

Using Value-by-Alpha Maps to Visualize the Bus Commute of Baltimore City Residents

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INTRODUCTION

The Maryland Transit Administration (MTA) recently announced its Baltimore Bus Network Improvement Project (BNIP). The initiative is designed to improve Baltimore City's local bus system and ultimately connect residents to the region and employment opportunities.

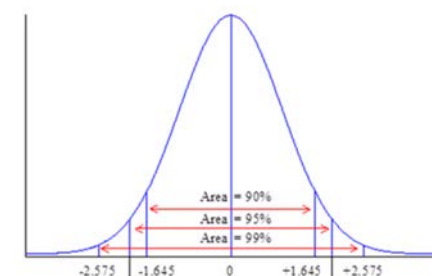
Value-by-alpha maps can be used to determine the statistical reliability and usability of estimates of Baltimore City residents who commute to work locally and throughout the region using the bus as their mode of transportation.

Bivariate choropleth maps are used to visualize two measures at the same time. Value-by-alpha maps are a type of bivariate choropleth map. The intensity of color represents the reported estimate the percent of commuters traveling by bus and the transparency will represent a measure of the reliability of the estimate, the coefficient of variation (CV).

Calculating New MOEs and CVs

- To visualize flow data, we will need to add tract estimates to get the total number of Baltimore residents from the city as a whole commuting to workplace tracts in the city and throughout the region by bus.
- Also, each time travel category represents the share of bus commuters in a tract traveling that length of time to work.
- Both these goals require calculating new MOEs for aggregated count data and deriving the percentage of bus commuters in each analysis.

Margin of Error (MOE):
Measure of the precision of an estimate (+/-)



MOE = Standard Error * 1.645 (90% Confidence Interval)

Margin of Error for Aggregated Count Data

$$MOE_{agg} = \pm \sqrt{\sum MOE_c^2}$$

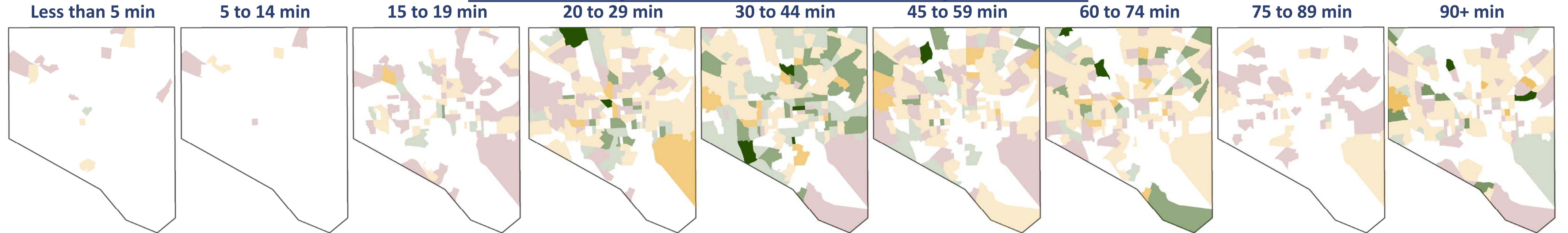
Margin of Error for a Percentage

$$MOE_p = \pm \frac{\sqrt{MOE_{num}^2 - (\hat{p}^2 * MOE_{den}^2)}}{\hat{X}_{den}}$$

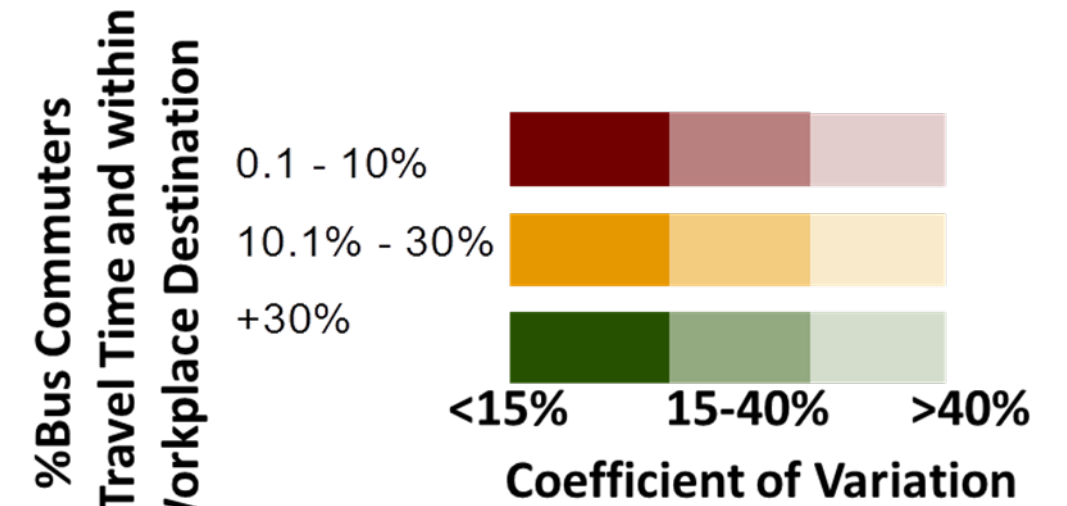
Coefficient of Variation (CV):
The relative amount of sampling error associated with a sample estimate

$$CV = \frac{MOE}{ESTIMATE} \times 100$$

Baltimore City Resident Bus Commuters by Travel Time



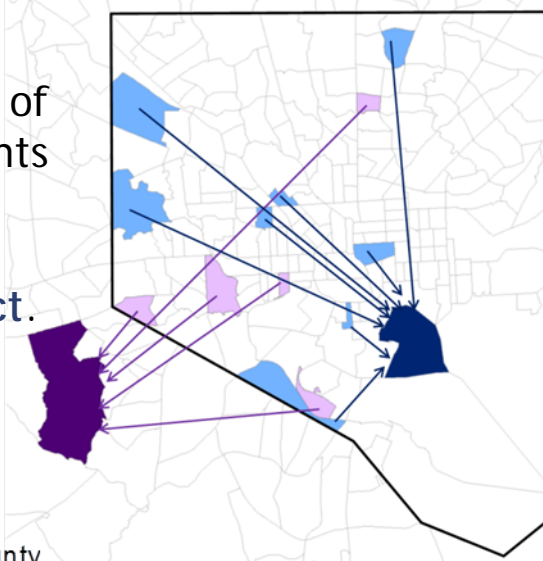
Interpreting the Coefficient of Variation Legend



- Estimate ranges go from top to bottom and the coefficient ranges go from left to right.
- The darkly shaded tracts have a low coefficient of variation (<15%). Therefore the estimate of the percentage of bus commuters by travel time or within a workplace destination is highly reliable.
- Moderately reliable estimates have CVs ranging between 15-39% and unreliable estimates have CVs greater than 40%.

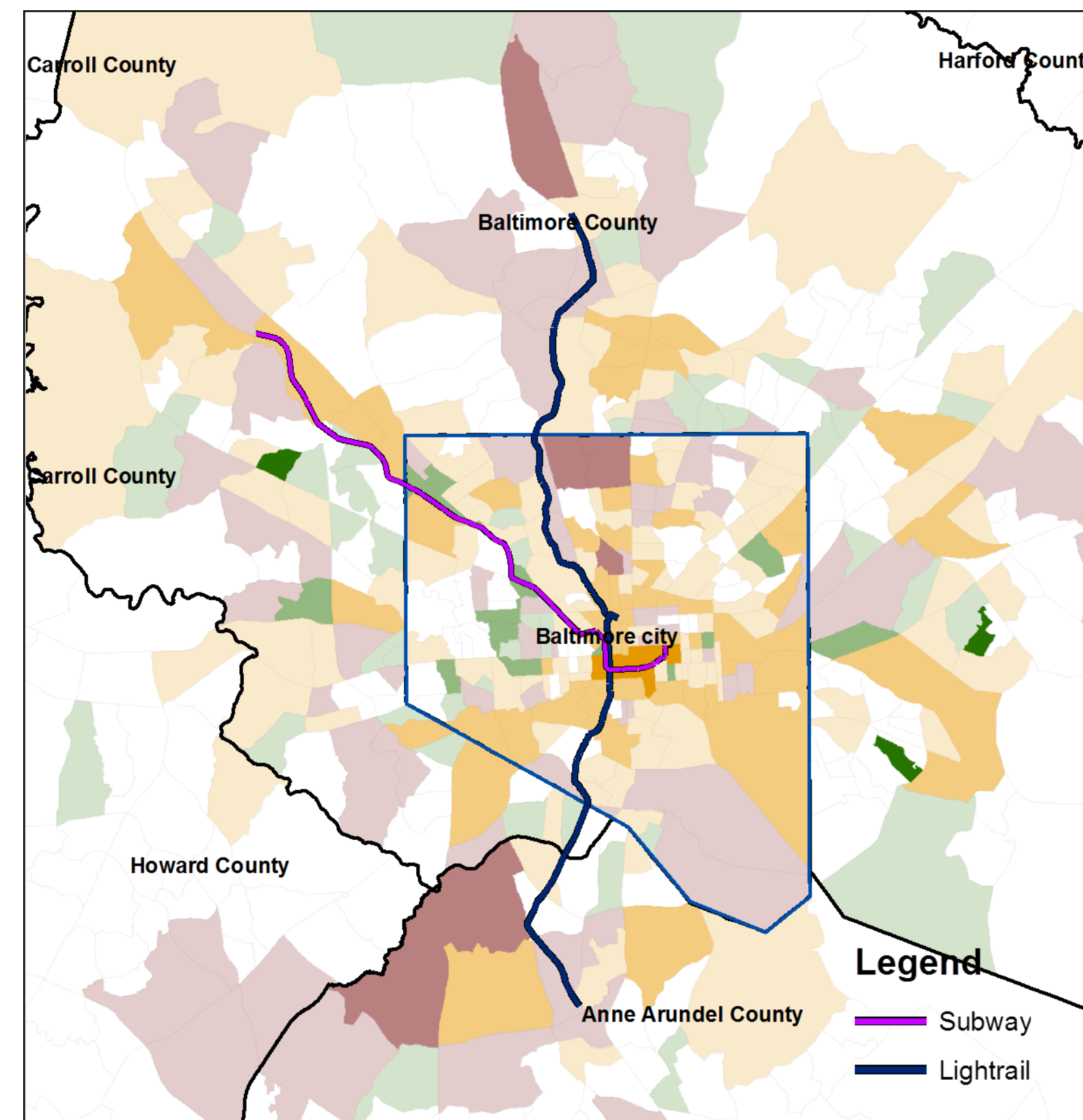
Understanding Tract to Tract Flow

- The initial CTPP data output will be counts of bus commuter residents from multiple residence tracts for each workplace tract.



- Residence Tracts (light purple)
- Workplace Tract 4004, B. City (dark purple)
- Residence Tracts (light blue)
- Workplace Tract 2401, B. County (dark blue)

Work Destinations of Baltimore City Bus Commuters



CONCLUSIONS

Coefficient of Variation and Travel Time

- Few residents have bus commutes under 15 minutes.
- The majority of tracts have larger coefficient of variations (>40%).
- The 30 to 44 minute travel time category has the highest concentrations of bus commuters. Also, commutes of this length have more moderately reliable estimates.

Coefficient of Variation and Workplace Destination

- There is no clear pattern as there are few workplace destinations within the city and throughout the region where a high concentration of commuters travel by bus.
- Estimates are moderately reliable around Baltimore City's Central Business District and along subway and light rail transit lines.

REFERENCES

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