REWEIGHTING OF THE MERGED 2017-2018 REGIONAL TRAVEL SURVEY AND 2018-2019 MARYLAND TRAVEL SURVEY

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Travel Forecasting Subcommittee
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Regional Household Travel Survey Usage for Models Development

2007/08

2017/18

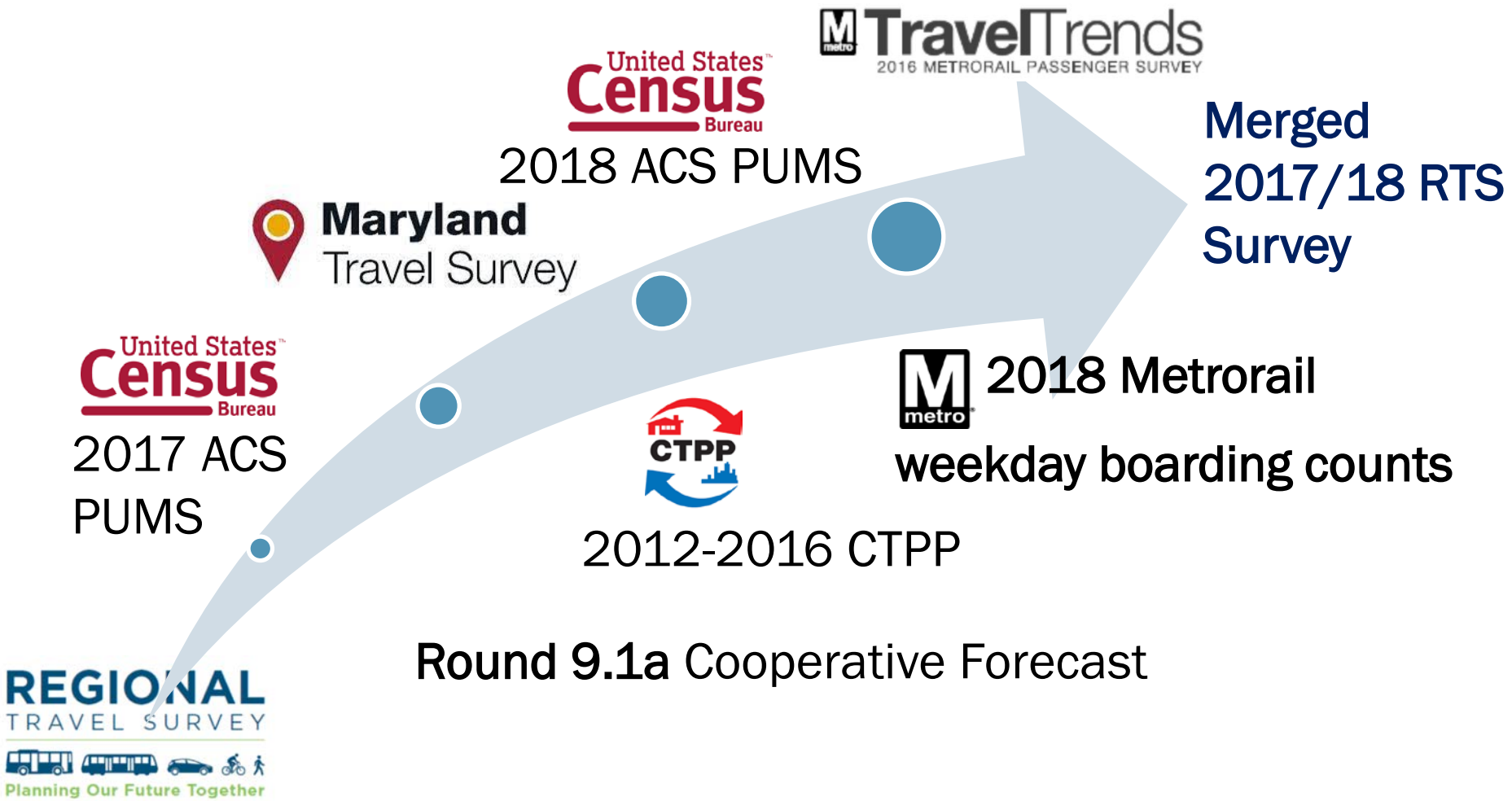
+

2018/19

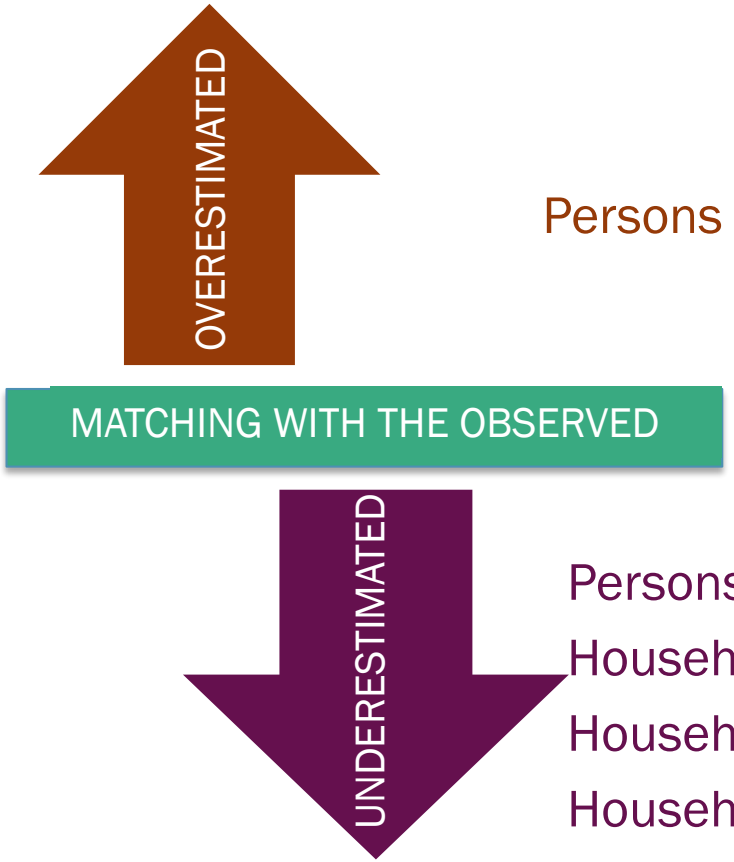
→ **The Gen2 (Ver 2.3, 2.4) Travel Models**

→ **The Gen3 Travel Model**

Multi-step Process of Survey Expansion



Issue 1: Implications of Using Household Size as the Single Expansion Variable

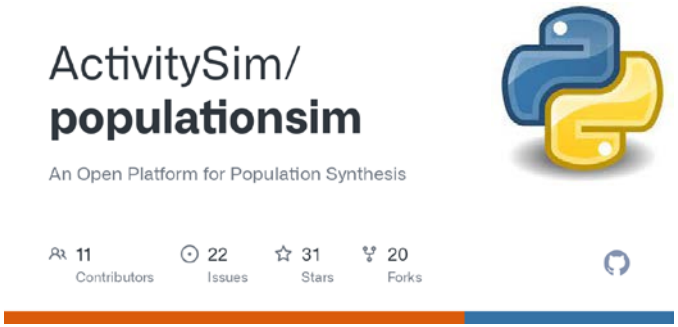


Persons aged 65-75

Household size distribution
Number of workers distributions

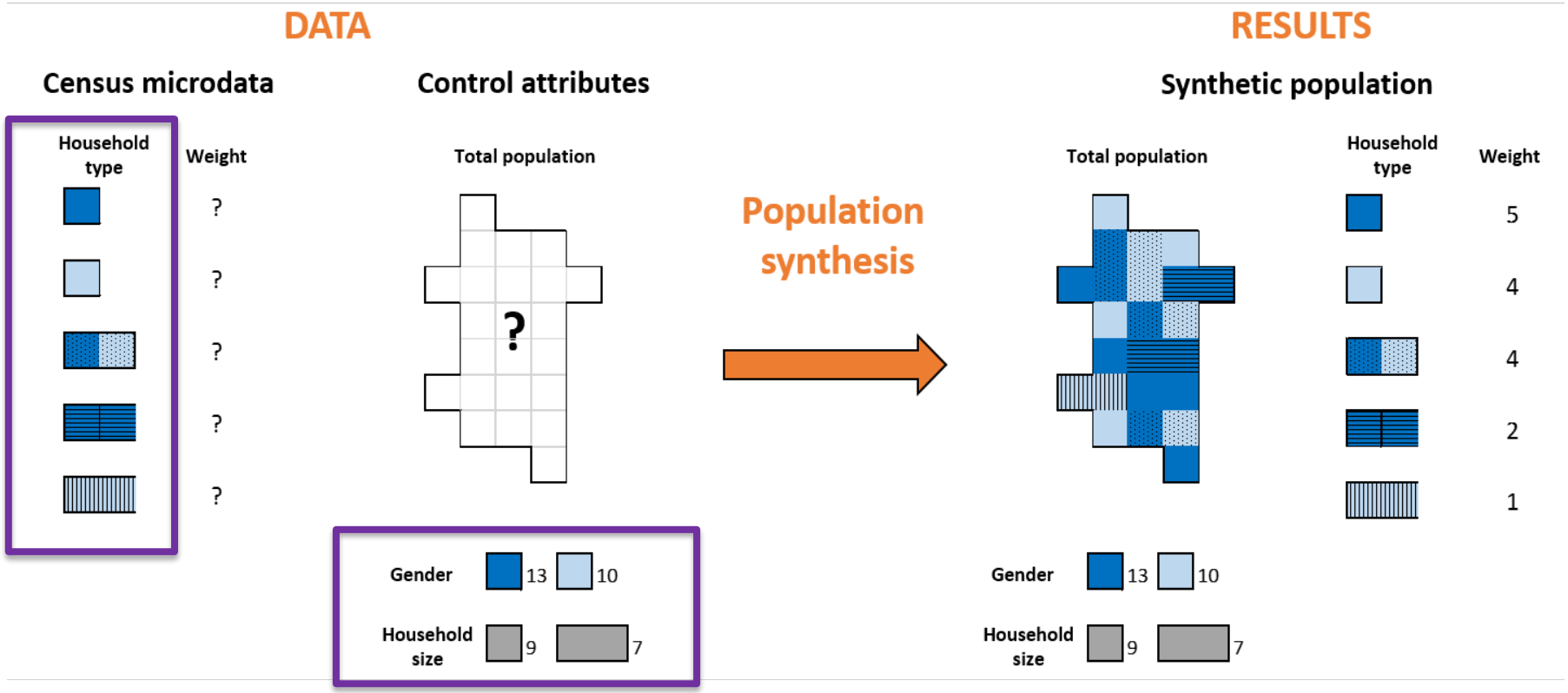
Persons aged 15-24
Households with low or very low income (<$50k)
Households with 0-vehicle in suburban areas
Households with 3+ workers

Reweight the Survey Using PopulationSim



- A population synthesizer based on maximum-entropy list-based approach
- The tool adjusts household expansion factors by a **combination of variables** specified at **different geographic levels**
- *PopulationSim methodology: Binny Mathew Paul et al., "Multi-Level Population Synthesis Using Entropy Maximization-Based Simultaneous List Balancing," 2018*

Population Synthesis Introduction



Source: https://silo.zone/synPopDE.html

Updated Household and Person-Level Weighting Variables

PUMA

21 dimensions

Income (5), Size (5), Workers (4), Vehicles (4), Presence of Children (2), Total Households (1)

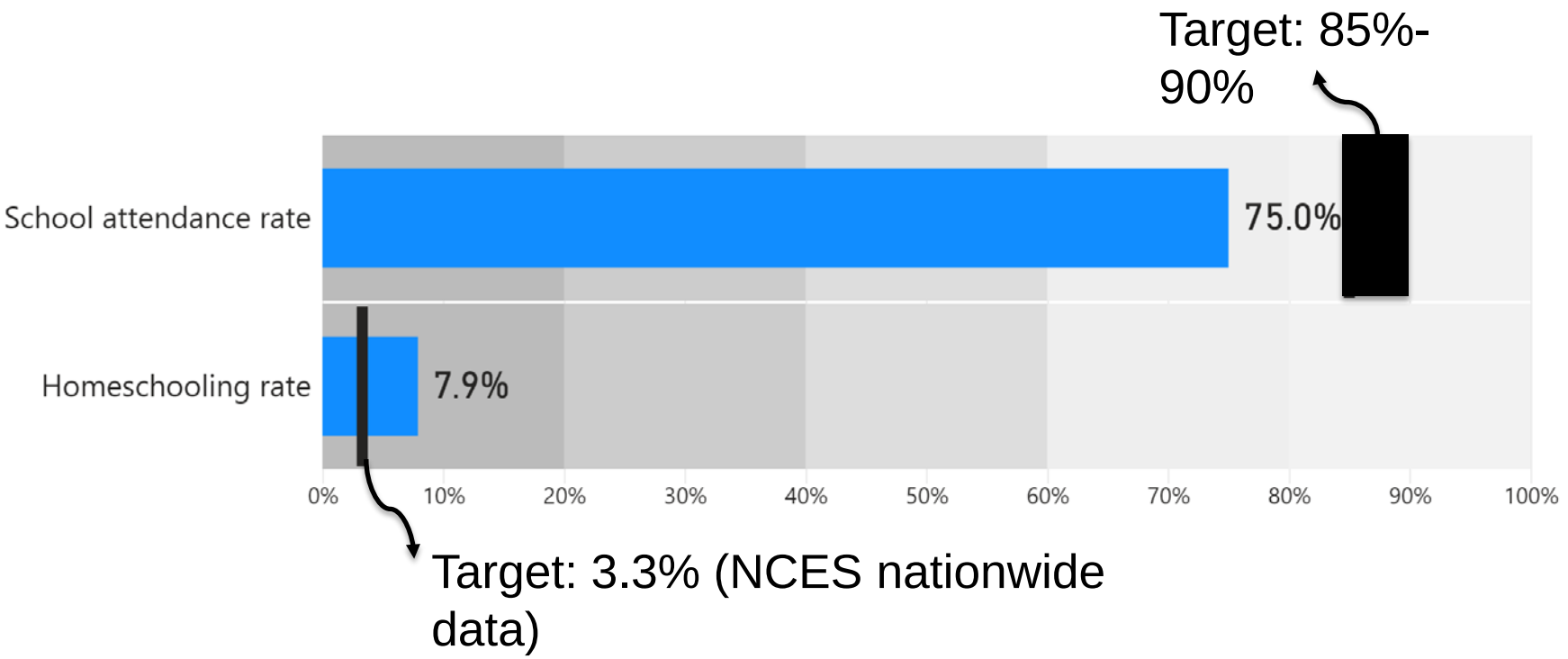
PUMA

24 dimensions

Gender (2), Age (7), Working Status (2), Student Status (2), Race/Ethnicity (5), Area Type (5), Total Person (1)

Note: Area Type indicates whether the home location is in a TPB Activity Center

Issue 2: Underrepresentation of Students Attending School and Overestimation of Homeschooled Students



Step 1: Removed Holiday Dates

- Federal holidays
- School holidays

School holiday dates vary. For example, summer breaks by jurisdiction

Step 2: Updated Household and Person-Level Weighting Variables

PUMA

21 dimensions

Income (5), Size (5), Workers (4), Vehicles (4), Presence of Children (2), Total Households (1)

PUMA

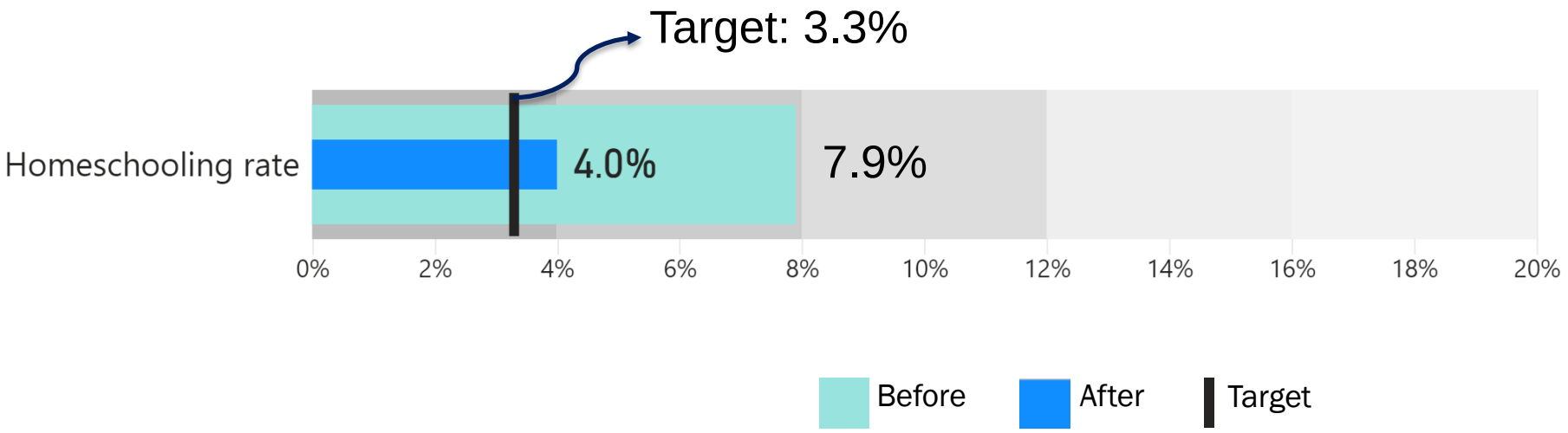
REGION

25 dimensions

Gender (2), Age (7), Working Status (2), Student Status (2), Race/Ethnicity (5), Area Type (5), Total Person (1)

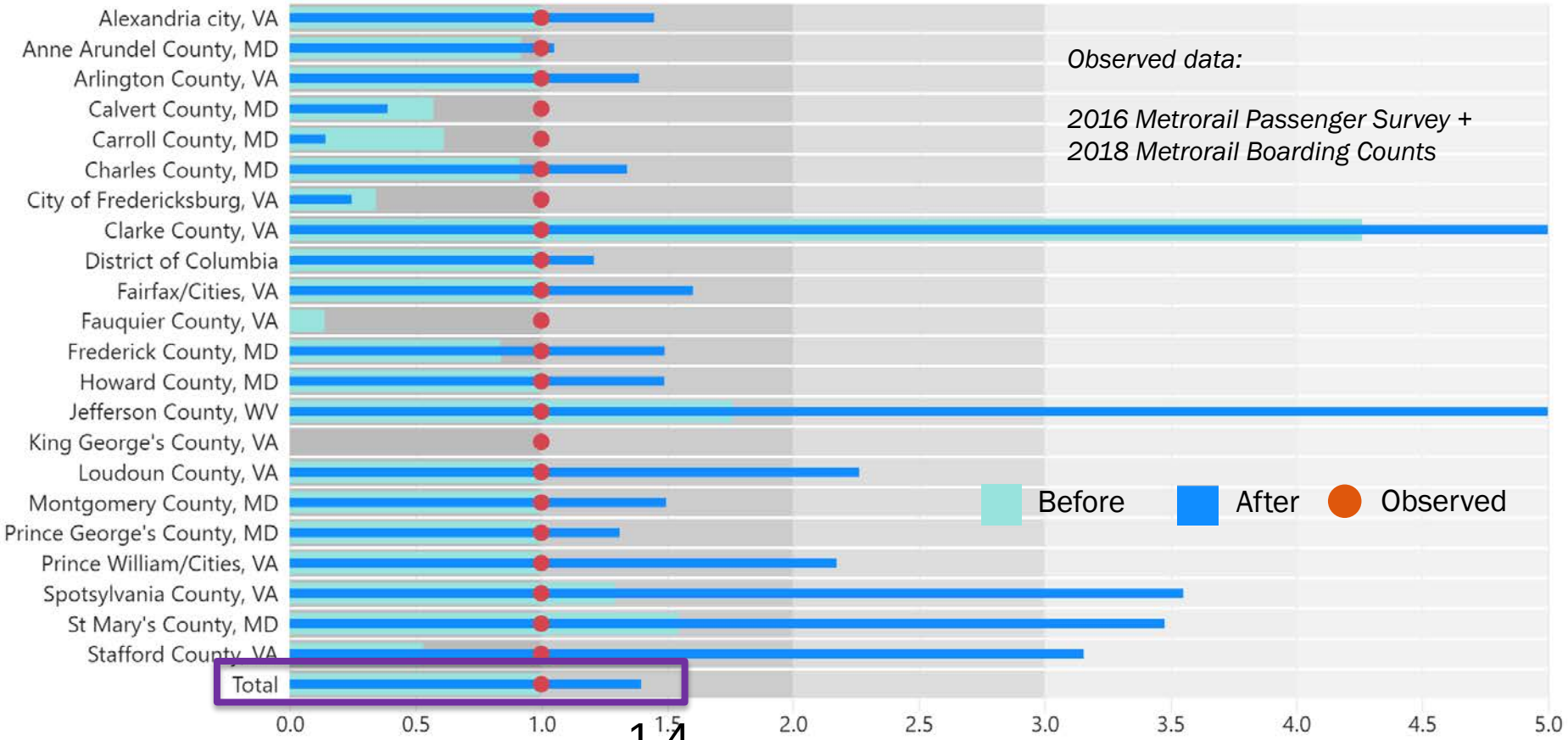
Homeschooling (1)

Improved Homeschooling Rate after the Reweighting



Issue 3: Overestimation of Metrorail Ridership after the Reweighting

Ratio of Average Weekday Metrorail Trips by Residence to the Observed



1.4

Updated Household and Person-Level Weighting Variables

PUMA

21 dimensions

Income (5), Size (5), Workers (4), Vehicles (4), Presence of Children (2), Total Households (1)

PUMA

REGION

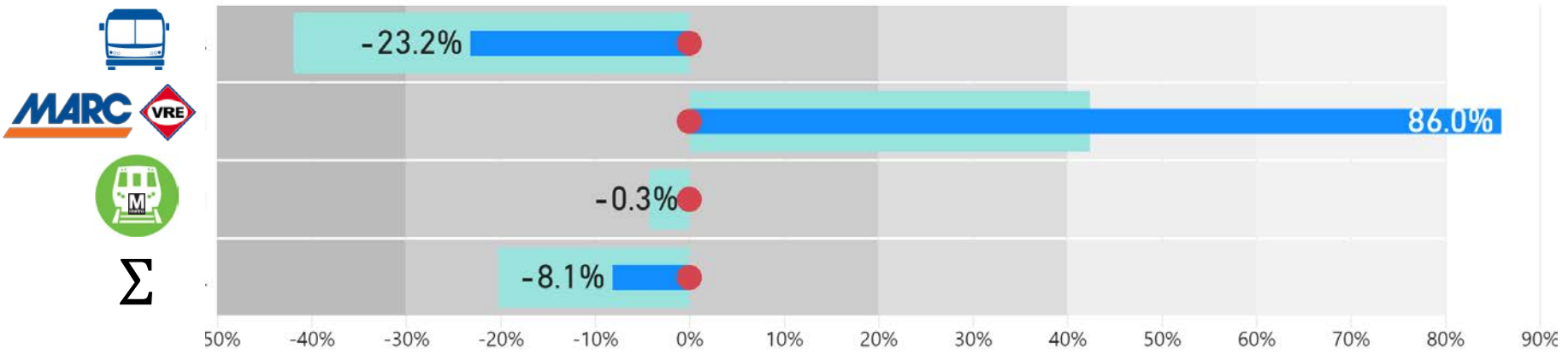
29 dimensions

Gender (2), Age (7), Working Status (2), Student Status (2), Race/Ethnicity (5), Area Type (5), Total Person (1)

Homeschooling (1), Metrorail rides (4)

Issue 4: Underestimation of Bus Ridership and Overestimation of Commuter Rail Ridership after the Reweighting

Difference (in Percentage) between Average Weekday Metrorail Trips by Residence and the Observed



Observed data:

Bus: *Regional Transportation Data Clearing House (RTDC)*
Commuter rail: *2016 MARC On-Board Survey, VRE 2019 On-Board Survey, VRE October 2018 Station Boarding*
Metrorail: *2016 Metrorail Passenger Survey*

Updated Household and Person-Level Weighting Variables

PUMA

21 dimensions

Income (5), Size (5), Workers (4), Vehicles (4), Presence of Children (2), Total Households (1)

PUMA

REGION

36 dimensions

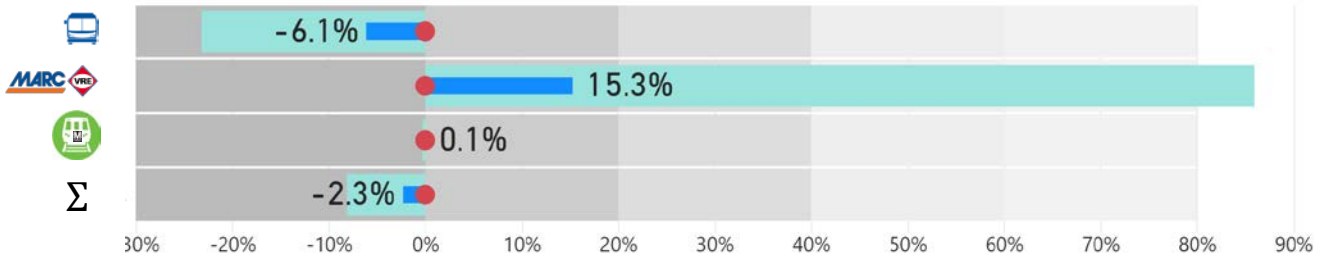
Gender (2), Age (7), Working Status (2), Student Status (2), Race/Ethnicity (5), Area Type (5), Total Person (1)

Homeschooling (1), Metrorail rides (4), Commuter rail rides (3), Bus trips (4)

Importance Values Set for Commuter Rail and Bus Variables: Sensitivity Testing

Scenario 1:

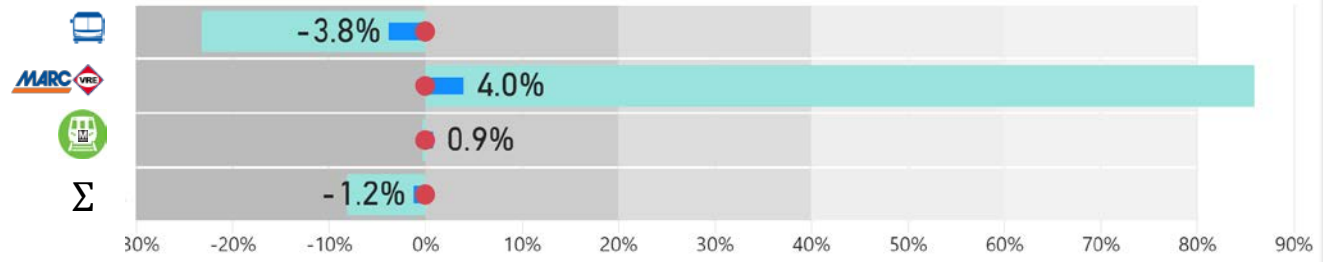
MARC 20,000



Scenario 2:

MARC 200,000

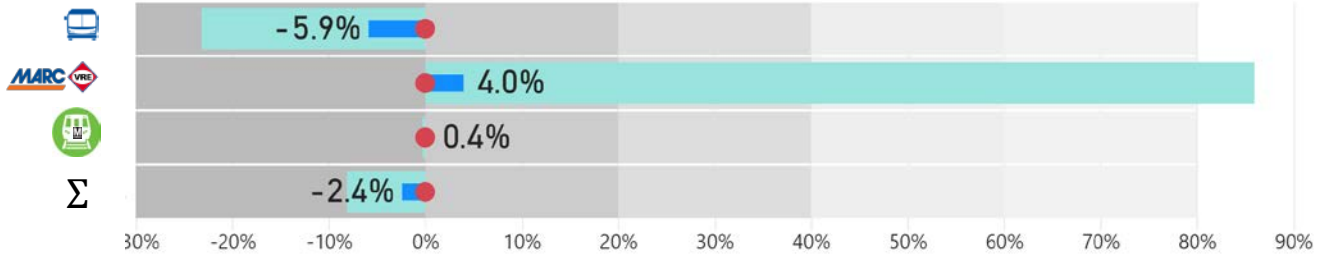
VRE 100,000



Scenario 3:

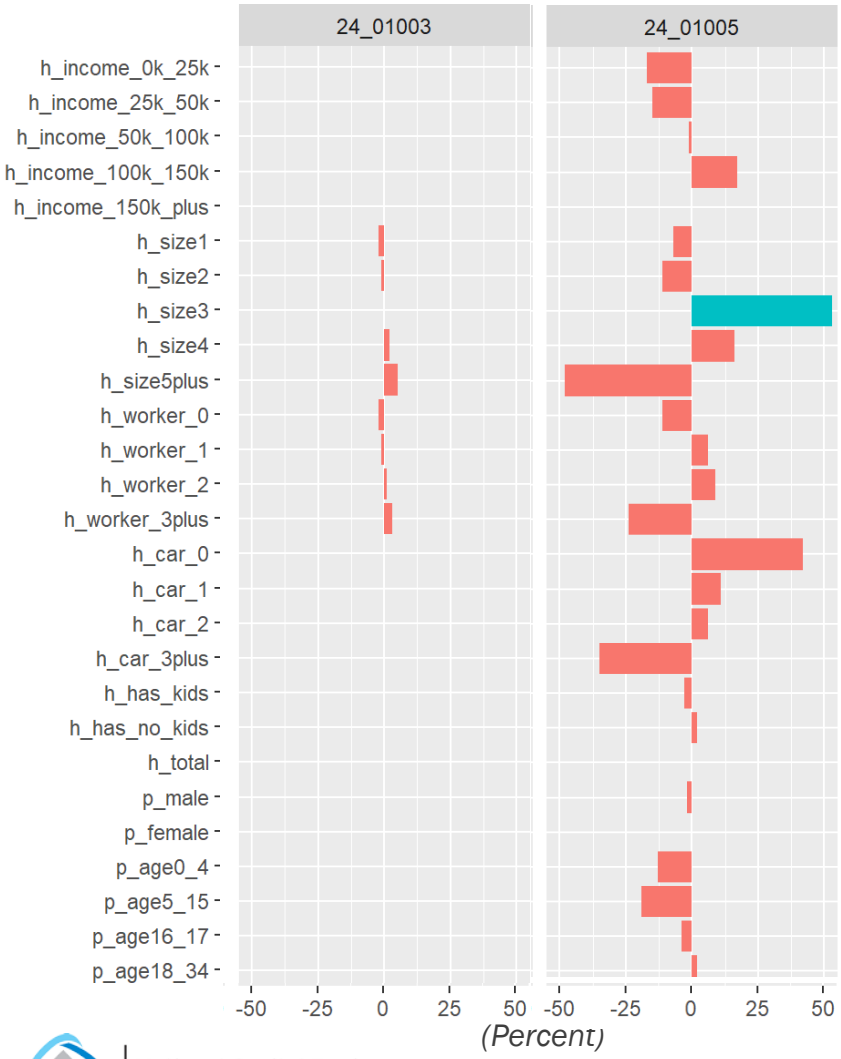
MARC 200,000

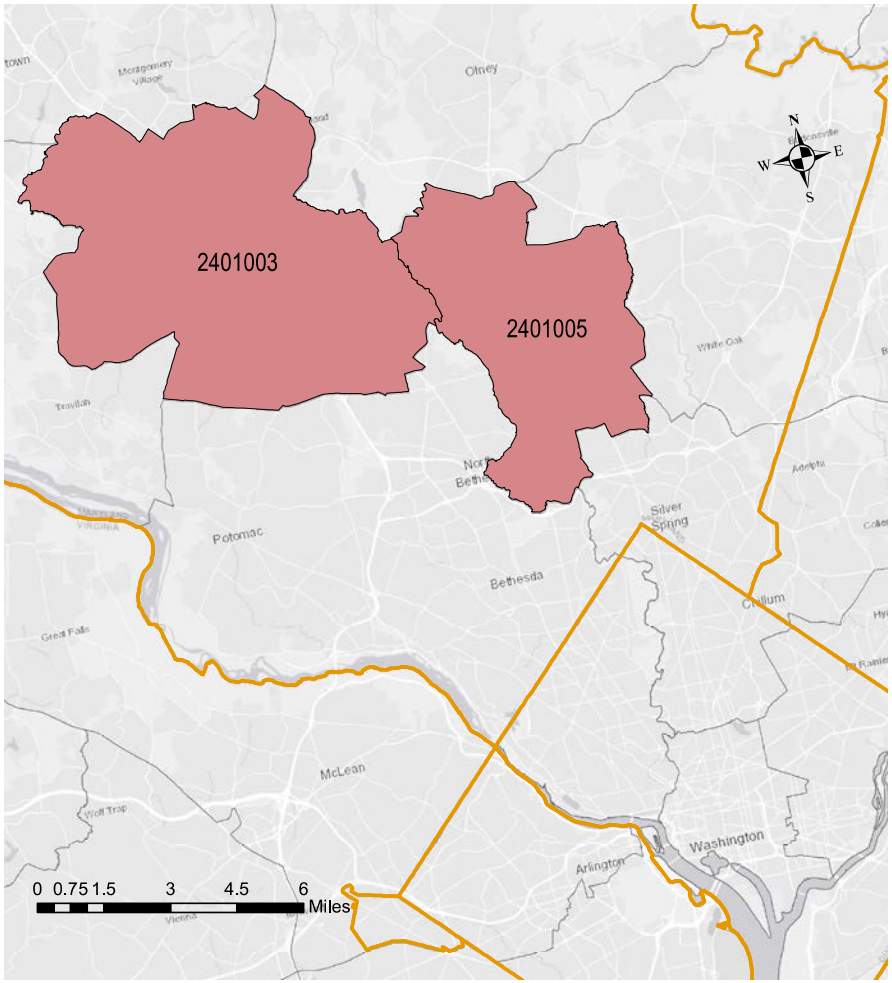
VRE 100,000



Before After Observed

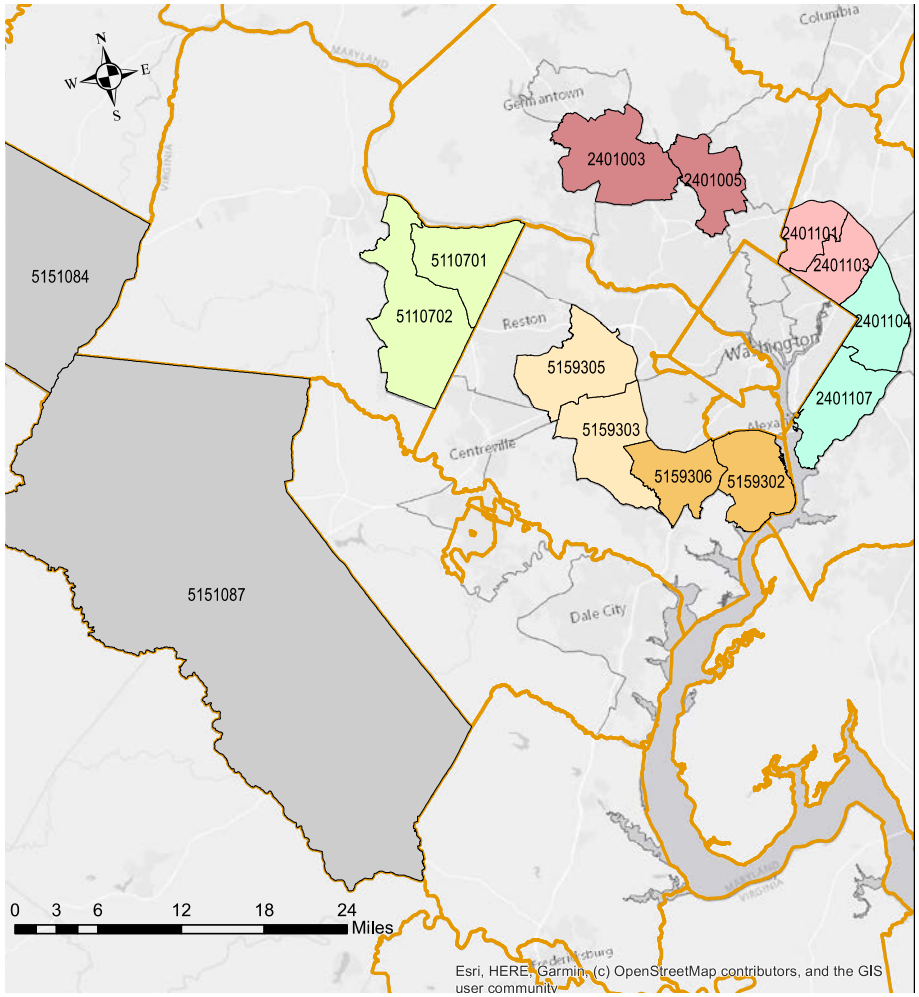
Issue 5: Differences with Targets at PUMA Level





PUMA Consolidation

7 combined PUMA sets



Final Reweighting Round

PUMA

21 dimensions

Income (5), Size (5), Workers (4), Vehicles (4), Presence of Children (2), Total Households (1)

PUMA REGION

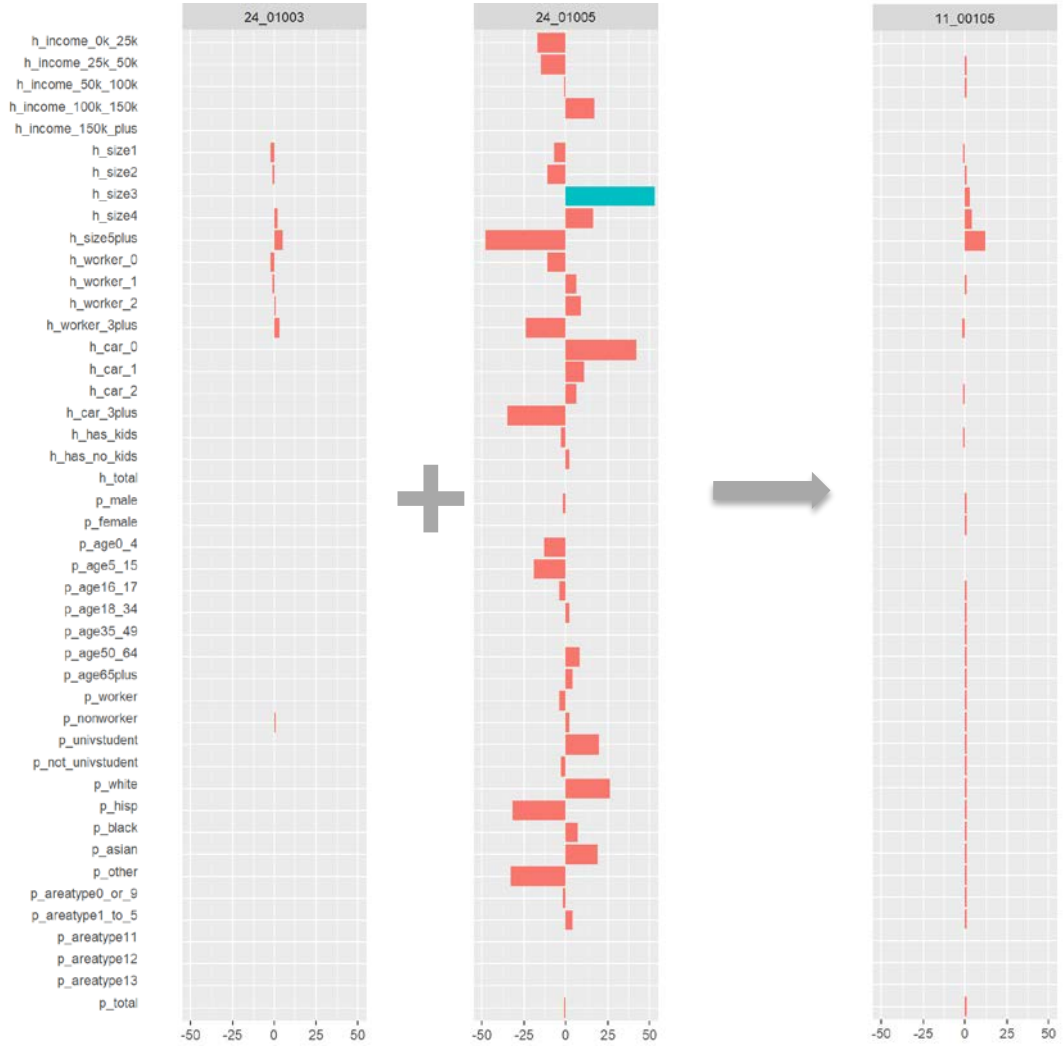
36 dimensions

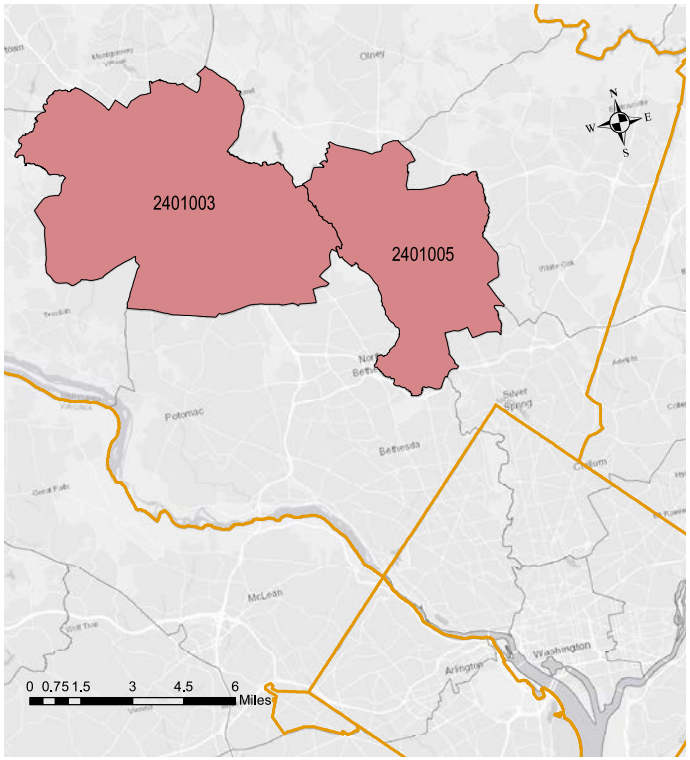
Gender (2), Age (7), Working Status (2), Student Status (2), Race/Ethnicity (5), Area Type (5), Total Person (1)

Homeschooling (1), Metrorail rides (4), Commuter rail rides (3), Bus trips (4)

7 combined PUMA sets

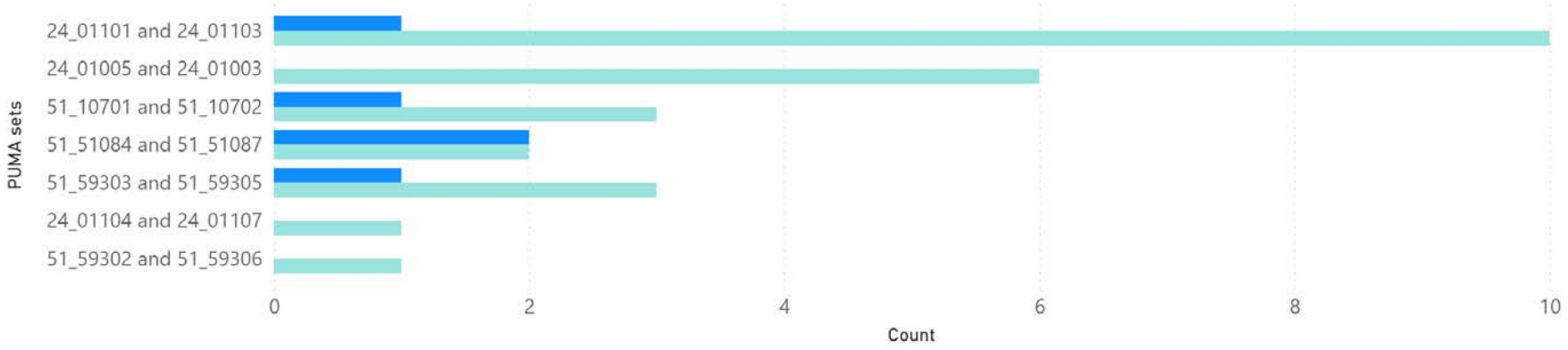
Comparison with Targets at PUMA Level



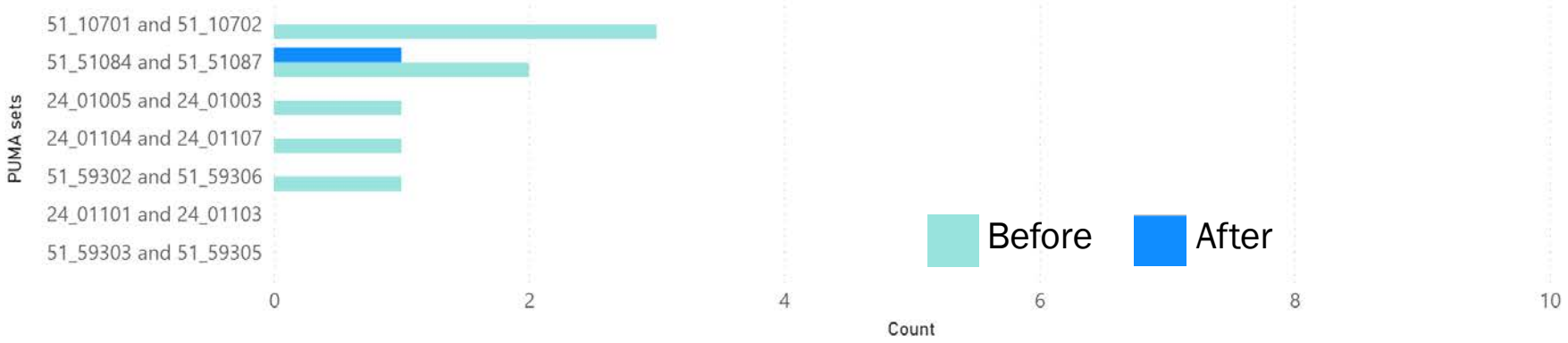


Comparison with Targets at PUMA Level

Count of Variables with >25% and <50% Difference from Target

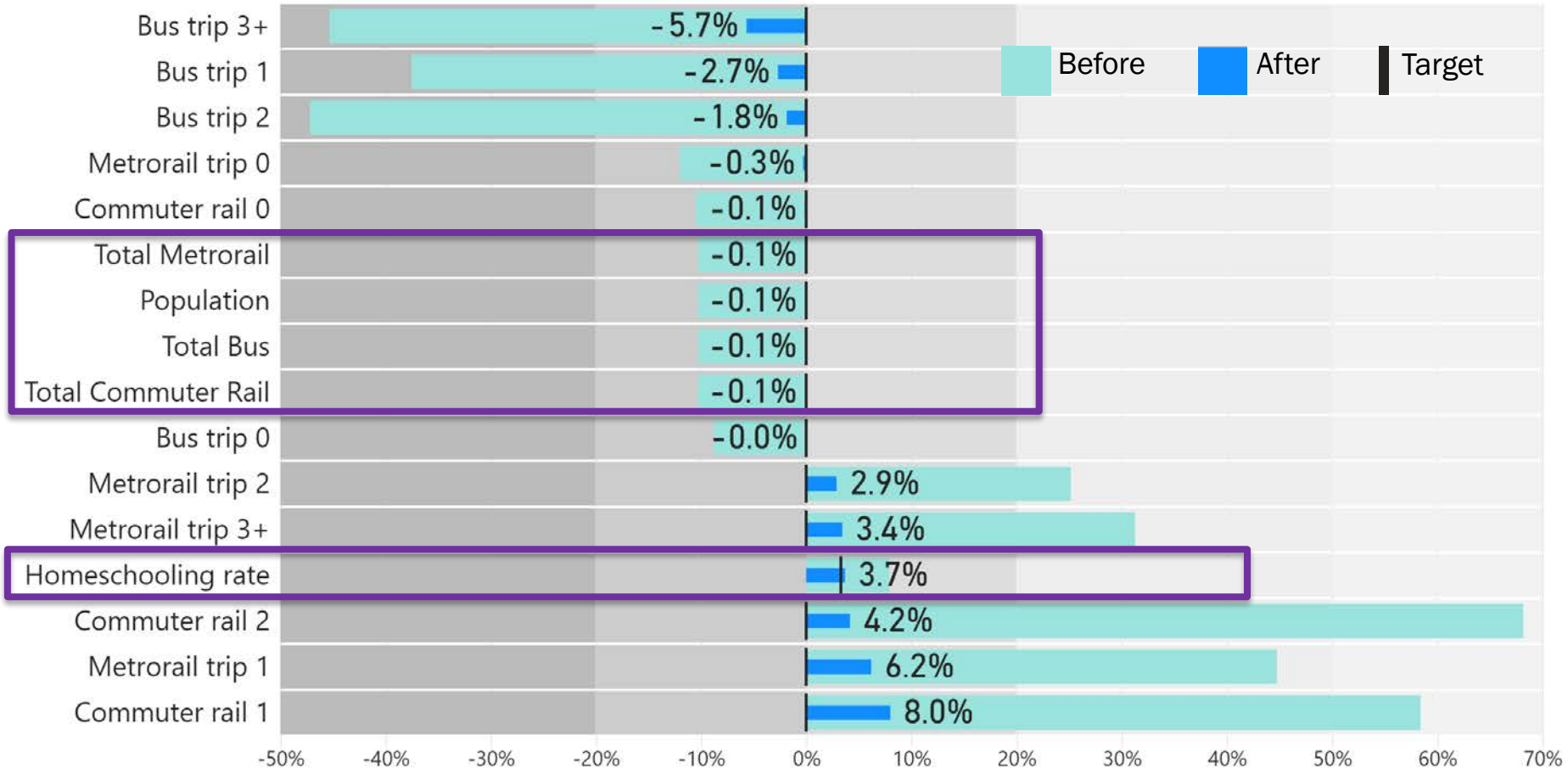


Count of Variables with >=50% Difference from Target



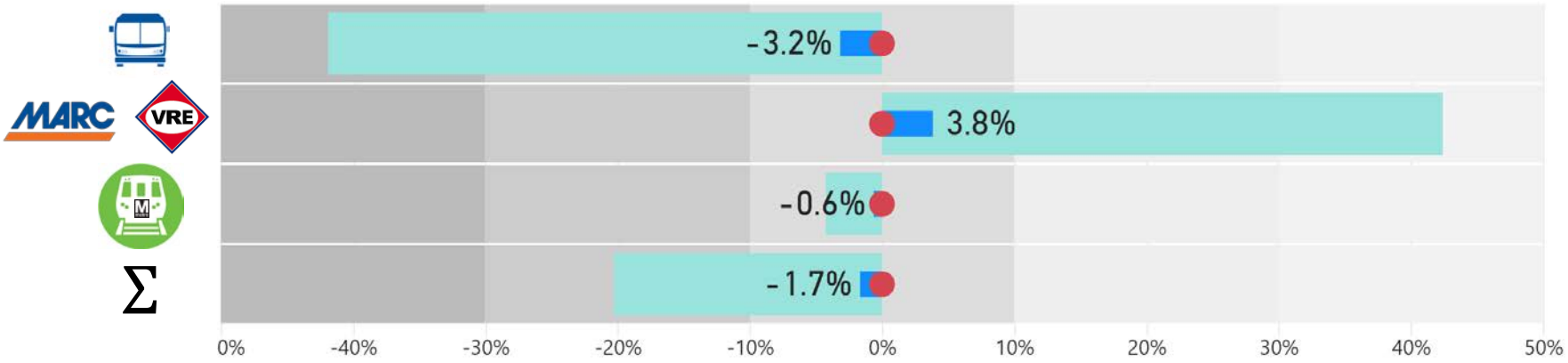
Comparison with Controls

Difference in Percentage (except Homeschooling Rate) from Key Variables to Their Targets



Comparison with the Observed Transit

Difference (in Percentage) between Average Weekday Metrorail Trips by Residence and the Observed



Observed data:

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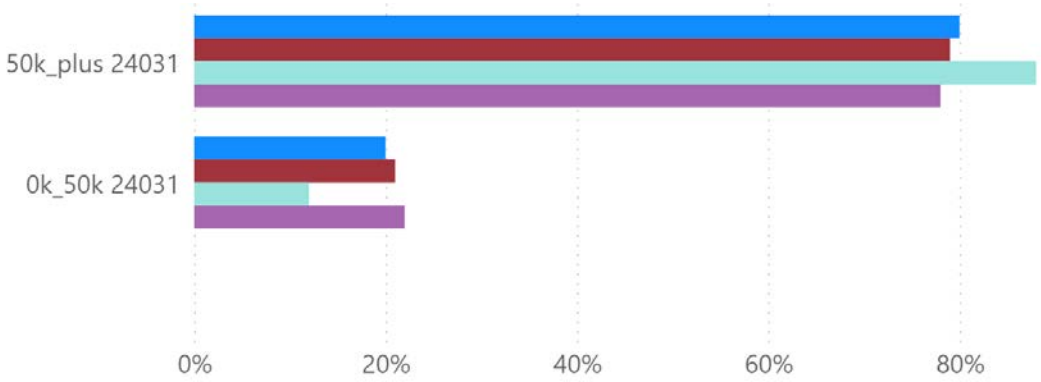
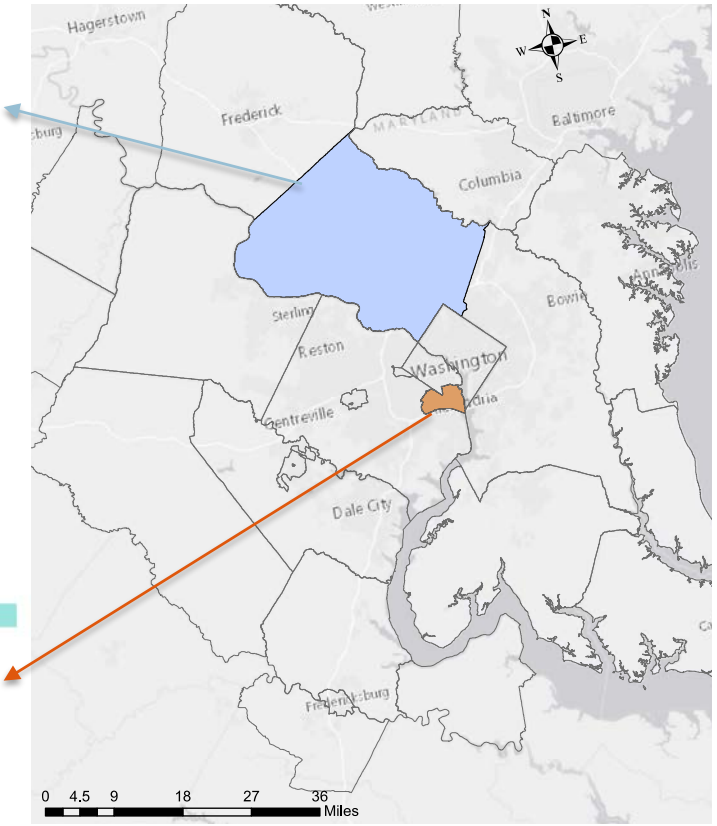
Metrorail: *2016 Metrorail Passenger Survey*

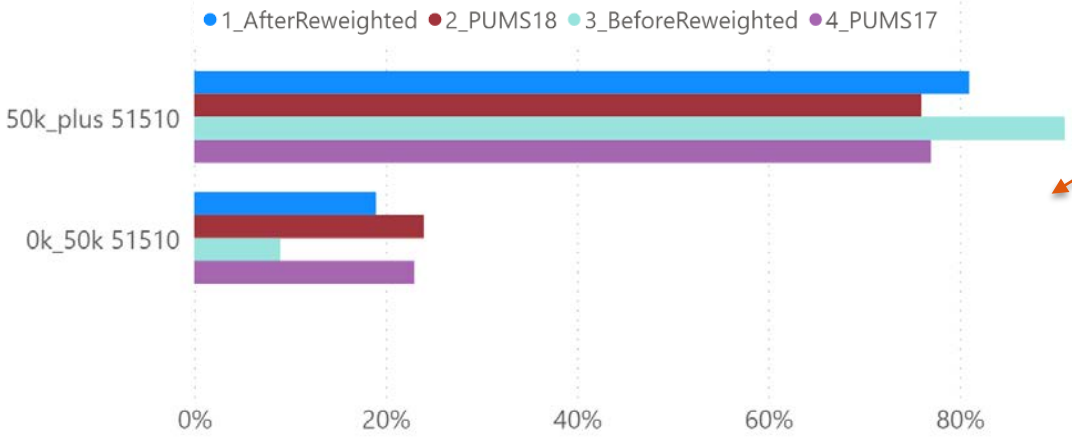
Income Comparison with PUMS Data

Household Income Share Comparison for Montgomery County, MD



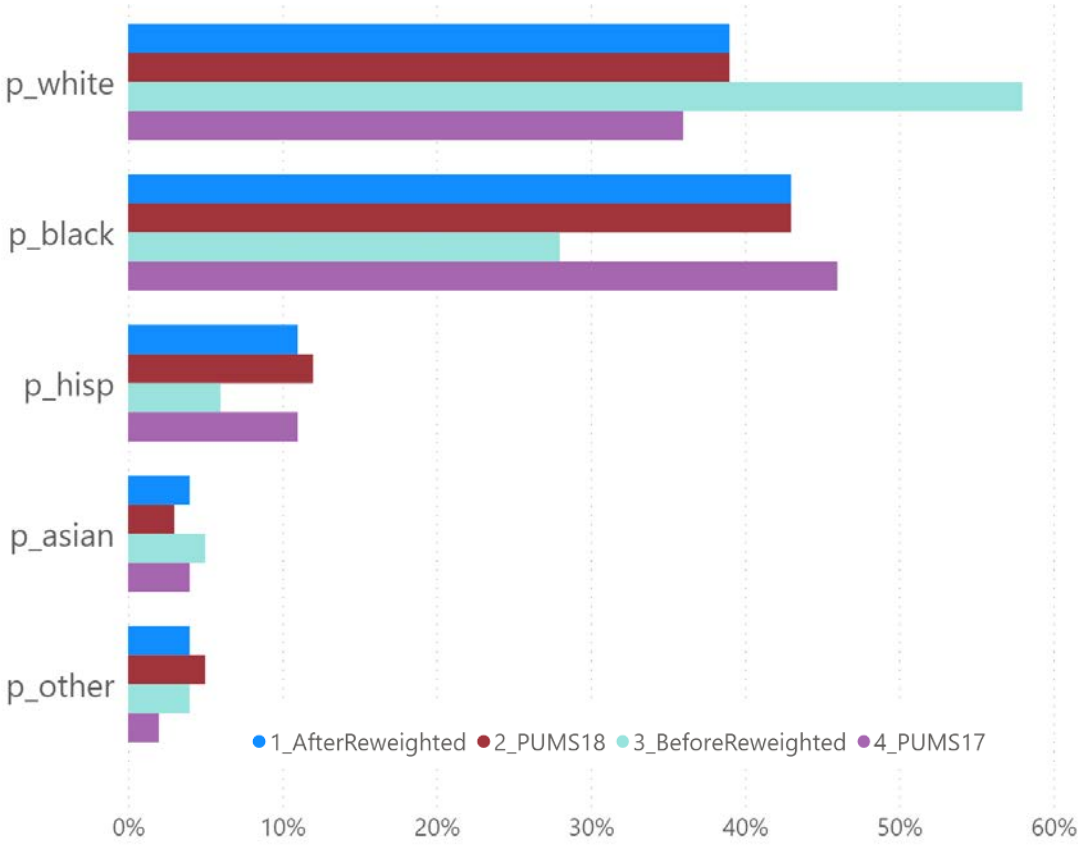


Household Income Share Comparison for Alexandria, VA



Race/Ethnicity Comparison with PUMS Data

Race/Ethnicity Share Comparison for Washington DC



Summary

Issues	   MARC VRE  *Source: https://www.familyeducation.com*
Solution	ActivitySim/ **populationsim** An Open Platform for Population Synthesis  + **PUMA Consolidation**
Results	 IMPROVEMENT  **The Gen3, Phase 1 Travel Model**

Acknowledgements

- Feng Xie (COG)
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- Mark Moran, Tim Canan (COG)
- Sanghyeon Ko (COG)

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