# Are Massachusetts Golf Courses Generally Located in Municipalities with Soaring Economy?

# Let the Ball Fly

Cartographer: Yue Wang Date: May 2020 Class: UEP 235 Advanced GIS Sources: ESRI, DataCommon, Tufts M Drive Projection: Lambert Conformal Conic

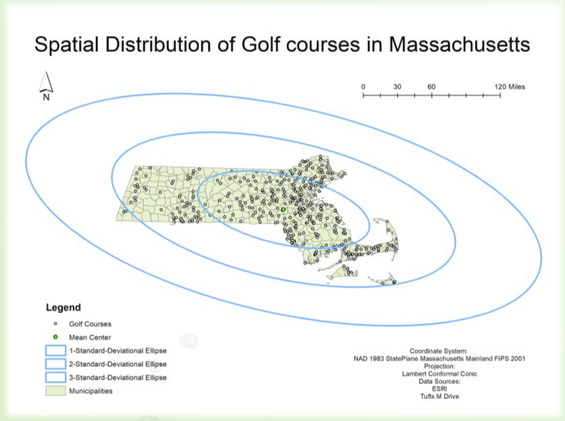


Figure 1. Spatial Distribution of Golf Courses in Massachusetts

## Introduction

As one of the most high-end sports, there is no doubt that golf is tightly related to money. Oftentimes, solely one golf course site could simply suggest wealth. Such wealth could be of the owner, or, it could be of the municipality. Whether a municipality is affluent or not can be indicated to some degree by its economic conditions. Evidence suggests that in the case of golf courses, employment and municipality finance are two major fields that can reflect how well the economy of a certain municipality is operating. Building more golf courses could boost employment in the municipality, and a brilliant example would be Algarve in Portugal, where constructing golf courses produces so much employment that it is more than most of the economic structure of this town (Correia et al. 190). Yet as for municipality finance, things might be different. One study found out that in Florida municipal golf courses, although not all golf courses, tended to have negative impacts financially on municipalities (Ingram et al. 46). In Massachusetts, there are hundreds of golf courses. According to the Alliance of Massachusetts Golf Organizations (AMGO), building golf courses has successively generated employment (14). It would be interesting and worthwhile to investigate the relationships between golf courses and the economic situation in the municipality level. This brings forward the research questions of this project:

- What is the spatial distribution of the golf courses in Massachusetts like?
- Are these golf courses clustered? If so, where are these golf courses clustered? Where are the outliers?
- How do these spatial patterns compare to those of municipalities in Massachusetts in terms of economy?

## Data Sources

***Golf Courses***

The golf course data was obtained from ArcGIS of ESRI. It was a layer package called USA Recreational Areas, including golf courses. Each and every recreational area was represented with a point, so this was a vector layer. It was last updated on June 18, 2019.

***Economy***

*Employment*

The employment data was acquired from DataCommon. The data actually had its origin in the ACS (American Community Survey). The domain of the data was people who were 16 years or older. It was 5-year data for the period 2013-2017 which was the latest on DataCommon. It was at the municipality level. It was a table in a csv file. The column that was most appropriate to use within the scope of this project was unemployment rate.

*Municipal Finance*

Similar to the employment data, the municipal finance data was acquired from DataCommon. The data had its origin in the Division of Local Services Databank from the Massachusetts Department of Revenue. It was a table in a csv file that encompassed information about municipal general fund revenue and taxes levied. It was 1-year data, as that corresponded to every single fiscal year. The data was for the fiscal year 2016 because that was the only year available for download. The most applicable column for this project was total municipal revenue.

***Municipality Boundary Map***

The municipality boundary map was obtained from the Tufts M drive. The map used was called CENSUS2010TOWNS_POLY. It represented the political boundaries in Massachusetts at the level of municipality. Each and every municipality was a polygon, so it was a vector layer.

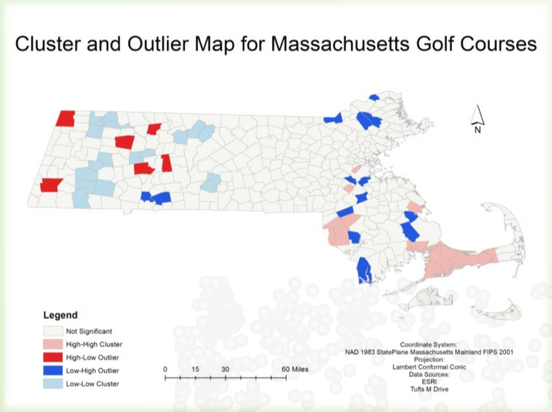


Figure 2. Cluster and Outlier Map for Massachusetts Golf Courses

## Methods

***Data Preparation***

*Geodatabase*

This project intended to use geodatabase, so this would be the first step at the preparation stage. An ArcGIS file geodatabase was created. It then imported the maps and tables needed.

*Golf Course*

As mentioned above, the golf course data was a point layer, so it was exported into the geodatabase created as a feature class.

*Municipal Finance*

It has been stated above that total municipal revenue would be used for this project. There were, however, 13 rows (which were individual municipalities) that showed 0 in this column after a data examination. Since this project would be using global Moran's I and local Moran's I, and all other municipalities had multiple digits, these 0's would definitely impact the results of these tools. As a consequence, these rows were removed from the original table.

***Spatial Analysis***

*ModelBuilder*

This project used modelbuilder to automate the processes. The following were all implemented utilizing modelbuilder unless otherwise noted.

*Centroid and Standard Deviational Ellipse*

To delineate the spatial distribution of the golf courses in Massachusetts, centroids and standard deviational ellipses were used. First, a spatial selection was carried out on USA Recreational Areas to filter out recreational areas that were not within Massachusetts. Then, since different types of recreational areas were marked with different codes, an attribute selection was done based on these codes to select only golf courses. Thus a Massachusetts golf course point layer was generated. Mean Center and Directional Distribution were then applied to find out the centroid and standard deviational ellipses (1, 2, and 3 standard deviations) of these golf courses.

*Moran's I*

For the clustering part of our research questions, it would be necessary to execute global Moran's I and local Moran's I. For golf courses, the Massachusetts golf course point layer was spatially joined to the Massachusetts municipality polygon layer so that all the golf courses were assigned to their corresponding municipalities and each municipality had a count of how many golf courses it contained. Then Spatial Autocorrelation (global Moran's I) and Cluster and Outlier Analysis (local Moran's I) could be performed. For employment, Copy Rows was first used to generate OIDs for the table. Then an attribute join was conducted on the new table and the Massachusetts municipality polygon layer based on municipality IDs so that every single municipality could have its own unemployment rate. Building on that, Spatial Autocorrelation and Cluster and Outlier Analysis were carried out. As for municipal finance, the same step could not be duplicated because in modelbuilder the join tool used above, Join Field, could not keep only matching records (which means there would still be 0's for municipalities in the polygon layer), and another tool Add Join could not have a feature class be the object to be joined to. Hence, the municipal finance table was joined to the Massachusetts municipality polygon layer outside the modelbuilder, followed by Spatial Autocorrelation and Cluster and Outlier Analysis.

## Results

Figure 1 shows the spatial distribution of the golf courses in Massachusetts. Overall, the standard deviational ellipses told us that it mainly scattered around on the Northwest-Southeast axis, which was similar to the general shape of Massachusetts.

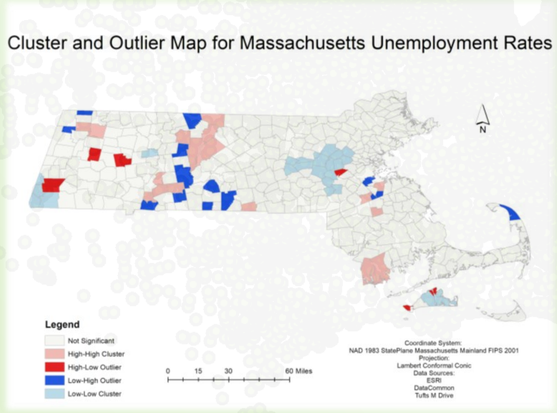


Figure 3. Cluster and Outlier Map for Massachusetts Unemployment Rates

The 1-standard-deviational ellipse incorporated golf courses that were located in central and eastern Massachusetts, the most populous areas within the state. The density of golf courses appreciably dropped to the left of this ellipse, which was the western Massachusetts region. The mean center was somewhere overlapped by central and eastern Massachusetts. As for clustering, there were indeed some areas where golf courses clustered--mainly part of Bristol County and part of Cape Cod--which were in the south of Massachusetts (Figure 2). The clusters of municipalities that had low numbers of golf courses were principally in the west of Massachusetts. There were a few outliers there that had high numbers of golf courses compared to the neighbors, and in the east of Massachusetts there were a few outliers that had low numbers of golf courses surrounded by neighbors with high numbers.

For unemployment rate, as shown by Figure 3, there were also clusters and outliers. The high unemployment rate clusters were chiefly in central Massachusetts, and most low unemployment rate outliers surrounded by high unemployment rate municipalities were here. There were a few high-high clusters in the west and south of Massachusetts as well. The low unemployment rate clusters were areas to the west of the city of Boston, those in the southwest corner of the state, and those on Martha's Vineyard. These are also regions with high unemployment rate outliers encircled by municipalities that had low unemployment rates. Lastly, the clustering situation for municipal finance was illustrated by Figure 4. The clusters with high municipal revenue were principally in the Metropolitan Boston region, in a northeast corner of the state, around Springfield, and around Worcester. The latter two were also areas that had low municipal revenue outliers that were surrounded by municipalities with high municipal revenue. The low-low clusters spread over much of the central and western Massachusetts, enclosing few outliers with high municipal revenue.

The final piece of our result analysis was to compare between these local Moran's I maps. For golf courses and unemployment rate, there was hardly any correlation at the municipality level, whether it was positive or negative. As for golf courses and municipal revenue, there was only a slight correlation in some areas in the west of the state where clusters of municipalities that had low numbers of golf courses were also those that had low municipal revenue. Overall, it is safe to say that there was barely any correlation between them, whether it was positive or negative.

## Limitations

Of course, there were limitations, difficulties, and likely errors regarding this project, besides those mentioned before. For instance, the golf course data was last updated in June, 2019, whereas our economic data was a few years before that. Some golf courses might be built after the publication dates of our economic data so there could be a delay. The two economic categories also had some restrictions about the data in that employment data was a 5-year estimate while the municipal finance data was on a specific year within this period. The municipal finance data used was municipal revenue, but it would be great if it had expenses as well. It would even be better if it contained golf-course-only finance data. In addition, the economic indicators employed in this project were very simple and straightforward due to the time constraint. There could be more comprehensive measures for municipal economies. All these areas discussed in this section can be modified for further work.

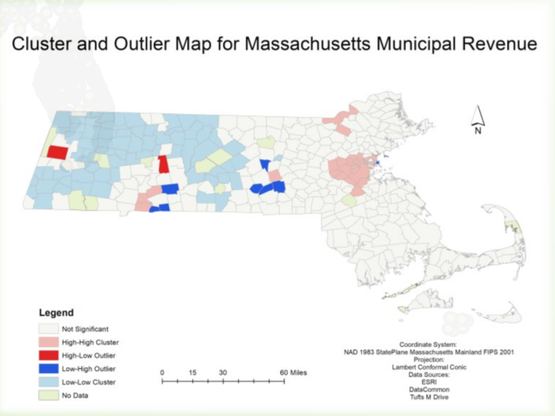


Figure 4. Cluster and Outlier Map for Massachusetts Municipal Revenue

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