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"And the Winner is..." Predicting Presidential Elections

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Predicting Presidential Elections

SUBMITTED TO

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Abstract

This paper establishes a model to forecast the Presidential election outcomes, particularly the 2016 United States Presidential Election by analyzing two distinctive approaches: predicting election wins through voting function, and using approval ratings as proxy for votes. I examine and replicate previous models for vote share of the Democratic Party and of the government for elections from 1948 to 2012. Then, I construct a model for approval ratings based on economic and non-economic variables. My findings have direct implications for forecasting elections and the political business cycle.

Contents

I. Introduction

Every four years the American electorate makes an important decision: late in the year, the political leader of the world is announced. This typically has far reaching strategic and economic consequences. The evening of November 8, 2016 will be no different. Throughout the election process so far, Hillary Clinton has been the clear leader for the nomination of the Democratic Party, performing confidently behind the podium at debates. There is little doubt that she will be one of the two candidates for President. At the same time, the Republican Party has struggled to find a strong, leading candidate to represent the party. Although the Republican candidate will not likely be chosen until next summer, various election models and forecasters have predicted the Republican Party to win the 2016 Presidential election. President Rubio or Cruz?

Forecasting election outcomes has been capturing significant interest among voters, academics (primarily social scientists), and the news media. Theories to predict the election winners range from detailed economic models to nonsense correlations. The Redskins Rule, for example, holds that if the Redskins won their last home game before the election, the incumbent party will stay in power[1]. Many studies in political economy attempt to identify determinants of the presidential election, using both economic and non-economic variables. However, it is natural to ask why economists would be interested in analyzing voting preferences.

[1] There is the occasional exception, such as in 2000, when George W. Bush was not declared the winner until late in January 2001. Also, the country so far only has had male presidents. However, this could change with the upcoming election given that the likely candidate of the Democrats is a female for the first time in the history of the country. Finally, it is the Electoral College that technically elects the President of the U.S.

One approach is based on the original idea of the political business cycle, first formally introduced by Nordhaus (1975).[2] This phenomenon includes "cycles in macroeconomic variables –output, unemployment, inflation – induced by the electoral cycles resulting from leaders having different policy objectives" (Nordhaus 1975, 42). The interaction between economic variables (here inflation and unemployment), election votes, and government policy instruments generates business cycles to win elections in a politico-economic framework. The underlying assumption is that Presidents have the ability, during the pre-election phase, to manipulate government instruments such as government expenditure, taxes, and perhaps even monetary policy so as to create a booming economy during the election years and thereby to increase their chances of staying in power. An earlier and different approach is taken by Downs (1957), who applies economic theory to non-market political decision-making. Previously, the process of government decision making had not been considered when analyzing decision making with private agents; instead the government sector was generally considered to be exogenous in economic models. However, Downs hypothesized that "political parties in a democracy formulate policy strictly as a means of gaining votes." As a result, the government "always acts to maximize the number of votes it will receive" (Downs 1957, 137).

The purpose of this thesis is to forecast the Presidential election outcomes in general, but with a special eye on the 2016 event. This will be done through the use of a variety of models, taking into account both vote shares and presidential approval ratings. First I examine the relationship between vote share functions and economic variables,

[2] Interestingly enough, Nordhaus served on the Council of Economic advisors from 1977 under President Carter

using both Fair's (1978) published model and Silver's (2011) alternative specification. The latter incorporates approval ratings during the fourth year of a presidency as an explanatory variable. Lastly I estimate presidential approval ratings by using the popularity function approach made popular by, *inter alia*, Frey and Schneider (1976) and Kramer (1971). These can be used either as a direct predictor of election outcomes, or to provide but one input into voting functions. The ultimate purpose of these models will be to name the likely winner of the 2016 election, which I will do in the concluding section, where I will also point to shortcomings and future research avenues.

II. Literature Review

Prior to the early 1970s, little literature existed regarding the impact of economic variables on presidential vote and presidential popularity functions in the U.S. and elsewhere. Kramer (1971) was one of the first who looked for the effect of economic fluctuations on congressional elections. He studied 31 elections for Congress between 1896 and 1964 and concluded that economic indicators have an important influence on congressional elections. More specifically, his model showed that real personal income was the most important economic variable in predicting outcomes with an R^2 of 0.66. With a ten percent decrease in real personal income per-capita, Kramer's model suggested a five percentage point decrease in congressional votes for the incumbents. The major innovation of his research was that voting preferences did not solely depend on prior habits or random decisions, but that they were influenced significantly by economic fluctuations, with an economic boom benefitting the incumbent party's congressional candidate and a decline benefitting the opposition party candidate. While the result is

itself of interest, note that finding incumbency inherently providing little benefit to the ruling party unless the economy is performing well. However if the incumbent were able to implement policies that will influence the economy in a way that would increase popularity for the incumbent party for the upcoming election, then surely they would attempt to do so, thereby creating economic fluctuations to win the election ("political business cycle").

This first connection between the economy and government support is measured through voting functions for presidential elections and so-called popularity functions. For the U.S., the latter are represented by presidential approval ratings typically measured through Gallup polls. There is a large literature on the subject, but conveniently Nannestad and Paldam (1994) provide an early survey of the most relevant papers. The authors conclude that voters reward the government for good economic performance and punish it for poor performance. Hence there is symmetry. A voting function attempts to explain vote shares while a popularity function assumes that presidential approval ratings can be translated to voter preferences for the upcoming election. The advantage of using vote share is that it is accurately portraying the outcome of an election. However, the number of observations is limited to the number of presidential elections: 100 years of observations only result in 25 data points resulting in a low number of degrees of freedom and hence potential problems with statistical inference. Thus, if popularity could accurately predict vote share, then popularity function would be the preferable method.

One of the most influential players in the field of vote functions is Ray Fair, who periodically makes popular press predictions based on his voting function model. The original publication is Fair (1978). The model developed here is intended to predict the

Democratic share of the two-party presidential vote using economic factors, incumbency variables, and the external effects such as wars. The economic variables analyzed include the growth rate of real per capita Gross Domestic Product (GDP), inflation as measured through the growth rate of the GDP deflator, and the number of quarters that growth rate of real per capita GDP is greater than 3.2 percent (a so-called "good news" effect). The model explains a remarkable 90 percent of the variation in the vote share, and all the coefficients except for the incumbency variable are significant at the five percent level. The Democratic presidential candidate receives 0.67 points more of the vote for every percentage point increase in real per capita GDP. The incumbent nominee loses 0.70 points for every one percentage point increase in inflation. Every good news quarter adds almost one percentage point for the incumbent party.

When examining popularity function, polling data is available almost every two weeks, allowing for higher frequency data. Having more observations is important because it allows for more determinants of voting preferences to be tested. Clearly you would have to make adjustments during the earlier years of the presidency, when voters in the U.S. do not have the opportunity to compare the president's performance with an alternative candidate - in this sense, approval ratings in the U.S. differ from those in many other countries, where the leader of the opposition is also the most likely opposition candidate for the next election. Certain adjustments have to be made to account for this fact if approval functions are to be used as a proxy for voting function. Some authors, e.g. Frey and Schneider (1978), have introduced some sort of honeymoon variable with a subsequent depreciation, and a "fear of change" variable to characterize recurring movements back to the incumbent as elections approach. At the same time,

popularity functions also allow for the specification of an inherent popularity of a president by designating dummy variables for each administration.

Mueller (1970) actually introduced popularity functions a year before Kramer's publication on voting functions. Similar to Fair's model, the Mueller's specification explained a high degree 986 percent) of the variation. This is remarkable for a time series where the LHS variable is not trended, but stationary. Mueller's model only contained unemployment as the single economic variable. His prediction was that for every percentage point increase in unemployment there would be a three percentage point decline in popularity of the incumbent president. To put matters into perspective, there has been a five percentage point decline in the unemployment rate during the last six years of the Obama administration. Mueller added other non-economic events on the RHS of his equation, such as wars, scandals, and international crises, finding that they have a significant impact on a president's popularity. In the short term, an international crisis boosts a president's popularity. However, unlike Kramer's conclusion, Mueller concludes that the effects of economic performance are significant only when the economy is performing badly, while a booming economy does not significantly improve the president's approval ratings.

Other scholars also shared Mueller's approach on non-economic events. Frey and Schneider probably have the most publications in the field, especially considering their many cross country specifications. For the U.S., Frey and Schneider (1978) argued that both economic and non-economic variables are important determinants of presidential popularity. Different from Mueller, who only showed a single economic variable affecting approval ratings in his model, Frey and Schneider found a variety of economic

variables to have a significant influence. The authors studied the effects of three economic variables, unemployment, inflation, and growth of income, taking into account potential multicollinearity between them. Inflation, for example reduces the president's popularity by 1.7 percentage points for every percentage point increase. Frey and Schneider concluded that personality influences represent important non-economic determinants. Each president's individual characteristics were measured through the inclusion of a dummy variable. Other political events, such as the Watergate scandal, also seem to be important.

Monroe and Laughlin (1983) disagreed with Frey and Schneider's conclusion regarding the relevant importance of the various influences. The authors found that the unemployment was the single most important variable with a one percentage increase in unemployment rate resulting in a decrease of 6.6 percentage points in presidential popularity. In addition, Monroe and Laughlin found instability across party lines regarding the specification: during Republican presidents, there was a regression R^2 of 0.84 while Democratic presidents showed a lower regression R^2 value of 0.70. This difference in explanatory power suggests that political party affiliation of the incumbent plays a critical role regarding on the influence that unemployment plays on presidential popularity. Monroe and Laughlin were among the first scholars to raise the importance of partisanship as a determinant of the public's response to economic events.

Monroe's and Laughlin's findings were contrary to research conducted by Fox and Phillips (2003). These two authors found that unemployment was more significant in affecting presidential popularity when the incumbent was a Democrat, rather than a Republican. Fox and Phillips concluded that Democratic presidents were viewed as more

unemployment-averse than Republicans. Hence voter attitudes appeared more sensitive to unemployment during Democratic administrations.

Norpoth (1984) expounded on the importance of understanding how time lags affect the way that various economic and non-economic determinants impact on presidential popularity. His study employed stochastic time series models using quarterly data from 1961 to 1980. Norpoth showed that changes in inflation rates lagged one quarter and had a significant effect on presidential popularity. For quarterly unemployment rates, however, no lag was necessary. Similar to other authors, Norpoth also stated that presidential popularity is subject to an independent electoral cycle, and each president begins with a "honeymoon effect" when there is unearned popularity that is later diminished throughout the term quarters. Non-economic variables such as significant and atypical occurrences were important only in the short run; their long run repercussions on presidential popularity are less notable.

Realizing that voters known as "floaters" are more easily swayed by candidates' ideological positions, Zaller (2004) focuses on utilizing surveys to measure presidential vote choice. "Floaters" are the low information voters who may not necessarily be loyal to one political party but are more responsive to be persuaded through the political content of the elections. The low information/less strongly attached voters determine voting preferences according to the "nature of the times" and candidate qualities.

One particular variable that Zaller examines is the measure of the candidate's ideology in relation to the ideological position of the average voter. From reviewing the surveys of voter responses (American National Election Survey or ANES), Zaller

concluded that voters were more sensitive to extreme candidates and would consequently be less likely to vote for those candidates.

More recently, Silver (2011) utilizes the ideology of the candidates that Zaller examined to forecast presidential elections through vote share of the government. Silver understands that Americans review the performance of the current president as being reflective of how voters view the incumbent party. As a result, approval ratings of the incumbent (during the election year) is the first determinant in Silver's model. The second factor is the economic performance measured through real GDP growth during the election year. The last factor is the ideological position of the opposition party candidate. Although the model incorporates economic and non-economic variables, it does not consider the difference between popular vote and the Electoral College. In addition, the model is very dependent on the survey response and those responses may differ from reality.

Although vote functions have been frequently estimated, Nannestad and Paldam (1994) conclude that vote functions are unstable analytical tools because it requires a sufficient political component of the model and only works within narrow variation for the explanatory variables. Thus, the model is unstable across time and countries. The degree that the government is responsible plays an important in the degree of how voters attempt to shift the blame and claim the credit of the economic conditions. Because of the many variables, the only strict way to control for the variations is to model cross country differences explicitly and have all else equal.

II. Data Construction and Results

Three different models are examined: Ray Fair Model, Nate Silver Model, and Keil-Lin Model. For the Ray Fair Model that predicts the Democrat vote share, I first replicate the results for the election years 1916 to 2012 and 1948 to 2012. Then, I modify the model by incorporating the change in unemployment rate instead of the economic variable in Fair's model. Lastly, I forecast for the 2016 election using the original Fair model but using different scenarios for the economic variables.

For the Nate Silver Model, I replicate the results according to the three factors found in a New York Times article that predicts the vote share of the government in the election year from 1948 to 2012. After replicating the model, I forecast for the 2016 election using different assumptions for the variables. The major difference between Fair and Silver's model is that Silver incorporates a variable that is specific to the candidate of the election year.

For the Keil-Lin Model, instead of predicting vote share which is conducted in Fair and Silver's model, I create a model to predict quarterly presidential approval ratings using a more comprehensive approach of four economic variables and four types of dummy variables. I explain the variables used in the unrestricted model and the solved restricted model. Then, I forecast the 2016 election approval ratings and incorporate those approval ratings to the Silver model to predict the 2016 vote share. Lastly, I perform different test the model for robustness and stability.

A.1 Ray Fair Model Data

To replicate the Ray Fair model, the incumbent share of the two-party presidential vote and House vote were the dependent variables. The independent variables included dummy variables called party (I), person (DPER), duration (DUR), and war (WAR). The party variable indicated that if there is a Democratic incumbent at the time of the election, it would be assigned a 1 and a -1 if there is a Republican incumbent. For the person variable, if the incumbent is running then it would be assigned a 1 and 0 otherwise. For the duration variable, the incumbent party in power for one term would receive 0, 1 if the incumbent party has been in power for two consecutive terms, 1.25 for three consecutive terms, 1.50 for four consecutive terms, etc. For the war variable, the election years of 1920, 1944 and 1948 were assigned 1 and 0 otherwise. The continuous variables of growth, inflation, and good news were also determined to be influential. The growth rate variable (G) is the annual growth rate of real per capita GDP in the first three quarters of the election year, or real disposable personal income (RDPI). The inflation variable (P) is the absolute value of the growth rate of the GDP deflator in the first 15 quarters, except for 1920, 1944, and 1948 when the values are zero. The good news variable (Z) is defined as the number of quarters in the first 15 quarters of the administration in which growth rate of real per capita GDP is greater than 3.2 percent, except for 1920, 1944 and 19948 when values are zero. However, the good news variable is also later modified to the number of quarters in the first 15 quarters of the administration in which the growth rate of real per capita GDP is greater than 2.2 percent to reflect the brave new world perspective that inflation is not as high as previous levels.

The Ray Fair Model is:

$$Vote_D = \underset{(0.60)}{47.8} + \underset{(0.12)}{0.67}GI - \underset{(0.30)}{0.69}PI + \underset{(0.24)}{0.97}ZI + \underset{(1.41)}{3.0}DPER - \underset{(1.22)}{3.8}DUR - \underset{(2.22)}{1.56}I + \underset{(2.54)}{4.89}War$$

$$t = 1916 - 2012,\ R^2 = 0.90, S.E.R. = 2.62$$

$$Vote_D = \underset{(0.68)}{48.2} + \underset{(0.23)}{0.78}GI - \underset{(0.32)}{0.81}PI + \underset{(0.33)}{0.84}ZI + \underset{(2.14)}{3.45}DPER - \underset{(1.77)}{7.31}DUR - \underset{(2.92)}{1.35}I + \underset{(3.98)}{10.5}War$$

$$t = 1948 - 2012,\ R^2 = 0.90, S.E.R. = 2.40$$

His model assumed that inflation and GDP would be the economic variables that would be relevant for Democrat vote shares. However, according to Okun's law, there is a relationship between an economy's unemployment rate and GDP. To test this relationship, I took out the GDP and replaced it with the annualized change in unemployment quarterly rates. The relationship between the change in unemployment rate and GDP and the relationship between the change unemployment rate and RDPI is shown below and also in Figure 1:

$$\Delta UR = 1.26 - 0.38_{g_y} \qquad (2.2)$$

$$R^2 = 0.68$$

$$\Delta UR = 0.71 - 0.32_{g_{yp}} \qquad (2.3)$$

$$R^2 = 0.28$$

Figure 1 displays how GDP and the change unemployment rate are related. They are seen to be negatively correlated with one percent increase in GDP results in 0.38 percent decrease in unemployment rate. When evaluating the difference between RDPI and GDP, GDP is one percent higher to achieve the same level of RDPI. In equation (2.2), GDP growth of 4.2 percent is necessary to constitute as a good news quarter. This results in the change of unemployment rate to be decrease in 0.3 percent. For equation (2.3), the quarter is considered good news if it exceeds 3.2 percent, which results in the

change in unemployment rate to also decrease by 0.3 percent. This decrease in unemployment rate means that for each month, unemployment rate needs to decrease by 0.1 percent, which is likely. Using the change in unemployment rate gives the model shown below:

$$Vote_D = \underset{(0.95)}{47.5} - \underset{(0.55)}{0.87PI} + \underset{(0.49)}{1.1ZI} - \underset{(0.81)}{1.4URI} + \underset{(3.04)}{3.9DPER} - \underset{(1.22)}{2.7DUR} - \underset{(2.22)}{1.8I} + \underset{(2.54)}{3.2War}$$

$$t = 1916 - 2012,\ R^2 = 0.79, S.E.R. = 3.42$$

$$Vote_D = \underset{(1.21)}{47.5} - \underset{(0.64)}{1.02PI} + \underset{(0.69)}{1.7ZI} + \underset{(01.34)}{0.46URI} + \underset{(3.80)}{0.51DPER} - \underset{(3.00)}{6.3DUR} - \underset{(11.78)}{3.15I} + \underset{(6.28)}{15.6War}$$

$$t = 1952 - 2012,\ R^2 = 0.81, S.E.R. = 3.5$$

Although the regression with unemployment has a slightly smaller R-square, unemployment rate is more indicative. Converting the GDP in a booming economy of 5 percent to unemployment rate yields a negative 0.6 percent in change in unemployment rate in one quarter. Using this assumption, the Democrat vote share is above 50. Replacing unemployment rate with GDP improves the ideology and inflation variable because the coefficients are now higher and have a greater impact on vote- share. A higher ideology variable means a larger ideology difference between the general public and the opposition party candidate, and the larger the ideology difference, the higher the probability that the incumbent will win the reelection.

A.2 Ray Fair Model Results

Using the assumptions of the economy found in Ray Fair's 2014 update, the forecast for the 2016 election is found in Table 1. Given the normal economy assumptions, the Democrat vote share is less than 50 in both cases when good news variable is adjusted. For the booming economy assumptions, the Democrat vote share would exceed 50 when the good news variable is adjusted for post-publication and the quarter is considered good news if it exceeds 2.2 percent instead of 3.2 percent. However, in the slow growth economy assumptions, the Democrat share is also below 50. Post-publication adjustments for the good news variable are necessary because I currently have more information about the economy's performance than what was available to Fair when he was forecasting the 2016 election. For example, in 2014 when Fair was updating his model for the 2016 election, it was possible for GDP to exceed 3.2 percent for more 8 quarters, which constitutes an 8 for good news variable. To reflect the current 2015 third quarter GDP growth of the economy, the good news variable is decreased because it is no longer possible to have 8 quarters of GDP growth exceeding 3.2%.

Using the assumptions of the economy provided by the UCLA Anderson Forecast, the Democrat vote share would be found in Table 2. The Ray Fair model is used to forecast the 2016 election votes-share. The model from 1916 to 2012 results in a 48.50 Democrat vote share while the 1948 to 2012 results in a 44.81 Democrat vote share. Although Fair's model accounts for economic variables, it doesn't look at the variables that relate to the candidate. As a result, if Adolf Hitler were running in Ray Fair's model, the candidate would not make a difference. The only determinants would be the current

state of the economy. As a result, I look at Nate Silver's model that looks at the qualities of the opponent.

B.1 Nate Silver Model Data

In Nate Silver's model, the main factors are the approval ratings, GDP, and ideology of opposition party candidates. The presidential approval ratings came from the University of California Santa Barbara's database of Gallup polling data. Although the data was presented on a weekly frequency, I took the average approval ratings from the year before the third quarter of the election year to retrieve the approval ratings in the year before the election year. However, there was no data available before 1950, so the approval ratings variable span from 1952 to 2012. Figure 2 displays the approval ratings over the years. The annual real GDP were secured from Federal Reserve of Economic Data (FRED).

Lastly, the ideology score of the opposition party candidate is derived from two different methods. Silver receives the score from Zaller (2004) who scales a candidate from negative 3 with the most conservative position, positive 3 with the most liberal position, and 0 was the midpoint. Zaller initially retrieves the score a candidate according to the American National Election Studies (ANES) where voters are surveyed on a scale of 1 to 7 rating of the candidates' ideology, with 1 being extremely liberal and 7 being extremely conservative. Zaller provides the score from 1948 to 2004, so the ideology score for 2008 and 2012 were estimated. I looked at the ANES survey for every election year from 1972 to 2004 to replicate the ideology score that Zaller provides. ANES provided the number of respondents who rated a candidate's ideological position on a

scale of 1 to 7, so I found the weight of each score by taking the number of respondents for one score divided by the total number of respondents for the candidate. The weights were multiplied by the score on the negative 3 to positive 3 scale and added together to get the total rating of the candidate. These calculated ideology scores were compared with the scores Zaller provides. Figure 3 plots the ANES and Zaller ideology scores for every election year from 1972 to 2004. The ANES scores are consistently higher than Zaller scores and the difference between the two scores seem to be consistent as well. Figure 4 explains the relationship between ANES scores and Zaller scores with the R-square of 0.72. The data points fall close to the regression line, which shows that the ANES scores calculated has a strong relationship with the Zaller scores and can be used to predict the ideology scores for the missing election years of 2008 and 2012. Using the methodology described earlier, I found that 2004 opposition party candidate had an ideology score of 1.1 and 1.8 in 2008. The model is shown below:

$$Vote_G = \underset{(4.78)}{28.2} + \underset{(0.07)}{0.22}Appr + \underset{(0.43)}{0.95}GDP + \underset{(0.08)}{0.17}Ideo$$

$$t = 1948 - 2012,\ R^2 = 0.72, S.E.R. = 3.22$$

B.2 Nate Silver Model Results

The most important difference between Fair and Silver's model is that Silver incorporates an ideology variable. In order to forecast the ideology of the opposition candidate, I asked three professors from the Claremont Colleges what their impression of what the general public would rank the Republican candidates on a scale of 0 to 100. A score of 100 would mean that the candidate is extremely conservative. The Republican candidates in question include Jed Bush, Mark Rubio, Donald Trump, Ben Carson, Carly Fiorina, Ted Cruz, Rand Paul, and John Kasich. The scores from the three professors

were averaged to retrieve the score for the opposition candidates. In Table 3**,** the results of the Republican candidate ideology are shown. The average ideology score for the candidates range from 49.7 to 89.7, which gives an average of about 70 for the eight candidates.

As a result, when using the Silver model to forecast the 2016 election, the ideology of opposition candidates are examined in three different ideology scenarios: 50, 60, 70, and 80. The GDP assumptions regarding the economy of normal, boom, and slow growth conditions are from Fair's model discussed before. The approval ratings of President Obama from 2008 and 2015 are displayed in Figure 5**.** The average approval rating for Obama is 47.43, so a range of 40, 50, and 60 for approval ratings were taken into account in the forecast.

The results are shown in Table 4 where shaded regions represent the scenarios when the vote share of the government, which is currently the Democratic Party, is above 50. There is only one scenario when the Democratic vote share is less than 50. This is when there is slow growth, the president approval rating is 40, and the ideology of the Republican candidate is 50. The Democrat vote share increases to 51.38 when the candidate's ideology increases to 60. This shows that the ideology of the candidate impacts the vote share of the government, something that the Fair model does not incorporate. In all other scenarios, the Democratic Party is above 50.

C.1 Keil-Lin Model Data

In this model, the presidential popularity function model, the Gallup poll of presidential approval ratings was the dependent variable. The independent variables included change in real GDP, unemployment rate, inflation, significant events that would affect presidential popularity, terms of each president, changes in political party, and quarterly variables. GDP, unemployment rate, and inflation were continuous variables while the remaining variables are dummy variables also aimed to discover to what extent these variables influenced the dependent variable. For the dummy variables, we assigned a 1 for quarters where the event was in effect and a 0 otherwise.

All data for the presidential popularity function model was collected and compared on a quarterly basis. During any scenario where data was missing, we averaged the available period data. The data for approval ratings were from the University of California Santa Barbara's database of Gallup polling data, and they are averaged for every quarter. All economic data and quarterly figures for GDP, unemployment rate, and inflation were secured from the Federal Reserve of Economic Data (FRED). The real GDP growth rate is taken from the growth rate of GDP in billions of chained 2009 dollars. The unemployment rate is presented in quarterly rates from FRED. The inflation rate is found through the percent change in Consumer Price Index (CPI) from FRED on a quarterly basis. Events which we deemed would be influential for approval ratings were gleaned from historical analysis of each president's term and comparison against available public perception data related to the event or comparison against approval ratings during the affected time period. These events included 9/11 and the Watergate scandal. Wars were accounted for separately with dummy variables to account for the

periods which we determined them to have significant influence on perceptions of the president.

To ensure that the variables are stationary in a time series regression, the three continuous variables are tested. When running the Augmented Dickey-Fuller Test (ADF) on these three variables: Gallup poll ratings, GDP, and unemployment rate, they would be considered stationary if I could reject the null hypothesis for each variable. The ADF test calculates a test statistic for whether the unit root is equal to zero under the null hypothesis and less than zero for the alternative hypothesis. The results are shown in Table 5. The critical values for significance at the five percent level is -2.87 and -3.46 for the one percent level. Therefore, all the variables are significant at the one percent level except for the log of GDP[3]. As a result, Gallup poll ratings, GDP, and unemployment rate variables are stationary.

The Granger Causality test is important to test whether one variable in a time series possesses statistically significant information to predict the future values of another variable. The test lags the independent variable against the dependent variable and tests the null hypothesis that the coefficient of each lag is equal to zero. Four lags were tested and the F-statistics of the Gallup poll, inflation, and unemployment rate variables are displayed in Table 6**.** There is evidence that economic variables Granger Cause Gallup. The CPI does not Granger Cause Gallup, and the unemployment rate variable cannot reject that Gallup cannot Granger Cause. Gallup poll ratings can be rejected at the five percent level. This suggests that besides Gallup's own lagged past, economic variables receive control in predicting Gallup poll ratings.

[3] While the difference between the log of GDP and the first lag of the log of GDP is stationary, the actual variable in the solved restricted model is the third difference of the lag of the log of GDP. It also appears to be stationary but results are not reported.

I also performed a Lagrange Multiplier test on the final regression. Given the fact that I used quarterly data in the regression, I tested the first and fourth order of autocorrelation. The data rejects the null hypothesis of serial correlation at the two percent level for the fourth order. I could not reject autocorrelation at the one percent level for the first order. Given the potential problems that autocorrelation causes with statistical inferences, I re-estimated the model using heteroskedasticity and HAC standard errors (Newey West standard errors). The major difference in my results was the annual inflation no longer appears to be statistically significant.

I also experimented with including a second lag of the dependent variable Gallup poll ratings, but it did not alleviate the problem of autocorrelation. This would have to be examined through further research.

To test for stability, I used the Quandt Likelihood Ratio (QLR) Statistic to maximize Chow statistics. The Chow test statistic tests the hypothesis of no break in coefficients to detect structural change. My model contains a break if there is a change in intercept or change in slope in the coefficients tested. The Stability Analysis leaves out points when administration changes and I am aware of structural breaks at these points due to the fact that approval ratings are trying to forecast the new president's first approval ratings with the predecessor's last approval ratings. Following Pissarides (1972), I have dealt with this behavior by dummying out that observation each time the political party changes. In addition, I have also tested for the Q4 variable that allows for the intercept to change for every point. The results are displayed in Figure 6. The five percent critical value is 3.66 and the coefficients are the Q5 and Q4 variables plotted. While the model behaves well in general, there seems to be a few periods, particularly in

President H. W. Bush era where the model appears to be a structural break. Trying to fix it is beyond the scope of this thesis.

In addition, I also conducted a stability test where I allowed coefficients of economic variables to vary by administration. This differs from the previously reported test in the sense that I do not allow coefficients to change one period at a time. I feel that this test is more indicative of the model. The *F*-statistic for the model without time effects is 4.22, so I found to reject the null hypothesis.

C.2 Keil-Lin Model Results

When forming the regression, the lags of the Gallup poll ratings and the economic variables were taken to test the time series analysis where the approval ratings depend on the previous period economic variables. By utilizing lagged variables, the data can show which lagged variables are important and plausible restrictions can be made to adjust the model. Results of the Gallup poll ratings and economic variables are presented in Table 7 with the unrestricted model in the first column and the solved restricted form in the second column. The unrestricted model contains four lags for the four economic variables, lag of Gallup poll, and all the dummy variables. In the terminology of David Hendry and LSE specification search methodology, I refer to the solved restricted form as the significant lags of the economic variables, lag of Gallup poll, and all the dummy variables.

In the unrestricted model, the lag of Gallup is statistically significant in the one percent level with the coefficient 0.62, meaning that the every one point increase approval ratings from the previous quarter increases the current approval ratings by 0.62.

The lag of Gallup poll ratings has the similar significant effect in the solved restricted form with the coefficient also being 0.62.

The log of CPI and its four lags do not appear to be significant in the ten, five, and one percent level but the log of CPI and the second lag of log of CPI have *t*-statistic of greater than 1 in the unrestricted model. With the solved restricted form, the log of CPI and its four lags are significant in the ten percent level. The variable that took difference of the log of CPI and the fourth lag of log of CPI was generated to capture the significance of the annual change of CPI. The variable that took the log of CPI subtracted from two times the first lag of the log of CPI plus the second lag of the log of CPI was generated to show the change of the change in CPI. This can be interpreted as the moving average of CPI throughout the quarters.

In the unrestricted model, the log of GDP and the third lag of the log of GDP are significant on the one percent level, but the other lags are not significant. The coefficients for the log of GDP and the third lag of the log of GDP are similar but have opposite effects with 127.7 and negative 124.8, respectively. In the solved restricted form, the variable that accounts for the three quarter growth rate is generated to show the significance of the lagged variables. This is taken from the difference in the log of GDP and the third lag of the log of GDP. It results in a 67.4 and negative 67.4 coefficient for the log of GDP and the third lag of the log of GDP respectively.

The unemployment rate and all of its lags except the fourth lag are insignificant in the unrestricted model. As a result, the solved restricted model only has the first lag of unemployment rate and is significant on the one percent level. The coefficient is negative

1.28 so a one percent increase in the previous quarter's unemployment rate decreases the current approval ratings by 1.28 points.

The first non-economic variable that pertains to the presidency is the term quarter variables. Similar to the honeymoon effect, the term variables have a high positive coefficient in the beginning of presidency, decrease throughout the term, and rise towards the end of the term. Figure 7 displays this trend with each president with 16 terms to signify each quarter for four years.

The presidential dummy variable is to differentiate each president's inherent personality and effects on approval ratings. The results are presented in Figure 8. The president possesses a higher intrinsic popularity with a higher coefficient when other variables are held constant. In the solved restricted form, most of the coefficients for the presidents were significant on the one percent level. Although the degree of increase in approval ratings varies, the coefficients for each president are important determinants of approval ratings. President Eisenhower, Kennedy, Johnson, Nixon, and Reagan have some of the highest personality coefficients, while President W. Bush and Nixon have the least intrinsic popularity in the second term. Presidents in the second term also received a lower coefficient when compared to the first term approval ratings. When comparing the coefficients between the unrestricted model and the solved restricted model that controls for pertinent economic variables, president coefficients frequently increased in the solved restricted model. For example, in the unrestricted form, President Nixon in his first term has a coefficient of 11.52 but in the solved restricted form, he receives a coefficient of 16.92. The approval ratings increased after poor economic variables were controlled because the public attributes approval to his individual personality.

The non-economic variable for the change in political party is important because when there is a change in political party, the incumbent's political party cannot predict the incoming president's approval ratings. Most of the coefficients in the solved restricted form are significant on a one percent level with a positive coefficient. This result is expected because the last approval ratings of the president leaving office should be lower than the incoming president's approval ratings. If the incumbent's party has high approval ratings, then it is expected that there would be no change in political party.

The events have positive and negative effects on approval ratings depending on the nature of the event. In the Appendix, the events variable is explained where Vietnam War and the Watergate Scandal were events that negatively influenced the presidential approval ratings, which means that the public disagreed with these events. However, the Kuwait War and the 9/11 attacks have a positive coefficient because the public believed that the president's actions were beneficial and prudent.

C.3 Keil-Lin Model Forecasts

To forecast for the 2016 presidential election, two approaches are conducted. The first approach directly uses Gallup poll ratings as a proxy for vote share of the incumbent party. This approach utilizes the Keil-Lin Model, which incorporates economic and personality factors that help predict the election. The second approach is to predict the election wins through voting functions. This approach utilizes the Silver Model that uses Gallup poll ratings as one of the determinants of vote share of the government.

With the first approach, if approval ratings during the last quarter of presidency are above 50, then the incumbent party is predicted to win the election. This approach has

correctly predicted the subsequent winner for fourteen out of sixteen post-World War II presidential elections. The two exceptions were President Kennedy's victory in 1960 and President G.W. Bush's victory in 2004 (his approval rating was 49.50 in the previous quarter)[4]. The economic variables used in the solved restricted model to predict the election outcome are shown in Table 8. Assumptions are made using a normal economic scenario and a more optimistic scenario. With the normal economic scenario, the last quarter approval rating is 47.2 with the incumbent party not winning the 2016 election. With the more optimistic scenario, the last quarter approval rating is 49.7 with the incumbent party, Democratic Party, also not winning the 2016 election. The results are displayed in Table 9. However, note that the S.E.R. on the regression is between two to four percent, meaning one standard deviation could swing the election outcome.

With the second approach, the election win is predicted using the Keil-Lin Model forecasted approval ratings, ideology of the opposition candidate, and economic variables. Silver accounts for an average of the approval ratings for the year before the election, which is 46.5 forecasted from the Keil-Lin Model. A range of ideology from 20 to 50 score is assigned to the opposition candidate, and a range of economic scenarios is used in the Silver Model. The results are shown in Table 10. As long as the Republican Party does not choose a candidate less than 40 for ideology, Silver predicts a Democratic win.

[4] This rule predicted Al Gore winning the 2000 election, which had it been popular vote, would have predicted the election correctly.

IV. Conclusion

The winner of the 2016 election is uncertain. At this point, Hilary is not a shoo-in winner and it is an open election. When examining the determinants of vote shares for a political party, economic variables such as GDP, inflation, and unemployment are influential. However, this prediction takes into account of candidate personality that is manifested through the ideology score. Examining only the forecasted economic variables for the 2016 election, the election winner would be a Republican candidate. However, when the candidate is a determinant, then there are scenarios when the Democratic Party candidate will win.

Although the model generally explains approval ratings during most quarters, there are shortcomings to the model as revealed through the stability analysis using the QLR test. When analyzing the stability of the solved restricted model with the QLR test, there were occasional quarters that would violate the five percent significance level. The quarter two of 1981 has a sudden increase in approval ratings, which can be explained by President Reagan being shot during that quarter. Another instant when the model is unstable is during President H.W. Bush's administration. His approval ratings increased in the beginning of his term but steadily declined since then. This behavior violates the model as the coefficients for him are higher than the model's predictions. Further research can be conducted to explain the quarters when approval ratings do not match with the Keil-Lin Model.

Though voting functions and popularity functions on a national level are examined, another possibility is to explore how swing states predict the election outcome. Swing states occur in states where no single candidate or political party has clear support

in the state's Electoral College votes. By identifying the swing states for the 2016 election and the determinants for the vote share of the swing states, it can predict the election outcome.

Another area of further research is predicting the Electoral College votes. In my model, approval ratings translate to popular votes, which correlates to the election winner. However, it does not explicitly account for Electoral College votes that can be different from popular votes, as can be seen in the 2000 election with President W. Bush and Democratic candidate Al Gore. By analyzing electoral votes in the state level and aggregating each state's winner to a national level, it should better predict election outcomes.

Figure 1: Okun's Law Showing the Relationship between GDP and Unemployment Rate

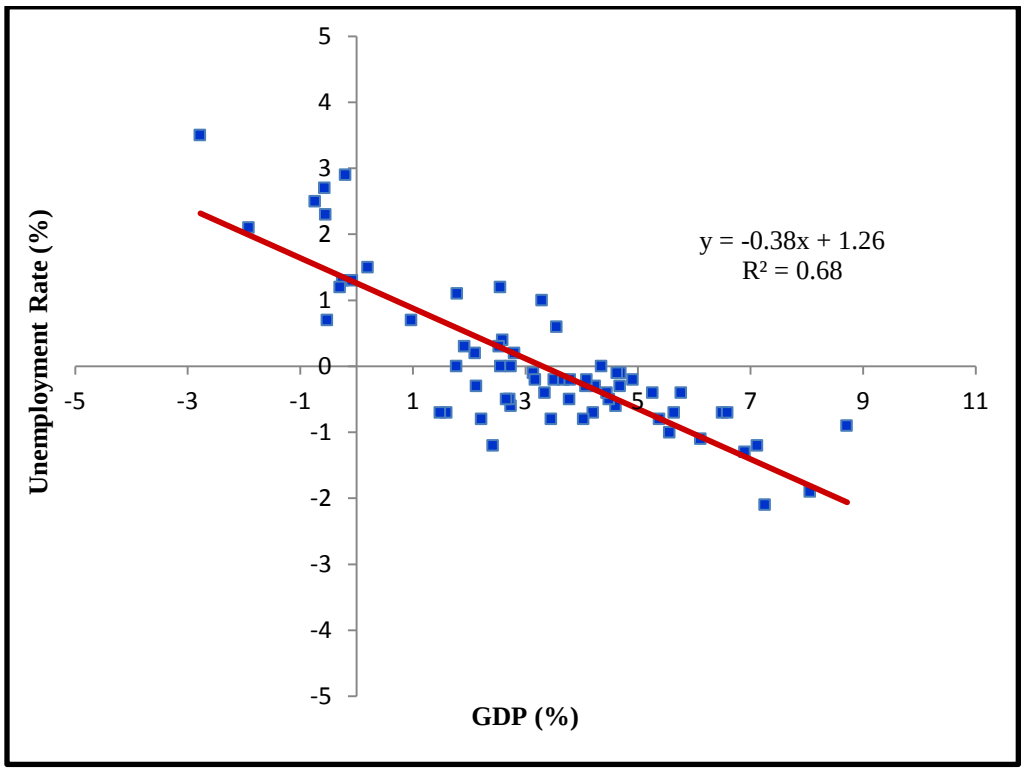


Figure 2: Presidential Approval Ratings in the United States, 1950-2015

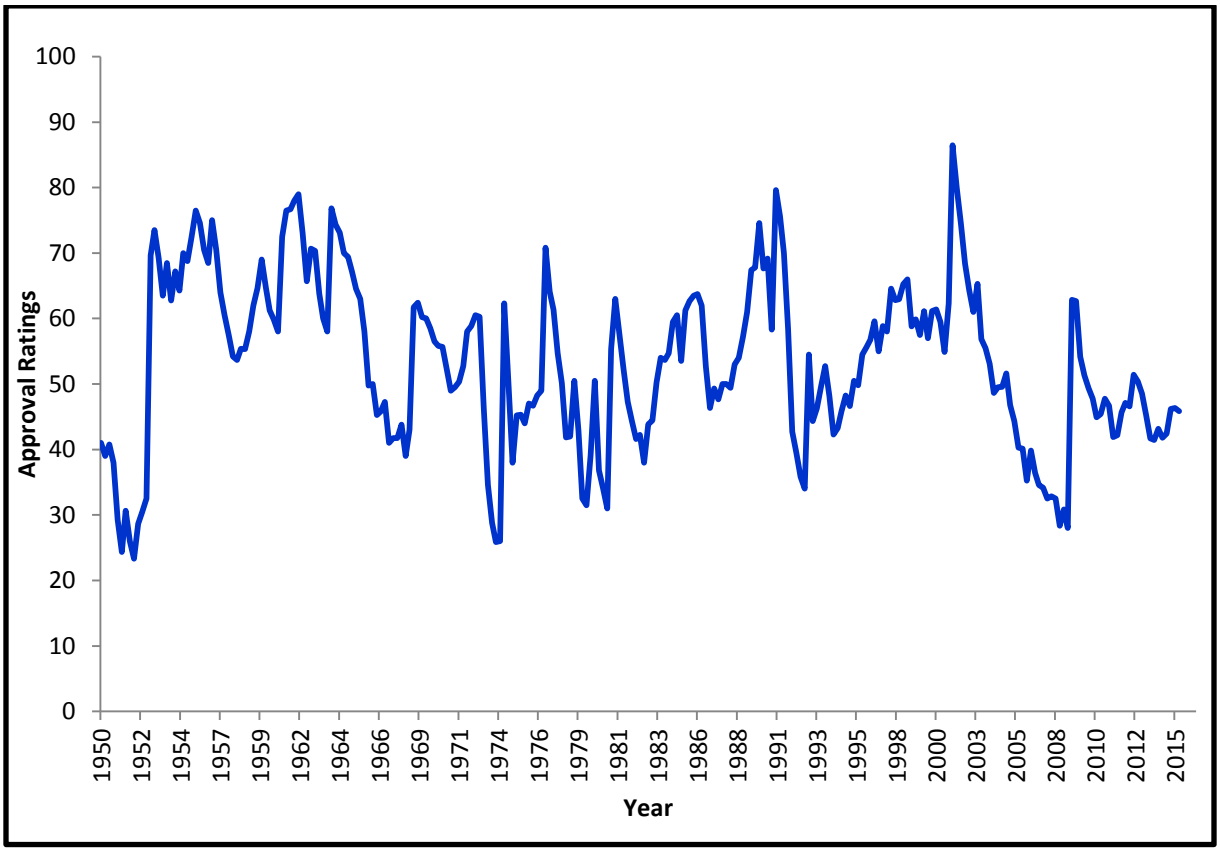


Figure 3: Relationship between ANES and Zaller Scores for Election Years 1972-2004

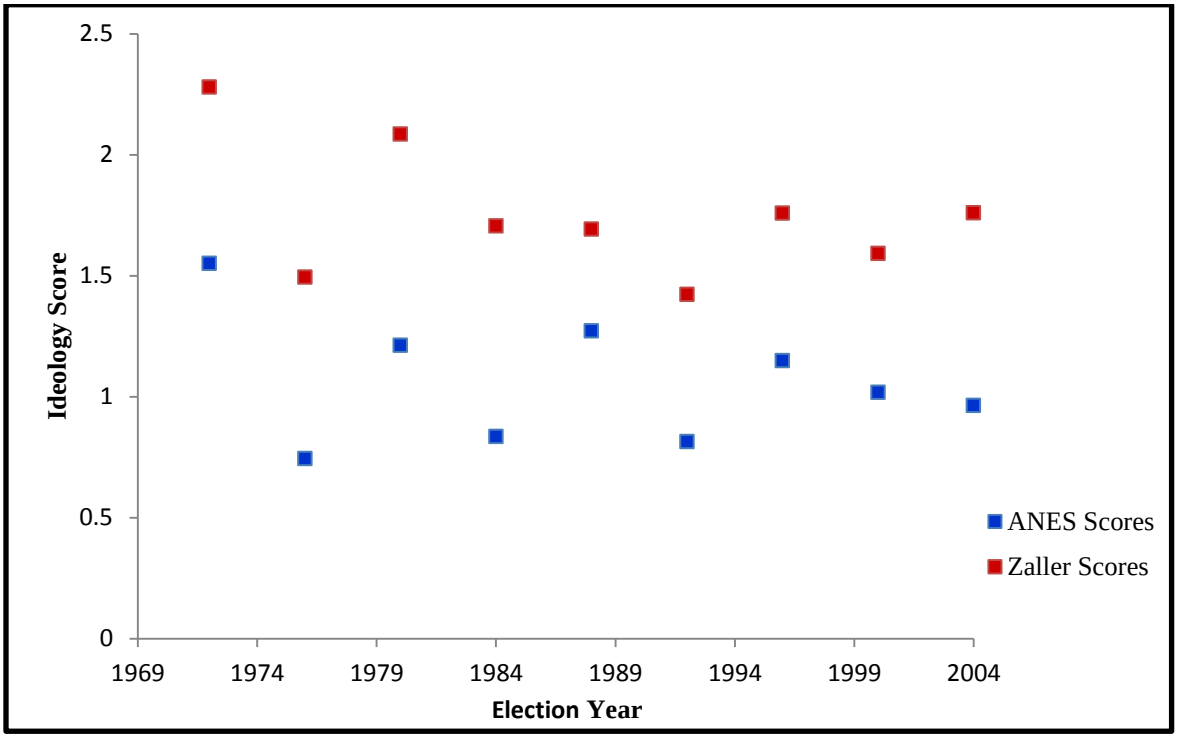


Figure 4: Relationship between Calculated ANES Scores and Zaller Scores

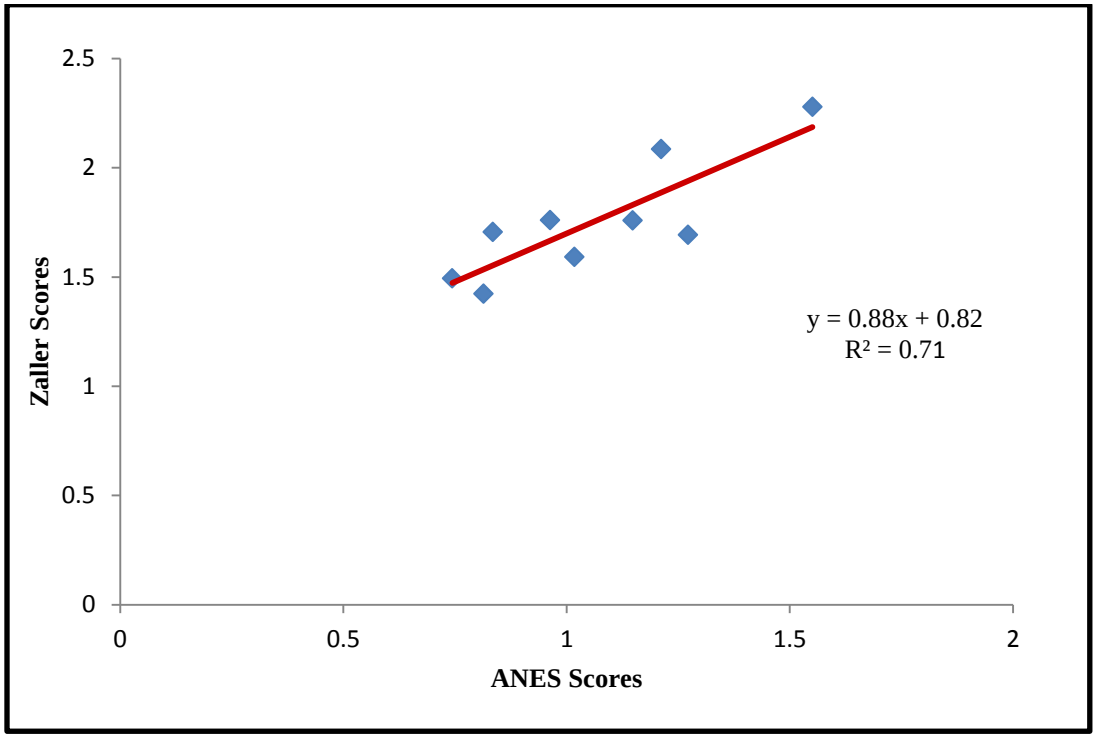


Figure 5: President Obama Approval Ratings, 2008-2015

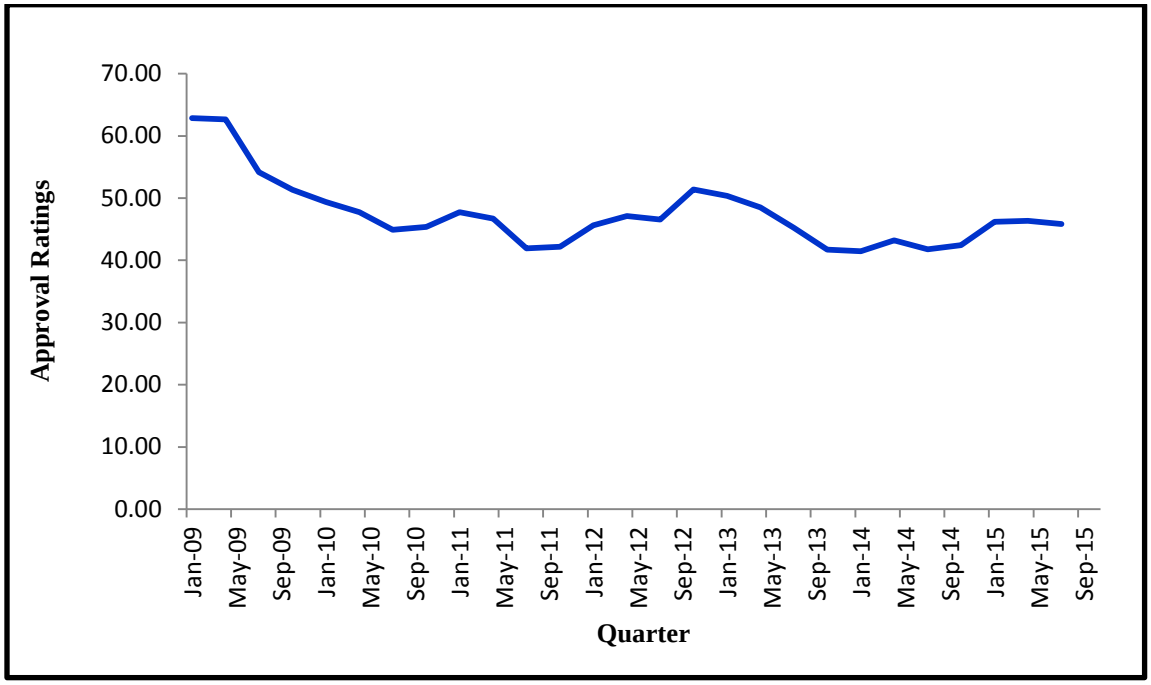
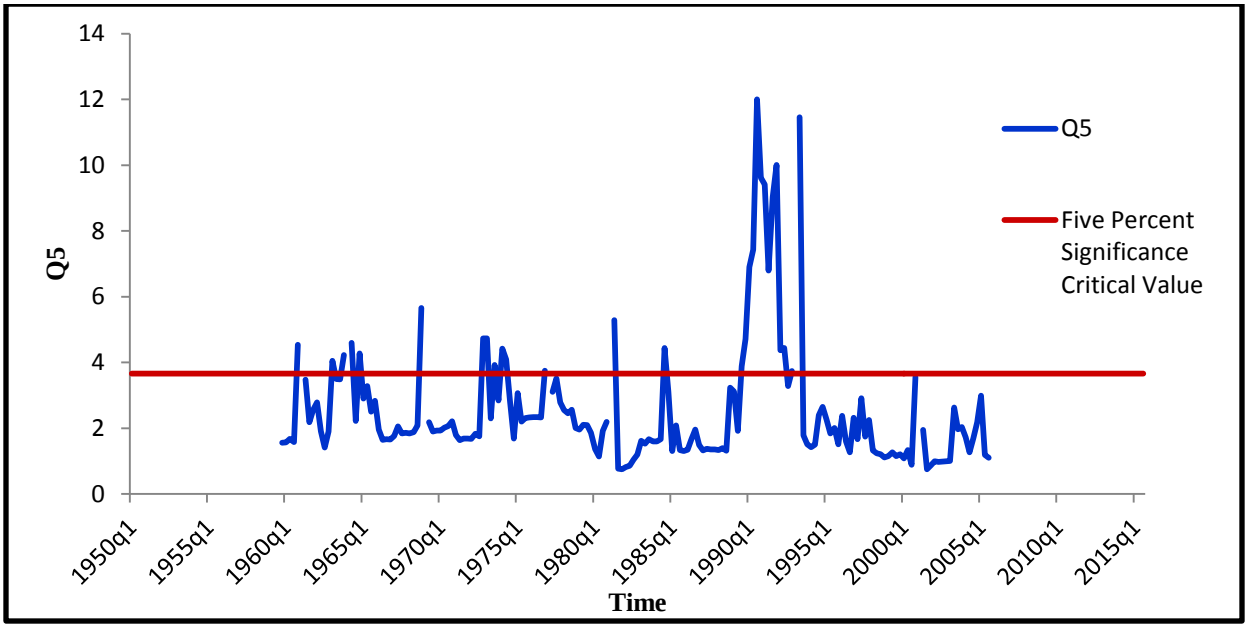


Figure 6: QLR Test for Stability Analysis



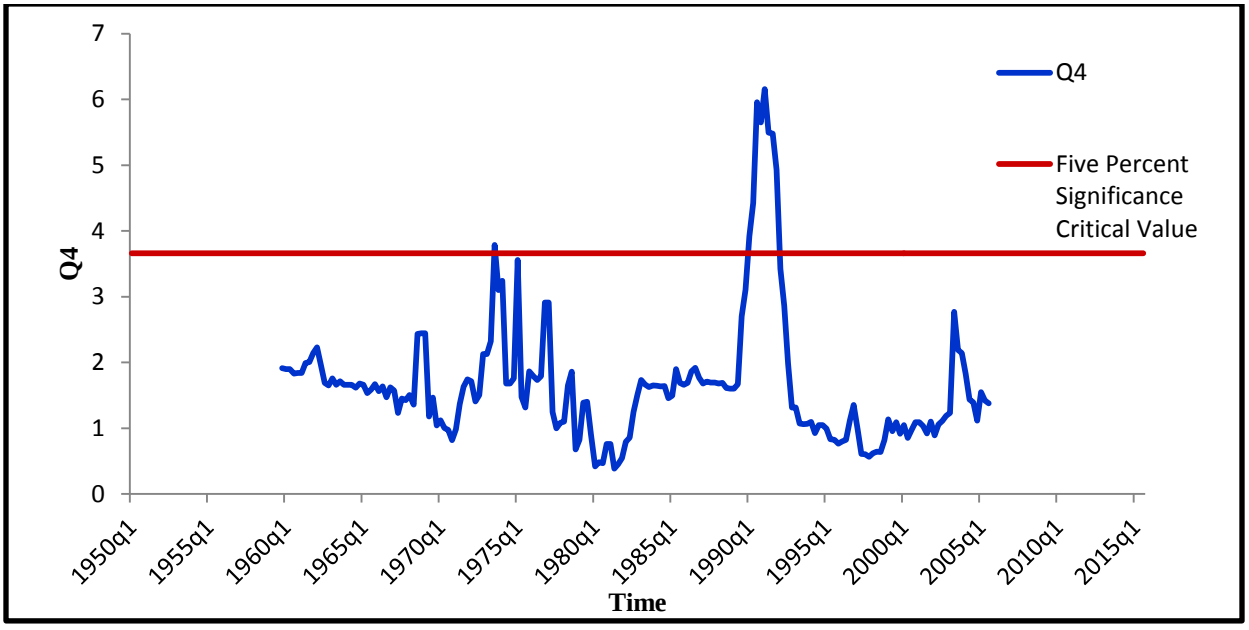


Figure 7: Term Quarter Regression Coefficients

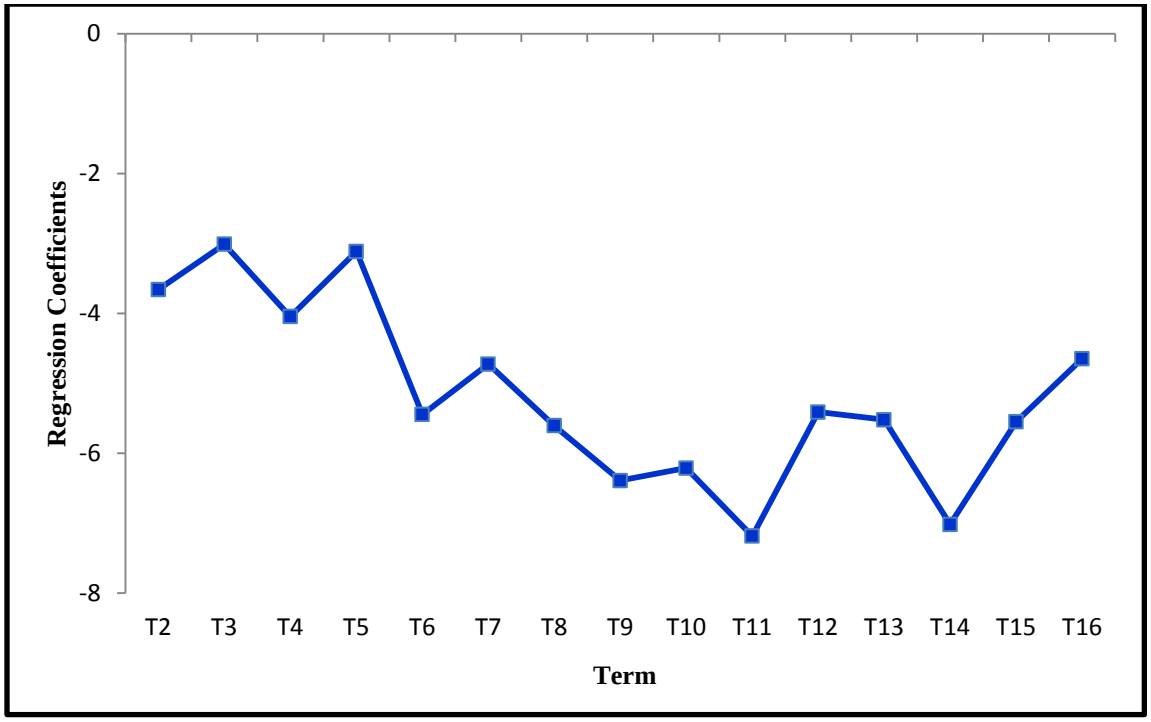


Figure 8: Change in President Regression Coefficients

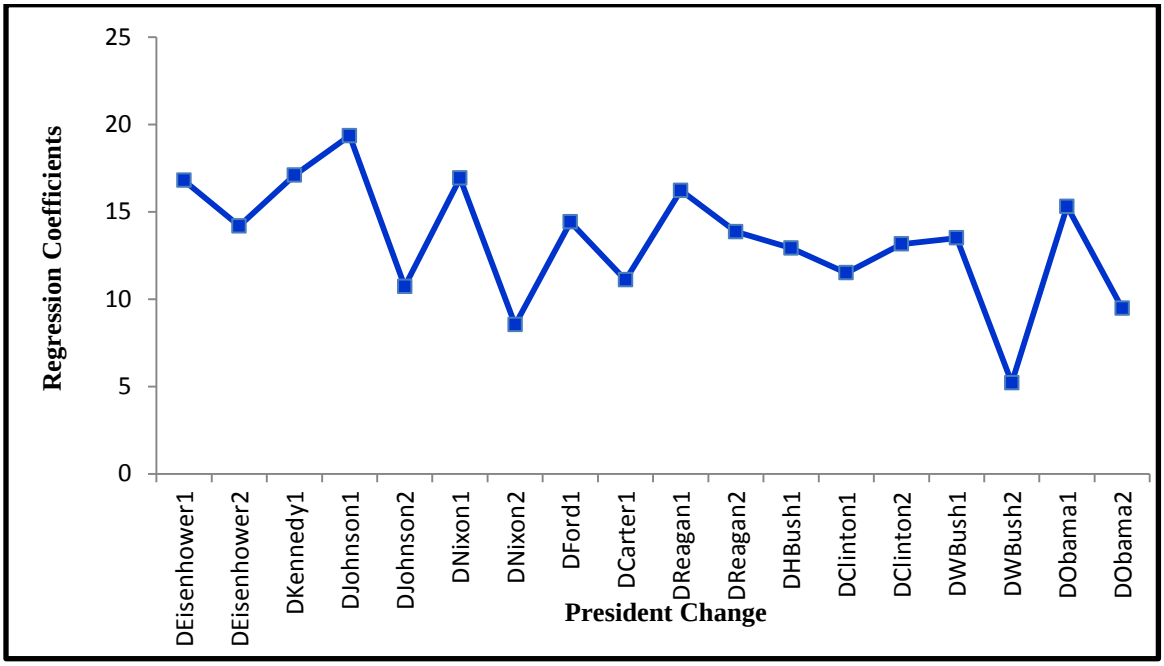


Table 1: Ray Fair Forecasts

	Normal	Boom	Slow Growth
Growth	2.97	4.00	1.00
Inflation	2.14	2.14	1.50
Good news [1]	6	8	2
Good news [2]	4	6	2
Forecast [1]	48.70	51.20	44.00
Forecast [2]	46.80	49.40	42.10

Source: Ray Fair

[1]*if adjust post-publication for Good news 2.2% not 3.2%*

[2]*if post-publication*

Table 2: Ray Fair Model of Vote Share of Democrats

Growth	3.00
Inflation	2.60
Good news	6
Forecast [1]	48.50
Forecast [2]	44.81

Source: Ray Fair,
UCLA Anderson Forecast

[1] *using Ray Fair model t=1916-2012*

[2] *using Ray Fair model t=1948-2012*

Table 3: Republican Candidates Ideology Score

Candidate	Respondent (1)	Respondent (2)	Respondent (3)	Average
Jed Bush	20	49	80	49.7
Mark Rubio	40	65	85	63.3
Donald Trump	65	99	80	81.3
Ben Carson	75	95	90	86.7
Carly Fiorina	50	75	85	70.0
Ted Cruz	90	89	90	89.7
Rand Paul	80	70	80	76.7
John Kasich	10	50	80	46.7

Source: Claremont Colleges Professors

Table 4: Nate Silver Model Predictions

Ideology 50

Popularity \ Econ	Normal	Boom	Slow Growth
40	51.30	52.52	48.98
50	54.60	55.82	52.28
60	57.90	59.12	55.58

Ideology 60

Popularity \ Econ	Normal	Boom	Slow Growth
35	53.70	54.92	51.38
45	57.00	58.22	54.68
55	60.30	61.52	57.98

Ideology 70

Popularity \ Econ	Normal	Boom	Slow Growth
40	56.10	57.32	53.78
50	59.40	60.62	57.08
60	62.70	63.92	60.38

Ideology 80

Popularity \ Econ	Normal	Boom	Slow Growth
40	58.50	59.72	56.18
50	61.80	63.02	59.48
60	65.10	66.32	62.78

Table 5: Augmented Dickey Fuller Test

Variables	*t*-statistics
Gallup	-4.58
Gallup - Gallup $_{t-1}$	-4.58
Log(GDP)	-2.08
Log(GDP) - Log(GDP) $_{t-1}$	-10.87
UR	-3.96
UR - UR $_{t-1}$	13.34

Source: Author

Table 6: Granger Causality Test

Variables	*F*-statistics
Gallup	2.08
CPI	1.30
UR	0.69

Source: Author

Table 7: Regression Analysis of Gallup Poll Ratings for Keil-Lin Model

Regressor	(1)	(2)
Gallup $_{t-1}$	0.620***	0.62***
	(0.04)	(0.04)
Log(CPI)	-64.96	-35.91*
	(52.49)	(21.22)
Log(CPI) $_{t-1}$	-34.10	-86.77*
	(85.30)	(44.99)
Log(CPI) $_{t-2}$	147.30	173.6*
	(95.98)	(44.99)
Log(CPI) $_{t-3}$	-80.47	-86.77*
	(89.26)	(44.99)
Log(CPI) $_{t-4}$	29.18	35.91*
	(56.00)	(21.22)
UR	0.31	
	(1.30)	
UR $_{t-1}$	-2.07	-1.28***
	(1.85)	(0.37)
UR $_{t-2}$	1.24	
	(1.87)	
UR $_{t-3}$	-2.66	
	(1.80)	
UR $_{t-4}$	1.833*	
	(1.08)	
Log(GDP)	127.7***	67.44***
	(45.47)	(15.68)
Log(GDP) $_{t-1}$	-59.69	
	(56.23)	
Log(GDP) $_{t-2}$	-7.60	
	(56.87)	
Log(GDP) $_{t-3}$	-124.8**	-67.44***
	(55.87)	(15.68)
Log(GDP) $_{t-4}$	73.04	
	(46.54)	
Years	1950-2015	1950-2015
Time effects?	yes	yes
State effects?	yes	yes
F-Statistics Testing Exclusion of Groups of Variables		
Time effects=0		4.22
State effects=0		1.77
Observations	258	258
R^2	0.93	0.93
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

Note: Dummy variables included to control for events and change in administration. See Appendix for detailed explanation of variables not listed. Regression (1) is the unrestricted form and regression (2) is the solved restricted form.

Table 8: Keil-Lin Model Forecast Assumptions

Normal Economic Condition

Variables	3Q15	4Q15	1Q16	2Q16	3Q16
GDP	3.00	3.20	3.10	3.20	3.30
UR	5.30	5.00	4.90	4.80	4.70
Inflation	2.20	2.20	2.20	2.20	2.20

Source: UCLA Anderson Forecast

Optimistic Economic Condition

Variables	3Q15	4Q15	1Q16	2Q16	3Q16
GDP	2.10	3.50	4.00	4.00	4.00
UR	5.30	4.90	4.80	4.70	4.60
Inflation	0.40	0.40	0.40	0.40	0.40

Source: UCLA Anderson Forecast, adjusted for current quarter outlook

Table 9: Keil-Lin Model Forecast Results using Assumptions

Quarter	Normal	Optimistic
2015: III	45.94	46.73
2016: I	46.32	48.03
2016: II	46.74	48.95
2016: III	47.17	49.65
Average	46.54	48.34

Source: Author

Table 10: Nate Silver Model Forecast using Keil-Lin Model Approval Ratings

Ideology \ Econ	Normal	Boom	Slow Growth
30	48.66	49.88	46.34
40	51.06	52.28	48.74
50	53.46	54.68	51.14
60	55.86	57.08	53.54

Appendix: Definition of Variables

Variable Abbreviation	Variable Definition
ANES Scores	American National Election Studies: ideology score in the Silver model. Data calculated from ANES survey for every election year from 1972 to 2004. It surveyed voters to rank a candidate's ideology on a scale of one to seven with one being extremely liberal and seven being extremely conservative.
D[name of president]	Presidential personality: dummy variables that take a president's inherent popularity for the respective administrations.
Dnp[name of president]	New party: dummy variables that occur during a change in political party which occurs in 1953: I, 1961: I, 1969: I, 1977: I, 1981: I, 1993: I, and 2009: I.
Events	Dummy variables for events such as Vietnam War, Kuwait, 9/11 attack, and Watergate Scandal. Vietnam War has a value of one from 1964: III to 1972: IV and has a negative 3.37 regression coefficient. Kuwait variable has a value of 3, 2, 1 in 1991: I, 1991: II, 1991: III respectively. This is to capture the magnitude of the effects of the invasion in Kuwait. There is a 7.98 positive regression coefficient. 9/11 attack has a positive 10.74 regression coefficient and occurs with a value of 2, 1 in 2001: IV, 2002: I respectively. Watergate Scandal has a value of one from 1973: II to 1974: II and has a negative 7.92 regression coefficient.
Gallup $_{t,(t-1)}$	Gallup poll ratings and the lag of Gallup poll ratings. This is the percent of respondents who answer "approve" to the Gallup question. It is quarterly data taken from the UCSB database.

$Log(CPI)_t$	Consumer Price Index: economic variable for the measure of inflation as seasonally adjusted change in the CPI from one quarter to the next. In my model, inflation enters as the natural log of CPI and as an acceleration term, i.e. the difference between the inflation rate of the previous quarter and the quarter before that. CPI data is from the Federal Reserve Bank of St. Louis, "FRED Database."
$Log(GDP)_t$	Gross Domestic Product: economic variable for seasonally adjusted change in real GDP each quarter. In my model, GDP enters as the natural log of GDP and as an acceleration term, i.e. the difference between GDP of the previous quarter and the quarter before that. GDP data is from the Federal Reserve Bank of St. Louis, "FRED Database."
T[number of quarters in presidential term]	Term quarter: honeymoon dummy variable that takes a value of one for every term quarter. This controls for time effects.
UR_t	Unemployment rate: economic variable of actual unemployment rate from the Federal Reserve Bank of St. Louis, "FRED Database."
Zaller Scores	Ideology score provided by John Zaller from UCLA. Data collected from "Floating Voters in U.S. Presidential Election, 1948-2000."

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