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| Photo displaying partial image of two pie charts on a canvas-textured page |
| Presidents by Ratings  1945-1974 |
| |  |  |  | | --- | --- | --- | | Brandy Davis and Rebecca Leu | 5/11/20 | ALY 6015 | |

Introduction

We are working with the dataset ‘presidents’ from the library ‘datasets.’ This dataset looks at the quarterly approval ratings from 1945 when approval ratings started to be tracked up until 1974. We wanted to examine a few questions related to this dataset:

* Are there any differences in the mean approval ratings between Republican and Democratic presidents?
* Are there any differences in the mean approval ratings between “wartime” and non-”wartime” periods?
* Are the ratings of presidents’ time predictable, and if so, to what degree?

In our analysis we will present the data graphically in order to get a better picture of the highs and lows in ratings over the years. We will create subsets of the data in order to run hypothesis tests and answer the questions above. Finally, we will decompose the time series to see if there is a pattern that we can discern to help predict approval ratings for the future.

Analysis

As always, the first step we want to take is to look at the data.

> presidents

Qtr1 Qtr2 Qtr3 Qtr4

1945 NA 87 82 75

1946 63 50 43 32

1947 35 60 54 55

1948 36 39 NA NA

1949 69 57 57 51

1950 45 37 46 39

1951 36 24 32 23

1952 25 32 NA 32

1953 59 74 75 60

1954 71 61 71 57

1955 71 68 79 73

1956 76 71 67 75

1957 79 62 63 57

1958 60 49 48 52

1959 57 62 61 66

1960 71 62 61 57

1961 72 83 71 78

1962 79 71 62 74

1963 76 64 62 57

1964 80 73 69 69

1965 71 64 69 62

1966 63 46 56 44

1967 44 52 38 46

1968 36 49 35 44

1969 59 65 65 56

1970 66 53 61 52

1971 51 48 54 49

1972 49 61 NA NA

1973 68 44 40 27

1974 28 25 24 24

This representation of the data is a bit hard to interpret. You aren’t able to see any divisions for presidents, parties, or historical events. In order to breakdown the data and examine it further we created subsets of the different presidents and their respective parties using the following codes:

> HST<-presidents[c(2:32,1)] #Harry S Truman

> DDE<-presidents[c(33:64,1)] # Dwight D Eisenhower

> JFK<-presidents[c(65:76,1)] #John F Kennedy

> LBJ<-presidents[c(77:96,1)] #Lyndon B Johnson

> RMN<-presidents[c(97:119,1)] #Richard M Nixon

> Republican<-c(DDE,RMN)

> Democrat<-c(HST,JFK,LBJ)

During the second quarter of 1945, Franklin D Roosevelt (arguably the most popular president in history though they didn’t track ratings during his 4 terms) was actually president, but he died early in that quarter, so we assigned that quarter to Truman.

Similarly, Nixon resigned at the end of the 3rd quarter of 1974 and Ford took over. We just omitted that last quarter data point in our subsets.

We also noted that WWII ended during the 4th quarter of 1945, the Korean War ran from the 2nd quarter of 1950 to the 3rd quarter of 1953, and US involvement in the Vietnam war ran from the 3rd quarter of 1964 to the 1st quarter of 1973. In order to test the popularity of a “wartime” president, we had to create subsets of that data and also subsets for each president during that time. To do so, we used the following code:

> WWII<-presidents[c(1:4)] #WWII

> KWar<-presidents[c(22:35)] #Korean War

> VWar<-presidents[c(79:113)] #Vietnam War

>WARTIME<-c(WWII, KWar, VWar)

>NonWARTIME <-presidents[c(5:21, 36:78, 114:119)]

Now that we have each of these subsets created, we can move on to our hypothesis tests to answer the questions from our introduction.

The first hypothesis test we are conducting is to conclude if Republican and Democratic presidents have the same mean rating. Our null hypothesis is H0: Republican and Democrats have the same mean rating, and our alternative is H1: Republicans and Democrats have different mean ratings.

To do this we use the subsets we have created that has sorted our Republican and Democratic presidents.

t.test(Democrat, Republican)

Welch Two Sample t-test

data: Democrat and Republican

t = -1.5092, df = 109.1, p-value = 0.1341

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-9.911423 1.342241

sample estimates:

mean of x mean of y

54.58333 58.86792

Here we find that the confidence interval does include 0 and our p value is larger than .05. From this info we conclude that we are not able to reject the null that there is a difference in means between Democratic and Republican presidents. Although the means of x and y are different here, that likely could be due to the variation in this specific sample, rather than in the population as a whole.

The next question we are looking to answer is if wartime presidents have higher approval ratings. In this test our null hypothesis is H0: wartime presidents have the same mean approval ratings as non-wartime presidents, and our alternative hypothesis is H1: wartime presidents have a higher approval rating than non-wartime presidents.

For this hypothesis we are using the WARTIME subset against the nonWARTIME subset.

> t.test(WARTIME, NonWARTIME)

Welch Two Sample t-test

data: WARTIME and NonWARTIME

t = -2.2597, df = 100.62, p-value = 0.026

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-12.2513368 -0.7964948

sample estimates:

mean of x mean of y

52.89796 59.42188

Since our confidence interval does not include 0, and our p value is significant, we can reject the null and accept the alternative hypothesis that wartime presidents have a different approval rating than non-wartime presidents. Our mean for ratings during wartime is lower than those during non-wartimes, so we could assume that means people approve of leaders less during war.

We also wanted to decompose the time series to see if there was any trend, seasonality, or cyclicity to the data, and whether there was a discernable pattern to the data once we had removed those factors. If so, we may be able to use that info to predict future approval ratings. We start by cleaning and viewing the data with the following code:

> Ratings<- tsclean(presidents)

> plot.ts(Ratings)

A close up of a logo

Description automatically generated  
This view gives us a much better visual understanding of the highs and lows for the different presidents. It appears that the highest rating of all is at the very beginning of the graph where Truman took over for Roosevelt. It looks like the lowest points are around the time that Truman and Nixon left office. Look at that fall from grace for Truman! Nixon resigned the presidency, so it is not all that surprising that he left with such a low rating.

The next highest peaks appear to be for Eisenhower and Kennedy, also not surprising since history remembers each favorably.

The edges are quite ragged, so it is hard to see whether there appears to be a trend or any seasonality to this data. To get a better look I am going to look at the data smoothed out with a moving average of 4 using the following code:

> RatingsSMA<-SMA(Ratings, n=4)

> plot.ts(RatingsSMA)

A close up of a logo

Description automatically generated

This view is smoother, but it is still hard to see whether there is actually any trend here. With the ups and downs, it is possible that there is seasonality or cyclicity that is impacting our data.

I am going to pull apart the data to look at each component separately to see if we can identify a pattern using the following code:

> Ratingscomponents<-decompose(Ratings)

> plot(Ratingscomponents)

A screenshot of a cell phone

Description automatically generated

Before we attempt to find a suitable model to predict future values using our auto ARIMA function, we are going to need to check and make sure the data is stationary. I would venture to say it is by looking at the raw data, but I ran an ADF test to be sure.

> adf.test(Ratings)

Augmented Dickey-Fuller Test

data: Ratings

Dickey-Fuller = -2.8415, Lag order = 4, p-value = 0.2271

alternative hypothesis: stationary

This concludes that the data is stationary. Now we can move on to checking the correlation of the lags with ACF and PACF plots.

> Acf(Ratings)

A screenshot of a cell phone

Description automatically generatedThere are significant correlations at lags1-5 according to ACF.

We will need to run PACF to double check these results.

> Pacf(Ratings)

A screenshot of a social media post

Description automatically generated

This plot only shows significant correlation at lag 1.

Next, we will use the auto ARIMA function to fit a model.

> auto.arima(Ratings)

Series: Ratings

ARIMA(1,0,0)(0,0,1)[4] with non-zero mean

Coefficients:

ar1 sma1 mean

0.8058 0.1995 56.7086

s.e. 0.0581 0.0966 4.8750

sigma^2 estimated as 82.82: log likelihood=-434.44

AIC=876.88 AICc=877.23 BIC=888.03

Then we will use this model to forecast the next couple of periods.

> fit2<-auto.arima(Ratings)

> fcast2 <- forecast(fit2,h=8)

> plot(fcast2)

A screenshot of a cell phone

Description automatically generated

This shows an upward trend in ratings is what we can expect for the next president. That is a logical assumption given that Nixon resigned, and his ratings were tanked. The next person in line almost had no where to go but up. Also, it seems that presidents seem to have higher approval ratings when the first enter office anyhow.

Conclusion

Ultimately, this data set is a little more difficult to predict future ratings accurately. There are so many factors that go into what changes approval ratings, and there is a different president every 4-8 years (usually), so the model would always be changing.

We can gather from our data that typically approval ratings are not very high during a war. I suppose that may not hold true always, but this data set covered 2 rather unpopular wars. If the American people are not in support of a war, then naturally they are not going to approval of a leader who is sending our troops out to fight.

Approval ratings appeared to be much higher during the Eisenhower and Kennedy administrations. They appear to climb around the time that we were making progress in the Space Race in the 1st and 2nd quarters of 1961 and 1962 respectively, and then again in Q3 of 1969. The ratings are also pretty high from 1963-1965 when the Equal Pay Act, Civil Rights Act, and Voting Rights Act were all passed. Naturally, one could assume that people tend to be happier with leadership when there is hope and prosperity.

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