Changes in MBTA Bus Ridership

Lily Ko
UEP 232 Intro to GIS
May 2018

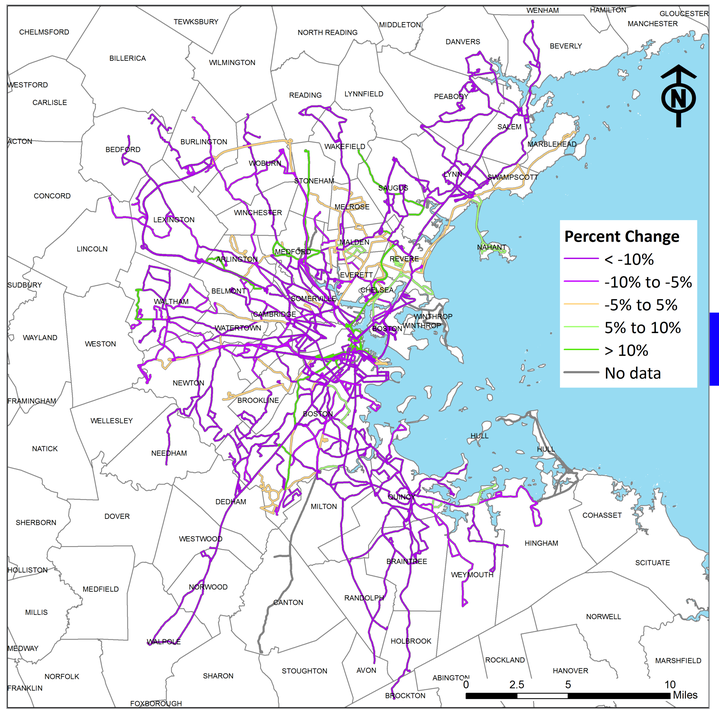
Sources: MassGIS, U.S. Census Bureau, Hubway, Mass.gov, MBTA OPMI
Photos Credit: James Hardison
Projection: NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001
Geographic Coordinate System: GCS_North_American_1983
Contact: lilytko@gmail.com

Introduction

Public transit ridership has been falling in nearly all U.S. cities. National trends have shown a steady decrease for the past few years, and that it is generally worse for bus ridership than rail ridership. The Massachusetts Bay Transit Authority (MBTA) has experienced both increases and decreases in bus ridership, but overall, bus ridership is down to 2014 levels. There has been a wide range of speculation from transit agencies and transportation specialists as to why this is occurring, including and not limited to: lower fuel costs, higher car ownership, increased use of bikeshare and ride-hailing services, increased telecommuting, and fare increases. In Fall 2017, the MBTA reported findings on correlations between ridership change and several factors: ridership characteristics, quality of service, reliability of service, percent minority, length of trip, and bus only vs transfer trips. They called for research on spatial changes in the region and competition from other modes. This project explored changes in commute-related variables that may or may not be spatially and temporally correlated with bus ridership changes for the MBTA. Four of the variables are shown here: Number of Hubway trips, number of ride-hailing trips per person, percent of commuters who drive or carpool, and percent of commuters who bike.

A huge thank you to Kyle Monahan (Tufts), Barbara Parmenter (Tufts), Carolyn Talmadge (Tufts), and Ian Thistle (MBTA) for their help with this poster.

MBTA Bus Ridership Change 2013 to 2017



Methods

The main goal was to overlay bus ridership changes on top of changes in commute-related variables. I gathered the following tabular datasets: 2006-2010 to 2012-2016 ACS 5-year estimates for Means of Transportation, and ACS 5-year estimates for Number of Vehicles per Household; (June) 2016 and 2017 Hubway trips; and the 2017 total ride-hailing trips per person. I also received a tabular dataset from the MBTA with the percent of bus route change between 2013 and 2017. Two census variables (2007-2011 to 2015-2016) are shown here due to the space limitation. The bus ridership change (large) map joined the bus route changes with the MBTA bus routes arc. The ACS 5-year estimates are broken out by census tracts. For the commute-related variables maps (below), I mapped the change between each set of ACS years (2006-2010 to 2012-2016), and the change between non-overlapping years (2007-2011 to 2012-2016). I collated the estimates into one spreadsheet tab using array formulas, calculated percent of total for each variable, and then calculated the percent change between each set of years. I also calculated the coefficient of variation from the margin of error. The data was ***highly unreliable*** for several of the census variables, including biking. I was unable to show changes in bus ridership overlaid with these maps due to limitations in data availability for bus ridership changes, but largely because of the challenge in dealing with changes with overlapping 5-year estimates, rather than changes from one year to the next.

Why is bus ridership decline important?

Bus ridership decline is potentially the most harmful to dependent riders who tend to be from low-income and immigrant populations, as well as communities of color. Declines in bus ridership lead to a decrease in farebox recovery, which is likely to lead to fare increases and reduced service.[1] This is a cyclical problem, as fare increases and reduced service leads to lower ridership, and lower ridership leads to more fare increases and reduced service.[1]

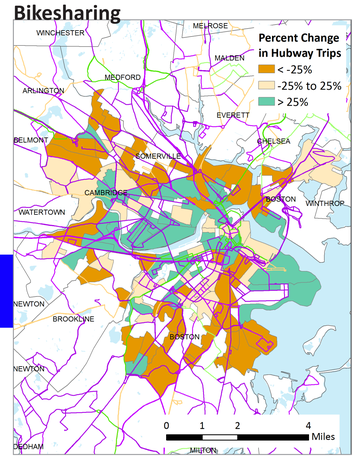
[1] Siddiqui, F. (2018, March 24). Falling transit ridership poses an 'emergency' for cities, experts fear. Washington Post. Retrieved from https://www.washingtonpost.com/

Discussion

There did not appear to be a spatial and temporal pattern and correlation with bus ridership patterns and the commute-related variables. Because of overlapping bus routes, it's difficult to view changes for the entire network at once since overlapping routes may include both increases and decreases in ridership. For instance, parts of route 39 are overlapped by several other routes. However, zooming into route 39 did not reveal further patterns. For the census data, this is not surprising as they are 5-year estimates and bus riders are generally a small percentage of the population in any census tract. Additionally, there is no way to account for people who take bus routes far away from their census tract (e.g., in the case of transfers). However, beyond this project, the tabular datasets will be added to a regression analysis to determine which factors are most statistically correlated with bus ridership changes.

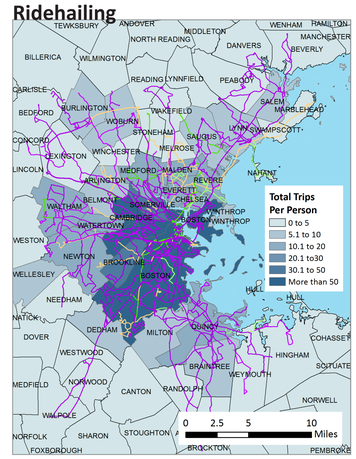
What May Be Correlated with Bus Ridership Changes?

Bikesharing



This map shows the percent change in the number of Hubway trips starting in each census tract, overlaid with changes in bus ridership. I used Excel to calculate the number of trips for each start station, removed duplicate start stations, combine the 2016 and 2017 data, and calculate the percent change. I performed a spatial join to connect census tracts and Hubway stations (plotted with latitude and longitude), which had the trip data. There doesn't appear to be a spatial correlation between bus ridership changes and the number of Hubway trips. Both increases and decreases in bus ridership occur in places where there are both increases and decreases in Hubway trips.

Ridehailing



This map shows the total number of ride-hailing trips taken per person by municipality, overlaid by changes in bus ridership. I joined the trip data with polygons of MA towns. Because data from transportation network companies (TNCs), like Uber or Lyft, were only mandated in Nov. 2016, data is only currently available for 2017 and temporal changes cannot yet be shown. The volume of ride-hailing trips appear to get higher inside of the Boston-area core, whereas bus ridership increases and decreases occur both inside and outside the core. The ride-hailing data needs to be much further disaggregated to see if there are patterns. TNCs are reluctant to share their data, so this demonstrates why we need stronger legislation demanding it.

Zoom into Route 39

Change in Percent of Commuters
- < -3%
- -3% to 3%
- > 3%
- Null

Change in Percent of Commuters
- < -3%
- -3% to 3%
- > 3%
- Null

0 0.5 1 2 Miles

These maps shows changes over time by census tracts near bus route 39.

2007-2011 to 2008-2012 | 2008-2012 to 2009-2013 | 2009-2013 to 2010-2014 | 2010-2014 to 2011-2015 | 2011-2015 to 2012-2016 | 2007-2011 to 2012-2016