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Recovering from the Great Recession: Understanding Change in Assessed Value in Boston's Neighborhoods

Introduction

Boston, like most other cities, was impacted by the housing bubble and general economic growth in the mid-2000s, as well as the Great Recession in the late 2000s, after which economic conditions have been improving, at least by some measures.¹ For the purposes of this project, these periods can be defined roughly as follows: “growth,” between 2000 and 2007; “crash,” between 2007 and 2011; and “recovery,” between 2011 and 2015. The values of properties in Boston as assessed by the City of Boston over the time period from 2000 to 2015 and compiled into the longitudinal tax assessor’s dataset reflect these periods of economic growth and decline. Although most properties throughout Boston experienced value fluctuation in one or more of these periods, it is likely that neighborhoods were impacted to different degrees and over different time scales. Using longitudinal tax assessor’s data, we have the ability to investigate where, to what degree, and when change occurred at different spatial resolutions, from the parcel to the neighborhood levels.

In addition, access to this longitudinal, parcel level dataset allows us to look at the relationship between changes in value and the presence or absence of other factors that could have influenced the degree and timing of change in areas of Boston. These factors include access

¹ Gavel, Doug. “Boston on the Rebound.” September 23, 2015. <http://www.hks.harvard.edu/news-events/news/articles/boston-on-the-rebound>

to public transportation, median income, presence of commercial districts, owner occupancy rates, property renovations, and others.

This project explores whether change in assessed value in the first half of the recovery period (2011 to 2013), as well as other measures, including census data, are related to change in assessed value in the second half of the recovery period (2013 to 2015) and whether these relationships vary across space. In addition, I will investigate whether particular areas of the city recovered (as measured by increase in assessed value) earlier or later than other areas and whether the recovery trends in areas of the city were sustained or short lived.

Methods

The longitudinal tax assessor's dataset contains parcel-specific data from Boston's Assessing Department for the more than 168,000 uniquely identifiable parcels in the city for the years 2000-2015. For each year and parcel, the dataset contains information about land use, assessed property value, and whether the property was owner-occupied. The dataset also contains additional information about the location of the parcel.

These fields were used to construct, using the programming language R, variables aggregated to the census block group level for the percent change in value from year to year for the years 2010 to 2015 and for two longer periods of time: 2011 to 2013 and 2013 to 2015. Using the tax assessor's dataset, I also calculated the proportion of residential parcels in each block group in 2011 that were owner occupied, as well as the proportion of residential parcels that were condos. 2013 five-year American Community Survey variables of interest at the block group

level were downloaded from the US Census Bureau American FactFinder website² and merged with change in assessed value variables. Various R packages³ were used to create graphs and maps of the data.

The *rcorr* function in R was used to explore correlations between change in assessed value variables and census data, and the *lm* function was used to run a linear regression to more rigorously evaluate relationships between these variables.⁴ Geographically weighted regression⁵ was used to investigate whether there was spatial variation in the relationships between variables.

Finally, the median percent change in value for the two periods (2011 to 2013 and 2013 to 2015) was used to classify block groups into four “recovery types”: High-High, block groups with above median percent change in both periods; Low-Low, block groups with below median percent change in both periods; and High-Low and Low-High, block groups with below median percent change in one period and above median percent change in the other.

Results

Median percent change in value

The median percent change in value across block groups from year to year steadily increased between 2011 and 2015 (Figure 1). There was more variation across block groups in the latter half of the recovery period, especially in 2014. This variation is illustrated in Figure 2, which shows the median percent change in value for two different block groups: one in the

² <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

³ R packages used to create figures: ggplot2, ggmap, rgdal, and sp

⁴ R packages QuantPsyc and Hmisc were also used

⁵ ESRI ArcMap software

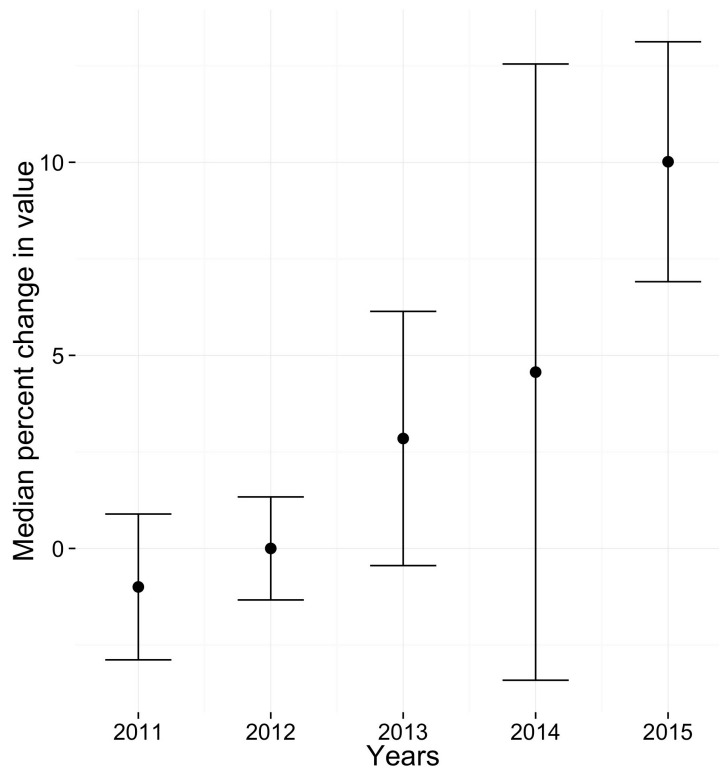


Figure 1. Percent change in value across block groups from year to year. Each point is the median across block groups of the percent change in value over the year leading up to the year indicated on the x-axis (error bars +/- one standard deviation). For example, the value for the year 2011 is the change from 2010 to 2011.

Mattapan neighborhood of Boston (blue) and another in South Boston (green). Although both neighborhoods saw little change from 2010 to 2011, between 2012 and 2013, the South Boston block group had a median percent increase of almost 7.5%, while the Mattapan block group had a median percent increase of about 1%. Although the year to year change for both block groups increased through 2015, there remained a difference between the two block groups of about 5-7%. The theme of variation in change in value between block groups will be explored further in the recovery typology work described later.

Figures 3 and 4, respectively, show the median percent change in value in each block group for 2011 to 2013 and 2013 to 2015. Despite the fact that some block groups increased in value between 2011 and 2013, as would be expected since this is considered to be the “recovery”

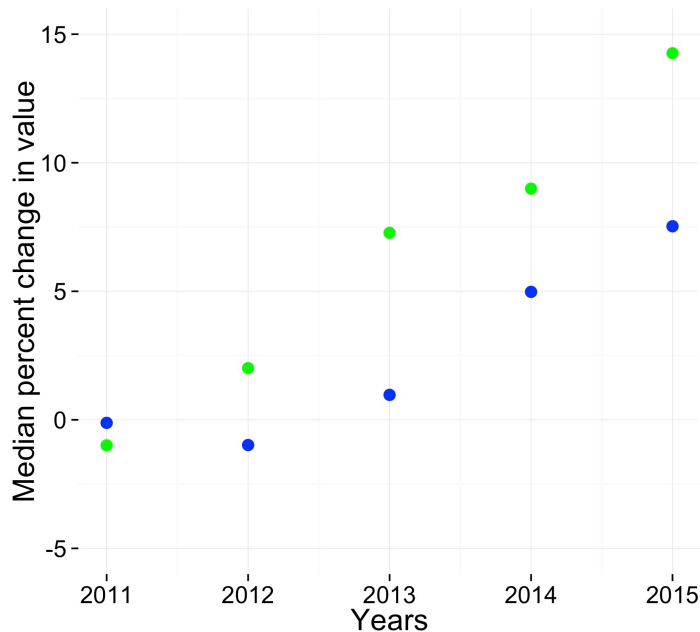


Figure 2. Percent change in value in individual block groups. Median percent change in value within each block group is shown as in Figure 1. Individual block groups were located in the neighborhoods of Mattapan (blue) and South Boston (green).

period, it is important to note that many block groups continued to decrease in value during this time period. However, by the second time period, almost all block groups are increasing in value, some very substantially.

Factors related to percent change in value, 2013 to 2015

Next, I explored whether change in value in the first half of the recovery period (2011 to 2013) was related to change in the second half (2013 to 2015). Additionally, I wanted to see whether other variables of interest (proportion of residential parcels that were owner-occupied and proportion that were condos, median household income, and proportion of residents commuting to work by transit) were related to change in the second half of the recovery period.

Results using a linear regression model (Table 1) show that proportion of residents commuting by transit and median household income have positive relationships with percent

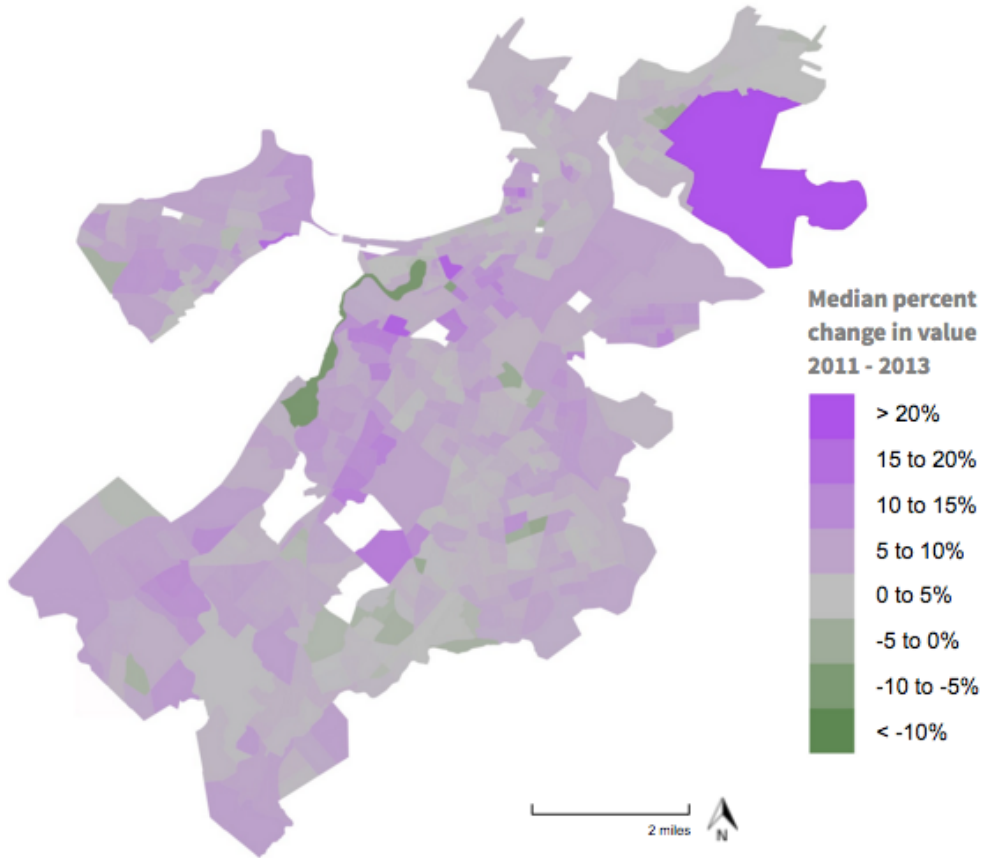


Figure 3. Median percent change by block group in Boston from 2011 to 2013. Purple indicates increase in value; green indicates decrease in value.

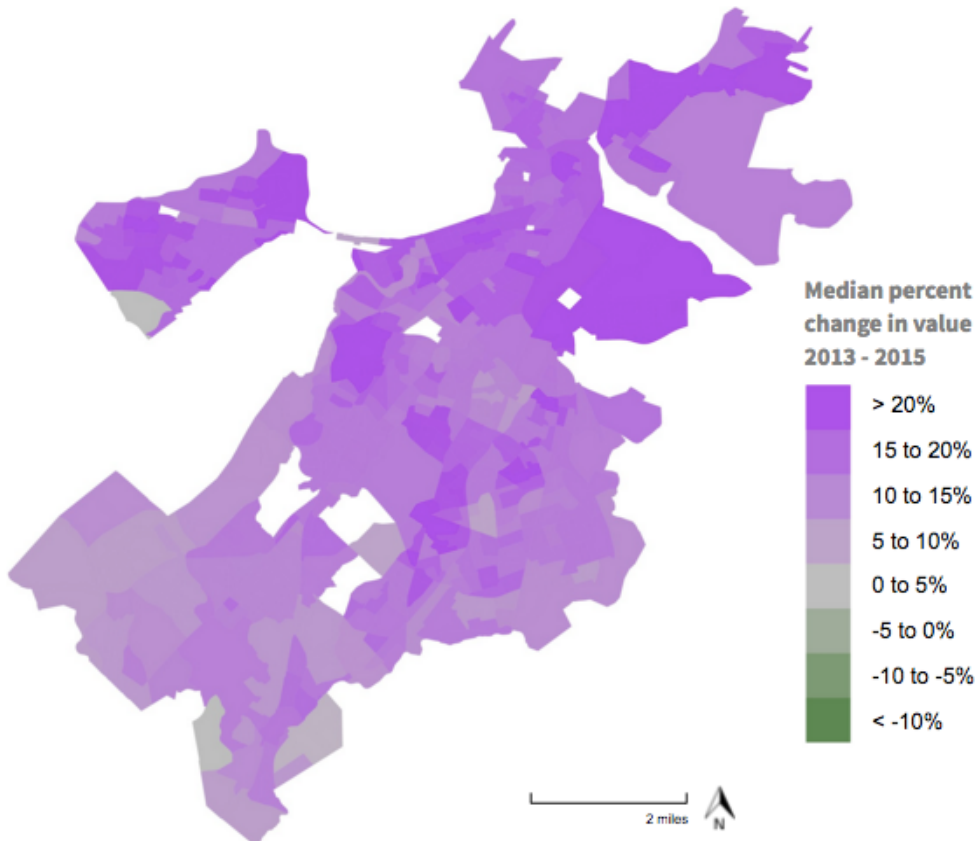


Figure 4. Median percent change by block group in Boston from 2013 to 2015. Purple indicates increase in value; green indicates decrease in value.

change in value between 2013 and 2015 ($\beta = 0.278$ and 0.213 , respectively; $p < 0.0001$).

Proportion owner-occupied residences has a strong, negative relationship with change in value ($\beta = -0.349$, $p < 0.0001$). The proportion of condos has a weaker, positive relationship ($\beta = 0.0928$, $p < 0.05$). Surprisingly, the median percent change in value in the first half of the recovery period has no relationship with the median percent change in value in the second half. These variables taken together account for 22% of the variance in the dependent variable.

A geographically weighted regression model using the same set of variables indicates that the relationships between independent and dependent variables vary across space. Overall, the fit of the model improved substantially ($R^2 = 0.57$). Coefficients for all independent variables showed some degree of variation throughout Boston; maps showing the variation in two of these variables are presented here. Proportion owner-occupied residences had a larger, more negative relationship with the dependent variable, median percent change in value, the further a block group was from downtown (Figure 5). This result may have to do with the fact that there are almost certainly higher proportions of owner-occupied residences outside of the core of the city. The coefficient for proportion of residents commuting by transit was positive in almost all cases but increased the further the block group was from a band stretching from Back Bay and Fenway

Table 1. Linear regression model output. Dependent variable: median percent change in value between 2011 and 2013. R^2 value: 0.22.

<i>Independent Variable</i>	<i>Coefficient</i>	<i>Standardized Coefficient</i>	<i>P-value</i>
Median percent change in value, 2011-2013	0.0367	0.0237	0.544
Proportion owner-occupied residential units	-10.0	-0.349	1.14×10^{-11} ***
Proportion condominium parcels	1.42	0.0928	0.039 *
Proportion residents commuting by transit	8.70	0.278	4.42×10^{-11} ***
Median household income	3.07×10^{-5}	0.213	1.89×10^{-5} ***

* $p < 0.05$, *** $p < 0.0001$

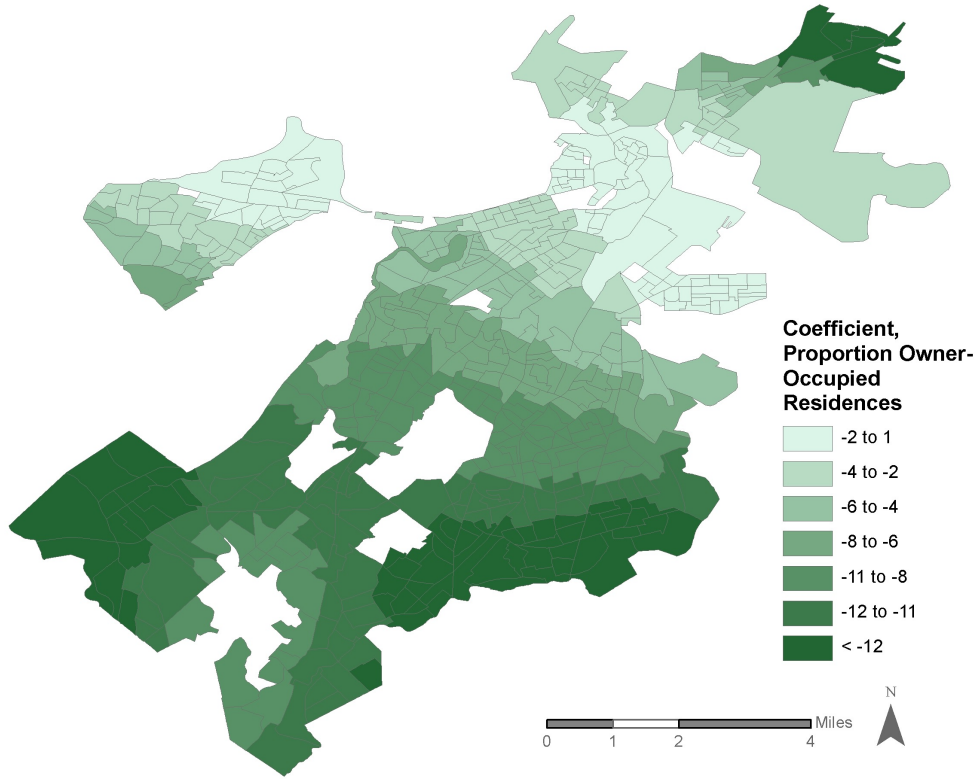


Figure 5. Geographically weighted regression coefficient for proportion owner-occupied residences. Darker green indicates more negative coefficient.

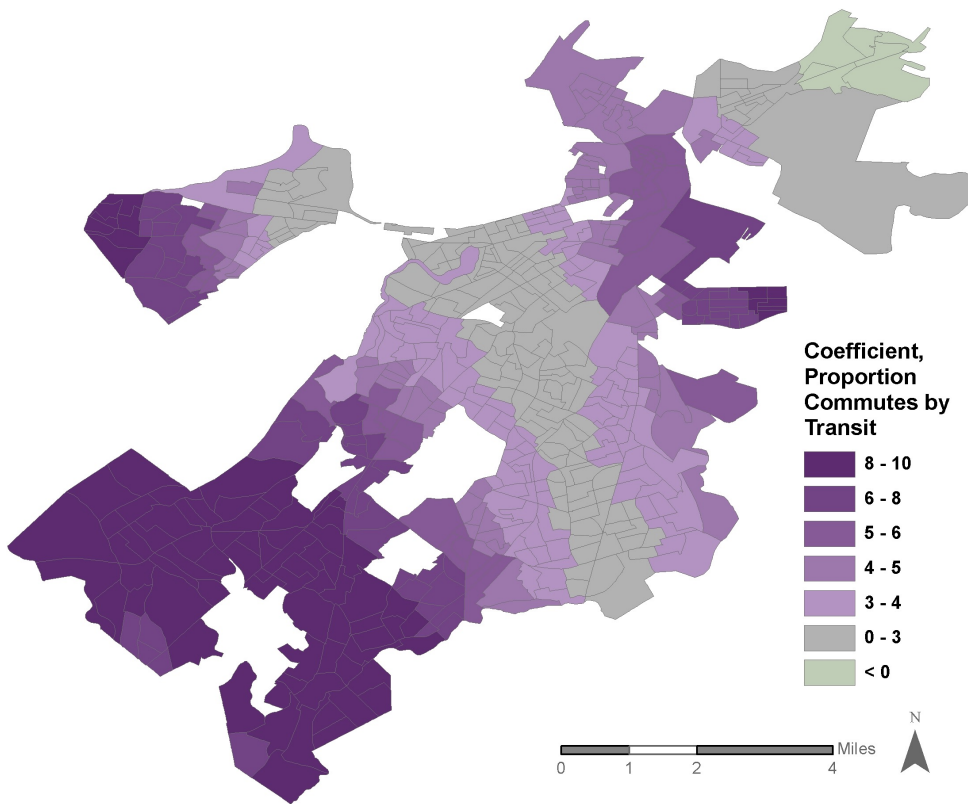


Figure 6. Geographically weighted regression coefficient for proportion residents commuting by transit. Darker purple indicates more positive coefficient.

through Roxbury to South Dorchester (Figure 6).

Recovery typology

Block groups were found to recover at different times and to different extents during the recovery period(Figure 2). When, in a regression model with other independent variables, the relationship between change in the first half of the recovery period was compared to change in the second half, there was found to be no relationship between the two. To further examine whether individual block groups had different patterns of recovery, block groups were grouped into each of four recovery types: High-High, block groups with above median percent change in both periods; Low-Low, block groups with below median percent change in both periods; and

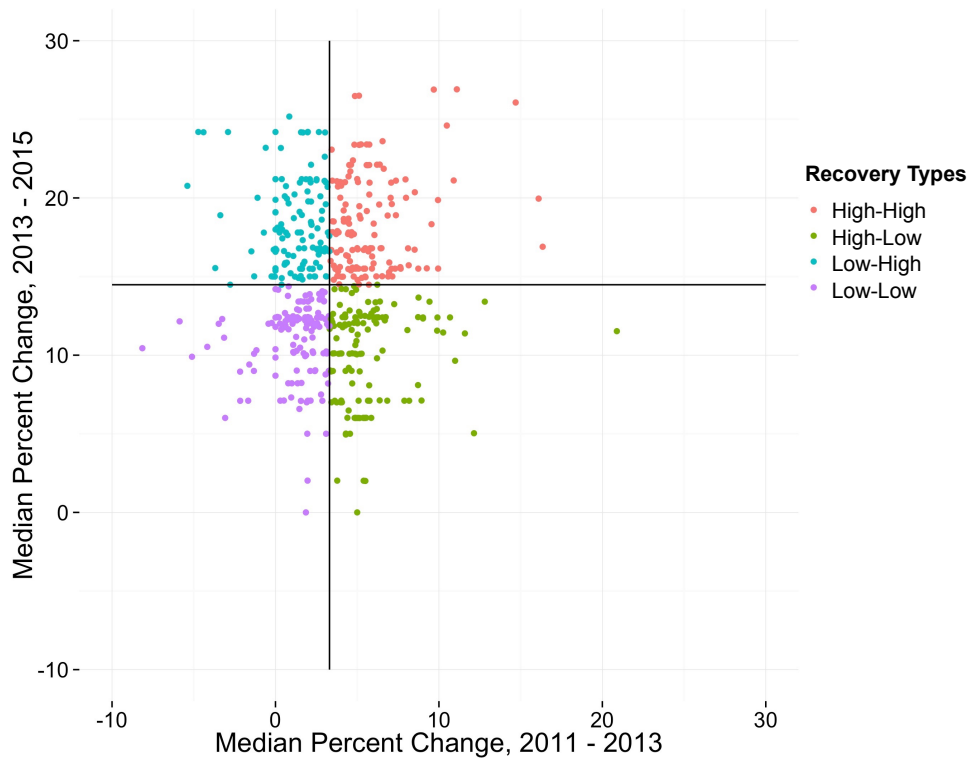


Figure 7. Median percent change in period 1 (2011 to 2013) and period 2 (2013 to 2015) by block group. Color indicates each block group’s recovery type: High-High (red), High-Low (green), Low-High (blue), and Low-Low (purple).

High-Low and Low-High, block groups with below median percent change in one period and above median percent change in the other (Figure 7).

Figure 8 maps the recovery types throughout the city. Block groups that had relatively high increases in value in both the first and second halves of the recovery are clustered in the South Boston and Seaport neighborhoods, as well as through the South End, parts of Roxbury, Allston, and Brighton. Downtown Boston and parts of East Boston and Dorchester were slow to recover but had higher than median increases in value in the last half of the recovery period. Other parts of East Boston (including the block group containing the airport), as well as Jamaica Plain, Roxbury, and West Roxbury showed relatively high increases in value initially but did not

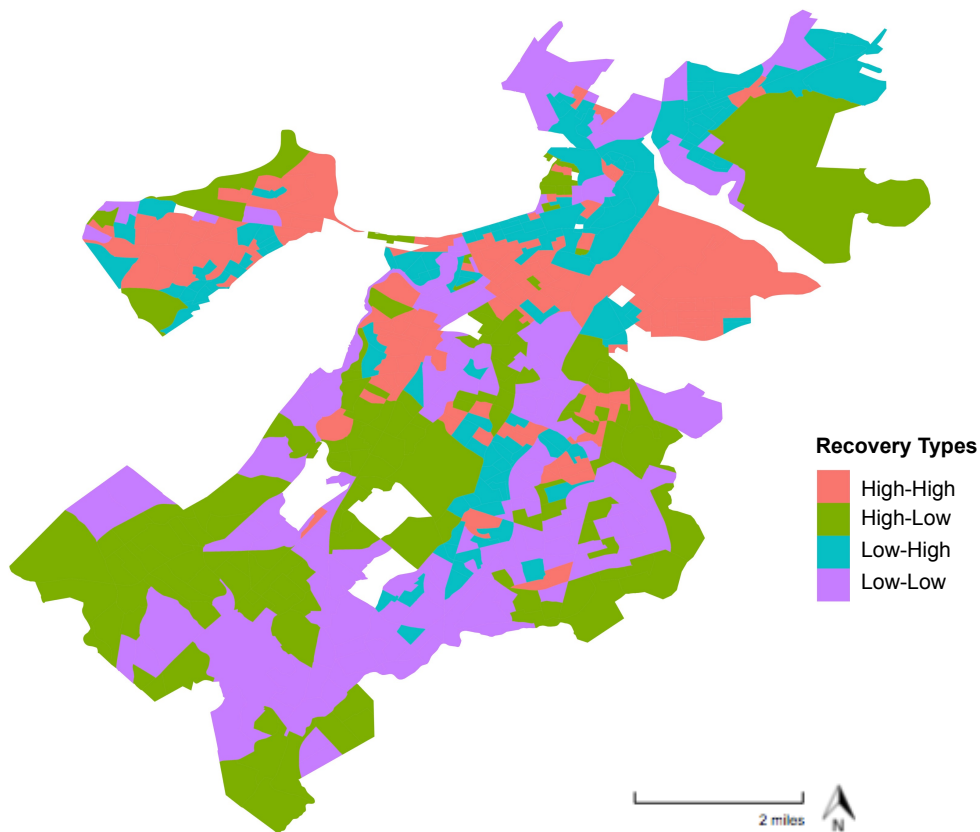


Figure 8. Recovery typology of block groups. Color indicates each block group's recovery type: High-High (red), High-Low (green), Low-High (blue), and Low-Low (purple).

maintain their lead through the second half of the recovery period. Areas scattered throughout Dorchester and Mattapan, primarily, were below median in both the first and second halves.

Discussion

Using the tax assessor's dataset, I was able to track assessed value at the block group level over time, during what we have defined to be the recovery period of 2011 to 2015. Median year to year change in value across block groups increased during this period, and by the second half of the recovery period, most block groups experienced substantial increases in value. Initial findings suggested that block groups "recovered" (increased in value) to different degrees and over different timescales.

Results from a linear regression model showed that proportion owner-occupied residences, median household income, proportion of residents commuting by transit, and proportion of residences that were condos were all, to some extent, predictive of change in value during the second half of the recovery period. Allowing the regression model to vary across space illustrated that these variables do not come together in the same way to predict change in value in all parts of the city. While it seems perfectly reasonable that areas close to downtown would be different from areas further away from downtown (for example, as suggested in Figure 5), the finding in Figure 6 is more complex and perplexing. Without more investigation, it seems likely that the proportion of transit commutes measure is, on the one hand, representing commuters who can afford to live closer to downtown (e.g., in the Fenway and Back Bay neighborhoods), where it is much more convenient to commute by transit (or walk) than drive to work, and, on the other hand, representing those who perhaps cannot afford to own a car and

have fewer commuting options (e.g., some residents of Roxbury, Dorchester, and Mattapan). Future work could incorporate a more objective measure of transit access, such as walking distance to bus or subway routes, to determine whether access to transit was predictive of change in value.

Finally, the recovery typology developed here perhaps helps to explain why there was no relationship between value change in the first half of the recovery period and value change in the second: neighborhoods across the city changed over different timescales, with some recovering early and others recovering late. Neighborhoods such as the Seaport District have been the focus of planning and development efforts for some time, which might be one reason why there was sustained growth throughout the recovery period there.

Change in neighborhoods, and particularly recovery after the Great Recession, is influenced by a number of different variables, some of which were examined here. Future research could include other variables of interest, particularly ones that city and state officials, as well as others, have some control over. When property values are increasing too quickly, as some would argue they are now in parts of the city, there may be policy solutions to limiting the factors that tend to be related to growth. Conversely, in times of economic decline, there may be policy solutions that would lead to increased growth, such as perhaps the development of new transit stations or policies that support homeowners where owner-occupancy rates are correlated with slower growth.