysis of 2012 California Household Travel Survey found that employment accessibility is negatively associated with gendered inequality in auto-driving distance, this study hypothesizes that higher employment accessibility could reduce gender difference in travel. Because of data limitations in 2009 NHTS, we use tract-level employment density to approach employment accessibility.

We analyzed two states with very different urban designs: California, known for urban sprawl and auto-oriented development, and New York, known for dense and transit-oriented development. We explore how employment accessibility influences gendered travel in all modes of transportation, walking and auto-driving, and we compare regional differences between the study states. Furthermore, we introduce Heckman model to capture the endogeneity concerns over location choice and differences in travel between urban and rural areas.

Results of our regression analyses show: (1) that employment density is not significantly associated with gendered differences in daily walking distance and in daily travel distance for all modes for paired household heads and (2) that urban men living in California have greater auto-driving travel distance than urban women as employment density decreases in contrast to urban paired heads in New York. We conclude that higher employment density may help reduce gendered differences in auto-driving trips and could help foster more equal travel among for men and women in paired households.

P8: **Using Socioeconomic and Travel Pattern Data to Boost Pay by Cell Adoption Rates in Washington, DC**

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Abstract: Washington, DC has the most successful pay by cell (for parking) program in the country and one of the most successful one globally. Launched in 2011, the program now accounts for over 55% of the District's parking revenues. The program has a high level of customer satisfaction and has significantly lower capital and operating costs compared to revenues generated at traditional parking meters. Consequently, DDOT is looking at ways to expand the program by trying to understand the characteristics of the "non-users" (customers paying at the meter) and trying to adapt the program to break down the barriers of adoption.

Evaluating existing PBC adoption rates in the District, the southeastern portion of the District, located east of the Anacostia River, disproportionally accounted for one of the lowest PBC adoption rates. The initial hypothesis to evaluate this area's low PBC adoption rate suggested that FHWA Environmental Justice factors might highlight barriers to adoption and usage. Findings from that research suggest the likelihood of PBC adoption in one out of five parkers, hinting at other factors that influence PBC adoption.

This proposed poster builds upon past DDOT research aimed at understanding pay-by-cell (PBC) users and non-users. The poster will demonstrate how DDOT utilized the National and Regional Household Travel Survey data along with other data sources to identify demographic, socio-economic, travel and banking characteristics of the non-users. This latest research looks at a hypothesis that correlates low PBC adoption rates to unbanked households as well as commuting trends that minimizes exposure to the PBC program or indicates limited automobile usage. This information developed will be critical in developing strategies for fine-tuning the pay by cell program to make it accessible and attractive to current non-users.

National Personal Transportation Survey Data to Estimate Rural Transit Needs

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The goal of the Transit Cooperative Research Program (TCRP Project B-36 was the development of methods for estimating need and demand for rural public transit services. To create a measure of the need for transit services in rural areas, the National Household Travel Survey (NHTS) - the 2001 dataset that was available at the time of the research -was used. The research and methodology were updated when the 2009 dataset became available. Average daily trip rates for rural households were analyzed related to:
- All rural households
- Age of household residents
- Income
- Vehicle ownership
- Age by income
- Age by vehicle ownership
- Income by vehicle ownership
- Age by income by vehicle ownership

Average daily trips rates were calculated nationally and for each of the nine census divisions. The data contained too few observations for rural households to analyze the trip rates by state. Household trip rates were found to decrease with increasing age and increase with increasing household income. The availability of a personal vehicle to rural households is a significant indicator of the need for rural passenger transportation service. The average daily trip rate for households with zero vehicles was found to be 3.3 trips, for households with one vehicle the rate was 5.4 trips, and for households with two or more vehicles, the rate was 10.1 trips. Vehicle ownership was found to more strongly relate to the number of trips than age or income.
From the relationship of trips rates related to vehicle ownership, a methodology to estimate need was developed - termed the "Mobility Gap." This reflects the gap between the number of trips made by households with vehicles and households without vehicles. The Mobility Gap was determined for each census region and could be applied to rural areas to estimate a total need for transportation services.

P10: **Estimating transportation physical activity using routinely collected data**
Evidence from the 2009 National Household Travel Survey

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Health impact assessment (HIA) has emerged as an important tool to make the case for investment in active transportation infrastructure. However, active transportation data are limited and expensive to collect. To address these data limitations, regression models were estimated to predict weekly time spent walking and biking based on routinely collected Census and built environment data taken from the 2009 National Household Travel Survey. First, zero-inflated negative binomial models were estimated to predict the number of walking and biking trips taken by individuals per week. Then, multinomial logistic models were used to estimate the probability that a given walk or bike trip was a work trip, a shopping trip, a social trip, a personal/family business trip, or a recreational trip. Finally, random effects models were used to estimate trip duration by purpose and mode. These three models were combined to estimate weekly time spent walking and biking as follows: estimated trip counts were multiplied by predicted trip probability to obtain weekly trip counts by mode and purpose, which were then multiplied by predicted trip duration by mode and purpose. Model predictions were validated using a 2006 household travel survey conducted in Raleigh, North Carolina. Model predictions were within 1.75 MET-hours per week (half on hour of walking) for 67% of the validation dataset and within 3.5 MET-hours per week (one hour of walking) for 90% of the validation dataset. As HIA gains prominence, establishing reliable and inexpensive methods for estimating baseline active transportation behavior will become increasingly important. This approach fills this gap by estimating active transportation behavior using routinely collected Census and built environment data.

P11: Updating the NHTS with ACS Data to Provide Annual Travel Behavior Data for Transportation Decision-Making

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The National Household Travel Survey (NHTS) provides valuable data that inform decision making for transportation projects. In part due to financial constraints, NHTS is conducted on a five- to eight-year cycle. As a result, an understanding of subtle and recent changes in travel behavior for intermediate years is limited by the available data. In contrast, the American Community Survey (ACS) is administered annually by the U.S. Census Bureau on a continuing basis.

The purpose of the study is to explore the relationships between these two data sources when comparable data exist in both the ACS and the NHTS, and to determine if and how we can develop mathematical models to synthesize NHTS data for those time periods where only ACS data are available.

Following a comprehensive review of publicly available data sources, we identified a group of key travel behavior measures from the NHTS Summary of Travel Trends reports that can be synthesized. Using 2009 NHTS data, linear regression and multinomial logit models were estimated to predict these measures by treating socio-demographic characteristics as explanatory variables. The prediction performance of each model was evaluated. We applied the estimated models to predict the travel behavior observed in the 2001 NHTS data using socio-demographic information from the 2000 Census Public Use Microdata Sample (PUMS) data.

In general, the study results supported the feasibility of interpolating a range of travel behavior measures using ACS data. The models for aggregate measures of trip making and vehicle-miles traveled (VMT) performed well providing predictions within 2.0 to 6.9 percent of the observed targets. The models also captured well the overall patterns of travel by time of day with prediction errors between -1.6 and 2.0 percent. However, the models were not as successful when predictions were segmented by income and trip purpose.
The study identified near and long term recommendations to improve the performance of the models developed, and to explore alternative approaches in the future.

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Travel Trends in Austin District: 2009 National Household Travel Survey
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Abstract
With the aim of supporting modeling efforts and examining travel behavior in Texas, the Texas Department of Transportation (TxDOT) purchased an additional sample of 20,000 households in Texas for the TxDOT National Household Travel Survey (NHTS) Add-On Program in 2009 to go along with the 2,255 samples collected from the national survey. Using this add-on data, and as a complementary tool to the earlier efforts at the national and state levels, the primary objective of this study was to provide an overview of the distinct travel characteristics in the Austin District region in Texas as well as to support travel demand modeling for the region. Based on a comprehensive univariate and bivariate analyses, a wide variety of travel trends in the Austin District were examined at the individual, household, and county levels. Trip and vehicle characteristics were assessed by demographic group, travel mode, and trip purpose. Included in the analysis were evaluations of vehicle use and availability, commute travel patterns, and the temporal distribution of trips. The study also highlighted the travel behavior of disadvantaged populations, such as older and rural residents, and data elements new to the 2009 NHTS.
The poster will present graphs and data visualizations representing notable findings from the study. These included, for instance, a higher VMT for rural drivers compared to urban residents. Average daily driving times were similar between the two groups despite this disparity, indicating that longer trip distances for rural drivers were offset by faster travel speeds. For elderly respondents, a significant decline in mobility was found as those aged 80 and older faced increasing rates of disability and vehicle unavailability. Additionally, rates of transit and active transportation use were low, with private vehicle travel representing 95% of commute mode share in the region. While providing valuable insights revealing patterns of travel and understanding regional needs to develop effective and targeted projects for policy and planning purposes, the analysis conducted also indicated the sample size limitations, particularly for some lower population counties.

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P13: **Relationship between travel concerns and activity using the 2009 National Household Travel Survey**

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ABSTRACT
Even though personal concern on travel is an important factor affecting travel propensity and
activities, the relationships it has with other variables have been less studied due to intangible
aspects of concern and limited data availability. These personal concerns or propensity to take
trips not only interconnect with each other but also relate to other explanatory information such
as individual socioeconomic characteristics. Hence, their complex relationships need to be
studied in a bi-directional modeling framework. This study applies a structural equations
modeling (SEM) approach that enables unobservable travel concerns and propensity (latent
variables) to investigate causal relationships with exogenous variables and measurement
indicators from the 2009 National Household Travel Survey (NHTS) dataset. Specifically, the
unobservable variables of psychological concerns are inferred by the survey responses about the
most issue on travel for respondents among safety, congestion, and transit accessibility. Travel
propensity is also measured by individual travel activity records such as annual travel miles and
travel mode. Exogenous socioeconomic information is identified by survey respondents'
household and personal characteristics including race, gender and income, as well as their
geographic characteristics such as population and housing density. Understanding these complex
relationships among socioeconomic factors, psychological effects, and travel activity is expected
to provide valuable insights relevant to transit planning, safety concern mitigation, and marketing
of travel for transportation planners and agencies.

Keywords : NHTS, travel concern, travel propensity, socioeconomic characteristics, structural
equation modeling.

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Abstract

From the travel behavior research literature, we know that travel outcomes are influenced by various facets of the built environment. However, capturing this influence remains a challenge, and researchers do not agree on what variable should be used to reflect the built environment in their models. While density data are relatively easy to get, land use diversity and design variables typically require substantial efforts to obtain and their modeling value is not unquestioned. In this context, the purpose of this paper is to analyze how various measures of urban form perform statistically in generalized structural equation models (GSEM) designed to tease out the relationship between urban form, gasoline prices, and travel behavior while accounting for residential self-selection and endogeneity of vehicle preferences. We analyze data from a Southern California subsample of the 2009 National Household Travel Survey (NHTS), which has a quasi-experimental nature thanks to large exogenous variations in gasoline prices during the administration of the NHTS (March 2008-April 2009). We contrast two models. The first model is a simple path model where urban form is only captured by population density. In the second model, residential urban form is a latent construct that depends on three density measures (population, housing, and employment), on the percentage of renter occupied housing, the inverse distance to the nearest sub-center, land use entropy, and transit access. Our results find no evidence that the more elaborate measures of urban form in the second model statistically improve our understanding of travel behavior compared to our first (simpler) model where density data proxies urban form.

P15: Local Vehicle Miles of Travel (VMT)

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Socio-economic characteristics, land use, and transportation system affect travel behavior and vehicle miles of travel (VMT) via trip rates, trip length, and mode selection (Polzin and Chu, 2004). Demographic characteristics of travelers have been proved to play an important role in determining the VMT growth. Polzin conducted research on the linkage between key demographic characteristics (e.g., age, sex) and VMT growth projection (Polzin, 2006). He found that, as the nation is moving toward a more aging region due to lower fertility and lower mortality, the changing age distribution alone would have a moderating impact on future travel demand. Although the national level analysis on the effects of demographic changes, in particular, population aging, on the VMT is made possible due to the easy availability of the national population projections by demographic characteristics and the VMT by individual characteristics calculated from NHTS data, the local level analysis is very difficult due to the limited database. As a result, there has been little research on the linkage between key demographic characteristics (e.g., age, sex) and VMT growth projection at the local level. This poster demonstrates how to measure the effects of population aging on the local VMT by using the local population projection tool (LPPT) (Choi et al, 2015) and local VMT rate by age and sex. The proposed local VMT projection model, an extended version of LPPT, can be used to understand the impacts of changing demographic compositions on local VMT projections, and may be a useful tool for local transportation and environmental planners to better understand the implication of local demographic changes for their impact on VMT.

The modeling framework is comprised of three steps. The first step is to calibrate the base year VMT estimate by age and sex at the city level using two major data sources: 2009 National Travel Household Survey (NHTS) and the SCAG's base year VMT estimate by origin transportation analysis zone (TAZ). The second step is to project total local population and population by age and sex using LPPT. LPPT is an innovative tool to project the city level population by age and sex, and can be a useful resource to anticipate future VMT and discuss local travel demand at the city level. LPPT is an upcoming web application used for projecting future populations and demographic characteristics at the city level for land use and transportation planning. LPPT is able to make growth forecasts that are consistent with larger-area projections without ignoring general plans and other city-level idiosyncrasies that may influence population and demographic shifts. The tool then links this data to the city-specific VMT data to provide local jurisdictions with an understanding of how the demographic changes (e.g., aging of population) may impact VMT. LPPT applies the housing unit method and the cohort component method to calculate an age and sex specific breakdown of population growth into the year 2040 (Swanson and Tayman, 2012; SCAG, 2008). LPPT utilizes city/county level population, households and demographic data from the 2000 and 2010 US Decennial Census as well as zipcode level birth and death figures from the California Department of Public Health (CDPH), along with the SCAG's county level population and household projections and assumptions during the projection period. The third and last step is to project local VMT by multiplying local population projections by age and sex by the calibrated base year VMT rate by age and sex.

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