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A Critical Assessment of the Determinants of Presidential Election Outcomes

Ryan Swezey

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Introduction

In an astonishing feat, the statistician Nate Silver accurately predicted the outcome of all 50 states in the 2012 presidential election. While this is certainly an amazing achievement, Silver's prediction explained nothing about the determinants of the electoral outcome. Because Silver strictly utilized poll data to make his predictions, the only lesson learned was that polls, when used properly and formulated into a complex methodology, can offer accurate predictions of an election winner. This method satisfies the craving to know which candidate is going to win and by how much, but is silent on the reasons behind voter decisions. Nate Silver's predictions exemplify the first of two election forecasting goals: prediction. However, useful election forecasting models should also be able to explain, at least in part, electoral outcomes. The goal of this paper is to develop a model that can explain electoral outcomes and contribute to the existing theory of voter behavior.

Election forecasting serves several unique purposes in the academic and practical realms. The development of forecasting models allows political scientists to empirically test their theories of voter behavior (Lewis-Beck 2005). Models provide information to academics about the determinants of electoral outcomes and the relative strength of factors influencing voter behavior. More practically, forecasting models provide information to political leaders and candidates about the context in which campaigns are set. Understanding the economic and political context of a particular campaign allows candidates to develop better campaign strategies and maximize their available resources. For outside interest groups, forecasting may provide information about the viability of particular strategies and policy prescriptions during specific election periods (Lewis-Beck 2005). Lastly, forecasting models satisfy the innate curiosity of all election observers regarding the likely winner of an election.

The development of empirical forecasting models began relatively recently in the 1980s. Prior to the development of scientific efforts, the Gallup organization began its pre-election polls in 1936, but its credibility was not firmly established until the 1950s and 1960s (Lewis-Beck 2005). Astute observers of history will be reminded of Gallup's infamous prediction (as well as the picture of President Truman the morning after the election holding a newspaper proclaiming his defeat) of a Dewey victory in the 1948 election. In 1983, Brody and Sigelman developed a statistical model that utilized the Gallup presidential approval poll to predict election results (Abramowitz 1988). The famous political scientist and election guru James Campbell developed a model that included Gallup trial-heat polls as well as macroeconomic variables in 1990 (Campbell 1990). Empirical models have grown in number and accuracy over the years. The Campbell model and other significant models will be explored in the Literature Review section.

Considering the very small number of sample observations available, the existing election forecasting models have been surprisingly accurate. Several of the models routinely predict the percentage of the popular vote for the incumbent party within a few percentage points accuracy. Nonetheless, the models do have their occasional blips in accuracy, and when this occurs, nearly all the models offer the wrong prediction. The 2000 election is the most demonstrative case of this modeling failure. Almost every model in existence overestimated the percentage of the popular vote for Gore (Abramowitz 2000). An attractive explanation for this failure is the influence of the campaign. Al Gore ran a very prospective campaign, instead of retrospectively emphasizing the economic growth of the Clinton administration. In distancing himself from the Clinton successes, Gore may have lost many "referendum" voters. Because most models assume the impact of the campaign to be minimal, these same models were unable to pick up on this campaign failure, and as a result overestimated the share of the popular vote awarded to Gore.

Literature Review

There is a rich literature of election forecasting, mostly by political scientists instead of econometricians. Almost all of the forecasting models in existence include some sort of macroeconomic variable (GDP or GNP) and political variable (incumbency or war). As discussed above, the underlying assumption of most of these models is that the impact of the campaign is minimal and most voters are retrospectively oriented in their voting decisions. One of the most interesting contributions to the literature is the “Time for Change” model developed by Abramowitz. With this model, the most important issue at stake in the election is assumed to be the choice of the electorate to continue or discontinue the policies of the incumbent party. The model employs three variables: presidential popularity (as measured by Gallup), change in GNP from the fourth quarter of the previous year to the fourth quarter of the election year, and a dummy incumbency variable that takes the value of 0 if the incumbent party has controlled the presidency for one term and 1 if more than one term (Abramowitz 1988). Abramowitz finds a four percentage point penalty for the incumbent party that controls the presidency for more than two terms; in effect, voters decide it is “time for a change” (Abramowitz 1988).

Just like the “Time for Change” model, most models also include a measure of presidential approval. Erikson and Wlezien utilize the index of leading economic indicators and presidential trial-heat polls (Erikson and Wlezien 2004). Campbell’s “Trial-Heat and Economy” model uses the incumbent party support in the Labor Day Gallup poll as well as the growth of real GDP in the second quarter of the election year. Campbell theorizes that the electorate assigns half the credit (or blame) to successor candidates of the incumbent party, so GDP growth is halved for candidates of the incumbent party who are not sitting presidents (Campbell 2004). The “Jobs” model of Lewis-Beck and Tien incorporates the first Gallup measure of presidential

popularity in July and an interaction variable that multiplies the growth rate of real GNP in the first half of the election year by a dummy variable determined by whether the incumbent president is running (1) or not (0). Additionally, in the case of vacant seat elections, the model incorporates another dummy variable that assigns different values based on the relationship between the successor candidate and the incumbent president. Finally, the model uses the total growth of jobs in the first 3.5 years of the term (Lewis-Beck and Tien 2004).

Two other models incorporate a measure of personal finances as a substitute for general macroeconomic variables. Holbrook incorporates the aggregate personal finances index in May of the election year as well as the Gallup measure of presidential approval in the second quarter of the election year (Holbrook 2004). The model developed by Lockerbie uses an interesting prospective-based approach, instead of the retrospective approach taken by the majority of the other models. Lockerbie includes a measure of prospective personal finances (from the Index of Consumer Sentiment in the Michigan Survey of Consumers) over the next year in the first quarter of the election year as well as a dummy variable similar to the “Time for Change” model (Lockerbie 2004). The model by Norpoth is innovative in that it utilizes primary election results as a predictor of the general election. This model uses three independent variables: incumbent party and opposition party primary support, a cyclical vote variable, and a partisan baseline variable. The results of the model indicate that the effect of primary support for the candidate of the incumbent party is much more important than for the opposition candidate (Norpoth 2004).

These models, although many of which are innovative and provide interesting contributions to election theory, differ from the model I will develop in significant respects. Almost all of the models utilize national-level observations of their variables. Unfortunately, data constraints force these scholars to be content with 11 or 12 observations. Norpoth’s primary

support model does manage to gain 23 observations, more than any other model in the literature (Norpoth 2004). To improve the explanatory power of the model, I use state-level measures of the variables, which allows the number of observations to expand to 81. While not large, this difference in sample size is significant. Additionally, I utilize per capita disposable personal income and inflation, neither of which appear in any known models in the literature. Finally, I do take a page from Abramowitz's "Time for Change" model and include an incumbency dummy variable that mimics the theory of voter punishment after two or more terms.

Model

To better facilitate the discussion of results in the next section, I will include both my initial and final model here. My initial model takes this form:

$$Y_{\text{Incumbent vote}} = \beta_1 + \beta_2 \text{GDPterm} + \beta_3 \text{GDP2year} + \beta_4 \text{URterm} + \beta_5 \text{URelect} + \beta_6 \text{DPIterm} + \beta_7 \text{DPI2year} + \beta_8 \text{Incumb}$$

My final model takes this form:

$$Y_{\text{Incumbent vote}} = \beta_1 + \beta_2 \text{DPI2year} + \beta_3 \text{DPI2yearXInf} + \beta_4 \text{Incumb}$$

The dependent variable in both models is the percentage of the popular vote obtained by the incumbent party in each election. Data for the dependent variable was obtained from the American Presidency project, which maintains a state-by-state database of the results of every presidential election. Both models include a mix of economic and political variables that seek to explain the significance of determinants of electoral outcomes in quantitative terms. Hypotheses and descriptions for the variables included in both models are discussed below.

GDPterm is the percentage change in real GDP (not compounded) over the four-year term. The value was calculated taking the simple percentage change between the level of real GDP at the state-level in the election year and the level of real GDP in the first year of the term.

Data for real GDP was obtained from the Bureau of Economic Analysis Regional Accounts. For the period from 1977-1997, GDP was chained to 1997 dollars. For the period from 1997-2012, GDP was chained in 2005 dollars. This discrepancy required an adjustment which was accomplished by dividing each state's GDP values in the 1997-2012 period by the ratio of the value of real GDP in the state in 1997 (chained 2005 dollars) to the same value in chained 1997 dollars. All else equal, I hypothesize that the impact of GDP_{term} will be positive. GDP_{term} reflects economic success throughout the entirety of the term, and greater economic success should be rewarded by the electorate. Similar to GDP_{term} is GDP_{2year} , which is the simple percentage change in real GDP between the election year and the year prior. All else equal, I hypothesize that the impact of GDP_{2year} should be positive and greater than that of GDP_{term} . Election theory in political science regards voter memory as relatively short-term, so voters should factor in recent economic performance more strongly than past performance.

UR term is the difference in the unemployment rate at the state-level between the first quarter of the term and the third quarter of the election year. UR_{elect} is the difference in the unemployment rate at the state level between the fourth quarter of the year prior to the election year and the rate in the third quarter of the election year. Unlike real GDP, which is only available annually at the state level, unemployment data is available quarterly. This allows UR_{elect} to be a more accurate representation of labor market conditions in the election year. Data for these two variables was obtained via FRED (St. Louis Federal Reserve). All else equal, the coefficient of UR_{term} should be negative; a rise in the unemployment rate throughout the term signifies deteriorating labor market conditions, and voters should punish the incumbent party. All else equal, the coefficient of UR_{elect} should be negative and stronger than UR_{term} , as voters should again factor in recent performance more so than past performance.

DPI_{term} is the simple percentage change at the state-level between per capita disposable personal income (in nominal terms) in the first year of the term and the election year. DPI_{2year} is the simple percentage change at the state-level between per capita disposable personal income (in nominal terms) in the year prior to the election year and the election year. DPI_{2year}INF is an interaction variable that is calculated by multiplying the DPI_{2year} by the simple difference in the national inflation rate between the fourth quarter of the year prior to the election year and the third quarter of the election year (INF). Data for the DPI variables is only available annually and was obtained from the Bureau of Economic Analysis. Data for inflation was obtained as CPI from FRED and then converted into inflation rates by taking simple percentage changes. All else equal, DPI_{term} should have a positive coefficient; a rise in personal income signifies improvement in an individual's personal financial situation, and voters should reward the incumbent party for an increase in income over the term. All else equal, DPI_{2year} should also have a positive coefficient and be stronger than DPI_{term}, as individuals factor recent performance more so than past performance into their voting decision. DPI_{2year}INF should have a negative coefficient. The impact of inflation on the marginal impact of DPI_{2year} on vote should be negative; holding constant nominal income, a rise in the inflation rate will reduce the individual's real income and lead to punishment for the incumbent party.

Unlike the previous variables, the last variable to be explored, Incumb, is a political variable in nature. Borrowing from Abramowitz's "Time for Change" model, this variable is a dummy variable that seeks to measure the impact of a party holding the White House for two terms or more (Abramowitz 1988). The variable takes the value 0 if the incumbent party has held the White House for one term and takes the value 1 if the incumbent party has held the White House for two terms or more. All else equal, I hypothesize that the coefficient on the

variable will be negative. The idea is that voters grow tired of the policies of a particular party after a certain time period (two terms), and consequently the candidate of the incumbent party will receive electoral punishment after two terms (Abramowitz 1988). The interpretation of this variable is slightly different; the coefficient can be interpreted as a parallel shift of the regression line downward by the amount of the variable coefficient. Data for this variable was obtained from the American Presidency Project.

Before examining the results of my regressions, a note on the functional form of the model, as well as the states and years examined, is helpful. The states are Colorado, Florida, Georgia, Iowa, Nevada, New Hampshire, New Mexico, Ohio, and West Virginia. Each of these states was picked with the criteria that they have changed their vote for political party at least three times in presidential elections since 1980. These states are “swing states,” and it is hoped that in the absence of national observations, these states provide a reasonable representation of the national competitiveness. The range of years is between 1980 and 2012, constrained only by the availability of state-level economic data. The functional forms of the initial and final model are both linear, and I think it unlikely that another functional form is more appropriate. The only other possible functional form would be one that takes into account the possibility of diminishing returns to economic performance, but I am skeptical that these diminishing returns exist. There is no rationale that suggests voters might taper their opinions of the incumbent party if the incumbent party provided too much economic success. In most of the elections following sizable economic growth, the results have been strongly one-sided (1984 is a good example). Even if there are diminishing returns, it is unlikely that it would be displayed in a small sample size (there are nine observations per state). Results from a RESET test, which will be discussed later, indicate that another functional form is not more appropriate.

Results

Before proceeding with a discussion of the results of my initial model, it is useful to examine the results from a model crafted from state level data (and more observations) that most closely mirrors the “Time for Change” model. This model has been among the most accurate at predicting the percentage of incumbent popular vote obtained, beating out almost all other models in its error in the 2000 election (Abramowitz 2000). Because state-level data is only available annually (and not quarterly), my approximation of this model takes this form and the results are pictured below:

$$Y_{\text{Incumbent vote}} = \beta_1 + \beta_2 \text{GDP2year} + \beta_3 \text{Incumb}$$

Source	SS	df	MS			
Model	653.163045	2	326.581523	Number of obs =	81	
Residual	5170.80239	78	66.2923383	F(2, 78) =	4.93	
Total	5823.96543	80	72.7995679	Prob > F =	0.0097	
				R-squared =	0.1122	
				Adj R-squared =	0.0894	
				Root MSE =	8.142	

Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
GDP2year	.6851673	.2699465	2.54	0.013	.1477452	1.222589
Incumb	-2.851195	1.831708	-1.56	0.124	-6.497845	.7954555
_cons	47.0397	1.608244	29.25	0.000	43.83793	50.24147

The first observation is that incumbency is insignificant even at the 10% level, which refutes the most basic point of the model. The base hypothesis of the model is that voters will punish the incumbent party after two terms in office, yet this variable is insignificant in this model. Part of this difference may be due to the change in sample set, but it is difficult to justify this hypothesis when the new sample set includes nearly 70 additional observations. Additionally, the coefficient on incumbency (while not significant), is less than Abramowitz’s negative four percentage points (Abramowitz 1988). GDP2year is significant and positive at the 5% level.

The value of the constant is about what is expected at 47.0397; in a two-party system, one party should start with a base of support at around 50% of the electorate. Adjusted R^2 only reaches 0.0894, which suggests that the goodness of fit of this model needs work. The AIC and BIC of this model are 572.5311 and 579.7144, respectively. A RESET test (see Fig. 1 in appendix) conducted with \hat{y}^2 fitted values yielded a p-value on \hat{y}^2 of .057. At the 10% level, this suggests that another functional form is appropriate or a key variable is omitted. Clearly, this model is not adequate given this particular sample set.

My initial model includes six measures of economic performance as well as incumbency. The idea behind the model is to capture a diversified view of economic performance as well as the impact of incumbency, and to evaluate the relative importance of the measures of economic performance to the electorate. The results of the model are below:

Source	SS	df	MS			
Model	1182.79822	7	168.971174	Number of obs =	81	
Residual	4641.16722	73	63.5776331	F(7, 73) =	2.66	
Total	5823.96543	80	72.7995679	Prob > F =	0.0166	
				R-squared =	0.2031	
				Adj R-squared =	0.1267	
				Root MSE =	7.9736	

Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Incumb	-4.334253	1.973471	-2.20	0.031	-8.267375	-.4011313
GDPterm	.1561328	.2087622	0.75	0.457	-.2599297	.5721952
GDP2year	-.0014048	.5743296	-0.00	0.998	-1.146042	1.143233
URterm	.0124638	.5956056	0.02	0.983	-1.174576	1.199504
URelec	-.6199566	1.479449	-0.42	0.676	-3.568495	2.328582
DPIterm	-.705419	.3465045	-2.04	0.045	-1.396001	-.0148366
DPI2year	1.591379	.9348969	1.70	0.093	-.2718674	3.454626
_cons	51.54439	2.672466	19.29	0.000	46.21817	56.87061

Incumbency is significant and negative at the 5% level, as is DPIterm. DPI2year is significant and positive at the 10% level, which is not a problem with smaller data sets. The constant is significant and about what is expected at 51.54439. All other variables are wildly

insignificant. A quick F-test on the coefficients of GDPterm, GDP2year, URterm, and URelec reveals a p-value of 0.6673, and we fail to reject the hypothesis that these coefficients are zero. What is most surprising is the negative coefficient on the DPIterm variable, which indicates that as the growth of personal income over the term increases, the electorate punishes the incumbent party. While at first counterintuitive, upon reflection this result makes sense. This result suggests that as growth in income increases throughout the term, the growth of income in the two years prior to the election appears less impressive to the electorate. Income growth may be strong in years three and four, but if income growth is equally strong or stronger in the first and second years (as it would have to be if growth is strong throughout the term), performance in the third and fourth years appears less impressive.

While this explains the negative coefficient on the DPIterm, there is also another possible explanation. A look at the actual vote plotted against the DPIterm variable (Figure 2) reveals the presence of several outliers that may be driving the negative coefficient on the variable. A closer look reveals that these outliers all belong to the 1980 election, in which the vote received by the incumbent president (Jimmy Carter) was quite low while DPIterm was actually quite high (30-40%). An obvious explanation for these outliers is the presence of another variable not in the model that is strongly driving the 1980 results. Throughout Carter's term, inflation rates were persistently high and economic growth was stagnant, leading to the coining of "stagflation." I hypothesize that inflation may be strongly driving the relationship in 1980, and that inflation will need to be included in another form of the model. When inflation is included, it should have a negative coefficient, reflecting the adverse effect of inflation on the nominal values of incomes.

However, before exploring the impact of inflation on the expected share of the popular vote obtained by the incumbent party, it is interesting to further explore the relationship between

the growth of income in the first two years of the term compared to the last two years. I regress vote against incumbency, DPI2year, and a new variable entitled DPI12, which is the simple percentage change in per capita disposable personal income between the first and second years of the term. I hypothesize that the coefficient on DPI12 will be negative, reflecting the theory that as growth increases in the first two years of the term, growth in the last two years appears less impressive, and voters (taking into account recent performance more strongly than past) punish the incumbent party. The results of the regression are displayed below:

Source	SS	df	MS			
Model	849.660995	3	283.220332	Number of obs =	81	
Residual	4974.30444	77	64.6013563	F(3, 77) =	4.38	
Total	5823.96543	80	72.7995679	Prob > F =	0.0067	
				R-squared =	0.1459	
				Adj R-squared =	0.1126	
				Root MSE =	8.0375	

Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
DPI2year	.7504806	.3999564	1.88	0.064	-.0459343	1.546896
DPI12	-1.223103	.3948293	-3.10	0.003	-2.009308	-.4368972
Incumb	-3.290683	1.837876	-1.79	0.077	-6.950362	.368997
_cons	51.68063	2.391275	21.61	0.000	46.91899	56.44226

Incumbency and DPI2year are significant at the 10% level, while DPI12 is significant at the 5% level. The coefficient on DPI12 is negative, which lends credence to the theory that as income growth increases during the first two years of the term, income growth in years three and four of the term appears less impressive. The -1.223103 coefficient on DPI12 indicates that for every one percentage point increase in the growth of per capita disposable personal income in the first two years of the term, the results in the second half of the term appear less impressive and the electorate punishes the incumbent party by 1.22 percentage points. Clearly, if the incumbent party could choose between economic performance at the beginning of the term and performance at the end, it should opt for stronger performance in the last two years. Nevertheless, this model

has problems: it only yields an adjusted R^2 of 0.0875 and its AIC and BIC are 572.697 and 579.8804, respectively. These values are slightly worse than even the approximation of the “Time for Change” model, which suggests a better model can be achieved using a different combination of variables.

Taking into account the fact that both GDP and unemployment variables were wildly insignificant in the initial model, while both measures of per capita disposable personal income were significant at the 10% level, it appears that individuals may assign more importance to their own personal financial situations in evaluating economic performance rather than their evaluations of broader economic performance (as reflected by GDP and unemployment). This is consistent with basic economic theory that posits that humans are inherently self-interested; when individuals feel that they are doing better financially, they will reward an incumbent party more so than when they feel the nation as a whole is better economically. Using this hypothesis, and the hypothesis that inflation may be a relevant factor in explaining electoral outcomes (from 1980 election outliers), I regress vote against incumbency, DPI2year, DPI12, and Inflation. The results appear below:

Source	SS	df	MS	Number of obs =	81
Model	1457.70003	4	364.425006	F(4, 76) =	6.34
Residual	4366.26541	76	57.4508606	Prob > F =	0.0002
Total	5823.96543	80	72.7995679	R-squared =	0.2503
				Adj R-squared =	0.2108
				Root MSE =	7.5796

Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Incumb	-5.298959	1.839834	-2.88	0.005	-8.963307	-1.634611
DPI2year	1.017541	.3860025	2.64	0.010	.2487499	1.786331
DPI12	-.1207379	.503443	-0.24	0.811	-1.123431	.8819556
Inflation	-1.633484	.5021084	-3.25	0.002	-2.63352	-.6334487
_cons	51.80329	2.255369	22.97	0.000	47.31133	56.29525

DPI12 retains its negative coefficient (smaller than the previous coefficient without inflation) but is now strongly insignificant. Incumbency, DPI2year and inflation are significant at the 5% level, and inflation has a negative coefficient. The interpretation of the inflation coefficient suggests that every one percentage point increase in inflation in the election year is associated with a 1.633484 percentage point punishment for the incumbent party. This fits with theory; as inflation rises, all else constant, real incomes decline and personal finances worsen. Thus, inflation has a very tangible effect on voters' pocketbooks. This strong impact of inflation raises the possibility of an interaction term between inflation and per capita disposable personal income. To explore this possibility, I create the interaction variable DPI2yearINF, which is computed by multiplying DPI2year by the inflation variable. DPI2year is chosen based on the insignificance of DPI12 in the model just performed as well as election theory that suggests voters take into account recent performance more so than past performance. DPI2yearINF should have a negative coefficient, reflecting the hypothesis that as inflation rises, holding income constant, the real value of income decreases, hurting voters' personal financial situations.

The results of this model are displayed below:

Source	SS	df	MS			
Model	1877.65476	3	625.88492	Number of obs =	81	
Residual	3946.31067	77	51.2507879	F(3, 77) =	12.21	
Total	5823.96543	80	72.7995679	Prob > F =	0.0000	
				R-squared =	0.3224	
				Adj R-squared =	0.2960	
				Root MSE =	7.159	

Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Incumb	-5.833331	1.689335	-3.45	0.001	-9.197227	-2.469434
DPI2yearINF	-.1883687	.0332192	-5.67	0.000	-.2545166	-.1222208
DPI2year	1.711502	.4122291	4.15	0.000	.8906492	2.532355
_cons	46.27949	2.197918	21.06	0.000	41.90288	50.65611

All four variables are strongly significant at the 5% level and the model reports the highest adjusted R² (0.2960) by far of any of the models performed. For context, the next best

adjusted R^2 is reported from the previous model (0.2108). Higher adjusted R^2 suggests a reduction in the variance of vote attributed to random chance. All coefficients are as expected. Incumbency remains negative, suggesting that the electorate inflicts a 5.83% punishment on the incumbent party after it has held the presidency for two terms or more. $DPI2year$ is again positive and influential, suggesting that voters strongly take into account their personal financial situations in the last two years of the term. The magnitude of the coefficient indicates that a one percent increase in the growth of per capita disposable personal income between the third and fourth years of the term is rewarded by an increase of 1.71% of the popular vote. The constant is a little below expected (46.27), but the hypothesized value of 50% is within the 95% confidence interval. Finally, the negative coefficient (-0.188) on $DPI2yearINF$ is exactly in line with theory. The coefficient suggests that the impact of a one percentage point increase in the inflation rate affects the marginal impact of $DPI2year$ on vote by -0.188 percent. Taking the partial derivate of vote with respect to $DPI2year$, the marginal impact of $DPI2year$ is equal to the coefficient on $DPI2year$ (1.71) plus the coefficient on $DPI2year$ inflation (-0.188) multiplied by the value of inflation. Thus, as inflation increases, the marginal impact of $DPI2year$ is decreased.

Because this model utilizes panel data, the usual assumption that the covariance of the error terms is equal to zero (no autocorrelation) is altered. Panel data is usually microeconomic in nature, and refers to the usage of multiple cross-sectional units (states) that are observed over time (presidential elections). In panel regressions, there is likely to be covariance between the error terms over time for the same state, due to the fact that unobserved influences on state voting are likely to maintain their effects on the state error terms across time (Hill et al 2011). Taking this into account, correlation between error terms within individual states is now assumed to be nonzero. Error terms for different states are assumed to have zero correlation. The

assumption of homoskedasticity is similarly relaxed, as error variance is assumed to be constant over each state but different in distinctive time periods (Hill et al 2011).

These new assumptions necessitate the calculation of different standard errors for the variables in the model. Standard errors as calculated by ordinary least squares regression techniques are incorrect in the face of the assumptions of covariance for panel data. These standard errors that correct the assumptions inherent in ordinary least squares standard errors are referred to as “cluster-robust standard errors.” Each of the clusters is the time-series observations (election years) for the individual states. The results for the final model with cluster-robust standard errors are displayed below:

```
Linear regression                               Number of obs =      81
                                                F( 3,      8) =    24.95
                                                Prob > F      =    0.0002
                                                R-squared    =    0.3224
                                                Root MSE    =    7.159
```

(Std. Err. adjusted for 9 clusters in State)

Vote	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Incumb	-5.833331	.8374937	-6.97	0.000	-7.764595	-3.902067
DPI2yearINF	-.1883687	.0432065	-4.36	0.002	-.2880031	-.0887343
DPI2year	1.711502	.4482498	3.82	0.005	.6778362	2.745168
_cons	46.27949	1.311548	35.29	0.000	43.25506	49.30393

All variables remain strongly significant at the 5% level, and p-values change only minimally, suggesting that the influence of autocorrelation in this regression is almost nonexistent. Coefficients on the variables do not change, as the new computation only affects calculated standard errors. It is interesting to note that the standard errors of the incumbency variable and the constant become smaller, while the standard errors of the other two variables (DPI2year and DPI2yearINF) grow larger. Generally the cluster-robust standard errors will be larger than the ordinary least squares standard errors, although the fact that standard errors for

two of the variables shrunk is not an issue. What matters is the significance of the variables, and as previously discussed, all variables remain highly significant.

The correlation matrix, as well as the AIC and BIC values, is displayed below. In the correlation matrix, it should be noted that the correlation between the DPI2year and DPI2yearINF variables is 0.7733. This correlation coefficient is not surprising given the fact that the DPI2yearINF variable is an interaction term that includes the DPI2year variable. Regardless, this somewhat high correlation is not a problem; none of the harmful symptoms of multicollinearity are present (high standard errors and p-values, low t-statistics), and all the variables in the model are highly significant at the 5% level. The values of the AIC and BIC are 552.6411 and 562.2189. Out of all the models tested so far, this final model minimizes both of these values. The measures of goodness-of-fit (AIC, BIC, adjusted R^2) together provide strong indication that this is the most reliable model for electoral behavior.

	Incumb	DPI2ye~F	DPI2year
Incumb	1.0000		
DPI2yearINF	-0.3144	1.0000	
DPI2year	-0.2073	0.7733	1.0000

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	81	-288.0832	-272.3206	4	552.6411	562.2189

Note: N=Obs used in calculating BIC; see [\[R\] BIC note](#)

Further supporting this model are the results of a RESET test (Figure 3) with \hat{y}^2 and \hat{y}^3 fitted values. The fitted variables are both insignificant at the 5% level, and a RESET test with only \hat{y}^2 is even more insignificant, suggesting that this model does not suffer from omitted variable bias or incorrect functional form. Finally, this model supports the hypothesis that individuals weigh recent economic performance (DPI2year) more heavily than past

economic performance (DPI12), and voters are more concerned about their own financial situations (DPI), as opposed to broader economic performance (GDP and unemployment).

Examination of the residual values of this model display no obvious signs of problems. Residuals are plotted against the predicted values of the model in Figure 4 of the appendix, and a histogram of the residuals is displayed in Figure 5. Looking at Figure 4, the residuals appear to display constant variance. Autocorrelation is not present, as previously demonstrated with the calculation of cluster-robust standard errors, and a visual study appears to confirm this conclusion. The residuals indeed appear to be randomly distributed around the value of zero. Figure 5 provides little cause for concern about the assumption of normality of the residuals. In any case, I compute the value of the Jarque-Bera statistic, which returns a value of 1.0222406 against a chi-square critical value (at the 5% level) of 5.9914645. Because the value of the Jarque-Bera statistic is well beneath the critical value, I fail to reject the hypothesis that the residuals are distributed normally.

There is a small cause for concern with the nonstationarity of Vote. A graph of Vote by state across time is displayed in Figure 6 in the appendix. Several of the states appear to be displaying possible signs of an upward trend of Vote across time. Dickey-Fuller unit root tests for each state are performed both with a constant and no trend and with a constant and trend variable. For the constant and no trend test, we fail to reject the hypothesis that Vote is nonstationary in Georgia and West Virginia. For the constant and trend test, we fail to reject that hypothesis that Vote is nonstationary in Georgia, Ohio, and West Virginia. These results are easily explained; there are merely nine observations (years) for each state, which makes it very difficult to trust the validity of any test for stationarity. In any short period of time, the importance of a small trend may become magnified, despite the fact that that trend would be

insignificant with a larger sample set. Additionally, we only fail to reject the null hypothesis in three states (out of nine), which is hardly indicative of widespread nonstationarity problems. With a larger sample set, the results discussed here would be concerning, but with this small sample size, there is little need to correct for possible nonstationarity.

Conclusion

The results from the final model serve as confirmation of election theory that posits that voters are more concerned about their personal financial situations, as opposed to broader economic performance, and that voters place more importance on recent economic performance than past performance in evaluating the performance of the incumbent party. The model also indicates that voters inflict significant punishment on incumbent parties that have held the White House for more than two terms. Finally, the model indicates that the inflation rate, as it pertains to the real value of voters' incomes, plays a significant role in the evaluation of economic performance. The message of this model to presidential candidates is clear: if a member of the incumbent party in a time of economic growth, emphasize how that growth is tied to the improvement in voters' personal financial situations. If a member of the incumbent party in negative economic conditions - good luck. Send strong messages about how the party's policies have improved or softened the blow to voter's financial situations. If a member of the opposition, emphasize how the policies of the incumbent party have hit voters' pocketbooks and stress the need to try new ideas (time for change), especially if the incumbent party has held the presidency for two terms or more.

As with any econometric model, this model has several problems that are worth discussing. The first problem is the small sample size. Although this model has more observations (81) than the next best model (23), achieved by virtue of state-level data, 81

observations cannot be considered numerous. Unfortunately, this is a problem only time will solve; with more presidential elections will come more observations and more accurate results. In its current form, this model also cannot forecast, although it does provide interesting insight into the determinants of electoral outcomes. Because per capita disposable income at the state level is collected annually, there is a period of time between the early November presidential election and the end of the year that is included in the model but not factored into voter decisions. While the impact of this period is likely relatively minor, in order to forecast, there would need to be a measure of per capita disposable personal income available no later than the end of the third quarter of the election year. Lastly, the adjusted R^2 value for this model is relatively low (0.2960), which indicates that there is a significant portion of Vote variance that is due to other variables and/or random chance. Regardless, the highly significant variables in this model indicate a relatively well-constructed model.

For future research, I am hopeful that a state-level quarterly measure of per capita disposable personal income will be developed. If not developed, I can use annual data to forecast quarterly values which will allow me to forecast the outcome of actual elections in advance. An interesting field of research in political science is also underway examining the influence of prospective voter behavior. Most political scientists (and models) assume that voters predominantly behave retrospectively in their voting decisions, but I suspect there is a role for prospective evaluations of candidates and parties. Consequently, I would like to develop a model that includes a prospective variable along the lines of Lockerbie's prospective voting model (Lockerbie 2004). Certainly this model would also include a retrospective component via per capita disposable personal income or other economic variable. Finally, I await the passage of time, which through sample size can greatly improve the accuracy and usefulness of my model.

Appendix

Figure 1

Source	SS	df	MS			
Model	891.564565	3	297.188188	Number of obs = 81		
Residual	4932.40087	77	64.0571541	F(3, 77) = 4.64		
				Prob > F = 0.0049		
				R-squared = 0.1531		
				Adj R-squared = 0.1201		
				Root MSE = 8.0036		
<hr/>						
Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
GDP2year	-9.831257	5.457721	-1.80	0.076	-20.69897	1.036454
Incumb	41.08914	22.84786	1.80	0.076	-4.406755	86.58504
yhattfc2	.1581262	.0819659	1.93	0.057	-.0050887	.3213412
_cons	-303.8684	181.9027	-1.67	0.099	-666.0829	58.34612

Figure 2

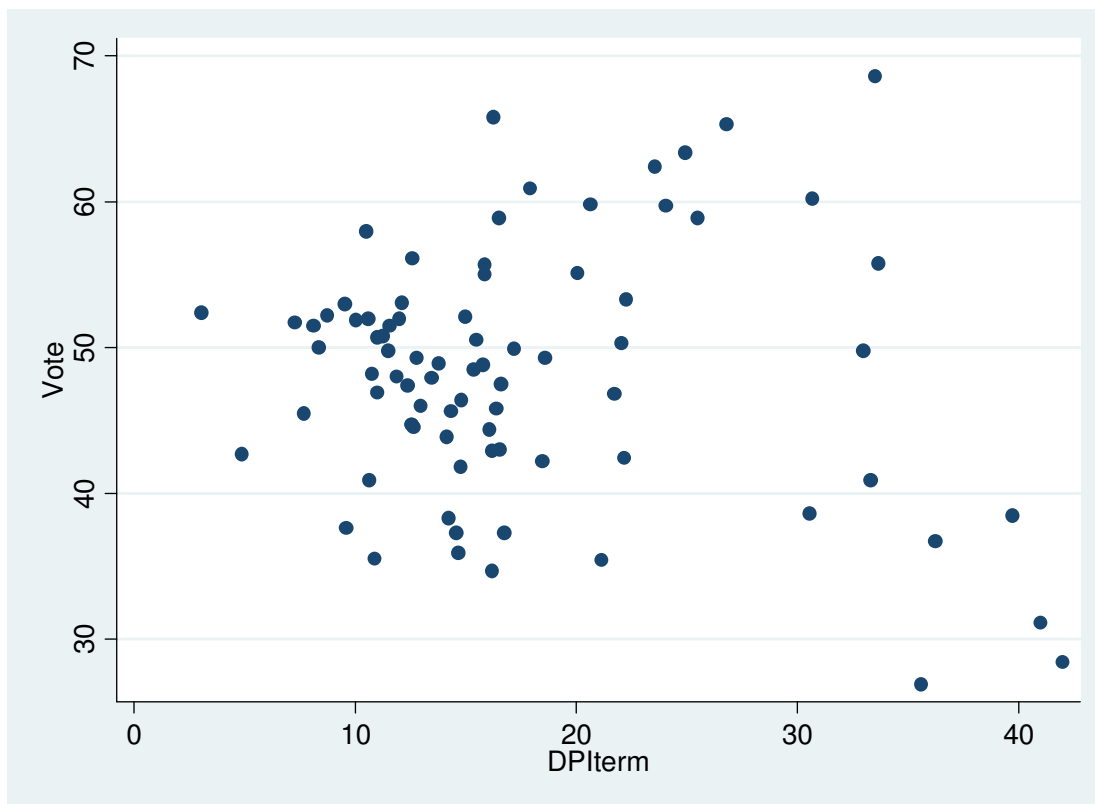


Figure 3

Source	SS	df	MS			
Model	2063.48172	5	412.696345	Number of obs =	81	
Residual	3760.48371	75	50.1397828	F(5, 75) =	8.23	
Total	5823.96543	80	72.7995679	Prob > F	= 0.0000	
				R-squared	= 0.3543	
				Adj R-squared	= 0.3113	
				Root MSE	= 7.0809	

Vote	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Incumb	-526.9598	278.6598	-1.89	0.062	-1082.079	28.15904
DPI2year	153.8486	81.34058	1.89	0.062	-8.190103	315.8874
DPI2yearINF	-16.917	8.937187	-1.89	0.062	-34.72079	.8867897
yhat2	-1.846784	.9774743	-1.89	0.063	-3.794013	.1004446
yhat3	.0126671	.0066522	1.90	0.061	-.0005847	.0259189
_cons	2749.021	1436.683	1.91	0.060	-112.9982	5611.041

Figure 4

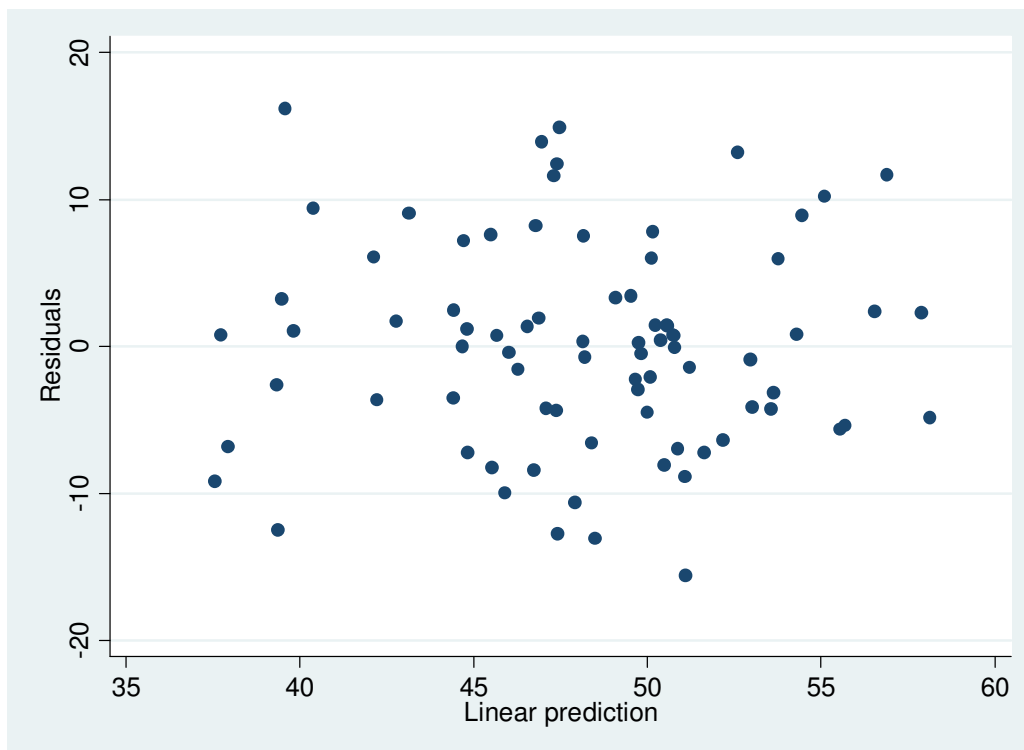


Figure 5

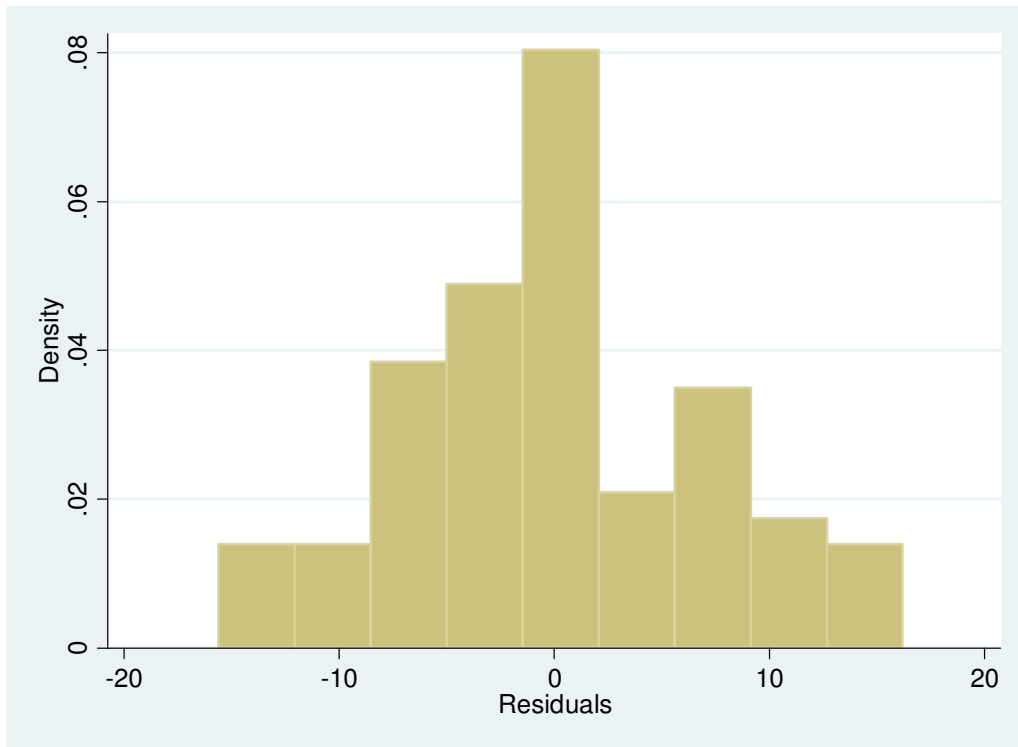
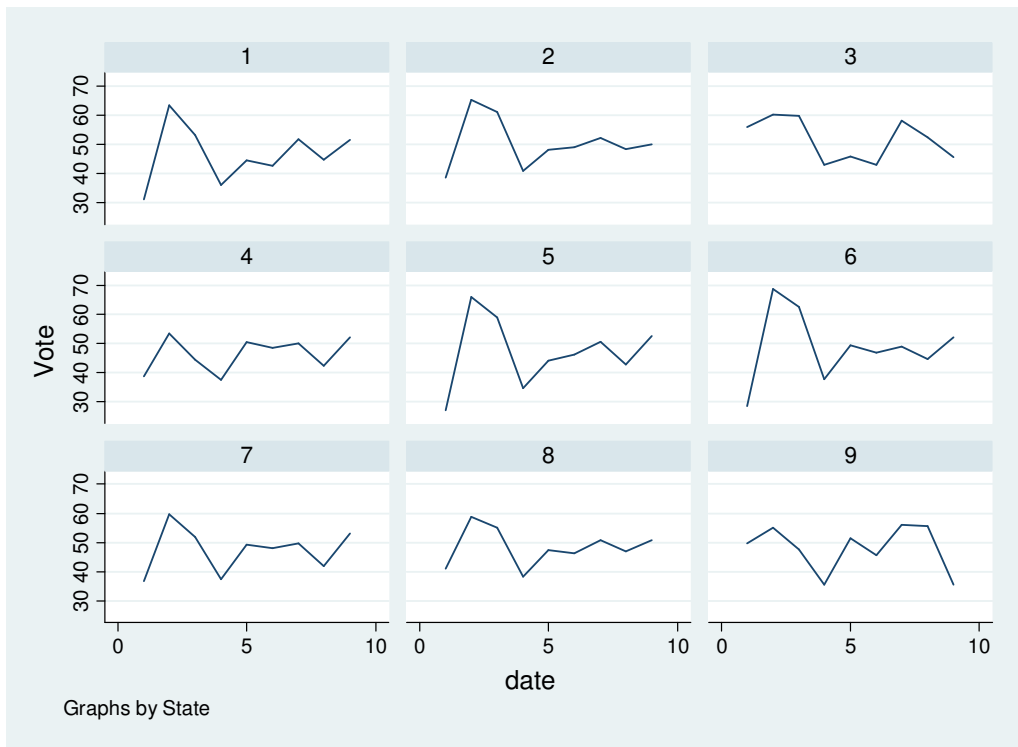


Figure 6



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