MEMORANDUM

Travel Behavior and Forecasting
Harvard University Graduate School of Design

To: Carole Turley Voulgaris, Couse Instructor
From: Hannah Jun and Alyssa Kawano, GSD SES 5394
Date: February 27, 2025
Re: T1

Note: Relevant datasets and code that were use used to produce the analysis summarized in this memo can be found at https://github.com/urbanbyline/ses5394_t1_team5

The purpose of this memo is to demonstrate and describe an imagined alternative scenario that represents a simulated implementation universal basic income (UBI) within the municipality Somerville, MA and explains how it affects household vehicle availability across the study area.

Key findings:

- Increasing household income encourages some households who have low income that are now middle or high income to gain a vehicle.
- Geographic discrepancies to vehicles gained can be partly attributed to access to public transit which negates the need for a (or additional) vehicle.

Background

The analysis uses the TDM23 model, running the Vehicle Availability step for the Base scenario, which represents the existing (2019) conditions.

Our UBI (Universal Basic Income) scenario imagined all residents in Somerville receiving a monthly basic income of $500, totaling $6,000 annually. This does include children or people who make no current income. We know that UBI in practice has secondary impacts such as better employment, better health outcomes, and lower childhood poverty rates. These changes, however, would be harder to map onto the TDM23 framework so we kept the recorded change strictly to individual and household income and seeing if income increases vehicle availability model or not.

Table 1 highlights the impact household income can have on the various vehicle availability coefficients in yellow. Low income households have the highest impact for zero vehicle coefficients meaning if we can push households out of the low income category, they are likely to gain a vehicle.

Variable	Value
Zero Vehicle Coefficients	
ASC	-3.05
Workers in HH	-0.475
Children in HH	-0.371
CBD or Dense Urban	0.5
Intersection Density	1.2
Low Income HH	3.5
Suburban or Rural	-0.95
Transit Accessibility/Highway Accessibility	0.758
Insufficient Vehicle Coefficients	
ASC	-0.289
CBD or Dense Urban	0.768
Intersection Density	0.928
Low Income HH	0.6
Seniors in HH	0.315

Suburban or Rural	-0.537
Number of Drivers above 2	0.45
Presence of Drivers above 2	0.85
Sufficient Vehicle Coefficients	
ASC	1
All drivers are workers	0.955
High Income HH	0.292

Table 1: TDM Vehicle Choice Availability Model Coefficients

These changes are modeled within the TDM23 framework to simulate the impact of UBI on household vehicle availability. The memo will explore how shifts in household income, resulting from the introduction of UBI, influence transportation patterns, specifically vehicle ownership, in the Somerville region.

Data

- The data used for the Base scenario is derived from the TDM23 model for the Somerville municipality, which provides insights into vehicle availability based on existing conditions.
- For the alternative scenario, adjustments to key variables, including employment and wage income for all individuals, were modeled to simulate the impacts of implementing a UBI policy within the municipality.

Analysis Approach

To evaluate the impact of the UBI scenario on vehicle availability, the following steps were performed:

1. Base Scenario:
   - The TDM23 model was run to represent the 2019 conditions and determine vehicle availability across households in the region.
2. Alternative Scenario:
   - A new scenario was created with changes to employment data, specifically changing the wage income for all individuals and increasing their wage by $6,000 regardless of age or employment status. This change was made to reflect the potential impact of UBI policy.
   - The same TDM23 model was run under this alternative scenario to compare the resulting vehicle availability to the Base scenario.
3. Vehicle Availability Analysis:
   - A comparison was made between the Base and alternative scenarios to assess any significant shifts in vehicle ownership patterns within the region.

Results

- Our analysis shows that the number of households who increased income categories (low→ med, med → high, or low → high) is as follows:
    a. Of the original 38,767 households in Somerville, 6,506 households experienced income category increases because of the UBI policy implementation.
    b. Of the 6,506 households who experienced income category increases, 1,801 households gained a vehicle.
    c. UBI policy drove 4.6% of total Somerville households to gain a vehicle.

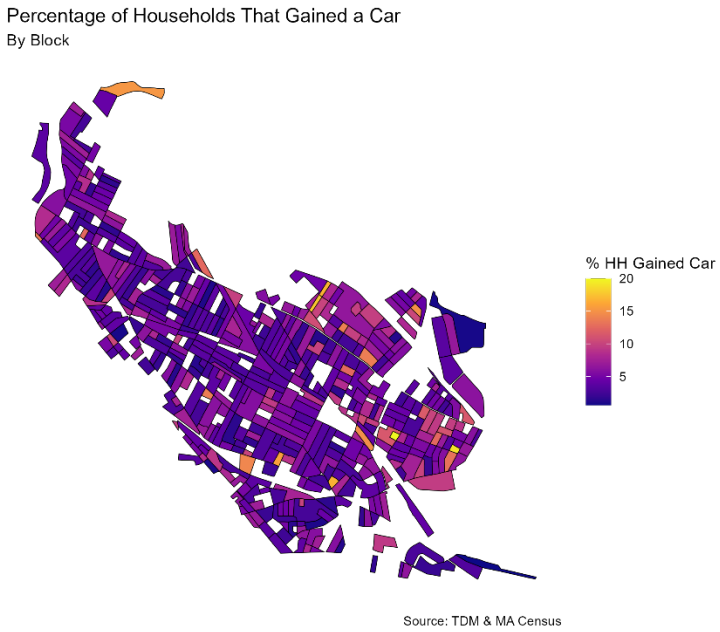

Figure 1: Percent of Blocks with over 20 Households that Gained a Car

- As shown in Figure 1, we see a geographic discrepancy in the distribution of blocks in Somerville.

Conclusions and Recommendations

Based on the results of this analysis, the following conclusions can be made:

- Income can be a blocker to car availability for low income households.
- UBI incentivizes some households to get a car whereas other households spend the additional income elsewhere.

To address these findings, we recommend:

- Based on these findings, we would recommend focusing investment on public transit or EV subsidies where gained a vehicle was highest to minimize the increase in carbon emissions from the increased vehicle availability.

Further investigation into the influence of public transit increasing zero availability of cars across incomes brackets will help refine these conclusions and guide future policy decisions. Additionally, comparing other communities and how many vehicles households would gain in Massachusetts with similar income variety, but less public transit would also tell us how influential access to public transit is. Mapping the percentage of households income level change by block could also tell us specifics about the distribution and potential clustering of where income changes were most significant.