Team Members:
Ngozi Omatu
Song Xie
Matan Ziegel
Gil Lotzky

Baystate Banner: LatinX Republican Support

Project Description:

The Bay State Banner, an independent newspaper based in Boston Massachusetts, would like to understand the components of support for Republicans over the period of 2016-2020 which included two Presidential elections. The goal of the project is to find whether or not there is a significant difference in the voting pattern of the LatinX community from 2016 to 2020. We compared changes in LatinX voting patterns for the Presidential elections within 2016-2020 for all cities in Massachusetts. Additionally, The Bay State Banner would like to understand the components of support for Republicans over 2014-2018, which included two Governor's elections. The main goal was to conclude which LatinX voter populations changed their votes and which voters stayed consistent.

Executive Summary:

The goal of this project was to analyze whether or not there was a significant difference in LatinX voting patterns in the Massachusetts Presidential elections from 2016-2020. Our team analyzed whether the LatinX demographics within each census tract** in Massachusetts had a significant effect (in terms of R^{2} * / R-squared for the linear regression model) on changes in election results. Republican R^2 trend line indicates the line of best fit between the LatinX population per tract and changes in Repulican support. The main challenge with this approach was that we can only infer whether LatinX demographics affected voting patterns based on the degree of correlation. However, just because two datasets are correlated does not imply that one variable caused the changes in the other. Our analysis indicated that the LatinX population in Massachusetts has shown an increase in Republican support from 2016-2020.

*R^2 measures how good of a fit a model is for a given dataset. The higher the value, the more likely that the data is explained by the model. I.e. R^2 value of 0.5 or higher for an upward trend of LatinX Republican support indicates a good chance that the data truly follows that trend

**tracts are geographic regions within counties defined for the purpose of taking a census.

Terms of Reference:

Our client, the Baystate Banner newspaper organization, wanted to understand the components of the increase in support for Republicans throughout 2014-2020 which includes the Presidential elections and the Governor's races. Our task was to analyze whether or not there was a significant difference in LatinX voting patterns in Massachusetts from 2014-2020. We were given three key questions to answer:

1. How has support for Trump shifted across the LatinX population from 2016 to 2020? Was there a significant shift?

2. What is the breakdown of LatinX sub-groups in their support for Democratic vs. Republican candidates?

3. Which LatinX groups exhibited changes in their votes and which groups remained the same?

We were originally given six cities (Lawrence, Lynn, Springfield, Southwick, Acushnet, and Douglas) before expanding to all the cities in Massachusetts. This project was authorized by Boston University Spark, a learning organization for students at BU to lead computational and data-driven projects while gaining the experience and network for future careers. This project started in January 2021 and was completed in April 2021.

Data Resources:

- PD43 MA state portal
    - 2016 and 2020 Presidential Elections
    - 2014 and 2018 MA Governor (General Elections)
- Census data (Demographics)
- LatinX Origin Demographics (2014)

Data processing:

Cleaned Datasets

Methods:

We gathered LatinX demographics data from the US government's census website and election results data from Massachusetts' election results website. Our focus was to analyze how the percentage of LatinX population per tract affected shifts in political support in Massachusetts. We increased our sample size from the original six cities to all cities in Massachusetts to help us better infer a correlation between the LatinX demographics and election results. We used linear regression models to analyze the correlation between the LatinX population and the percentage point change of support for political parties.

Tract Data:

Cleaning of Data: The data used in this report consisted of the population data for all tracts in Massachusetts for 2014, 2016, 2018, and 2019. Some basic deletion of unnecessary rows was performed in excel. The data was read into DataFrames, 2-dimensional spreadsheets, by using the read_csv() function from the Pandas library. We separated the important columns from the main DataFrame into a separate DataFrame for processing. These columns consisted of the population data attributes of each LatinX sub-group, the general population count, and the tract number. The columns were then renamed for simpler understanding and the tracts were converted from float values to string values, as they are identifiers and not numerical values. We then merged the tract DataFrames for 2014 and 2018 as well as the DataFrames for 2016 and 2019. This made it easier to merge the comprehensive population data to their respective election data.

New columns were created to describe the percentage changes for the LatinX populations. Additionally, new latitude and longitude columns with arbitrary values were added to help convert the DataFrame to a GeoPandas DataFrame. GeoPandas is an open source library that allows you to work with geospatial data. We then read in the Massachusetts tract shapefile using the GeoPandas read_file function and converted the tracts from floats to strings to directly match the values from the population data with the shapefile. This conversion is a necessary step as the DataFrames will not merge correctly if they do not find an exact match for their respective tracts.

Using GeoPandas merge, we combined our population data with our geospatial tract data. This was important to correctly map population data and merge it with election data. We then dropped all unnecessary attributes and renamed columns for further processing with GeoPandas. This completed the necessary processing for the tract and population data.

Precinct Data:

We first read in the 2016 and 2020 Presidential election data as well as the 2014 and 2018 Governor's election data using the Pandas read_csv() function. We also read the precinct shapefile for Massachusetts into a GeoPandas DataFrame. We then renamed columns to be consistent with categorical names (Democratic and Republican). We dropped all empty cells using the dropna() function. However, we encountered an error when trying to combine the DataFrames, so it was important to diagnose the problem. No precincts with missing wards appeared after merging the data so we attempted to look closely at those cases. After setting boolean statements for five sample cells, it was showing the wards were False when set equal to each other. After printing out a sample from each set, the Presidential data for 2020 had a space in front of it that was difficult to notice without printing the data set. We stripped the spaces and were then ready to merge the Presidential data with the geospatial DataFrame for precincts.

The matching Presidential data and Governor's data were successfully merged into a single Pandas DataFrame. We then appended arbitrary latitude and longitude columns to the merged DataFrame to convert it to a GeoPandas DataFrame. We dropped the unnecessary columns from the GeoPandas DataFrame and set the city/town values to uppercase to match the cases with the geospatial DataFrame for the precincts. We replaced the None values with '-' to create exact match cases. We then successfully merged all the Presidential election and Governor's election data with their respective precinct geospatial DataFrames. Further cleaning was done by renaming the attributes and dropping unnecessary information.

Final Dataset:

We created two GeoPandas DataFrames containing the Presidential and Governor's voting information with their respective geospatial information. We also created DataFrames for the population information and their respective geospatial information. This allowed us to merge the GeoPandas DataFrames with the voting and population data for both the Presidential and Governor's elections using spatial joins. The spatial joins were performed on the intersection of each row's geospatial information. We then converted the data sets into CSV files in order to perform further analyses. No further issues with the DataFrames were present.

Regression Cleaning:

For each of the final datasets, we took the .CSV outputs and turned them into DataFrame objects using the Pandas read_csv() function for further processing. Every value in the DataFrames were of type string, therefore, we needed to remove values such as unnecessary spaces, NaNs, and commas using .replace(), in order to convert these string values to either integers or floats. After cleaning, we converted the values of the necessary columns (any column containing voting data and demographics data) to integers/floats using .to_numeric(). This allowed us to conduct mathematical computations on the values of the desired columns.

Regression:

We calculated the percentage point change over a 4-year interval using these methods:

<u>Percentage Democratic Support:</u>
(Total Democratic Votes / Total Votes) for a given year

<u>Percentage Republican Support:</u>
(Total Republican Votes / Total Votes) for a given year

<u>Percentage Point Change in Democratic Support:</u>
(Dem votes 2020 / total votes 2020) - (Dem votes 2016 / total votes 2016)

<u>Percentage Point Change in Republican Support:</u>
(Rep votes 2020 / total votes 2020) - (Rep votes 2016 / total votes 2016)

LatinX Population:
SUM(LatinX sub-group populations) / Total Population

LatinX Sub-group Population:
LatinX Sub-group Population / Total Population

After all of the calculations, we created two separate DataFrame objects, one to hold only the Presidential election and demographics data and the other to hold the Governor's election and demographics data. We then created a scatter plot using matplotlib's .scatter() for a pair of DataFrame columns (% Democratic support and % LatinX population, % Republican support and % LatinX population) which includes data for all tracts in Massachusetts.

In addition, we fitted the same columns that were used for the scatter plot to a linear regression using LinearRegression().fit() and then plotted the predicted line of best fit onto the same scatter plot. This was done for the total LatinX population percentage, LatinX sub-group population percentage, and each political party's support percentage. We also added each line of best fit's R^2 value using sklearn's r2_score package to identify the significance and strength of the correlation between the percentage of LatinX population per tract and the percentage point change of the support for each political party.

Overall Demographics and Election Trends

Before answering the strategic questions, our team first used the merged datasets to gain an overall sense of general LatinX demographics and election changes in Massachusetts from 2016-2020. Our data showed a 6.02 percentage point increase in Democratic support and a 0.33 percentage point decrease in Republican support in MA from 2016-2020. This data is similar to that of official polls, which showed a 5.6 percentage point increase in Democratic support and a 0.7 percentage point decrease in Republican support from 2016-2020. The similarity of our findings with official poll data is a positive indicator that our team was successfully able to merge demographics and election data. In addition, when looking at the LatinX demographics, our data showed a 10.51% increase in LatinX population in MA from 2016-2020.

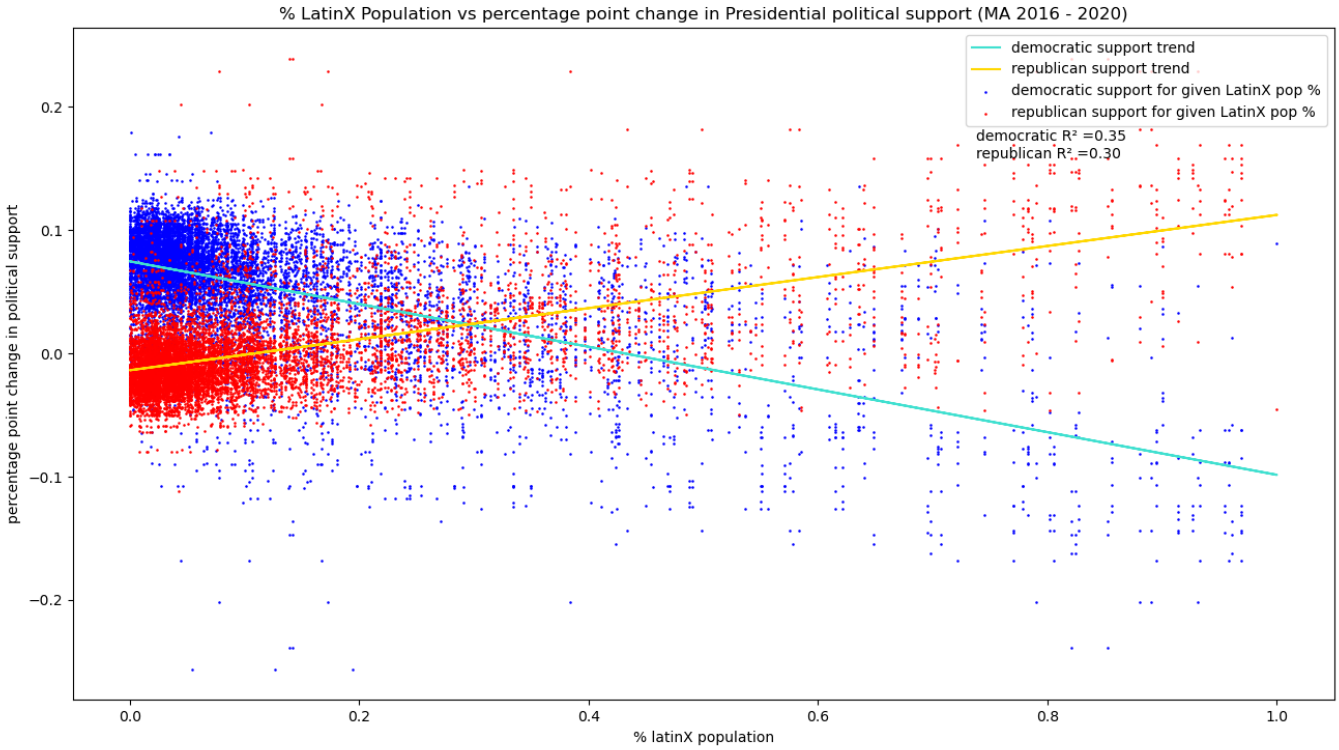
Graph Overview

For the graphs below, each point represents one of the 1,478 census tracts in Massachusetts, which are geographic entities within counties. For each graph, we plotted each tract twice, one to showcase the Democratic support % relative to a LatinX population percentage and the other to showcase the Republican support % relative to a LatinX population. An R^2 value less than .3 is considered low, below .5 is considered moderately low, below .7 is considered moderately high, and above .7 is considered high.

Results:

Question 1: How has support for Trump shifted across the LatinX population from 2016 to 2020? Was there a significant shift?

Graph 1: Latin X Population % vs. % Point Change in Presidential Political Support (2016 - 2020)[1]



Democratic Support: R-squared is 0.35, therefore, 35% of the variance for the percentage point change of Democratic support from 2016 to 2020 can be explained by the percentage of LatinX population in each tract.*
Republican Support: R-squared is 0.30, therefore, 30% of the variance for the percentage point change of Republican support from 2016 to 2020 can be explained by the percentage of LatinX population in each tract.*

[1] This graph describes the identified LatinX demographics and the changes in political support in the state of Massachusetts between the 2016 and 2020 presidential elections. The LatinX population represents individuals who identify with the LatinX ethnicity. Each point represents a city tract. Each city tract has both a point to represent its change in Democratic Support and its change in Republican Support. The X-axis describes the percentage of the overall LatinX population within each city tract.The Y-axis describes the percentage point change between 2016 and 2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Key Question 1:

Our team analyzed how voting patterns may have changed between 2016 and 2020 by looking at the percentage point change in political support for a given LatinX population for each tract. Political support is calculated by dividing the total votes a political party received out of the total votes cast in a single election. The results of these calculations were plotted on Graph 1 with a linear regression applied to the data to show the general direction of the trend. Each point on the graph represents the change in political support relative to each tract's 2020 LatinX population.

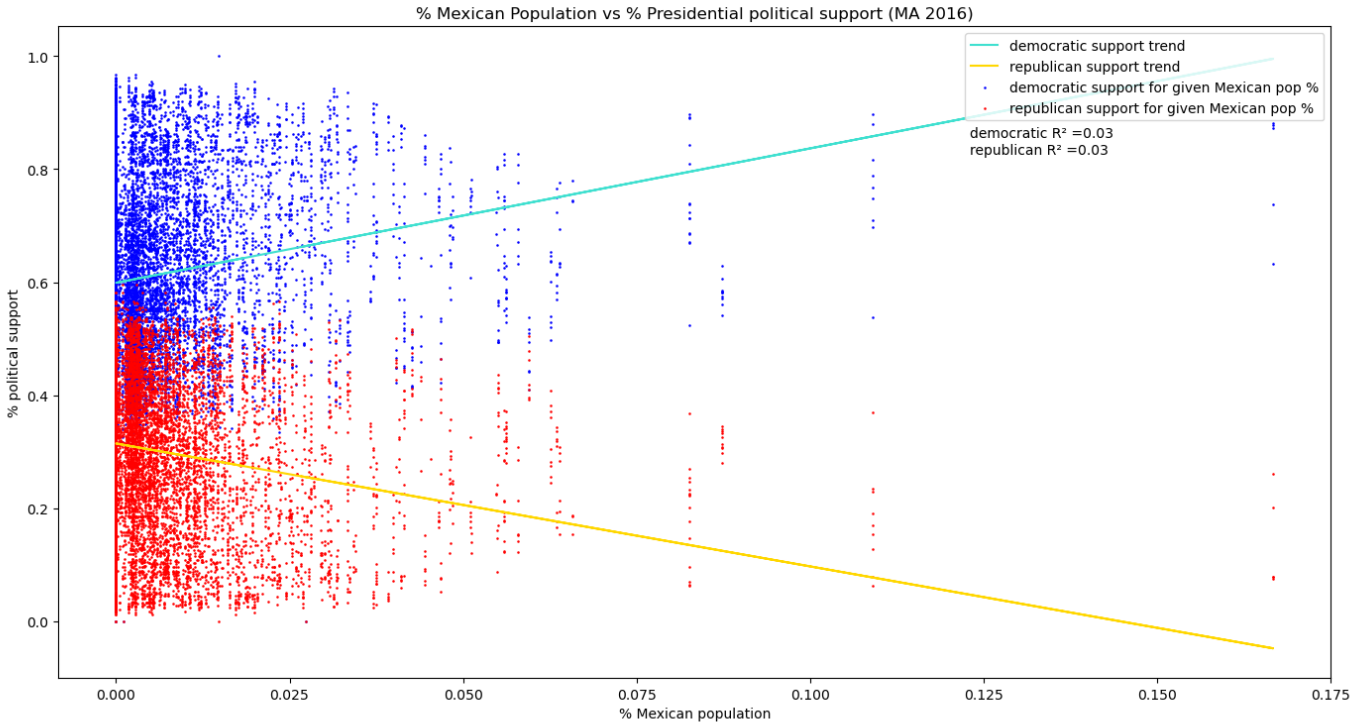
Based on Graph 1, there is a positive sloped trend for the overall changes in Republican support and a negative sloped trend for the changes in Democratic support. What this means is that as we moved from tracts with low LatinX population to tracts with higher LatinX population, the support for Trump increased and support for Democratic candidates decreased. This means that there may have been a change in how the overall LatinX population in Massachusetts voted between 2016 and 2020. However, the R^2 values (0.30 for Republican trend and 0.35 for Democratic trend) of this trend, which describes how well this trend fits our data, is weak which implies that much of the increase in support for Trump is not explained by the trend line.

Although the R^2 value of the trend may be weak, there seems to have been a significant shift. Tracts with a higher LatinX population saw an increase in Republican support and a decrease in Democratic support even though the overall Democratic support is higher than Republican support for those same tracts.

Even if the R^2 value of the trend was higher, it would not imply that tracts with a higher LatinX population actually increased in their support for Trump. This analysis only analyzes the correlation between the LatinX population and how the votes for each political party (from all demographics) changed. We do not know who exactly the LatinX population actually voted for in the election because we do not have that data. We are simply looking at the direction of the trend between the changes in political support relative to each tract's LatinX population percentage.

Question 2: What is the breakdown of LatinX sub-groups in their support for Democratic vs. Republican candidates?

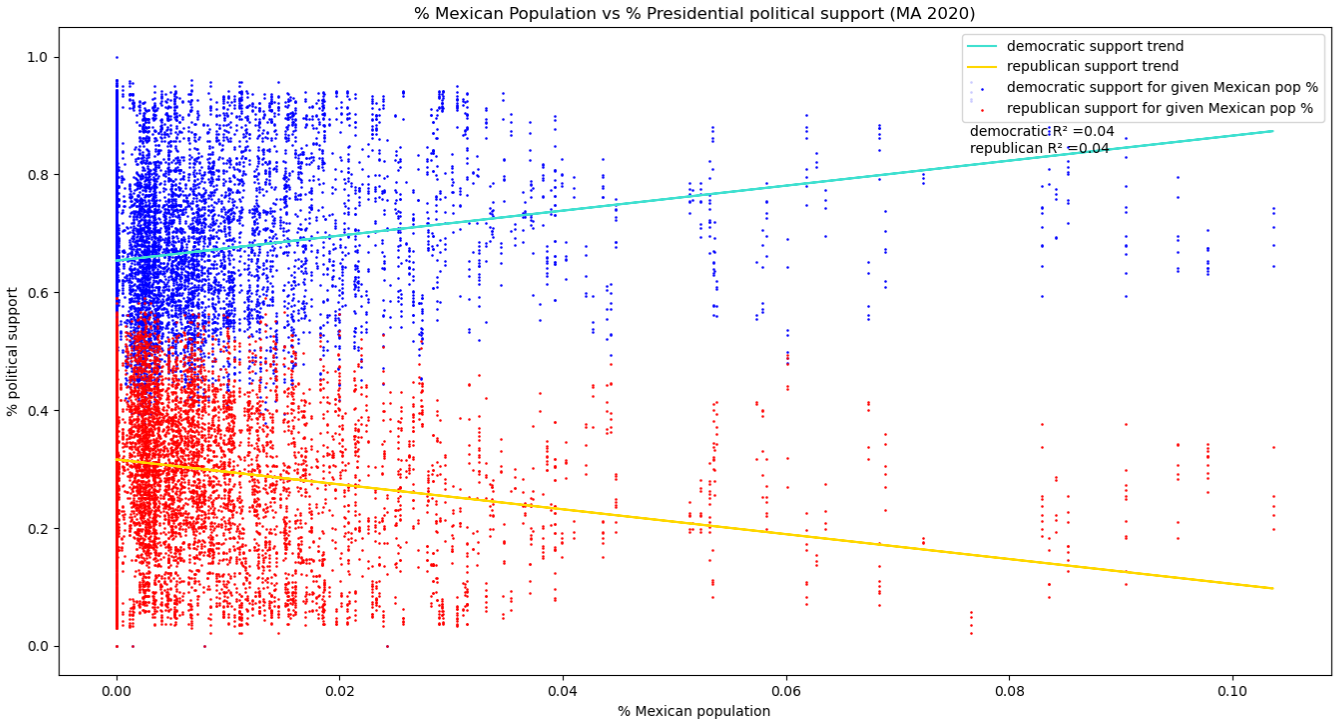
Graph 2: Mexican Population % vs. Presidential Political Support % (2016)[2]



Democratic Support: R-squared is 0.03, therefore, 3% of the variance for the percentage of Democratic support in 2016 can be explained by the percentage of Mexican population in each tract.*
Republican Support: R-squared is 0.03, therefore, 3% of the variance for the percentage of Republican support in 2016 can be explained by the percentage of Mexican population in each tract.*

[2] This graph describes the identified Mexican demographics and the political support percentage in the state of Massachusetts during the 2016 presidential election. The Mexican population represents individuals who identify with the Mexican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Mexican population within each city tract.The Y-axis describes the political support percentage during 2016 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

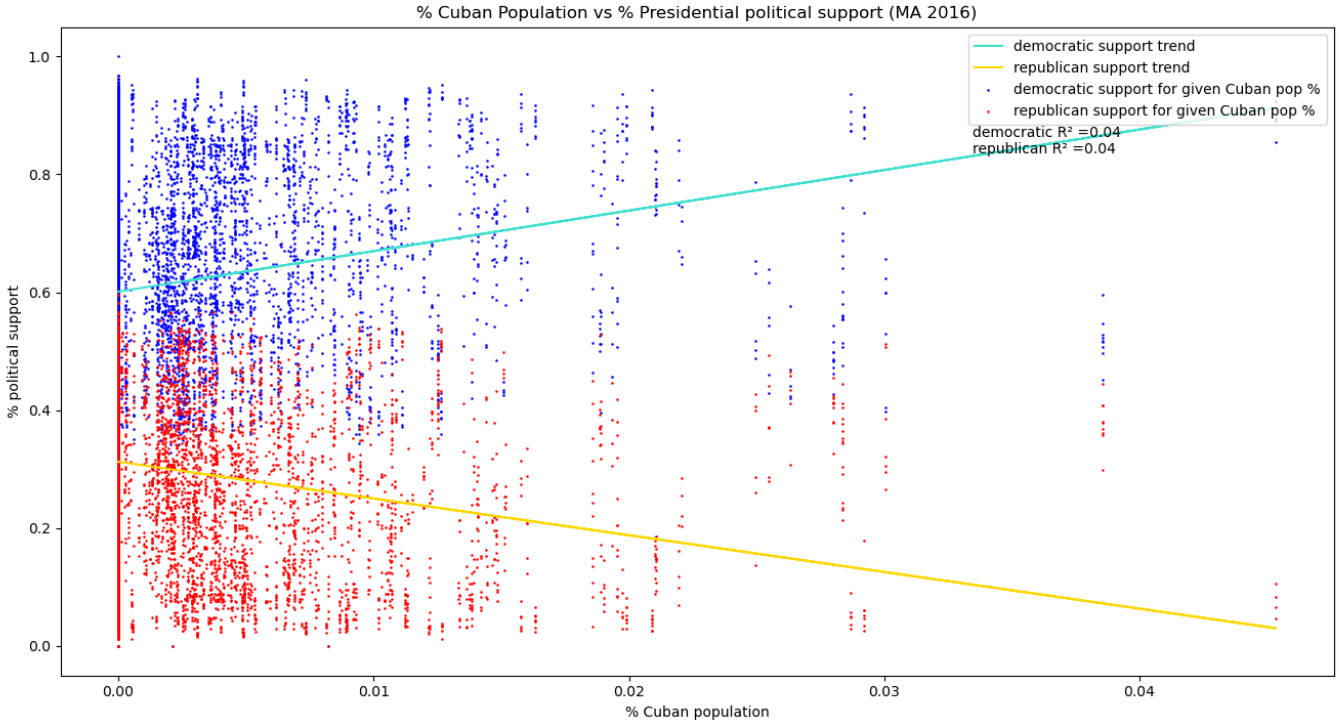
Graph 3: Mexican Population % vs. Presidential Political Support % (2020)[3]



Democratic Support: R-squared is 0.04, therefore, 4% of the variance for the percentage of Democratic support in 2020 can be explained by the percentage of Mexican population in each tract.*
Republican Support: R-squared is 0.04, therefore, 4% of the variance for the percentage of Republican support in 2020 can be explained by the percentage of Mexican population in each tract.*

[3] This graph describes the identified Mexican demographics and the political support percentage in the state of Massachusetts during the 2020 presidential election. The Mexican population represents individuals who identify with the Mexican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Mexican population within each city tract.The Y-axis describes the political support percentage during 2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

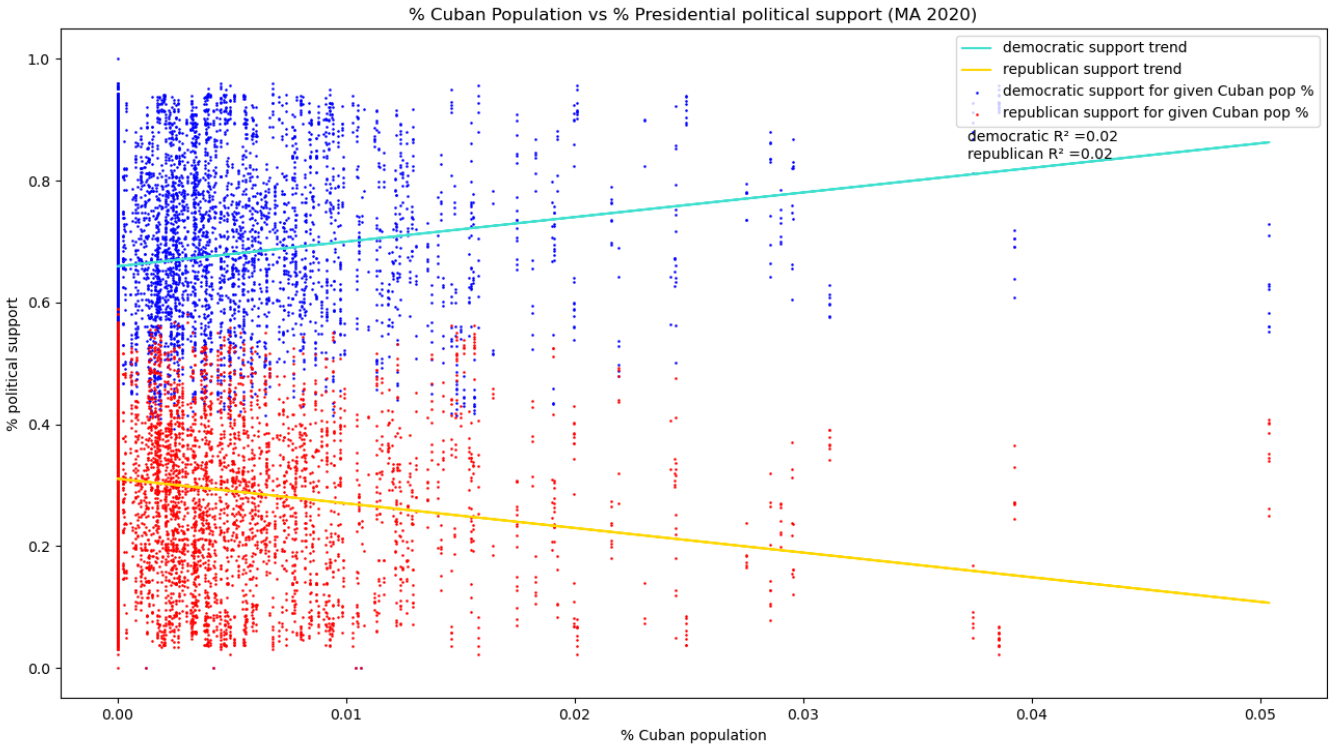
Graph 4: Cuban Population % vs. Presidential Political Support % (2016)[4]



Democratic Support: R-squared is 0.04, therefore, 4% of the variance for the percentage of Democratic support in 2016 can be explained by the percentage of Cuban population in each tract.*
Republican Support: R-squared is 0.04, therefore, 4% of the variance for the percentage of Republican support in 2016 can be explained by the percentage of Cuban population in each tract.*

[4] This graph describes the identified Cuban demographics and the political support percentage in the state of Massachusetts during the 2016 presidential election. The Cuban population represents individuals who identify with the Cuban ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Cuban population within each city tract.The Y-axis describes the political support percentage during 2016 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

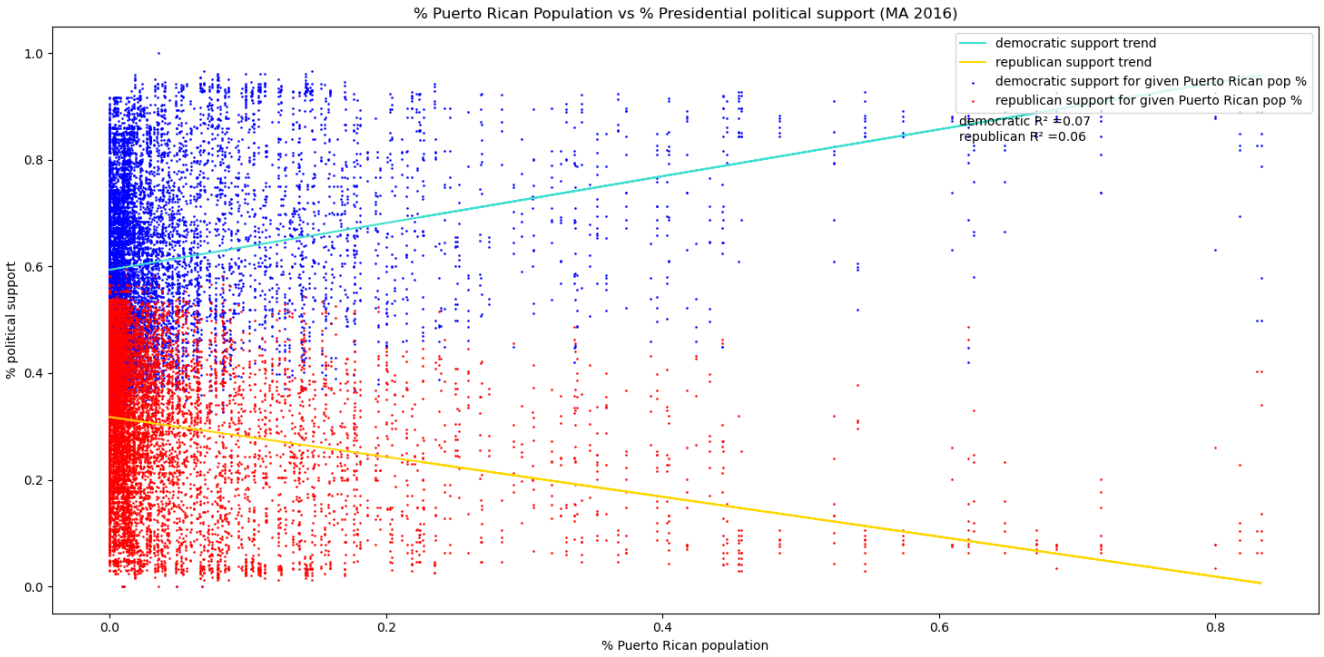
Graph 5: Cuban Population % vs. Presidential Political Support % (2020)[5]



Democratic Support: R-squared is 0.02, therefore, 2% of the variance for the percentage of Democratic support in 2020 can be explained by the percentage of Cuban population in each tract.*
Republican Support: R-squared is 0.02, therefore, 2% of the variance for the percentage of Republican support in 2020 can be explained by the percentage of Cuban population in each tract.*

[5] This graph describes the identified Cuban demographics and the political support percentage in the state of Massachusetts during the 2020 presidential election. The Cuban population represents individuals who identify with the Cuban ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Cuban population within each city tract.The Y-axis describes the political support percentage during 2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

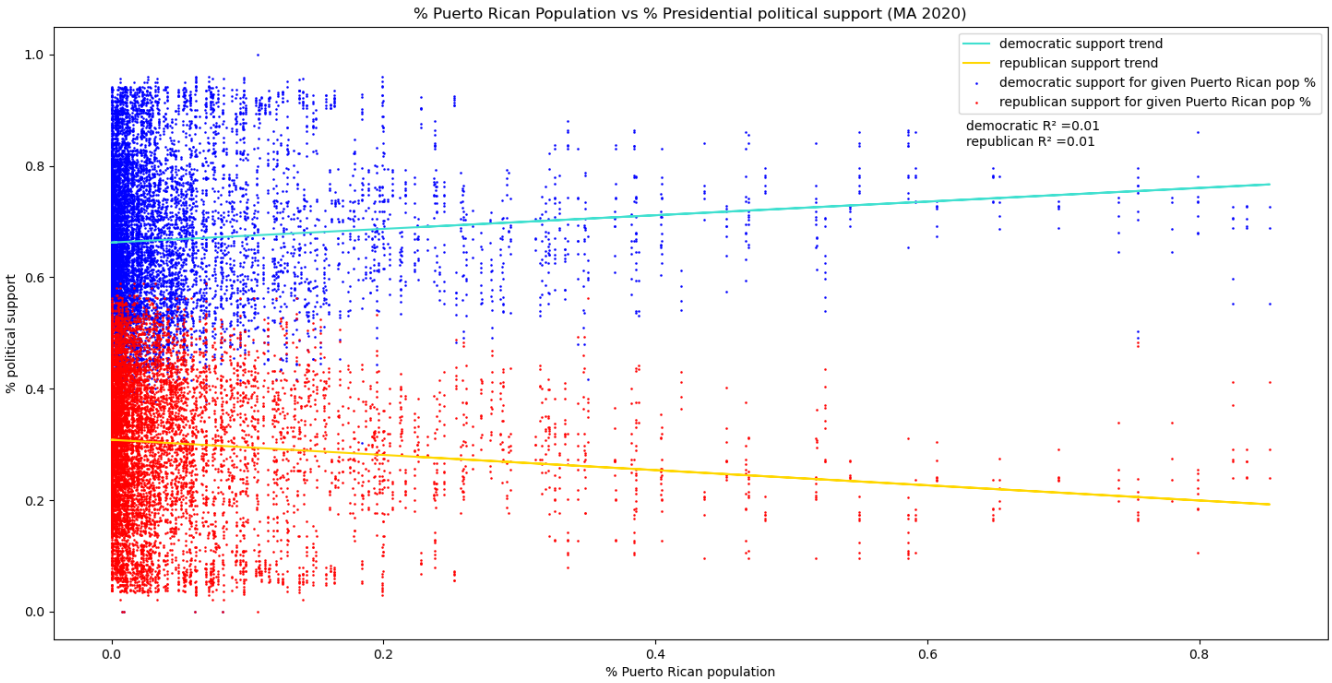
Graph 6: Puerto Rican Population % vs. Presidential Political Support % (2016)[6]



Democratic Support: R-squared is 0.07, therefore, 7% of the variance for the percentage of Democratic support in 2016 can be explained by the percentage of Puerto Rican population in each tract.*
Republican Support: R-squared is 0.06, therefore, 6% of the variance for the percentage of Republican support in 2016 can be explained by the percentage of Puerto Rican population in each tract.*

[6] This graph describes the identified Puerto Rican demographics and the political support percentage in the state of Massachusetts during the 2016 presidential election. The Puerto Rican population represents individuals who identify with the Puerto Rican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Puerto Rican population within each city tract.The Y-axis describes the political support percentage during 2016 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Graph 7: Puerto Rican Population % vs. Presidential Political Support % (2020)[7]

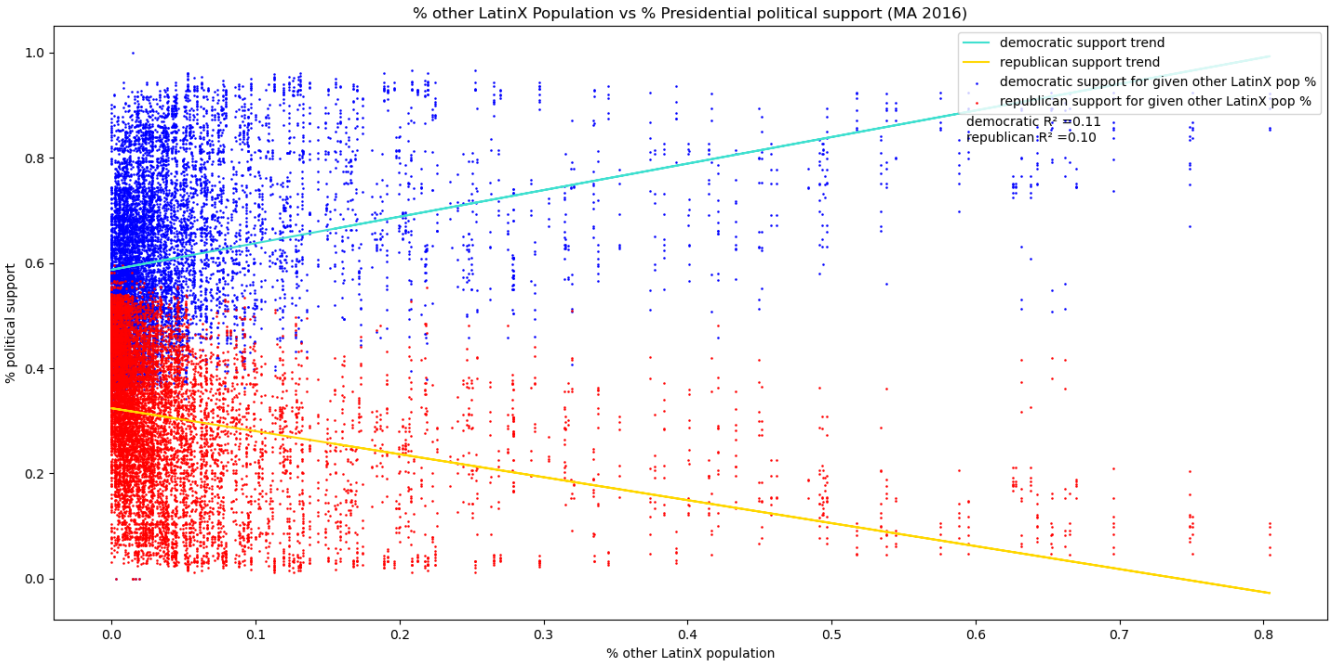


Democratic Support: R-squared is 0.01, therefore, 1% of the variance for the percentage of Democratic support in 2020 can be explained by the percentage of Puerto Rican population in each tract.*

Republican Support: R-squared is 0.01, therefore, 1% of the variance for the percentage of Republican support in 2020 can be explained by the percentage of Puerto Rican population in each tract.*

[7] This graph describes the identified Puerto Rican demographics and the political support percentage in the state of Massachusetts during the 2020 presidential election. The Puerto Rican population represents individuals who identify with the Puerto Rican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Puerto Rican population within each city tract.The Y-axis describes the political support percentage during 2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Graph 8: Other LatinX Population % vs. Presidential Political Support % (2016)[8]

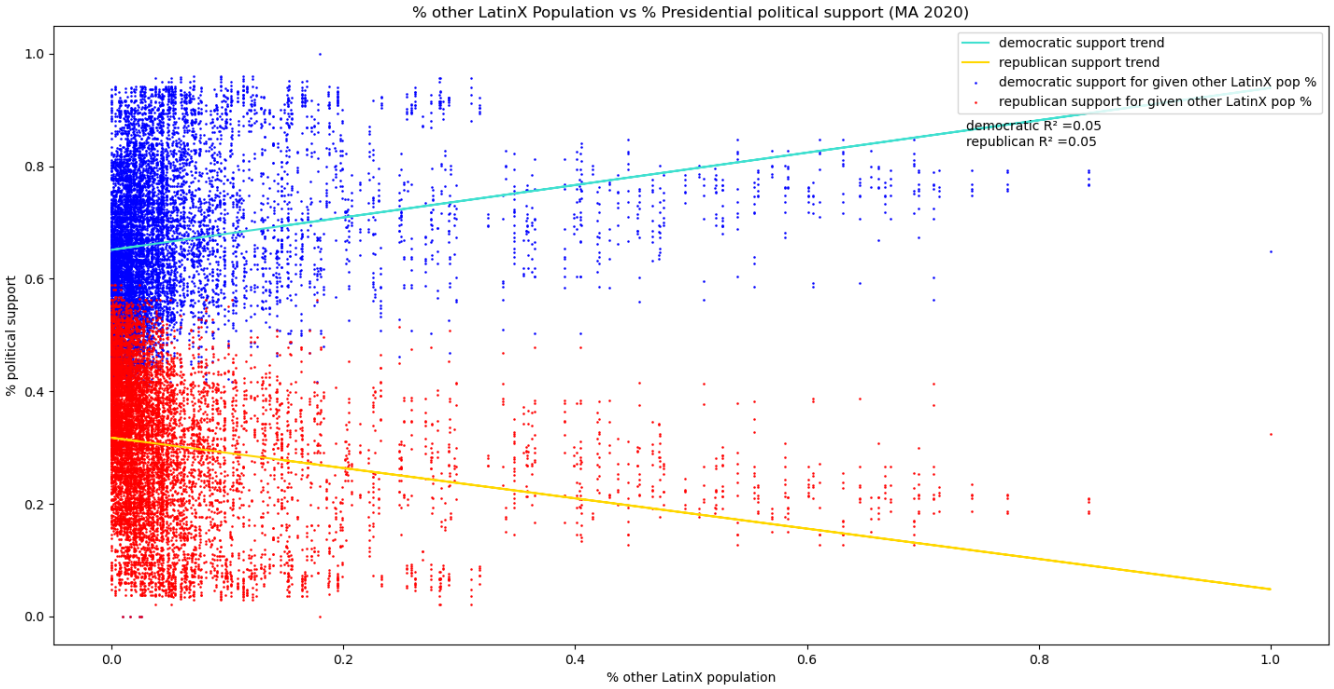


Democratic Support: R-squared is 0.11, therefore, 11% of the variance for the percentage of Democratic support in 2016 can be explained by the percentage of other LatinX population in each tract.*

Republican Support: R-squared is 0.10, therefore, 10% of the variance for the percentage of Republican support in 2016 can be explained by the percentage of other LatinX population in each tract.*

[8] This graph describes the identified Other LatinX demographics and the political support percentage in the state of Massachusetts during the 2016 presidential election. The Other LatinX population represents individuals who identify with the other LatinX ethnicities not previously analyzed. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Other LatinX population within each city tract.The Y-axis describes the political support percentage during 2016 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Graph 9: Other LatinX Population % vs. Presidential Political Support % (2020)[9]



Democratic Support: R-squared is 0.05, therefore, 5% of the variance for the percentage of Democratic support in 2020 can be explained by the percentage of other LatinX population in each tract.*

Republican Support: R-squared is 0.05, therefore, 5% of the variance for the percentage of Republican support in 2020 can be explained by the percentage of other LatinX population in each tract.*

[9] This graph describes the identified Other LatinX demographics and the political support percentage in the state of Massachusetts during the 2020 presidential election. The Other LatinX population represents individuals who identify with the other LatinX ethnicities not previously analyzed. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Other LatinX population within each city tract.The Y-axis describes the political support percentage during 2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Key Question 2:

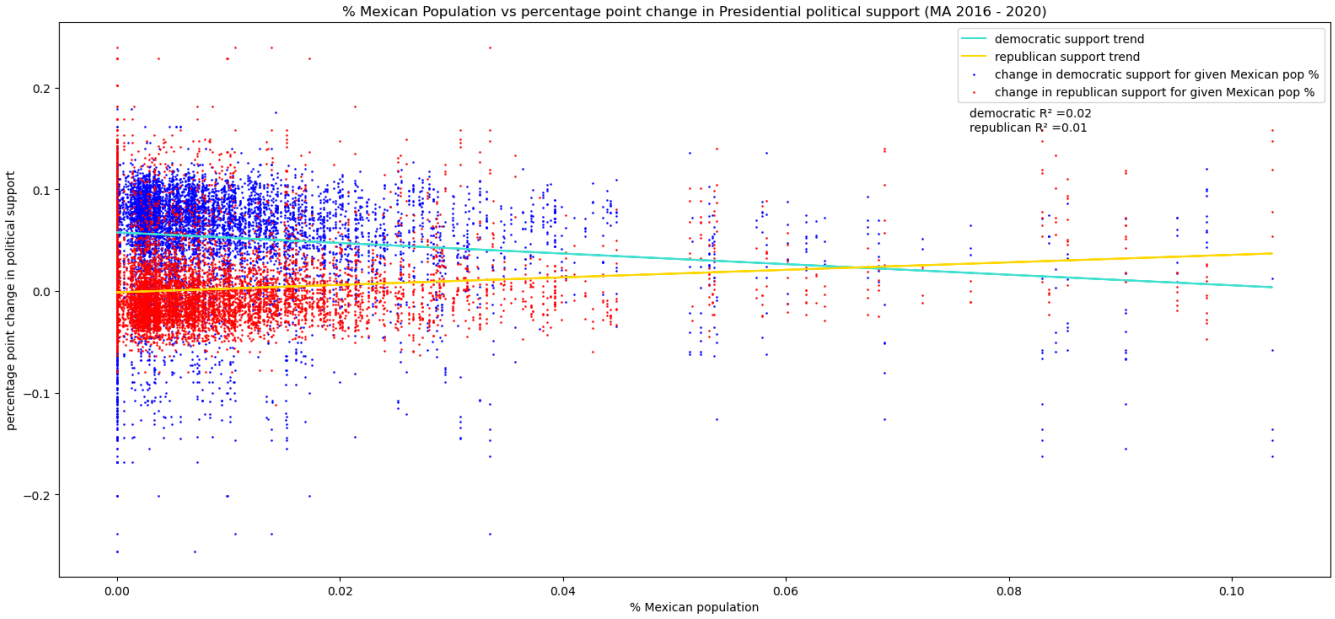
What is the breakdown of LatinX sub-groups in their support for Democratic vs. Republican candidates?

We also wanted to analyze how LatinX sub-groups varied in their support for Republican and Democratic candidates between 2016 and 2020. Political support is calculated by dividing the total votes a political party received out of the total votes cast in a single election. The results of these calculations were plotted on Graphs 2 to 9 with a linear regression applied to the data to show the general direction of the trend. Each point on the graph represents the percentage political support relative to each tract's 2020 LatinX population.

Our team sought to find the breakdown of LatinX sub-groups in their support for Democratic vs. Republican candidates in Massachusetts for both the 2016 and 2020 presidential elections. We analyzed how the percentage of LatinX sub-group populations in each tract in Massachusetts affected political support in those tracts by running linear regressions for each sub-group in both 2016 and 2020. Overall, for each LatinX sub-group our team analyzed, as the percentage of the LatinX sub-group in each tract increases, Democratic support showed an increasing trend and Republican support showed a decreasing trend. This shows that for the LatinX sub-groups that we analyzed, tracts with a higher percentages of each LatinX sub-group tended to have higher Democratic support and lower Republican support in both 2016 and 2020.

Compared to our analysis for Key Question 1, although there is an increase in Republican support and a decrease in Democratic support among tracts with higher LatinX populations between 2016 and 2020, the number of Democratic votes in most tracts still outnumber the amount of Republican votes, which is expressed in Graphs 2 to 9. These graphs (2 to 9) show that tracts with higher LatinX populations tend to have more Democratic votes than Republican votes. However, the percentage point increase of Republican votes is greater than that of Democratic votes from 2016-2020, which could signify that Repulican support is gaining traction in tracts with high LatinX population percentages.

Graph 10): Mexican Population % vs. % Point Change in Pres Political Support (2016 - 2020)[10]

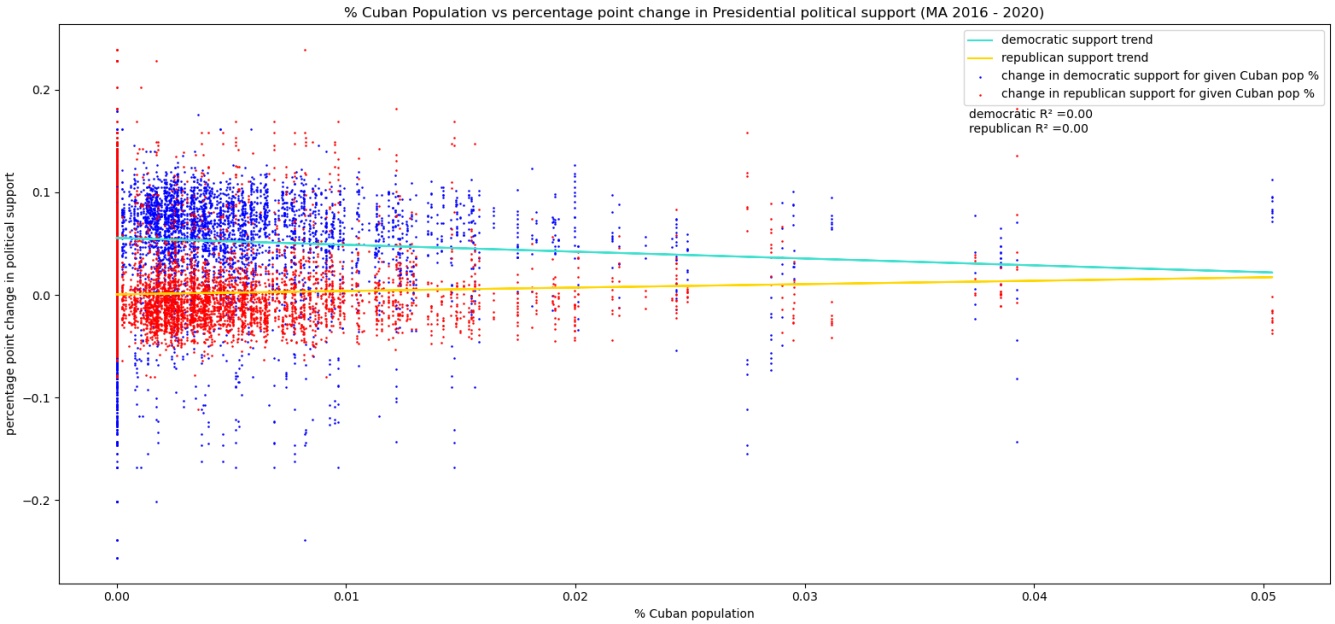


Democratic Support: R-squared is 0.02, therefore, 2% of the variance for the percentage point change of Democratic support in 2016 to 2020 can be explained by the percentage of Mexican population in each tract.*

Republican Support: R-squared is 0.01, therefore, 1% of the variance for the percentage point change of Republican support in 2016 to 2020 can be explained by the percentage of Mexican population in each tract.*

[10] This graph describes the identified Mexican demographics and the political support percentage point change in the state of Massachusetts during the 2016 - 2020 presidential elections. The Mexican population represents individuals who identify with the Mexican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Mexican population within each city tract.The Y-axis describes the political support percentage point change during 2016-2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Graph 11: Cuban Population % vs. % Point Change in Presidential Political Support (2016 - 2020)[11]

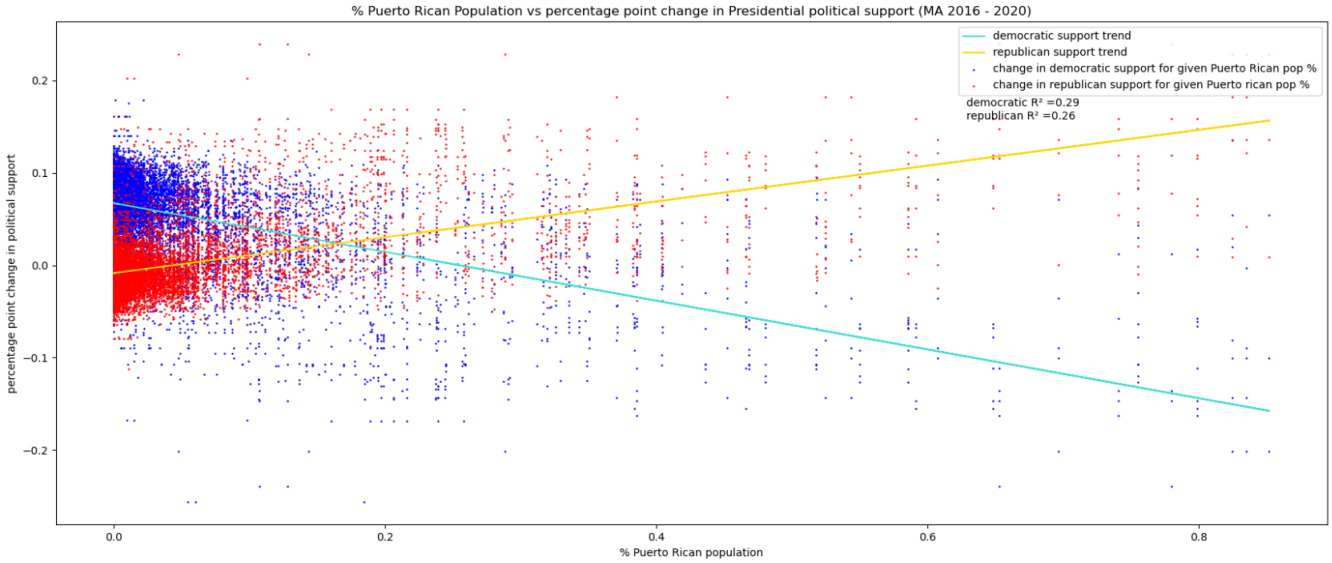


Democratic Support: R-squared is 0, therefore, 0% of the variance for the percentage point change of Democratic support in 2016 to 2020 can be explained by the percentage of Cuban population in each tract.*

Republican Support: R-squared is 0, therefore, 0% of the variance for the percentage point change of Republican support from 2016 to 2020 can be explained by the percentage of Cuban population in each tract.*

[11] This graph describes the identified Cuban demographics and the political support percentage point change in the state of Massachusetts during the 2016 - 2020 presidential elections. The Cuban population represents individuals who identify with the Cuban ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Cuban population within each city tract.The Y-axis describes the political support percentage point change during 2016-2020 colored by their political support; Blue represents democratic support and Red represents republican support.

Graph 12: Puerto Rican Population % vs. % Point Change in Pres Political Support (2016 - 2020)[12]

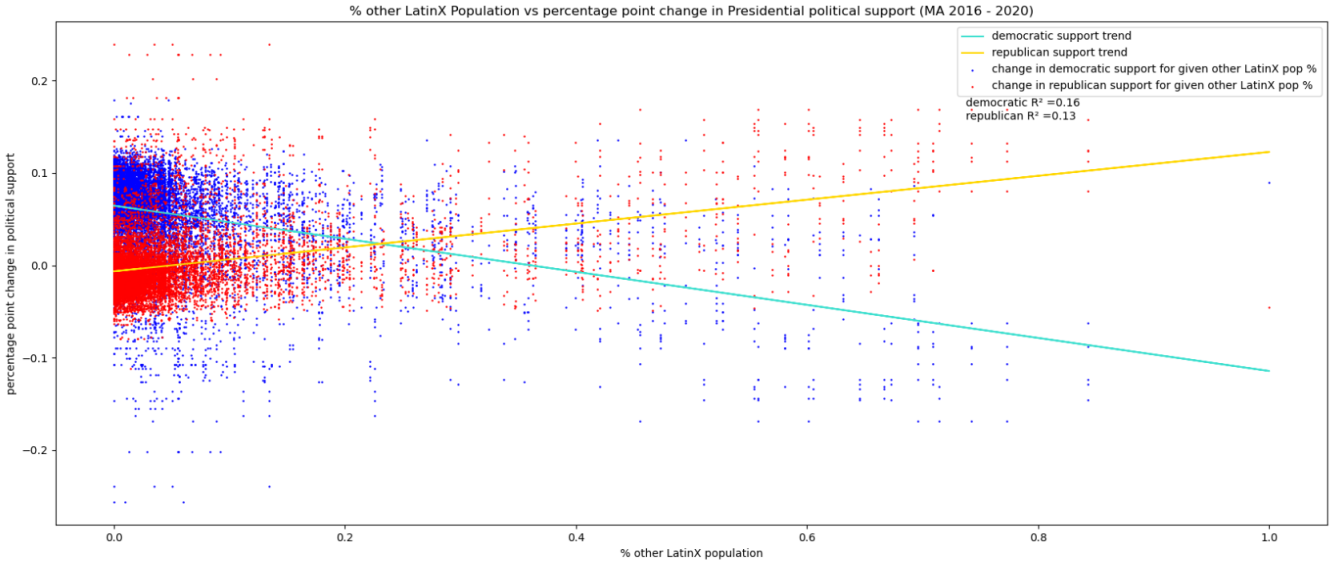


Democratic Support: R-squared is 0.29, therefore, 29% of the variance for the percentage point change of Democratic support from 2016 to 2020 can be explained by the percentage of Puerto Rican population in each tract.*

Republican Support: R-squared is 0.26, therefore, 26% of the variance for the percentage point change of Republican support from 2016 to 2020 can be explained by the percentage of Puerto Rican population in each tract.*

[12] This graph describes the identified Puerto Rican demographics and the political support percentage point change in the state of Massachusetts during the 2016 - 2020 presidential elections. The Puerto Rican population represents individuals who identify with the Puerto Rican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Puerto Rican population within each city tract.The Y-axis describes the political support percentage point change during 2016-2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Graph 13: Other LatinX Population % vs. % Point Change in Pres Political Support (2016 - 2020)[13]



Democratic Support: R-squared is 0.16, therefore, 16% of the variance for the percentage point change of Democratic support from 2016 to 2020 can be explained by the percentage of other LatinX population in each tract.*

Republican Support: R-squared is 0.13, therefore, 13% of the variance for the percentage point change of Republican support from 2016 to 2020 can be explained by the percentage of other LatinX population in each tract.*

[13] This graph describes the identified Other LatinX demographics not previously analyzed and the political support percentage point change in the state of Massachusetts during the 2016 - 2020 presidential elections. The Other LatinX population represents individuals who identify with Other LatinX ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Other LatinX population within each city tract.The Y-axis describes the political support percentage point change during 2016-2020 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Key Question 3:

Which LatinX groups exhibited changes in their votes and which groups remained the same?

To determine which LatinX groups exhibited changes in their voting patterns in Massachusetts elections, we analyzed the R-squared of each line of best fit for the scatter plots above. The R-squared for each of the LatinX sub-groups within Massachusetts displayed that most of the LatinX sub-groups did not exhibit significant changes(R^2 greater than .5) in their voting patterns other than the Puerto Rican population. A higher R-squared value would indicate that the independent variable, LatinX population percentage, can explain a significant amount of the variance in the dependent variable, support for a political party. Most population groups that were analyzed were not able to explain a significant amount of the variance in political support, as their R-squared values were below .2. However, the Puerto Rican population had coefficients of determination of .291 for Democratic support and .258 for Republican support. This indicates that ~29% of the changes in political support for Democratic candidates and ~26% of the changes in political support for the Republican support can be explained by changes in the Puerto Rican population.

Although these results are not significant enough to explain if these LatinX sub-groups exhibited changes in their votes, it can be inferred that the Puerto Rican population most likely exhibited changes in the way they had voted since 2016 it showed the increase in support for the Republican party from 2016 to 2020 was the most significant among all LatinX sub-groups.

Top Ten Cities in Massachusetts that exhibited LatinX Population Changes (2016 - 2020):

1. Hopedale	**+6.59%**	**6. Richmond**	**+4.51%**
2. Dudley	**+6.53%**	**7. Somerville**	**+4.15%**
3. Chelsea	**+5.15%**	**8. Ashland**	**+3.95%**
4. Methuen	**+4.71%**	**9. Rutland**	**+3.93%**
5. Saugus	**+4.63%**	**10. Walpole**	**+3.92%**

Additional Visualizations:

Fig 1.[14]

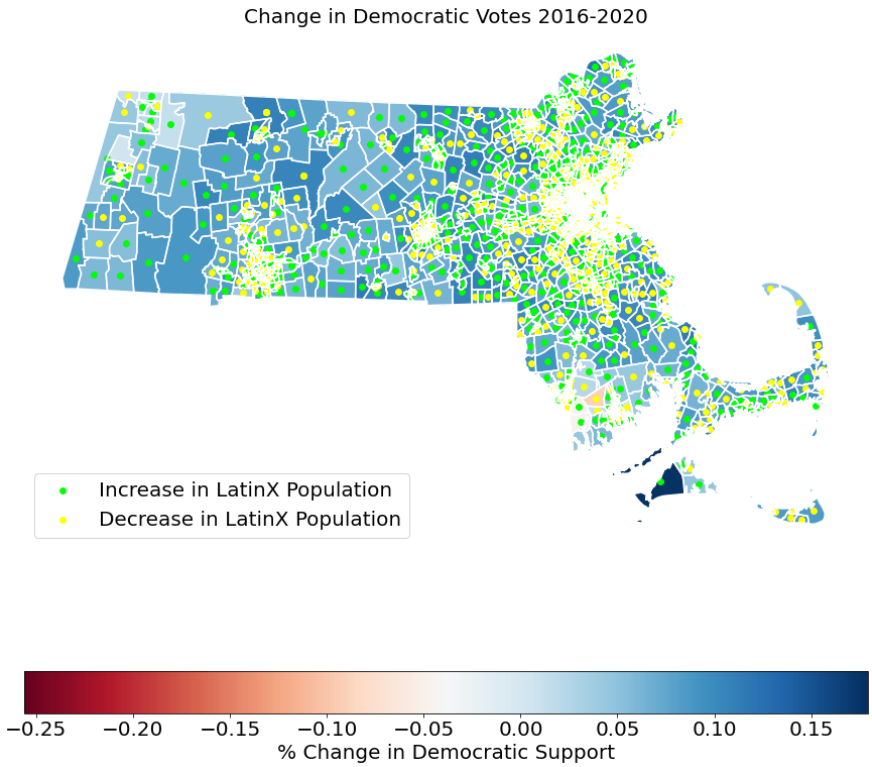


Fig 1 description: The visualization shows a heatmap of the changes in Democratic support for the 2016 to 2020 Massachusetts Presidential election. Coloration of red indicates a decrease in democratic support. Coloration of blue indicates a positive change in Democratic support. Additionally, the dots depict changes in the LatinX populations within each tract. A yellow dot shows a decrease in the LatinX population. A lime dot shows an increase in LatinX population.

[14] This is a geospatial visualization of the state of Massachusetts that represents each city Tract's percentage point change in Democratic Support and changes in LatinX population from the 2016 and 2020 presidential elections. A coloration toward darker red represents a negative change in Democratic support in that tract. A coloration toward darker blue represents a positive change in Democratic support for that tract. A lime point in the tract represents a positive change in LatinX population. A yellow point represents a negative change in LatinX population.

Top Ten Cities in Massachusetts that Exhibited the Largest Percentage Point Changes in Democratic Support (2016 to 2020):

1. Northbridge	**+11.82%**	**6. Norfolk**	**+10.99%**
2. Dover	**+11.76%**	**7. Sherborn**	**+10.94%**
3. Southborough	**+11.68%**	**8. Millis**	**+10.88%**
4. Wenham	**+11.32%**	**9. Hamilton**	**+10.80%**
5. Wendell	**+11.04%**	**10. Stow**	**+10.71%**

Fig 2:[15]

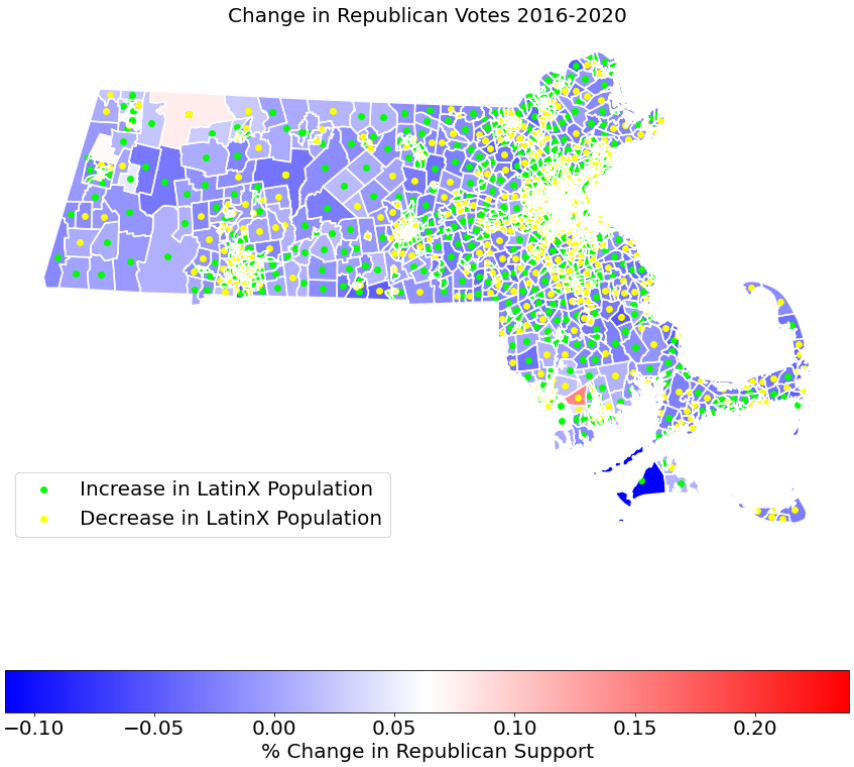


Fig 2 description: The visualization shows a heatmap of the changes in Republican support for the 2016 to 2020 Massachusetts Presidential election. Coloration of red indicates a decrease in Republican support. Coloration of blue indicates a positive change in Republican support. Additionally, the dots depict changes in the LatinX populations within each tract. A yellow dot shows a decrease in the LatinX population. A lime dot shows an increase in LatinX population.

[15] This is a geospatial visualization of the state of Massachusetts that represents each city Tract's percentage point change in Republican Support and changes in LatinX population from the 2016 and 2020 presidential elections. A coloration toward darker blue represents a negative change in Republican support in that tract. A coloration toward darker red represents a positive change in Republican support for that tract. A lime point in the tract represents a positive change in LatinX population. A yellow point represents a negative change in LatinX population.

Top Ten Cities in Massachusetts that Exhibited the Largest Percentage Point Changes in Republican Support (2016 to 2020):

1. Lawrence	**+12.56%**	**6. Acushnet**	**+5.15%**
2. Fall River	**+8.68%**	**7. Windsor**	**+4.93%**
3. New Bedford	**+6.67%**	**8. Springfield**	**+4.80%**
4. Holyoke	**+6.62%**	**9. Chelsea**	**+4.05%**
5. Florida	**+5.83%**	**10. Lynn**	**+3.87%**

Fig 3:[16]

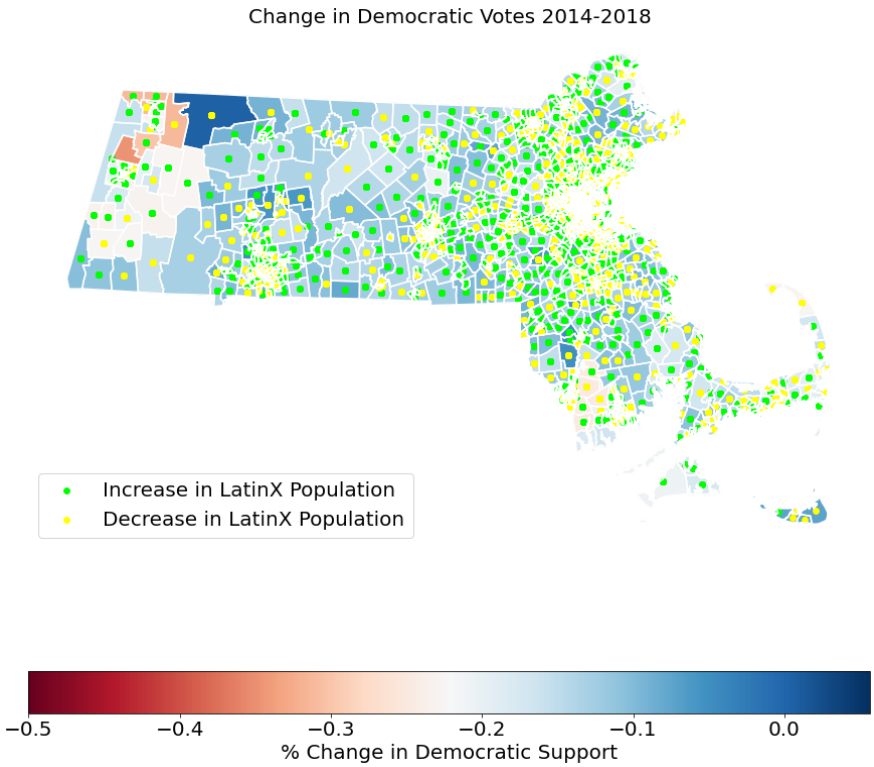


Fig 3 description: The visualization shows a heatmap of the changes in Democratic support for the 2014 to 2018 Massachusetts Governor election.Coloration of red indicates a decrease in Republican support. Coloration of blue indicates a positive change in Democratic support. Additionally, the dots depict changes in the LatinX populations within each tract. A yellow dot shows a decrease in the LatinX population. A lime dot shows an increase in LatinX population.

[16] This is a geospatial visualization of the state of Massachusetts that represents each city Tract's percentage point change in Democratic Support and changes in LatinX population from the 2014 and 2018 governor elections. A coloration toward darker red represents a negative change in Democratic support in that tract. A coloration toward darker blue represents a positive change in Democratic support for that tract. A lime point in the tract represents a positive change in LatinX population. A yellow point represents a negative change in LatinX population.

Fig 4:[17]

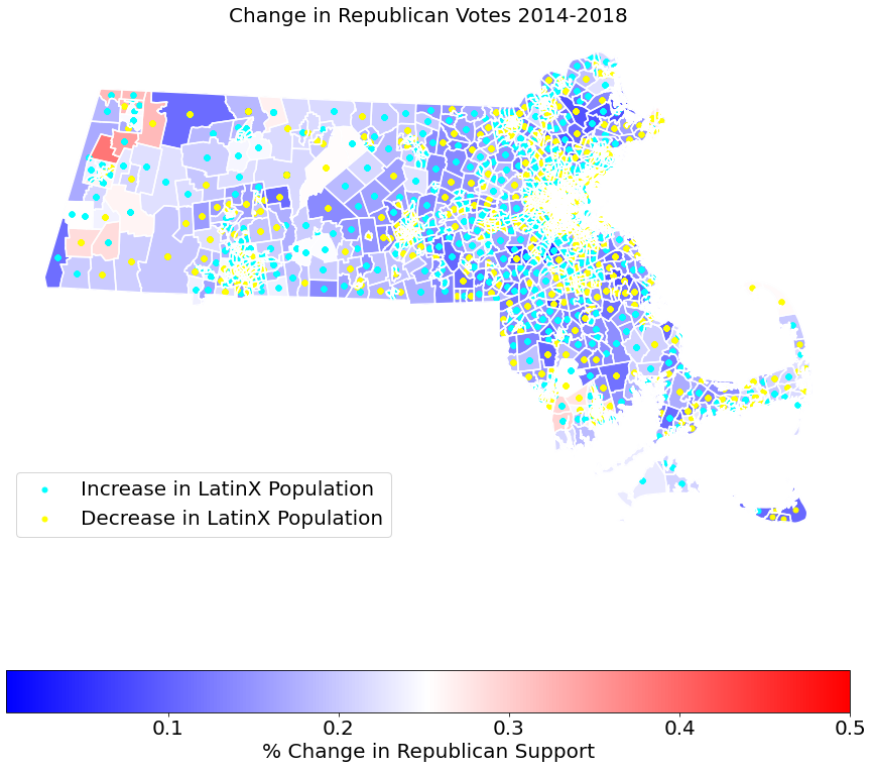
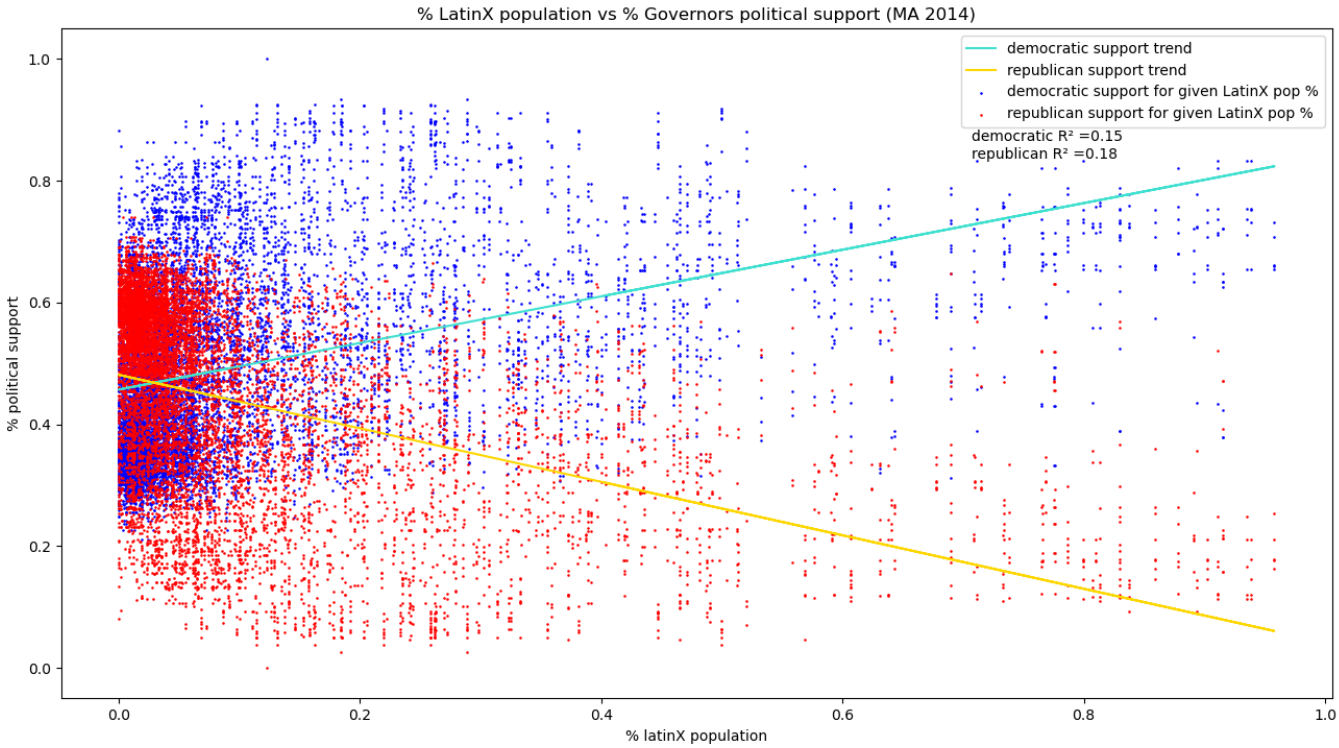


Fig 4 description: The visualization shows a heatmap of the changes in Republican support for the 2014 to 2018 Massachusetts Governor election. Coloration of red indicates a decrease in Republican support. Coloration of blue indicates a positive change in Republican support. Additionally, the dots depict changes in the LatinX populations within each tract. A yellow dot shows a decrease in the LatinX population. A lime dot shows an increase in LatinX population.

[17] This is a geospatial visualization of the state of Massachusetts that represents each city Tract's percentage point change in Republican Support and changes in LatinX population from the 2014 and 2018 governor elections. A coloration toward darker blue represents a negative change in Republican support in that tract. A coloration toward darker red represents a positive change in Republican support for that tract. A lime point in the tract represents a positive change in LatinX population. A yellow point represents a negative change in LatinX population.

Governors 1[18]:

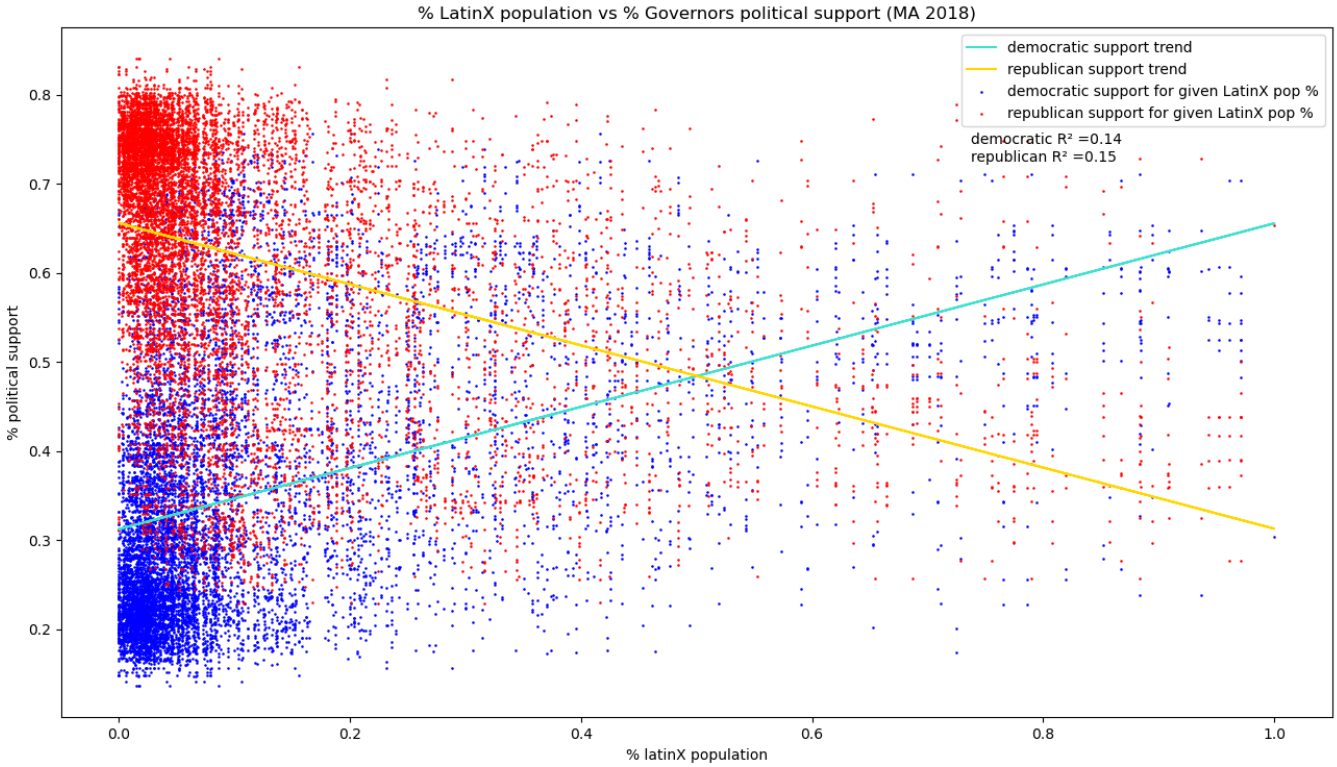


Democratic Support: R-squared is 0.15, therefore, 15% of the variance for percentage of Democratic support in 2014 can be explained by the percentage of LatinX population in each tract.*

Republican Support: R-squared is 0.18, therefore, 18% of the variance for the percentage of Republican support in 2014 can be explained by the percentage of LatinX population in each tract.*

[18] This graph describes the identified LatinX demographics and the political support percentage in the state of Massachusetts during the 2014 governor election. The LatinX population represents individuals who identify with LatinX ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall LatinX population within each city tract.The Y-axis describes the political support percentage during 2014 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 2:[19]

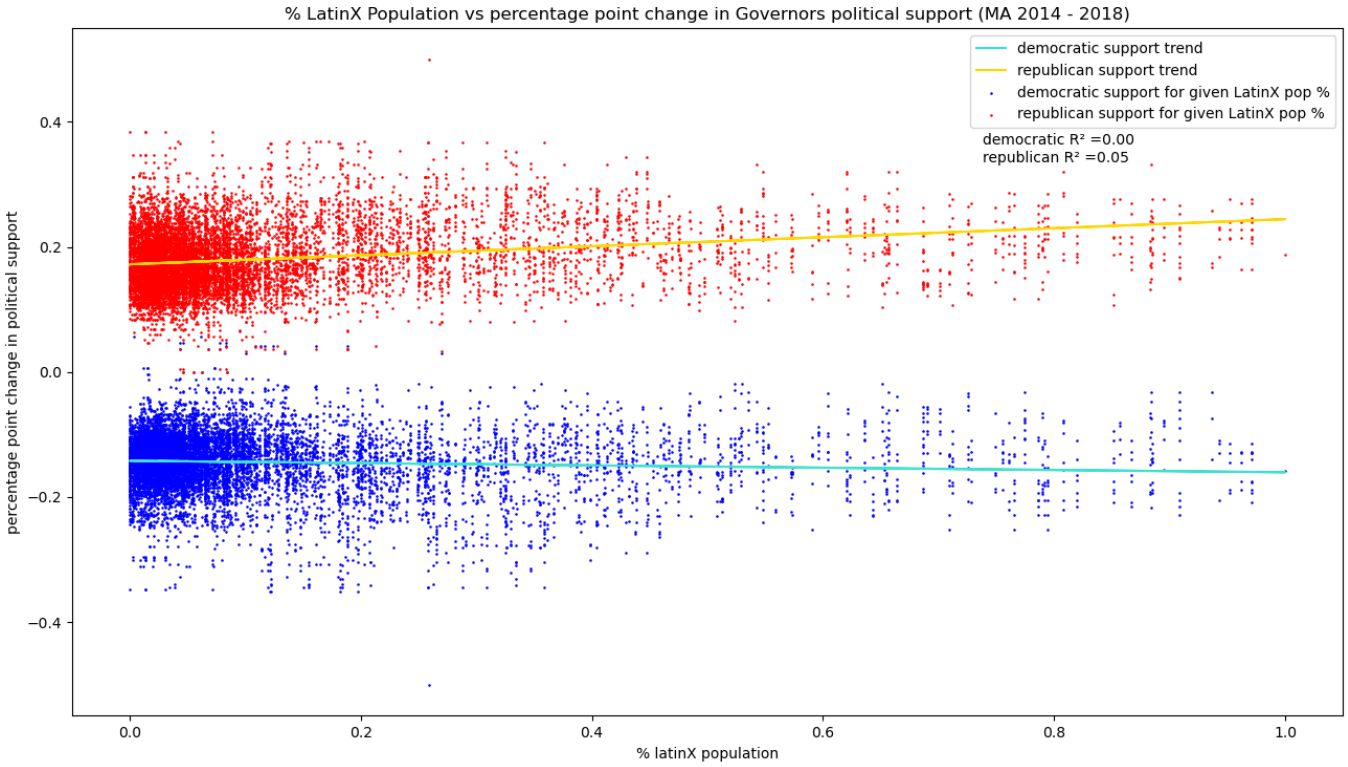


Democratic Support: R-squared is 0.14, therefore, 14% of the variance for the percentage of Democratic support in 2018 can be explained by the percentage of LatinX population in each tract.*

Republican Support: R-squared is 0.15, therefore, 15% of the variance for the percentage of Republican support in 2018 can be explained by the percentage of LatinX population in each tract.*

[19] This graph describes the identified LatinX demographics and the political support percentage in the state of Massachusetts during the 2018 governor election. The LatinX population represents individuals who identify with LatinX ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall LatinX population within each city tract.The Y-axis describes the political support percentage during 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 3:[20]

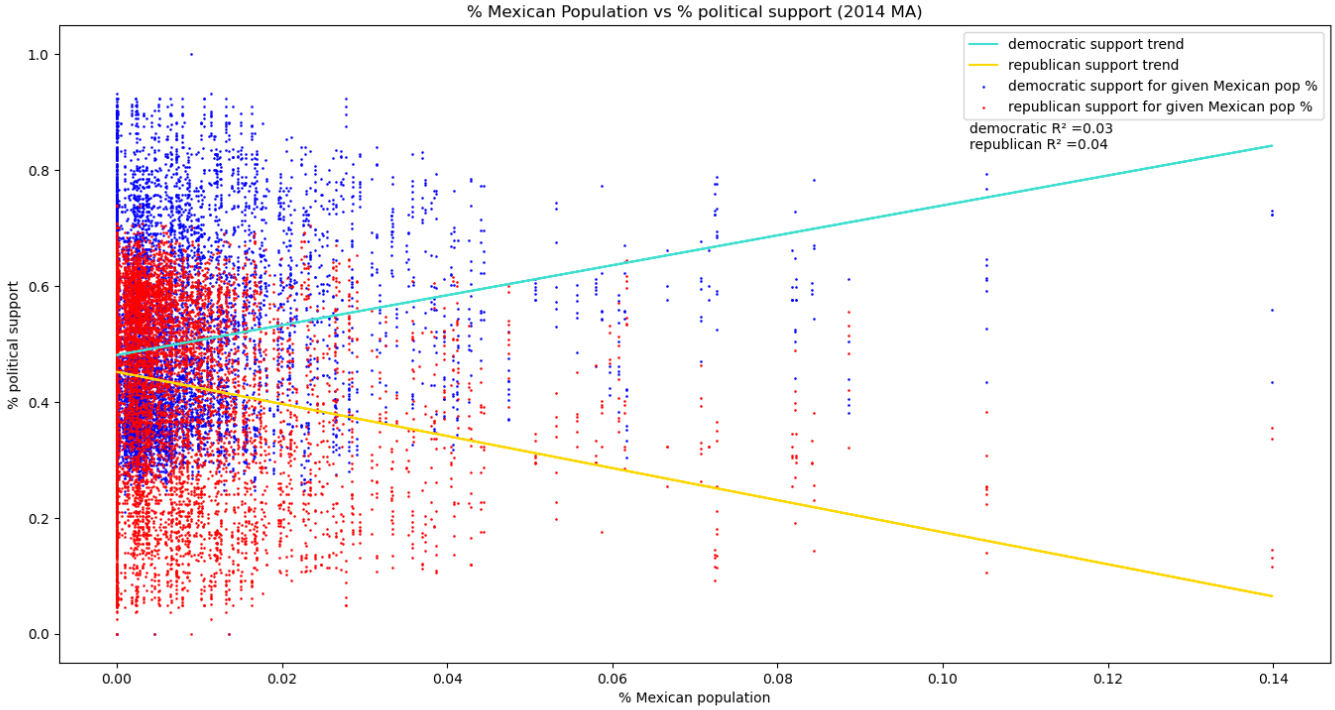


Democratic Support: R-squared is 0.00, therefore, 0% of the variance for the percentage point change of Democratic support from 2014 to 2018 can be explained by the percentage of LatinX population in each tract.*

Republican Support: R-squared is 0.05, therefore, 5% of the variance for the percentage point change of Republican support from 2014 to 2018 can be explained by the percentage of LatinX population in each tract.*

[20] This graph describes the identified LatinX demographics and the political support percentage point change in the state of Massachusetts during the 2014-2018 governor elections. The LatinX population represents individuals who identify with LatinX ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage point change in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall LatinX population within each city tract.The Y-axis describes the political support percentage point change from 2014 to 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 4:[21]

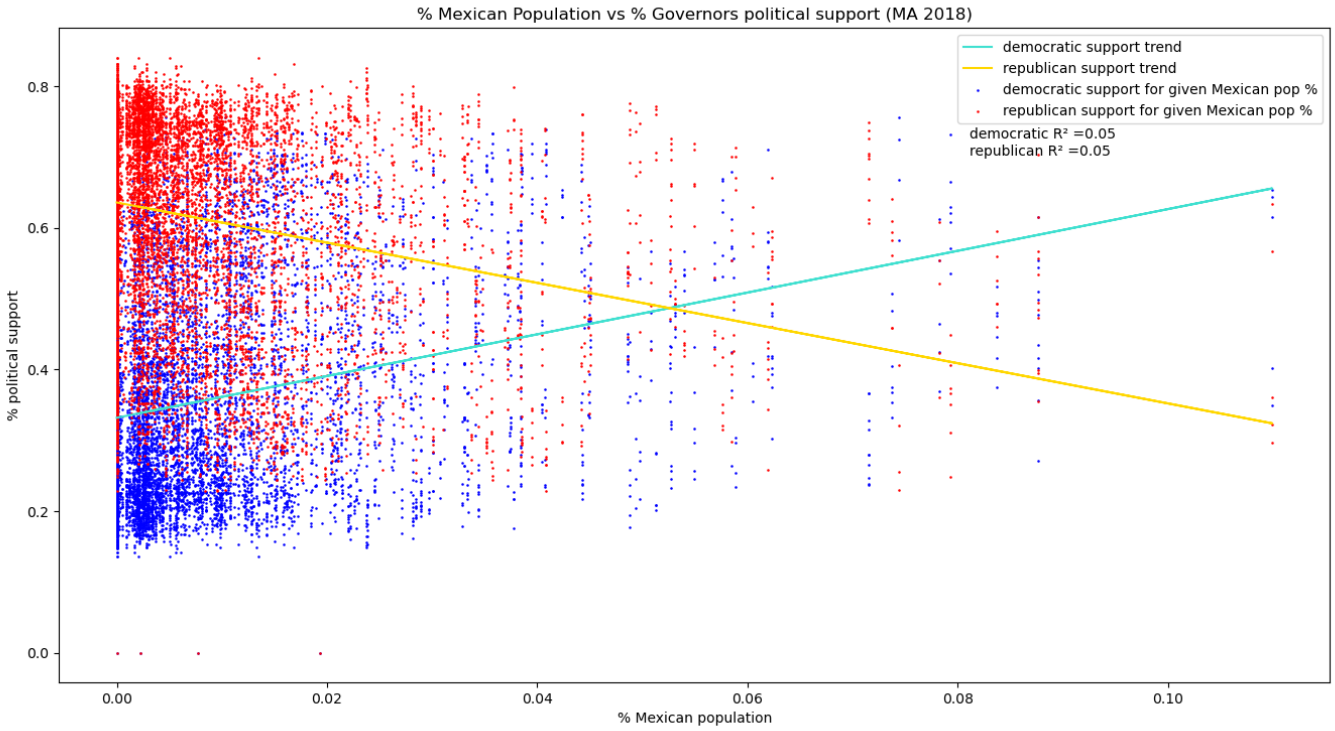


Democratic Support: R-squared is 0.03, therefore, 3% of the variance for the percentage of Democratic support in 2014 can be explained by the percentage of Mexican population in each tract.*

Republican Support: R-squared is 0.04, therefore, 18% of the variance for the percentage of Republican support in 2014 can be explained by the percentage of Mexican population in each tract.*

[21] This graph describes the identified Mexican demographics and the political support percentage in the state of Massachusetts during the 2014 governor election. The Mexican population represents individuals who identify with the Mexican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Mexican population within each city tract.The Y-axis describes the political support percentage in 2014 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 5:[22]

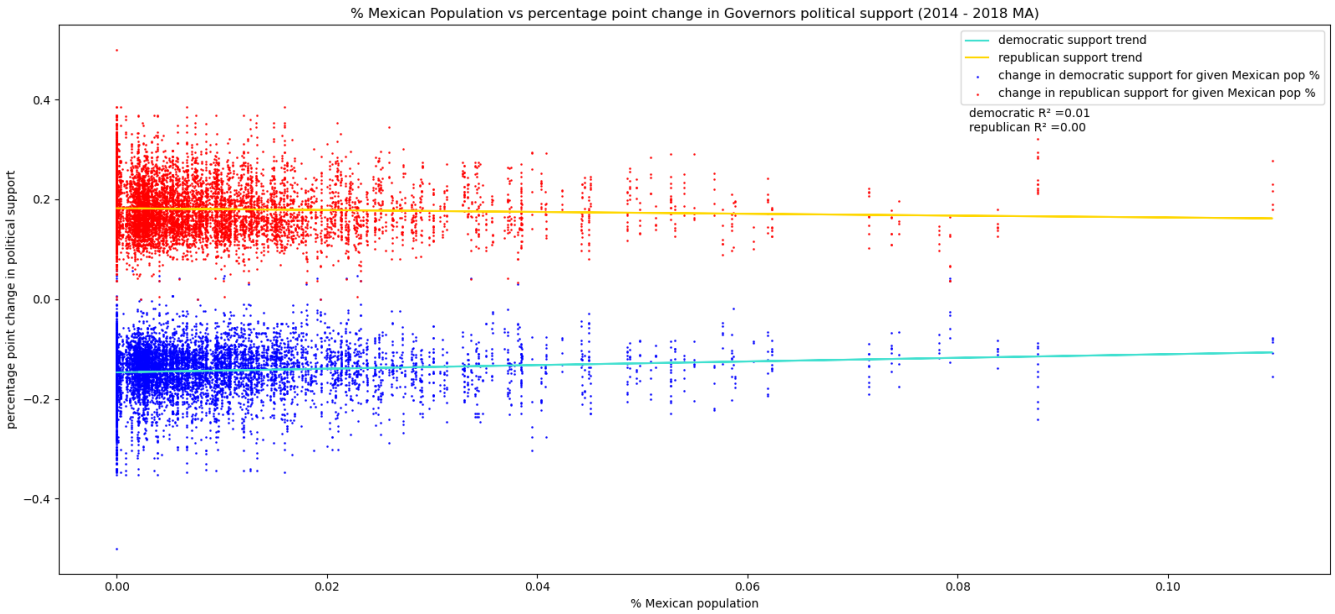


Democratic Support: R-squared is 0.05, therefore, 5% of the variance for the percentage of Democratic support in 2018 can be explained by the percentage of Mexican population in each tract.*

Republican Support: R-squared is 0.05, therefore, 5% of the variance for the percentage of Republican support in 2018 can be explained by the percentage of Mexican population in each tract.*

[22] This graph describes the identified Mexican demographics and the political support percentage in the state of Massachusetts during the 2018 governor election. The Mexican population represents individuals who identify with the Mexican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Mexican population within each city tract.The Y-axis describes the political support percentage in 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 6:[23]

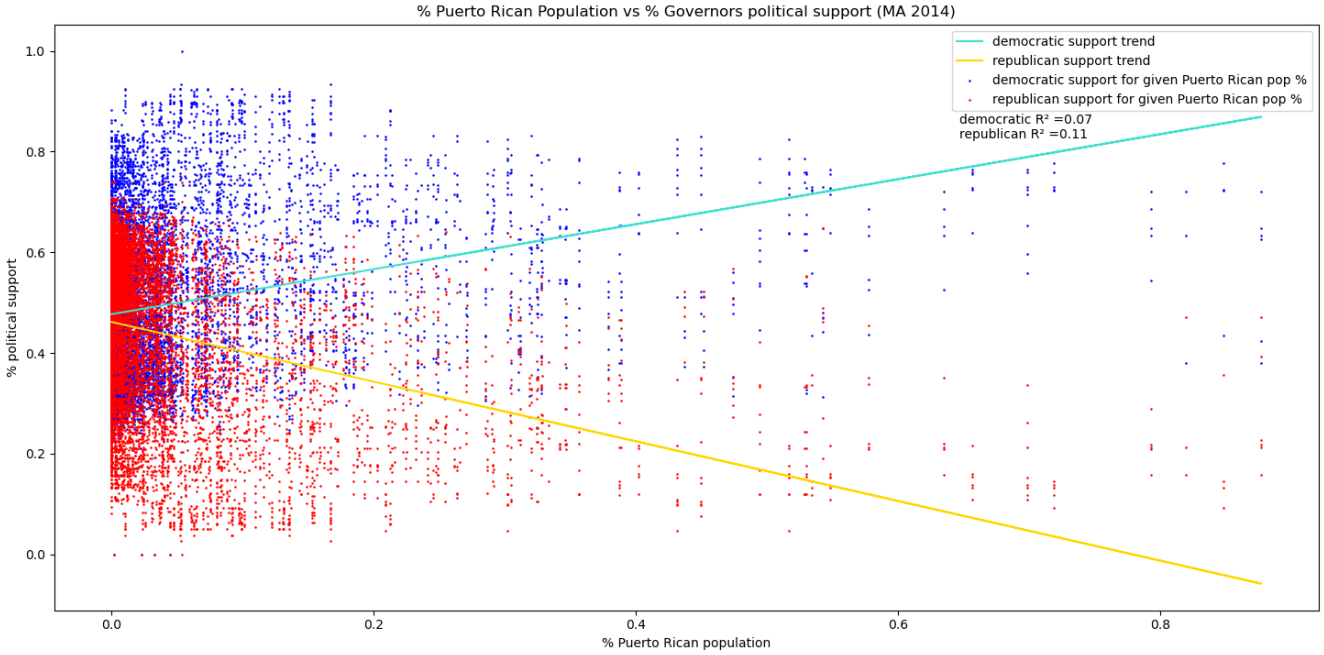


Democratic Support: R-squared is 0.01, therefore, 1% of the variance for the percentage point change of Democratic support from 2014 to 2018 can be explained by the percentage of Mexican population in each tract.*

Republican Support: R-squared is 0.0, therefore, 0% of the variance for the percentage point change of Republican support from 2014 to 2018 can be explained by the percentage of Mexican population in each tract.*

[23] This graph describes the identified Mexican demographics and the political support percentage point change in the state of Massachusetts during the 2014-2018 governor elections. The Mexican population represents individuals who identify with Mexican ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage point change in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Mexican population within each city tract.The Y-axis describes the political support percentage point change from 2014 to 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 7:[24]

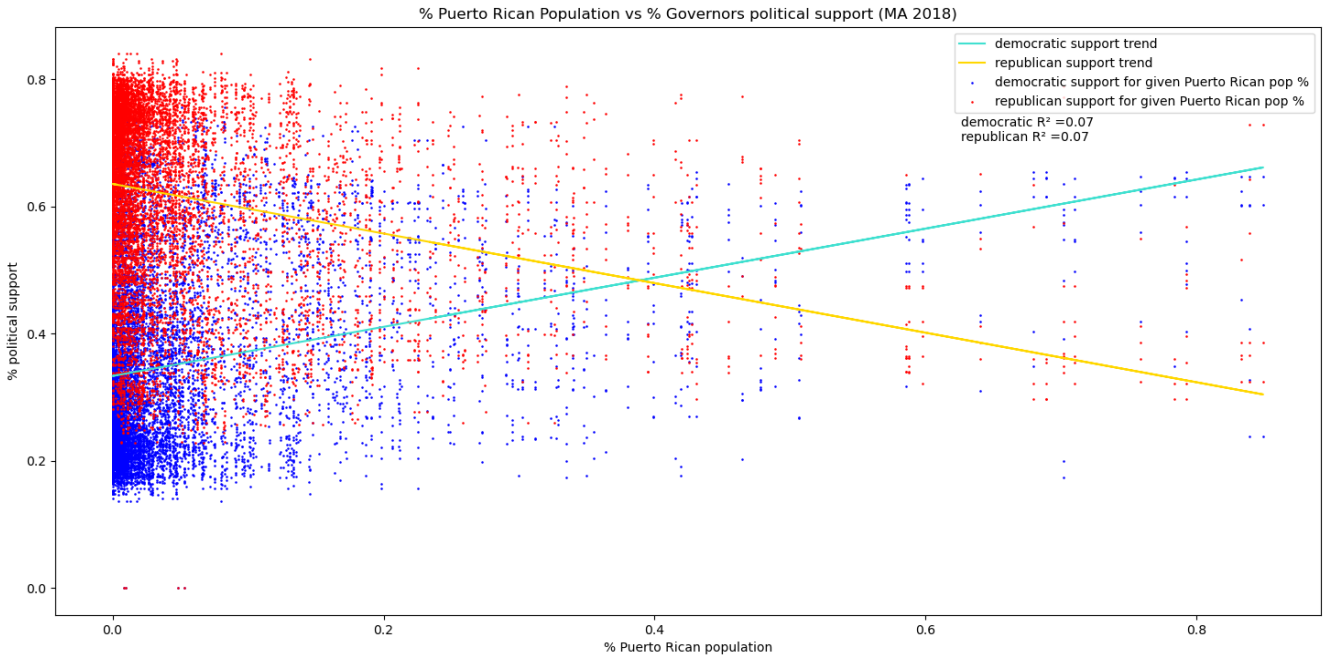


Democratic Support: R-squared is 0.07, therefore, 7% of the variance for the percentage of Democratic support in 2014 can be explained by the percentage of Puerto Rican population in each tract.*

Republican Support: R-squared is 0.11, therefore, 11% of the variance for the percentage of Republican support in 2014 can be explained by the percentage of Puerto Rican population in each tract.*

[24] This graph describes the identified Puerto Rican demographics and the political support percentage in the state of Massachusetts during the 2014 governor election. The Puerto Rican population represents individuals who identify with the Puerto Rican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Puerto Rican population within each city tract.The Y-axis describes the political support percentage in 2014 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 8:[25]

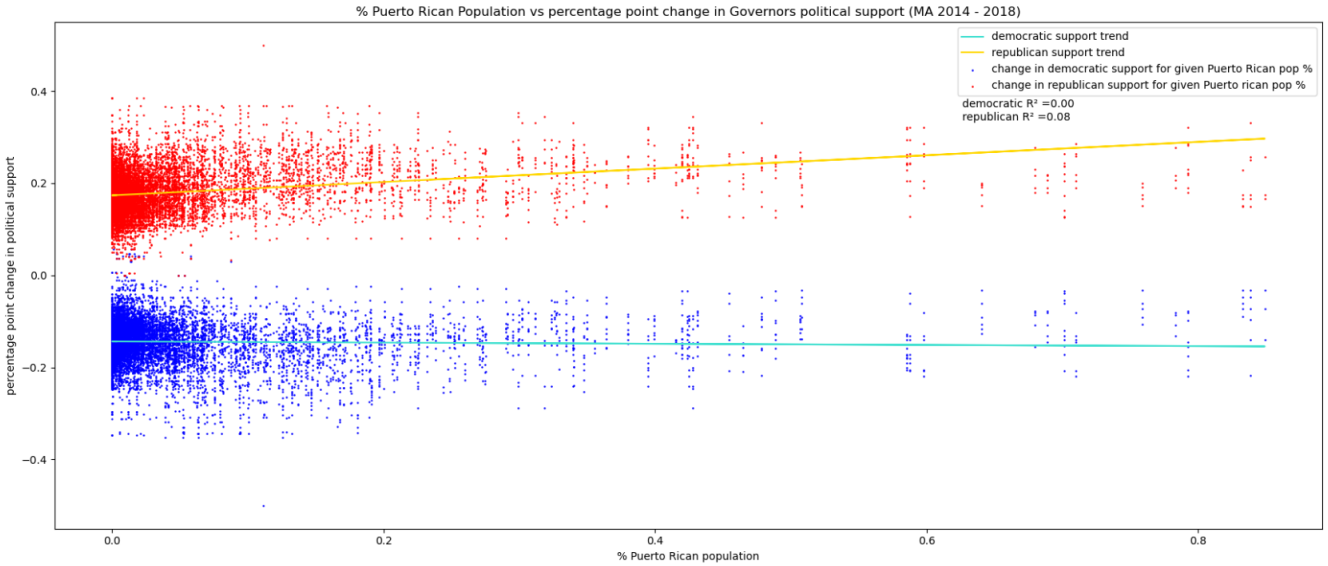


Democratic Support: R-squared is 0.07, therefore, 7% of the variance for the percentage of Democratic support in 2018 can be explained by the percentage of Puerto Rican population in each tract.*

Republican Support: R-squared is 0.07, therefore, 7% of the variance for the percentage of Republican support in 2018 can be explained by the percentage of Puerto Rican population in each tract.*

[25] This graph describes the identified Puerto Rican demographics and the political support percentage in the state of Massachusetts during the 2018 governor election. The Puerto Rican population represents individuals who identify with the Puerto Rican ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Puerto Rican population within each city tract.The Y-axis describes the political support percentage in 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 9:[26]

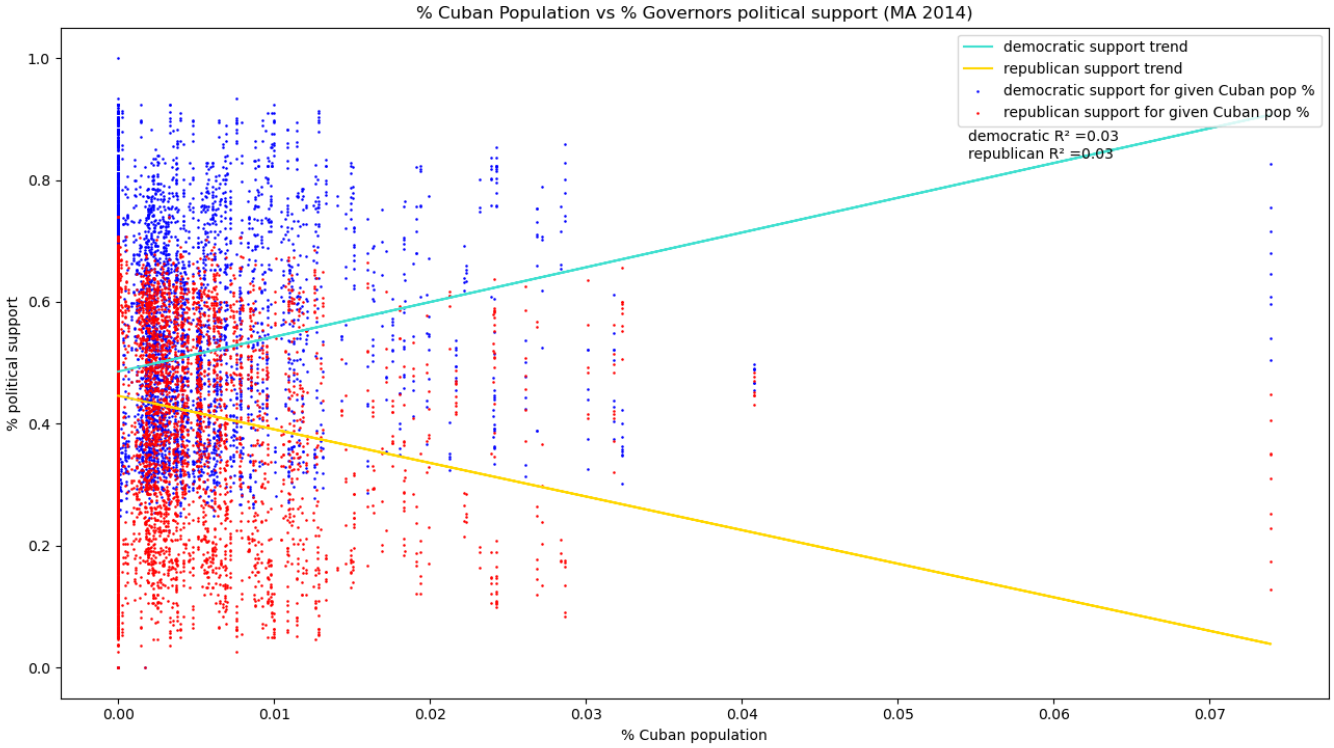


Democratic Support: R-squared is 0.00, therefore, 0% of the variance for the percentage point change of Democratic support from 2014 to 2018 can be explained by the percentage of Puerto Rican population in each tract.*

Republican Support: R-squared is 0.08, therefore, 8% of the variance for the percentage point change of Republican support from 2014 to 2018 can be explained by the percentage of Puerto Rican population in each tract.*

[26] This graph describes the identified Puerto Rican demographics and the political support percentage point change in the state of Massachusetts during the 2014-2018 governor elections. The Puerto Rican population represents individuals who identify with Puerto Rican ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage point change in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Puerto Rican population within each city tract.The Y-axis describes the political support percentage point change from 2014 to 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 10:[27]

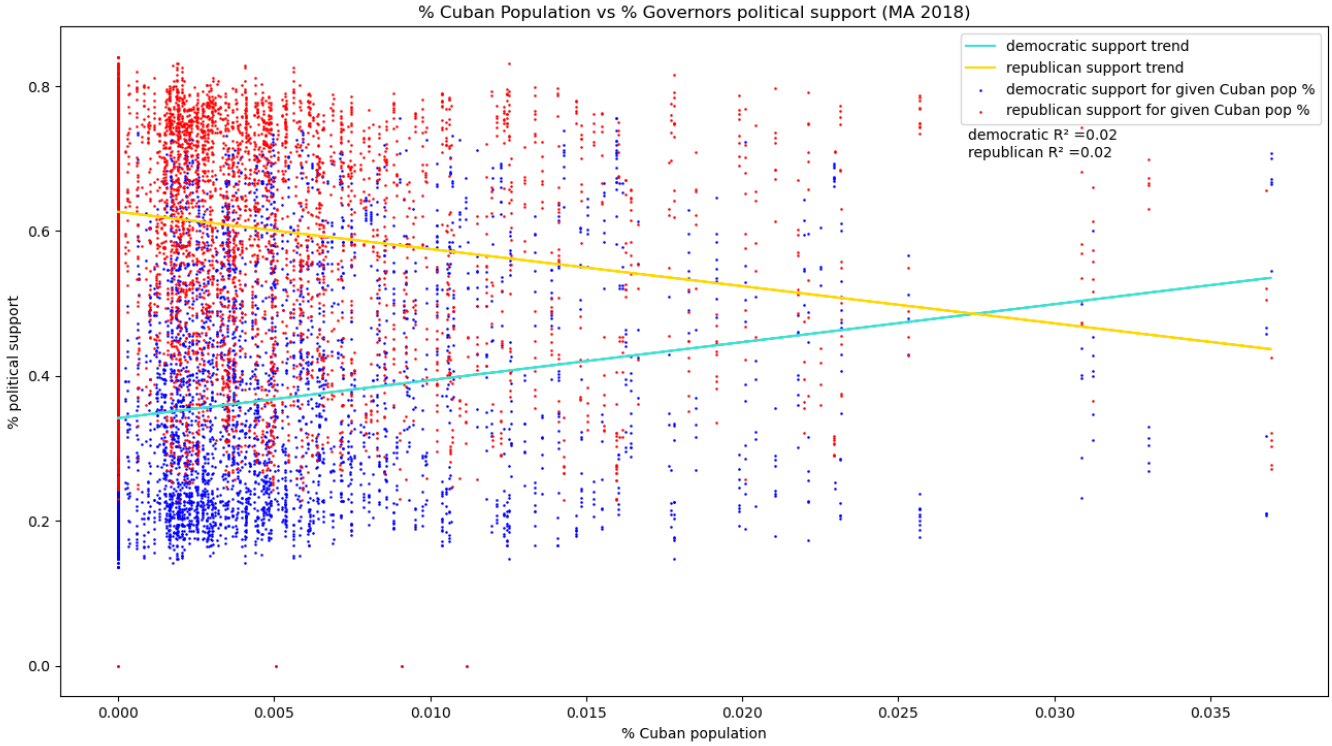


Democratic Support: R-squared is 0.03, therefore, 3% of the variance for the percentage of Democratic support in 2014 can be explained by the percentage of Cuban population in each tract.*

Republican Support: R-squared is 0.3, therefore, 3% of the variance for the percentage of Republican support in 2014 can be explained by the percentage of Cuban population in each tract.*

[27] This graph describes the identified Cuban demographics and the political support percentage in the state of Massachusetts during the 2014 governor election. The Cuban population represents individuals who identify with the Cuban ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Cuban population within each city tract.The Y-axis describes the political support percentage in 2014 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 11:[28]

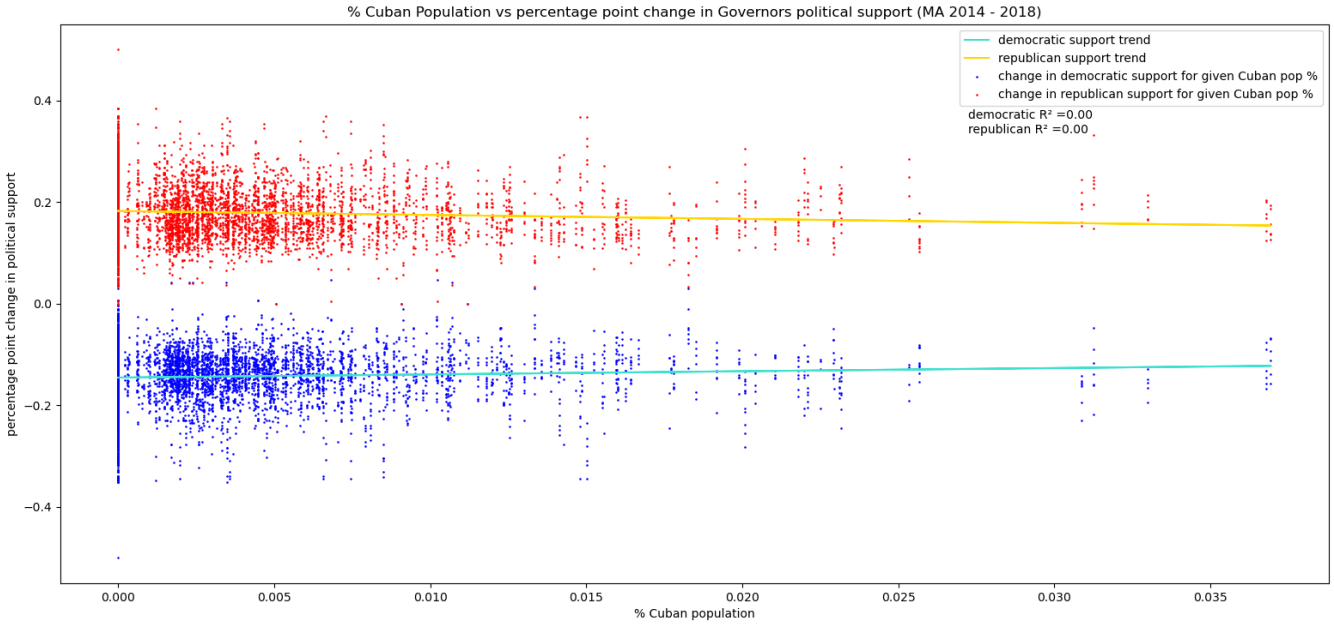


Democratic Support: R-squared is 0.02, therefore, 2% of the variance for the percentage of Democratic support in 2018 can be explained by the percentage of Cuban population in each tract.*

Republican Support: R-squared is 0.02, therefore, 2% of the variance for the percentage of Republican support in 2018 can be explained by the percentage of Cuban population in each tract.*

[28] This graph describes the identified Cuban demographics and the political support percentage in the state of Massachusetts during the 2018 governor election. The Cuban population represents individuals who identify with the Cuban ethnicity. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Cuban population within each city tract.The Y-axis describes the political support percentage in 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 12:[29]

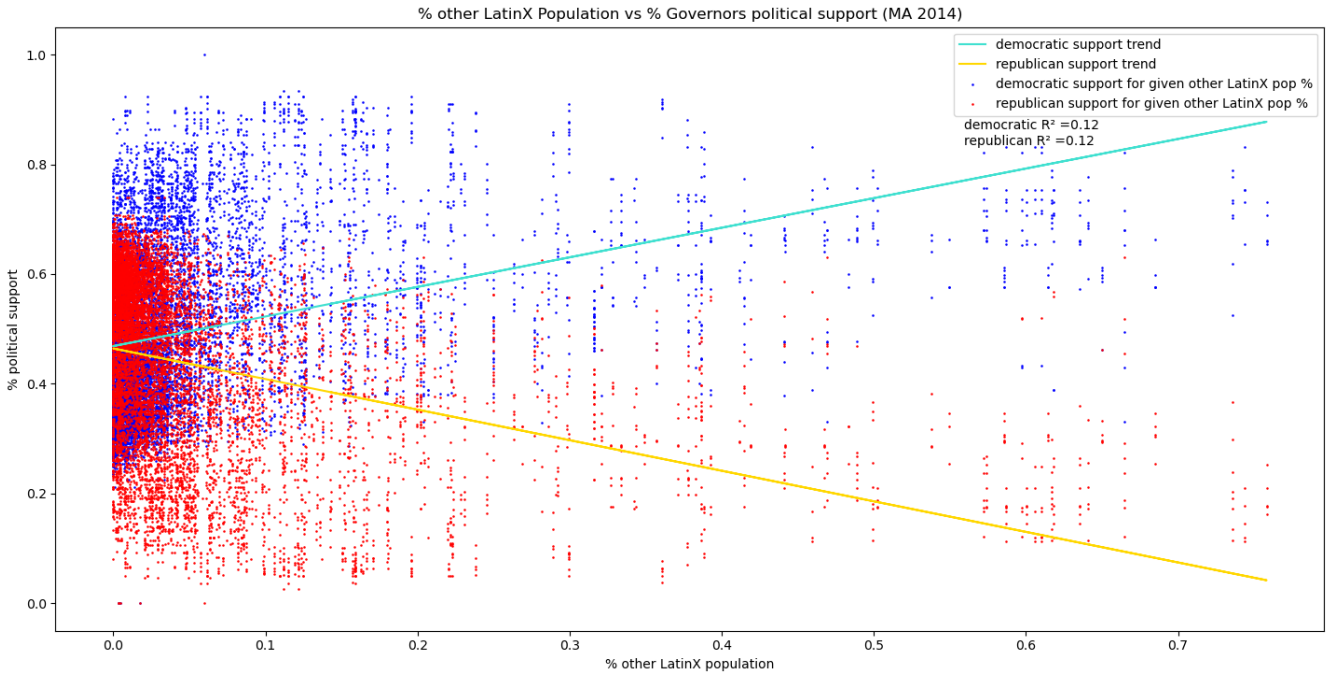


Democratic Support: R-squared is 0.00, therefore, 0% of the variance for the percentage point change of Democratic support from 2014 to 2018 can be explained by the percentage of Cuban population in each tract.*

Republican Support: R-squared is 0.08, therefore, 8% of the variance for the percentage point change of Republican support from 2014 to 2018 can be explained by the percentage of Cuban population in each tract.*

[29] This graph describes the identified Cuban demographics and the political support percentage point change in the state of Massachusetts during the 2014-2018 governor elections. The Cuban population represents individuals who identify with Cuban ethnicities. Each point represents a city tract. Each city tract has both a point to represent its percentage point change in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Cuban population within each city tract.The Y-axis describes the political support percentage point change from 2014 to 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 13:[30]

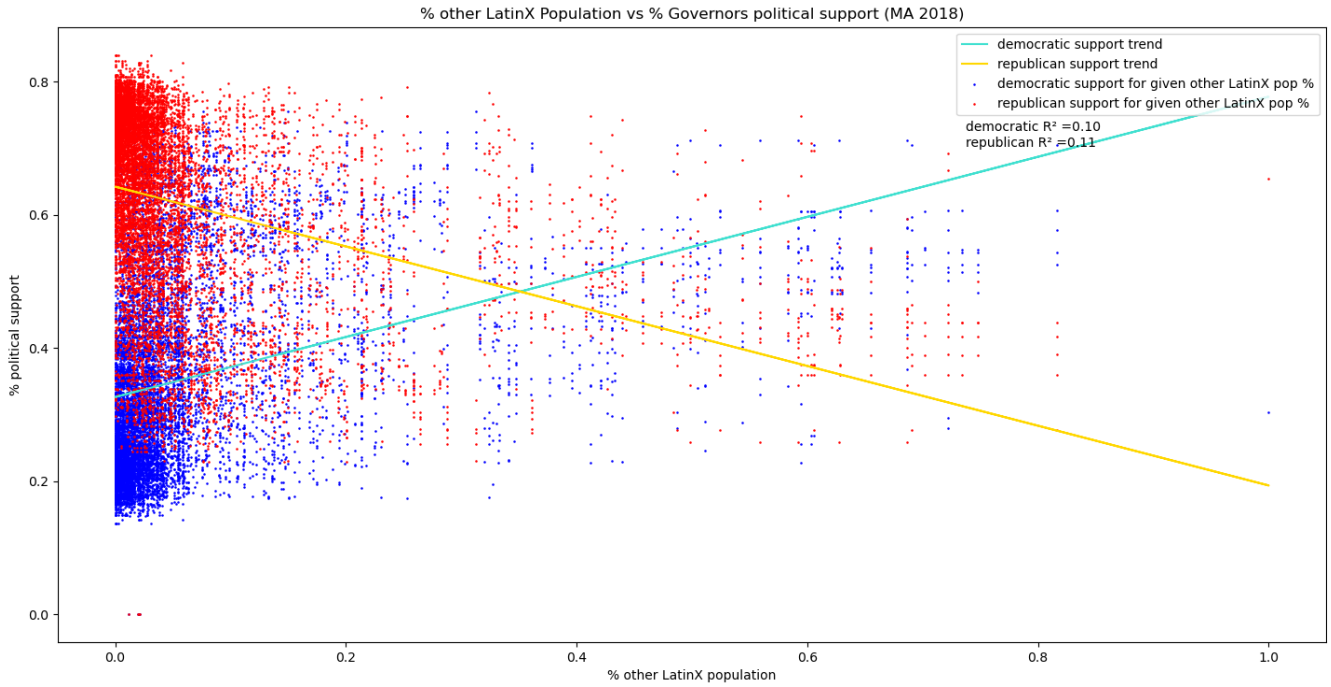


Democratic Support: R-squared is 0.12, therefore, 12% of the variance for the percentage of Democratic support in 2014 can be explained by the percentage of other LatinX population in each tract.*

Republican Support: R-squared is 0.12, therefore, 12% of the variance for the percentage of Republican support in 2014 can be explained by the percentage of other LatinX population in each tract.*

[30] This graph describes the identified Other LatinX demographics not previously analyzed and the political support percentage in the state of Massachusetts during the 2014 governor election. The Other LatinX population represents individuals who identify with the Other LatinX ethnicities not previously analyzed. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Other LatinX population within each city tract.The Y-axis describes the political support percentage in 2014 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 14:[31]

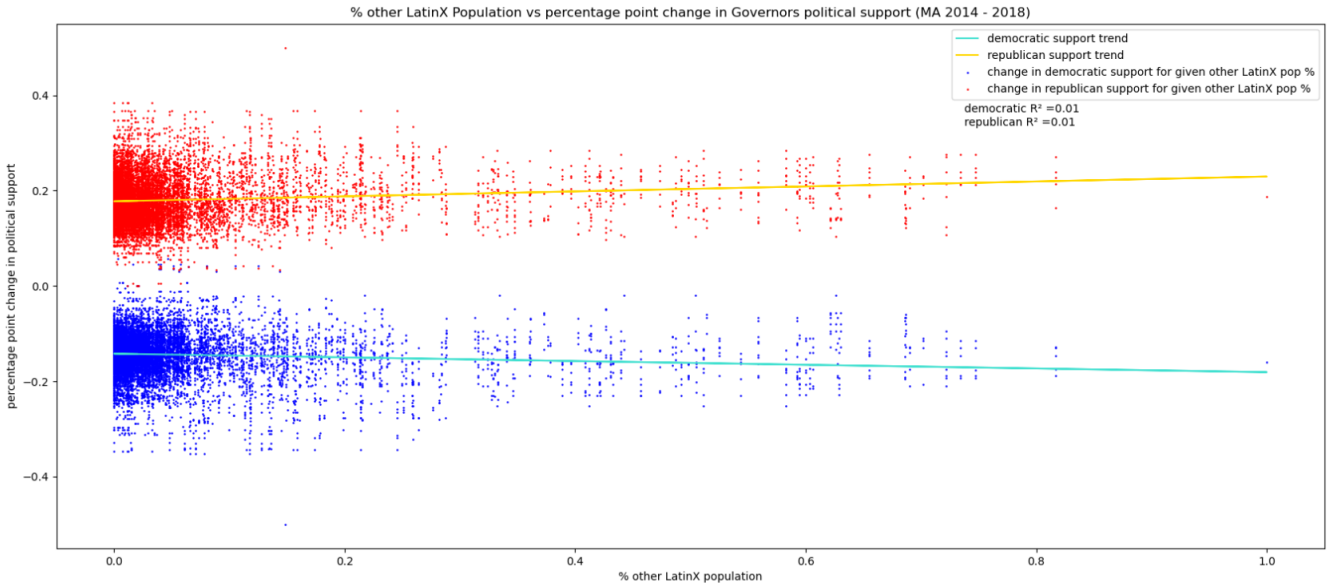


Democratic Support: R-squared is 0.10, therefore, 10% of the variance for the percentage of Democratic support in 2018 can be explained by the percentage of other LatinX population in each tract.*

Republican Support: R-squared is 0.11, therefore, 11% of the variance for the percentage of Republican support in 2018 can be explained by the percentage of other LatinX population in each tract.*

[31] This graph describes the identified Other LatinX demographics not previously analyzed and the political support percentage in the state of Massachusetts during the 2014 governor election. The Other LatinX population represents individuals who identify with the Other LatinX ethnicities not previously analyzed. Each point represents a city tract. Each city tract has both a point to represent its percentage in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Other LatinX populations within each city tract.The Y-axis describes the political support percentage in 2014 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Governors 15:[32]



Democratic Support: R-squared is 0.01, therefore, 1% of the variance for the percentage point change of Democratic support from 2014 to 2018 can be explained by the percentage of other LatinX population in each tract.*

Republican Support: R-squared is 0.01, therefore, 1% of the variance for the percentage point change of Republican support from 2014 to 2018 can be explained by the percentage of other LatinX population in each tract.*

[32] This graph describes the identified Other LatinX demographics not previously analyzed and the political support percentage point change in the state of Massachusetts during the 2014-2018 governor elections. The Other LatinX population represents individuals who identify with Other LatinX ethnicities not previously analyzed. Each point represents a city tract. Each city tract has both a point to represent its percentage point change in Democratic Support and its percentage in Republican Support. The X-axis describes the percentage of the overall Other LatinX population within each city tract.The Y-axis describes the political support percentage point change from 2014 to 2018 colored by their political support; Blue represents democratic support and Red represents republican support. The lines indicate the regression line of best fit colored blue for democratic data and orange for republican data.

Conclusion:

Our analysis showed that LatinX support for Republican candidates has been increasing since 2014. Despite the overall weak correlation between the LatinX population and changes in support for a political party, we observed an increase in Republican support from the LatinX community from the 2016 to 2020 presidential elections. When analyzing the voting patterns of each LatinX subgroup, the Mexican, Puerto Rican, and Cuban populations had increased their support for Republican candidates from the 2016 to 2020 presidential elections with the Puerto Rican sub-group showing the most significant (in terms of R^2) increase.

Limits & Challenges:

A major limitation of this project was that our data did not go into detail about the demographics breakdown of votes, specifically within the LatinX population. The lack of connection between city election results and LatinX demographics data made it difficult to directly answer the key questions for this project. Therefore, we had to analyze the LatinX voting patterns by comparing the LatinX population and changes in the LatinX population to changes in the election results of all demographics. This method was not ideal because we cannot assume that changes in the LatinX demographics had a direct impact on election results. There could be several external factors that cause shifts in election results that are not related to changes in the LatinX population.

Next Step to Improve:

Having access to voting data broken down by demographics would help improve our analysis. With our current data, we were only able to analyze the correlation between changes in the LatinX population relative to changes in total votes for all demographics groups. However, it would be much more effective to analyze changes in the LatinX population relative to changes in the total votes that only came from LatinX individuals.

A potential new project could be to see which LatinX cities supported Trump and to find the contributing factors for their support. There is the possibility that the voter turnout information for the LatinX population in the 2020 Presidential election will soon be available. This data would allow us to properly analyze the LatinX voter population and compare our results to that of other racial groups. An analysis of the changes in voter patterns based on the relationship between gender and political support would give more insight to this project. We can also compare the pre-election polling data from 2016 - 2020 to the election results in order to assess the accuracy of the pre-election data.

Research:

Our team conducted analyses to see the connection between changes in the LatinX population to changes in political support in Massachusetts. 73.8% of towns saw an increase in the LatinX population from 2016-2019, while only 24.3% of towns in Massachusetts saw an increase in Republican support from 2016-2020. However, the five towns with the highest LatinX percentage in 2019 all showed a percentage point increase in Republican support from 2016-2020. All 5 towns with the highest concentration of LatinX population showed significant increases in Republican support. These results directly correlated to our external research, which emphasized the fact that Trump built LatinX support in a number of gateway cities[33] in Massachusetts. Although Joe Biden received nearly three times the votes of Donald Trump in Lawrence, Trump's support had increased from 14% in 2016 to 25% in 2020[1].

City/Town	% LatinX 2019	Democratic Percentage point Change	Republican Percentage point Change
LAWRENCE	0.747413	-10.425567	12.561895
CHELSEA	0.579951	3.134887	4.054185
HOLYOKE	0.405884	-1.616373	6.618964
SPRINGFIELD	0.400684	-3.071012	4.796808
METHUEN	0.397335	4.121485	0.773999

The increase in LatinX support for Trump in Massachusetts can be due to several factors. For example, many members of the LatinX population were positively influenced by the coronavirus stimulus package. The stimulus check influenced many members of the LatinX population who were undecided to cast a vote[1]. In addition, the LatinX population in MA could have been influenced by the increase of anti-communist propaganda against democrats[1]. This most likely had the strongest influence on Cuban and Venezuelan immigrants, who had experienced socialism in the past. The increase in LatinX support in these towns could be attributed to Trump's anti-abortion stance[2]. Evangelical LatinX voters in MA and first-generation citizens from very Catholic countries were in support of Trump's anti-abortion stance and therefore might have been more inclined to vote for him.

[33] Gateway cities are midsize urban centers that anchor regional economies around the state. For generations, these communities were home to industry that offered residents good jobs and a "gateway" to the American Dream.[3]

References:

[1] Zea, Tibisay, and Simón Rios. “Trump Lost In Massachusetts, But Built Latino Support In Gateway Cities.” Trump Lost In Massachusetts, But Built Latino Support In Gateway Cities | WBUR News. WBUR, November 16, 2020. https://www.wbur.org/news/2020/11/16/latino-vote-massachusetts-gateway-cities-trump

[2] Jonas, Michael. “One Place Trump Gained in Mass.: Heavily Latino Cities .” CommonWealth Magazine, November 6, 2020. https://commonwealthmagazine.org/politics/one-place-trump-gained-in-mass-heavily-latino-cities/.

[3] “About the Gateway Cities.” MassINC. Accessed April 16, 2021. https://massinc.org/our-work/policy-center/gateway-cities/about-the-gateway-cities/.

Appendix:

GitHub repository with all python/csv files and code:

https://github.com/glotzky/LatinXBaystate.git

```
In [63]: test16['Ward']==test20['Ward']
Out[63]: 0    False
         1    False
         2    False
         3    False
         4    False
         Name: Ward, dtype: bool

In [64]: print(test20['Ward'][0])
         print(test16['Ward'][0])
          -
         -

In [65]: pres2016['Ward'] = pres2016['Ward']#.str.replace('-','0')
         pres2020['Ward'] = pres2020['Ward'].str.strip(' ') #.str.replace('-',)
```

Debugging the Ward issue

```
type(mergedP)
pandas.core.frame.DataFrame

mergedP['Latitude'] = -40.266666
mergedP['Longitude'] = 72.3452

mergedPG = gpd.GeoDataFrame(
   mergedP, geometry=gpd.points_from_xy(mergedP.Longitude, mergedP.Latitude))

mergedPG = mergedPG.drop(columns = ["Latitude","Longitude"])

type(mergedPG)
geopandas.geodataframe.GeoDataFrame
```

Converting Pandas DataFrameDataFrames to GeoPandas DataFrames with arbitrary latitude and longitude columns

```
MA_t = gpd.read_file("CENSUS2010_BLK_BG_TRCT_SHP/CENSUS2010TRACTS_POLY.shp")
```

```
MA_p = gpd.read_file("wardsprecincts_poly/WARDSPRECINCTS_POLY.shp")
```

Reading in shapefile

```
FinalData.columns
```

```
Index(['STATEFP10', 'COUNTYFP10', 'TRACTCE10', 'GEOID10', 'NAME10',
       'NAMELSAD10', 'MTFCC10', 'ALAND10', 'AWATER10', 'INTPTLAT10',
       'INTPTLON10', 'AREA_SQFT', 'AREA_ACRES_left', 'POP100_RE', 'HU100_RE',
       'LOGPL94171', 'LOGSF1', 'LOGACS0610', 'LOGSF1C', 'SHAPE_AREA_left',
       'SHAPE_LEN_left', 'geometry', 'Tract', '% Point Change in LatinX Pop.',
       '% Point Change in Total Pop.', '% Point Puerto Rican Change',
       '% Point Mexican Change', '% Point Cuban Change',
       '% Point Other LatinX Change', 'Total Population 2016',
       'LatinX Population 2016', 'Mexican 2016', 'Puerto Rican 2016',
       'Cuban 2016', 'Other LatinX 2016', 'Total Population 2019',
       'LatinX Population 2019', 'Mexican 2019', 'Puerto Rican 2019',
       'Cuban 2019', 'Other LatinX 2019', 'index_right', 'WP_NAME', 'WARD',
       'PRECINCT', 'DISTRICT', 'POP_2010', 'TOWN', 'TOWN_ID', 'AREA_SQMI',
       'AREA_ACRES_right', 'YEAR', 'SHAPE_AREA_right', 'SHAPE_LEN_right',
       'City/Town', 'Pct', 'Ward', 'Democratic 2016', 'Republican 2016',
       'Total Votes Cast', 'Democratic 2020', 'Republican 2020',
       'Total Votes Cast 2020', '% Point Change in Democratic Votes',
       '% Change in Total Votes', '% Point Change in Republican Votes'],
      dtype='object')
```

```
FinalData.shape
```

```
(10567, 66)
```

Successful Merged Dataset with all columns necessary for geospatial mapping and statistical analyses.

Code:

Import Necessary Libraries

```
import pandas as pd
import numpy as np
import shapely
from shapely.geometry import shape, mapping
import geopandas as gpd
from geopandas.tools import sjoin
import requests
import json
import matplotlib.pyplot as plt
```

```
print('Necessary libraries have been imported successfully.')
```

```
Necessary libraries have been imported successfully.
```

tracts2016 = pd.read_csv('plzwrk141619/2016alltractdata.csv') tracts2019 = pd.read_csv('plzwrk141619/2019alltractdata.csv')

Load in CSV Files for Tract data(contains population data)

```
tracts2016 = pd.read_csv('plzwrk141619/2016alltractdata.csv')
tracts2019 = pd.read_csv('plzwrk141619/2019alltractdata.csv')
```

Keep necessary attribute columns only

```
proct16 = tracts2016[['Geographic Area Name','Estimate!!SEX AND AGE!!Total population','Estimate!!HISPANIC OR LATINO AND RACE!!To
```

```
proct19 = tracts2019[['Geographic Area Name','Estimate!!SEX AND AGE!!Total population','Estimate!!HISPANIC OR LATINO AND RACE!!To
```

```
proct19.columns
```

```
Index(['Geographic Area Name', 'Estimate!!SEX AND AGE!!Total population',
       'Estimate!!HISPANIC OR LATINO AND RACE!!Total population!!Hispanic or Latino (of any race)',
       'Estimate!!HISPANIC OR LATINO AND RACE!!Total population!!Hispanic or Latino (of any race)!!Mexican',
       'Estimate!!HISPANIC OR LATINO AND RACE!!Total population!!Hispanic or Latino (of any race)!!Puerto Rican',
       'Estimate!!HISPANIC OR LATINO AND RACE!!Total population!!Hispanic or Latino (of any race)!!Cuban',
       'Estimate!!HISPANIC OR LATINO AND RACE!!Total population!!Hispanic or Latino (of any race)!!Other Hispanic or Latino'],
      dtype='object')
```

Rename columns for easier processing

```
proct16 = proct16.rename(columns = {'Geographic Area Name':'Tract','Estimate!!SEX AND AGE!!Total population':'Total Population 20
proct19 = proct19.rename(columns = {'Geographic Area Name':'Tract','Estimate!!SEX AND AGE!!Total population':'Total Population 20
```

Convert Tract Number columns from float values to strings

```
proct16['Tract'] = proct16['Tract'].astype(str)
proct19['Tract'] = proct19['Tract'].astype(str)
```

Merge the two tract pandas dataframes into one that contains all the years you want to compare

```
merged = pd.merge(proct16,proct19, how = "left", left_on = ['Tract'],right_on =['Tract'])
```

```
merged
```

	Tract	Total Population 2016	LatinX Population 2016	Mexican 2016	Puerto Rican 2016	Cuban 2016	Other LatinX 2016	Total Population 2019	LatinX Population 2019	Mexican 2019	Puerto Rican 2019	Cuban 2019	Other LatinX 2019
0	101.0	2962	164	0	105	0	59	2973	124	6	23	32	63
1	102.06	3168	10	1	1	0	8	3617	44	0	0	26	18
2	102.08	1589	30	17	0	0	13	1122	17	17	0	0	0
3	103.04	2107	23	7	0	6	10	2394	20	0	0	14	6
4	103.06	2817	53	0	0	0	53	2507	23	0	0	0	23
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1497	7601.0	3386	0	0	0	0	0	3441	1	0	0	0	1
1498	7611.0	5178	42	0	41	0	1	5213	62	0	0	0	62
1499	7612.0	5541	397	101	95	0	201	5506	483	154	20	0	309
1500	7613.0	3397	515	9	471	11	24	3259	341	0	161	50	130
1501	7614.0	6570	311	64	114	0	133	6569	399	68	130	24	177

1502 rows × 13 columns

```
points = merged.copy()
```

Create new columns for the changes between the populations being compared

```
points['% Point Change in LatinX Pop.'] = (points['LatinX Population 2019']/points['Total Population 2019'])-(points['LatinX Popu
```

```
points['% Point Change in Total Pop.'] = (points['Total Population 2019']-points['Total Population 2016'])/points['Total Populati
```

```
points['% Point Puerto Rican Change'] = (points['Puerto Rican 2019']/points['Total Population 2019'])-(points['Puerto Rican 2016'
```

```
points['% Point Mexican Change'] = (points['Mexican 2019']/points['Total Population 2019'])-(points['Mexican 2016']/points['Total
```

```
points['% Point Cuban Change'] = (points['Cuban 2019']/points['Total Population 2019'])-(points['Cuban 2016']/points['Total Popul
```

```
points['% Point Other LatinX Change'] = (points['Other LatinX 2019']/points['Total Population 2019'])-(points['Other LatinX 2016'
```

```
points
```

Keep necessary attributes only

```
points = points[['Tract','% Point Change in LatinX Pop.','% Point Change in Total Pop.','% Point Puerto Rican Change','% Point Me
```

Add arbitrary columns Latitude and Longitude. This is for converting the pandas dataframe to a geopandas dataframe only. Its only use is for the conversion, you may delete after the conversion.

```
points['Latitude'] = -40.266666
points['Longitude'] = 72.3452
```

```
from geopy.geocoders import Nominatim
```

Convert the pandas dataframe to geopandas using GeoDataFrame() function

```
points = gpd.GeoDataFrame(
    points, geometry=gpd.points_from_xy(points.Longitude, points.Latitude))
```

Import shapefiles for the tracts of MA

```
MA_t = gpd.read_file("CENSUS2010_BLK_BG_TRCT_SHP/CENSUS2010TRACTS_POLY.shp")
```

```
MA_t
```

	STATEFP10	COUNTYFP10	TRACTCE10	GEOID10	NAME10	NAMELSAD10	MTFCC10	ALAND10	AWATER10	INTPTLAT10	...	AREA_ACRES	POP
0	25	021	418003	25021418003	4180.03	Census Tract 4180.03	G5020	1705668.0	2936.0	+42.2350240	...	422.1740	
1	25	021	417701	25021417701	4177.01	Census Tract 4177.01	G5020	1543651.0	12275.0	+42.2523398	...	384.4502	

Convert the Tracts of MA to match the same format as you created in the previous steps. If the tracts do not match character for character, then it will not make merges successfully.

```
MA_t['NAME10'] = MA_t['NAME10'].astype(float).astype(str)
```

Merge the Tract Geopandas dataframe with the Geopandas Dataframe you created with the population data

```
Tractjoin = gpd.pd.merge(MA_t, points,  how='left', left_on=['NAME10'], right_on = ['Tract'])
```

Drop columns if irrelevant to your data analysis. The columns from the first geopandas dataframe will have the suffix '_x' and the second geopandas dataframe with have the suffix '_y' for its columns that have the same name between the two dataframes.

```
Tractjoin = Tractjoin.drop(columns = ["Latitude","Longitude",'geometry_y'])
```

```
Tractjoin = Tractjoin.rename(columns = {'geometry_x':'geometry'})
```

```
Tractjoin.columns
```

```
Index(['STATEFP10', 'COUNTYFP10', 'TRACTCE10', 'GEOID10', 'NAME10',
       'NAMELSAD10', 'MTFCC10', 'ALAND10', 'AWATER10', 'INTPTLAT10',
       'INTPTLON10', 'AREA_SQFT', 'AREA_ACRES', 'POP100_RE', 'HU100_RE',
       'LOGPL94171', 'LOGSF1', 'LOGACS0610', 'LOGSF1C', 'SHAPE_AREA',
       'SHAPE_LEN', 'geometry', 'Tract', '% Point Change in LatinX Pop.',
       '% Point Change in Total Pop.', '% Point Puerto Rican Change',
       '% Point Mexican Change', '% Point Cuban Change',
       '% Point Other LatinX Change', 'Total Population 2016',
       'LatinX Population 2016', 'Mexican 2016', 'Puerto Rican 2016',
       'Cuban 2016', 'Other LatinX 2016', 'Total Population 2019',
       'LatinX Population 2019', 'Mexican 2019', 'Puerto Rican 2019',
       'Cuban 2019', 'Other LatinX 2019'],
      dtype='object')
```

Drop all NA values.

```
Tractjoin.dropna()
```

Load in the precinct geopandas dataframes.

```
MA_p = gpd.read_file("wardsprecincts_poly/WARDSPRECINCTS_POLY.shp")
MA_p['WARD'] = MA_p['WARD'].astype(str)
```

Load in your csv files containing the election data for each precinct.

```
pres2016 = pd.read_csv('2016PresidentPrecinct.csv')
pres2020 = pd.read_csv('2020PresidentPrecint.csv')
```

Make selections for your columns and rename columns if necessary.

```
pres2016 = pres2016.rename(columns = {'Clinton/ Kaine':'Democratic 2016','Trump/ Pence':'Republican 2016'})
pres2016 = pres2016[['City/Town','Pct','Ward','Democratic 2016','Republican 2016','Total Votes Cast']]
pres2020 = pres2020.rename(columns = {'Democratic': 'Democratic 2020','Republican':'Republican 2020','Precinct':'Pct','Total Vote
pres2020 = pres2020[['City/Town','Pct','Ward','Democratic 2020','Republican 2020','Total Votes Cast 2020']]
```

Drop all NA values.

```
pres2020 = pres2020.dropna()
pres2016 = pres2016.dropna()
```

Merge the two dataframes that contain the election results from each election.

```
mergedP = pd.merge(pres2016,pres2020, how = 'inner', left_on = ['City/Town','Pct','Ward'],right_on = ['City/Town','Pct','Ward'])
```

```
type(mergedP)
```

```
pandas.core.frame.DataFrame
```

Create Lat and Lon columns for the geopandas merge function only.

```
mergedP['Latitude'] = -40.266666
mergedP['Longitude'] = 72.3452
```

Convert the merged dataframe to a geopandas dataframe.

```
mergedPG = gpd.GeoDataFrame(
   mergedP, geometry=gpd.points_from_xy(mergedP.Longitude, mergedP.Latitude))
```

```
mergedPG = mergedPG.drop(columns = ["Latitude","Longitude"])
```

```
type(mergedPG)
```

```
geopandas.geodataframe.GeoDataFrame
```

Review both of the election results and your shapefiles to help make exact match for every City, Precinct, and Ward name. If any values that should be equal are not matching exactly, the merge will fail.

```
mergedPG['City/Town']=mergedPG['City/Town'].str.upper()
```

Create any additional columns you may find useful for your analysis.

```
mergedPG['% Point Change in Democratic Votes'] = (mergedPG['Democratic 2020']/mergedPG['Total Votes Cast 2020'])-(mergedPG['Democ
```

```
mergedPG['% Change in Total Votes'] = (mergedPG['Total Votes Cast 2020']-mergedPG['Total Votes Cast'])/mergedPG['Total Votes Cast
```

```
mergedPG['% Point Change in Republican Votes'] = (mergedPG['Republican 2020']/mergedPG['Total Votes Cast 2020'])-(mergedPG['Repub
```

```
finalP = mergedPG.copy()
```

Drop all NA values.

```
finalP.dropna()
```

Load in Precinct shapefile.

```
MA_p = gpd.read_file("wardsprecincts_poly/WARDSPRECINCTS_POLY.shp")
```

Make necessary conversions as discussed previously.

```
MA_p['WARD'] = MA_p['WARD'].astype(str)
```

```
MA_p['WARD'] = MA_p['WARD'].str.replace('None','-')
```

Merge the shapefile geopandas dataframe with the Precinct Geopandas dataframe you created.

```
joinP = gpd.pd.merge(MA_p, finalP,  how='left', left_on=['PRECINCT','WARD','TOWN'], right_on = ['Pct','Ward','City/Town'])
```

```
joinP
```

	WP_NAME	WARD	PRECINCT	DISTRICT	POP_2010	TOWN	TOWN_ID	AREA_SQMI	AREA_ACRES	YEAR	...	Democratic 2016	Republican 2016	Total Votes Cast	Der
0	Braintree Town Precinct 5B	-	5B	5B	2883	BRAINTREE	40	1.217000	778.800000	2012	...	NaN	NaN	NaN	
1	Braintree Town Precinct 6A	-	6A	6A	3070	BRAINTREE	40	1.994000	1275.960000	2012	...	NaN	NaN	NaN	

```
joinP=joinP.drop(columns = 'geometry_y')
joinP=joinP.rename(columns = {'geometry_x':'geometry'})
```

```
joinP = joinP.dropna()
```

Use a spatial merge to combine the two geopandas dataframes.

```
FinalData = gpd.sjoin(Tractjoin, joinP, how="left", op="intersects")
```

```
FinalData.columns
```

```
Index(['STATEFP10', 'COUNTYFP10', 'TRACTCE10', 'GEOID10', 'NAME10',
       'NAMELSAD10', 'MTFCC10', 'ALAND10', 'AWATER10', 'INTPTLAT10',
       'INTPTLON10', 'AREA_SQFT', 'AREA_ACRES_left', 'POP100_RE', 'HU100_RE',
       'LOGPL94171', 'LOGSF1', 'LOGACS0610', 'LOGSF1C', 'SHAPE_AREA_left',
       'SHAPE_LEN_left', 'geometry', 'Tract', '% Point Change in LatinX Pop.',
       '% Point Change in Total Pop.', '% Point Puerto Rican Change',
       '% Point Mexican Change', '% Point Cuban Change',
       '% Point Other LatinX Change', 'Total Population 2016',
       'LatinX Population 2016', 'Mexican 2016', 'Puerto Rican 2016',
       'Cuban 2016', 'Other LatinX 2016', 'Total Population 2019',
       'LatinX Population 2019', 'Mexican 2019', 'Puerto Rican 2019',
       'Cuban 2019', 'Other LatinX 2019', 'index_right', 'WP_NAME', 'WARD',
       'PRECINCT', 'DISTRICT', 'POP_2010', 'TOWN', 'TOWN_ID', 'AREA_SQMI',
       'AREA_ACRES_right', 'YEAR', 'SHAPE_AREA_right', 'SHAPE_LEN_right',
       'City/Town', 'Pct', 'Ward', 'Democratic 2016', 'Republican 2016',
       'Total Votes Cast', 'Democratic 2020', 'Republican 2020',
       'Total Votes Cast 2020', '% Point Change in Democratic Votes',
       '% Change in Total Votes', '% Point Change in Republican Votes'],
      dtype='object')
```

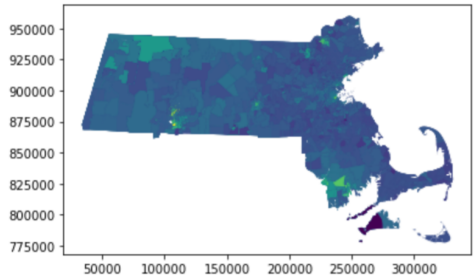
The final merge is complete and further analyses may be performed on the data.

Examples:

Geospatial Analysis

```
FinalData.plot(column = '% Point Change in Republican Votes')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd071cc5580>
```




```
Lneg = points.loc[(points['% Point Change in LatinX Pop.'] < 0)]
Lpos = points.loc[(points['% Point Change in LatinX Pop.'] > 0)]
```

```
Lneg = Lneg[['Tract']]
Lpos = Lpos[['Tract']]

Lneg['Tract'] = Lneg['Tract'].astype(float).astype(str)
Lpos['Tract'] = Lpos['Tract'].astype(float).astype(str)
```

```
Lpos['Latitude'] = -40.266666
Lpos['Longitude'] = 72.3452

Lneg['Latitude'] = -40.266666
Lneg['Longitude'] = 72.3452
```

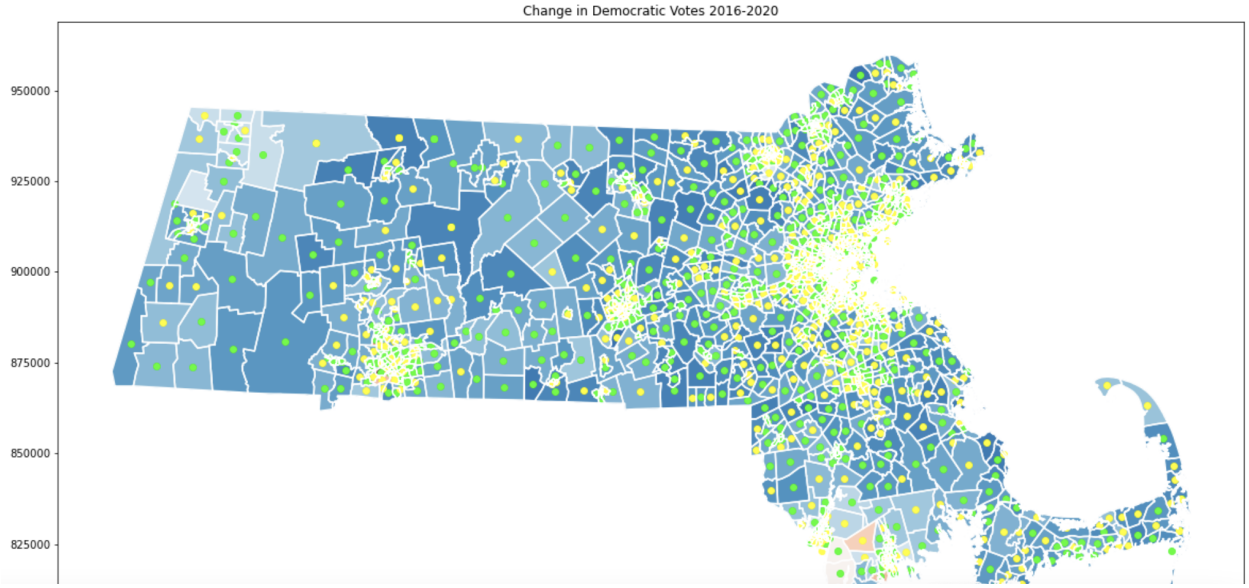
```
Lpos = gpd.GeoDataFrame(
    Lpos, geometry=gpd.points_from_xy(Lpos.Longitude, Lpos.Latitude))

Lneg = gpd.GeoDataFrame(
    Lneg, geometry=gpd.points_from_xy(Lneg.Longitude, Lneg.Latitude))
```

```
LTpos = gpd.pd.merge(MA_t, Lpos,  how='left', left_on=['NAME10'], right_on = ['Tract'])

LTneg = gpd.pd.merge(MA_t, Lneg,  how='left', left_on=['NAME10'], right_on = ['Tract'])
```

```
LTpos = LTpos.dropna()

LTneg = LTneg.dropna()
```

```
import matplotlib.pyplot as plt
fig, ax = plt.subplots(figsize = (20,20))
ax.set_aspect('equal')
ax = MA_t.boundary.plot(ax = ax, color = 'white')
plt.title('Change in Democratic Votes 2016-2020')
FinalData.plot(column='% Point Change in Democratic Votes',cmap = 'RdBu',ax=ax,legend=True,legend_kwds={'label': "% Change in Dem
LTpos.centroid.plot(ax =ax, color = 'lime', marker = 'o', markersize =35, label = 'Increase in LatinX Population')
LTneg.centroid.plot(ax = ax, color = 'yellow', marker = 'o', markersize = 35, label = 'Decrease in LatinX Population')
plt.legend(loc = 'lower left',prop={'size': 20})
```

```
<matplotlib.legend.Legend at 0x7fd06713ed60>
```



Regression Cleaning:

```
#cleaning for presidential election

pres2020 = pres2020.replace(",", "", regex = True)

pres2016 = pres2016.replace(",", "", regex = True)

pres2020["Democratic 2020"] = pd.to_numeric(pres2020["Democratic 2020"])

pres2020["Republican 2020"] = pd.to_numeric(pres2020["Republican 2020"])

pres2020["Total Votes Cast 2020"] = pd.to_numeric(pres2020["Total Votes Cast 2020"])

pres2020["Mexican 2019"] = pd.to_numeric(pres2020["Mexican 2019"])

pres2020["Puerto Rican 2019"] = pd.to_numeric(pres2020["Puerto Rican 2019"])

pres2020["Cuban 2019"] = pd.to_numeric(pres2020["Cuban 2019"])

pres2020["Other LatinX 2019"] = pd.to_numeric(pres2020["Other LatinX 2019"])

pres2020["Total Population 2019"] = pd.to_numeric(pres2020["Total Population 2019"])

pres2016["Democratic 2016"] = pd.to_numeric(pres2016["Democratic 2016"])

pres2016["Republican 2016"] = pd.to_numeric(pres2016["Republican 2016"])

pres2016["Total Votes Cast"] = pd.to_numeric(pres2016["Total Votes Cast"])

pres2016["Mexican 2016"] = pd.to_numeric(pres2016["Mexican 2016"])

pres2016["Puerto Rican 2016"] = pd.to_numeric(pres2016["Puerto Rican 2016"])

pres2016["Cuban 2016"] = pd.to_numeric(pres2016["Cuban 2016"])

pres2016["Other LatinX 2016"] = pd.to_numeric(pres2016["Other LatinX 2016"])

pres2016["Total Population 2016"] = pd.to_numeric(pres2016["Total Population 2016"])
```

Calculating Percentage Point Change and LatinX (and sub-group) Population Percentages:

```
#analyzing changes between the most recent elections for president

changeDemPres = (pres2020["Democratic 2020"] / pres2020["Total Votes Cast 2020"]) - (pres2016["Democratic 2016"] / pres2016["Total Votes Cast"])

changeRepPres = (pres2020["Republican 2020"] / pres2020["Total Votes Cast 2020"]) - (pres2016["Republican 2016"] / pres2016["Total Votes Cast"])

changeMexPres = (pres2020["Mexican 2019"] / pres2020["Total Population 2019"]) - (pres2016["Mexican 2016"] / pres2016["Total Population 2016"])

changePRPres = (pres2020["Puerto Rican 2019"] / pres2020["Total Population 2019"]) - (pres2016["Puerto Rican 2016"] / pres2016["Total Population 2016"])

changeCubanPres = (pres2020["Cuban 2019"] / pres2020["Total Population 2019"]) - (pres2016["Cuban 2016"] / pres2016["Total Population 2016"])

changeOtherLatinXPres = (pres2020["Other LatinX 2019"] / pres2020["Total Population 2019"]) - (pres2016["Other LatinX 2016"] / pres2016["Total Population 2016"])

changeTotalLatinXPres = ((pres2020["Mexican 2019"] + pres2020["Puerto Rican 2019"] + pres2020["Cuban 2019"] + pres2020["Other LatinX 2019"])
  / pres2020["Total Population 2019"]) - ((pres2016["Mexican 2016"] + pres2016["Puerto Rican 2016"] + pres2016["Cuban 2016"] +pres2016["Other LatinX 2016"])
  / pres2016["Total Population 2016"])

totalLatinXPres2020 = (pres2020["Mexican 2019"] + pres2020["Puerto Rican 2019"] + pres2020["Cuban 2019"] + pres2020["Other LatinX 2019"]) / pres2020["Total Population 2019"]

totalDemSupport2020 = (pres2020["Democratic 2020"] / pres2020["Total Votes Cast 2020"])

totalRepSupport2020 = (pres2020["Republican 2020"] / pres2020["Total Votes Cast 2020"])

mexPop2020 =  pres2020["Mexican 2019"] / pres2020["Total Population 2019"]

prPop2020 = pres2020["Puerto Rican 2019"] / pres2020["Total Population 2019"]

cubanPop2020 = pres2020["Cuban 2019"] / pres2020["Total Population 2019"]

otherPop2020 = pres2020["Other LatinX 2019"] / pres2020["Total Population 2019"]

totalLatinXPres2016 = (pres2016["Mexican 2016"] + pres2016["Puerto Rican 2016"] + pres2016["Cuban 2016"] +pres2016["Other LatinX 2016"]) / pres2016["Total Population 2016"]

totalDemSupport2016 = (pres2016["Democratic 2016"] / pres2016["Total Votes Cast"])

totalRepSupport2016 = (pres2016["Republican 2016"] / pres2016["Total Votes Cast"])

mexPop2016 =  pres2016["Mexican 2016"] / pres2016["Total Population 2016"]

prPop2016 = pres2016["Puerto Rican 2016"] / pres2016["Total Population 2016"]

cubanPop2016 = pres2016["Cuban 2016"] / pres2016["Total Population 2016"]

otherPop2016 = pres2016["Other LatinX 2016"] / pres2016["Total Population 2016"]
```

Merging and creating DataFrame object for each election:

```
#merge presidential election changes with demographic changes during those years

merged_presidential = pd.DataFrame({"change in democratic support" : changeDemPres, "change in republican support" : changeRepPres, "change in mexican population" : changeMexPres,"%
                                    "change in puerto rican population" : changePRPres, "% pr population 2020" : prPop2020, "% pr population 2016" : prPop2016,
                                    "change in cuban population" : changeCubanPres, "% cuban population 2020" : cubanPop2020, "% cuban population 2016" : cubanPop2016,
                                    "change in other latinX population" : changeOtherLatinXPres,"% other LatinX population 2020" : otherPop2020, "% other LatinX population 2016" : o
                                    "change in total latinX population" : changeTotalLatinXPres, "% LatinX 2020" : totalLatinXPres2020, "% LatinX 2016" :totalLatinXPres2016, "% Demo
                                    "% Republican Support 2020" : totalRepSupport2020, "% LatinX 2016" : totalLatinXPres2016, "% Democratic Support 2016" :totalDemSupport2016, "% Re

merged_presidential = merged_presidential.replace([np.inf, -np.inf], np.nan)    #replace inf values by NaN, occurs when starting value is zero

merged_presidential = merged_presidential.fillna(0)     #repalce any NaN with 0
```

Create Scatter Plot, Plot Line of Best Fit, and Include R^2 (Same method for all graphs):

```
#percent total latinX vs percentage point change presidential political support 2016 - 2020
plt.scatter(totalLatinXPres2020, merged_presidential["change in democratic support"], color = "blue", label = 'democratic support for given LatinX pop %', s=0.7)
plt.scatter(totalLatinXPres2020, merged_presidential["change in republican support"], color = "red", label = 'republican support for given LatinX pop %', s=0.7)
latinX2020 = merged_presidential["% LatinX 2020"].values.reshape(-1, 1)
dem2020 = merged_presidential["change in democratic support"].values.reshape(-1, 1)
linregDem.fit(latinX2020, dem2020)
Y_predDemSupport = linregDem.predict(latinX2020)
demSupportR2 = r2_score(dem2020, Y_predDemSupport)
plt.figtext(.68, .75, ("democratic R² =" + "{:.2f}".format(demSupportR2)))
plt.plot(latinX2020, Y_predDemSupport, color='turquoise', label = "democratic support trend")
rep2020 = merged_presidential["change in republican support"].values.reshape(-1, 1)
linregRep.fit(latinX2020, rep2020)
Y_predRepSupport = linregRep.predict(latinX2020)
repSupportR2 = r2_score(rep2020, Y_predRepSupport)
plt.figtext(.68, .73, ("republican R² =" + "{:.2f}".format(repSupportR2)))
plt.plot(latinX2020, Y_predRepSupport, color='gold', label = "republican support trend")
plt.xlabel("% latinX population")
plt.ylabel("percentage point change in political support")
plt.title("% LatinX Population vs percentage point change in Presidential political support (MA 2016 - 2020)")
plt.legend(loc="upper right")
plt.show()
```

Statistical Analysis:

Read in merged CSV files

In [1]:
```
import pandas as pd
import numpy as np

pres_data = pd.read_csv('MergedMassData.csv')

gov_data = pd.read_csv('MergedMassDataGov.csv')
```

In [2]:
```
pres_data.columns
```

Out[2]:
```
Index(['STATEFP10', 'COUNTYFP10', 'TRACTCE10', 'GEOID10', 'NAME10',
       'NAMELSAD10', 'MTFCC10', 'ALAND10', 'AWATER10', 'INTPTLAT10',
       'INTPTLON10', 'AREA_SQFT', 'AREA_ACRES_left', 'POP100_RE', 'HU100_RE',
       'LOGPL94171', 'LOGSF1', 'LOGACS0610', 'LOGSF1C', 'SHAPE_AREA_left',
       'SHAPE_LEN_left', 'geometry', 'Tract', '% Point Change in LatinX Pop.',
       '% Point Change in Total Pop.', '% Point Puerto Rican Change',
       '% Point Mexican Change', '% Point Cuban Change',
       '% Point Other LatinX Change', 'Total Population 2016',
       'LatinX Population 2016', 'Mexican 2016', 'Puerto Rican 2016',
       'Cuban 2016', 'Other LatinX 2016', 'Total Population 2019',
       'LatinX Population 2019', 'Mexican 2019', 'Puerto Rican 2019',
       'Cuban 2019', 'Other LatinX 2019', 'index_right', 'WP_NAME', 'WARD',
       'PRECINCT', 'DISTRICT', 'POP_2010', 'TOWN', 'TOWN_ID', 'AREA_SQMI',
       'AREA_ACRES_right', 'YEAR', 'SHAPE_AREA_right', 'SHAPE_LEN_right',
       'City/Town', 'Pct', 'Ward', 'Democratic 2016', 'Republican 2016',
       'Total Votes Cast', 'Democratic 2020', 'Republican 2020',
       'Total Votes Cast 2020', '% Point Change in Democratic Votes',
       '% Change in Total Votes', '% Point Change in Republican Votes'],
      dtype='object')
```

```
pres_city = pres_data[['Tract', 'Total Population 2016', 'LatinX Population 2016',
       'Mexican 2016', 'Puerto Rican 2016', 'Cuban 2016', 'Other LatinX 2016',
       'Total Population 2019', 'LatinX Population 2019', 'Mexican 2019',
       'Puerto Rican 2019', 'Cuban 2019', 'Other LatinX 2019', 'City/Town',
       'Democratic 2016', 'Republican 2016', 'Total Votes Cast',
       'Democratic 2020', 'Republican 2020', 'Total Votes Cast 2020']]
```

```
#convert Tract column to type str

pres_city['Tract'] = pres_city['Tract'].astype(str)
```

```
<ipython-input-4-34c4ffa88167>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.
  pres_city['Tract'] = pres_city['Tract'].astype(str)
```

```
#Drop Tract Duplicates
pres_city = pres_city.drop_duplicates(['Tract'])

#Sum up rows by Town
pres_city = pres_city.groupby('City/Town').sum()
```

Add columns with percent change

```
pres_city['% LatinX 2016'] = pres_city['LatinX Population 2016']/pres_city['Total Population 2016']

pres_city['% LatinX 2019'] = pres_city['LatinX Population 2019']/pres_city['Total Population 2019']


pres_city = pres_city.rename(columns = {'Total Votes Cast':'Total Votes Cast 2016'})


pres_city['% Democratic 2016'] = pres_city['Democratic 2016']/pres_city['Total Votes Cast 2016']

pres_city['% Democratic 2020'] = pres_city['Democratic 2020']/pres_city['Total Votes Cast 2020']


pres_city['% Republican 2016'] = pres_city['Republican 2016']/pres_city['Total Votes Cast 2016']

pres_city['% Republican 2020'] = pres_city['Republican 2020']/pres_city['Total Votes Cast 2020']
```

Add columns with percentage point change

```
pres_city['Democratic Percentage point Change'] = (pres_city['% Democratic 2020'] - pres_city['% Democratic 2016'])*100

pres_city['Republican Percentage point Change'] = (pres_city['% Republican 2020'] - pres_city['% Republican 2016'])*100

pres_city['Change LatinX'] = pres_city['% LatinX 2019'] - pres_city['% LatinX 2016']
```

```
pres_city.head()
```

City/Town	Total Population 2016	LatinX Population 2016	Mexican 2016	Puerto Rican 2016	Cuban 2016	Other LatinX 2016	Total Population 2019	LatinX Population 2019	Mexican 2019	Puerto Rican 2019	...	Total Votes Cast 2020	% LatinX 2016	% LatinX 2019
ABINGTON	16586	361	63	157	0	141	17908	342	98	60	...	5553.0	0.021765	0.019098
ACTON	18514	292	27	47	19	199	19437	709	19	102	...	9784.0	0.015772	0.036477
ACUSHNET	7589	245	13	140	51	41	7718	321	11	194	...	3961.0	0.032284	0.041591
ADAMS	7258	189	16	112	0	61	6748	350	68	218	...	2809.0	0.026040	0.051867
AGAWAM	48369	5396	115	4611	111	559	48276	5607	227	4945	...	18782.0	0.111559	0.116145

5 rows × 27 columns

```
#Find Towns where the LatinX pop was greater than 30% in 2016
towns_LatinX_2016 = pres_city.loc[(pres_city['% LatinX 2016'] >= .30)]
```

```
towns_LatinX_2016.shape
```

```
(6, 27)
```

See which of those towns had majority Republican support

```
towns_LatinX_2016 = towns_LatinX_2016.loc[(towns_LatinX_2016['% Republican 2016'] > towns_LatinX_2016['% Democratic 2016'])]
```

```
towns_LatinX_2016.shape
```

```
(0, 27)
```

```
towns_LatinX_2019 = pres_city.loc[(pres_city['% LatinX 2019'] >= .30)]
```

```
towns_LatinX_2019.head()
```

```
towns_LatinX_2019.shape
```

```
(6, 27)
```

```
#Find Towns where the LatinX pop was greater than 10 in 2016%
towns_10_2016 = pres_city.loc[(pres_city['% LatinX 2016'] >= .10)]
```

```
towns_10_2016.shape
```

```
(39, 27)
```

```
towns_10_2016 = towns_10_2016.loc[(towns_10_2016['% Republican 2016'] > towns_10_2016['% Democratic 2016'])]
```

```
towns_10_2016.shape
```

```
(6, 27)
```

```
towns_10_2016
```

```
#Find Towns where the LatinX pop was greater than 10% in 2019
towns_10_2019 = pres_city.loc[(pres_city['% LatinX 2019'] >= .10)]
```

```
towns_10_2019.shape
```

```
(36, 27)
```

```
towns_10_2019 = towns_10_2019.loc[(towns_10_2019['% Republican 2020'] > towns_10_2019['% Democratic 2020'])]
```

```
towns_10_2019
```

City/Town	Total Population 2016	LatinX Population 2016	Mexican 2016	Puerto Rican 2016	Cuban 2016	Other LatinX 2016	Total Population 2019	LatinX Population 2019	Mexican 2019	Puerto Rican 2019	...	Total Votes Cast 2020	% LatinX 2016	% LatinX 2019	% Democratic 2016
AGAWAM	48369	5396	115	4611	111	559	48276	5607	227	4945	...	18782.0	0.111559	0.116145	0.423589

1 rows × 27 columns

```
#Find Towns 2016 where the LatinX pop is greater than 15%
towns_15_2016 = pres_city.loc[(pres_city['% LatinX 2016'] >= .15)]
```

```
towns_15_2016.shape
```

```
(23, 27)
```

```
towns_15_2016 = towns_15_2016.loc[(towns_15_2016['% Republican 2016'] > towns_15_2016['% Democratic 2016'])]
```

```
towns_15_2016 = towns_15_2016.loc[(towns_15_2016['% Republican 2016'] > towns_15_2016['% Democratic 2016'])]
```

```
towns_15_2016
```

City/Town	Total Population 2016	LatinX Population 2016	Mexican 2016	Puerto Rican 2016	Cuban 2016	Other LatinX 2016	Total Population 2019	LatinX Population 2019	Mexican 2019	Puerto Rican 2019	...	Total Votes Cast 2020	% LatinX 2016	% LatinX 2019	% Democratic 2016	% Democratic 2020	% Republican 2016
WILBRAHAM	24087	4880	345	4111	36	388	23480	4486	300	3667	...	12008.0	0.202599	0.191056	0.442097	0.527898	0.463689

1 rows × 27 columns

```
towns_15_2019 = pres_city.loc[(pres_city['% LatinX 2019'] >= .15)]
```

```
towns_15_2019.shape
```

```
(25, 27)
```

```
towns_15_2019 = towns_15_2019.loc[(towns_15_2019['% Republican 2020'] > towns_15_2019['% Democratic 2020'])]
```

```
towns_15_2019.shape
```

```
(0, 27)
```

Top 10 Towns with the highest LatinX Percentage

```
Top 10 Towns with the highest LatinX Percentage

largest_LatinX = pres_city.nlargest(10, ['% LatinX 2019', 'Republican Percentage point Change'])
```

```
largest_LatinX
```

City/Town	Total Population 2016	LatinX Population 2016	Mexican 2016	Puerto Rican 2016	Cuban 2016	Other LatinX 2016	Total Population 2019	LatinX Population 2019	Mexican 2019	Puerto Rican 2019	...	Total Votes Cast 2020	% LatinX 2016	% LatinX 2019	% Democratic 2016	% Democratic 2020
LAWRENCE	67102	48596	297	13146	447	34706	67842	50706	440	12501	...	15104.0	0.724211	0.747413	0.838300	0.734044
CHELSEA	52441	27712	787	4599	217	22109	54565	31645	1299	4502	...	7131.0	0.528441	0.579951	0.734743	0.766092
HOLYOKE	45058	16675	111	15439	41	1084	45343	18404	217	16586	...	13320.0	0.370079	0.405884	0.673746	0.657583
SPRINGFIELD	167915	62062	2538	51688	273	7563	167224	67004	2087	56767	...	33729.0	0.369604	0.400684	0.728685	0.697975
METHUEN	62471	21879	275	7071	173	14360	64852	25768	255	6979	...	26881.0	0.350227	0.397335	0.535401	0.576615
LYNN	102991	34226	1600	5379	155	27092	103603	38091	1839	3930	...	28753.0	0.332320	0.367663	0.686249	0.701040
EVERETT	39641	9394	202	1166	53	7973	40852	11215	224	1620	...	9545.0	0.236977	0.274528	0.657777	0.692300
REVERE	46091	11178	641	1279	83	9175	45426	12432	542	1862	...	7643.0	0.242520	0.273676	0.568050	0.599764
FITCHBURG	44974	10155	853	6710	34	2558	46329	11950	1060	8446	...	15794.0	0.225797	0.257938	0.561271	0.601051
SHERBORN	24450	6091	576	2225	11	3279	25212	5860	349	2223	...	14955.0	0.249121	0.232429	0.648549	0.757940

10 rows × 27 columns

```
insight = pres_city.nlargest(5, ['% LatinX 2019', 'Republican Percentage point Change'])

insight = insight[['% LatinX 2019', 'Democratic Percentage point Change', 'Republican Percentage point Change']]
```

```
insight
```

City/Town	% LatinX 2019	Democratic Percentage point Change	Republican Percentage point Change
LAWRENCE	0.747413	-10.425567	12.561895
CHELSEA	0.579951	3.134887	4.054185
HOLYOKE	0.405884	-1.616373	6.618964
SPRINGFIELD	0.400684	-3.071012	4.796808
METHUEN	0.397335	4.121485	0.773999

Percentage of cities that saw an increase in the LatinX pop from 2016-2019

```
percent of cities that saw an increase in the LatinX pop from 2016-2019

increase = pres_city[(pres_city['Change LatinX']) > 0].count()[0] / pres_city.shape[0]

decrease = 1 - increase

print("Increase =", increase)
print("Decrease =", decrease)
```

```
Increase = 0.73828125
Decrease = 0.26171875
```

```
#avg LatinX Percentage change for all Towns in MA
pres_city['Change LatinX'].mean()
```

```
0.0075259252143843975
```

```
#avg Percentage change in Republican Support for all Towns in MA
pres_city['Republican Percentage point Change'].mean()
```

```
-0.9359053731964311
```

Percent of cities that saw an increase in the Republican Support from 2016-2019

```
increase = pres_city[(pres_city['Republican Percentage point Change']) > 0].count()[0] / pres_city.shape[0]

decrease = 1 - increase

print("Increase =", increase)
print("Decrease =", decrease)
```

```
Increase = 0.2421875
Decrease = 0.7578125
```