

# The Great Society, Reagan's Revolution, and Generations of Presidential Voting

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## Abstract

We build a model of American presidential voting in which the cumulative impression left by political events determines the preferences of voters. The impression varies by voter, depending on their age at the time the events took place. We find the Gallup presidential approval rating time series reflects the major events that influence voter preferences, with the most influential occurring during a voter's teenage and early adult years. Our fitted model is predictive, explaining more than ninety percent of the variation in voting trends over the last half-century. It is also interpretable, dividing voters into five meaningful generations: New Deal Democrats, Eisenhower Republicans, 1960s Liberals, Reagan Conservatives, and Millennials. We present each generation in context of the political events that shaped its preferences, beginning in 1940 and ending with the 2016 election.

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We study generational voting in American presidential elections by modeling voters' partisan preferences as a running tally of impressions left by the political events they live through. When fit to data, the tally is weighted heavily by events that occur in a voter's teenage and early adult years. After early adulthood, voter preferences become consistent, and political events hold considerably less weight. The fitted model is predictive—explaining nearly all of the macro-level variation in voting trends over the past half-century—and interpretable—dividing voters into five meaningful generations.

Our model builds on a substantial literature in political science, sociology, and social psychology, beginning with the theory of “political socialization” (Hyman, 1959) and developed through seminal works on American political behavior, such as *The American Voter*. These works used panels of high school students to establish the micro-level determinants of voting behavior. For example, Campbell et al. (1964) found party identification, the basis of political attitudes and voting behavior, is formed early in life and is influenced primarily by parents.<sup>1</sup>

However, these works were unable to agree on the macro-level determinants. For example, researchers observed that older voters were more likely to identify as Republican. Some argued this was the effect of aging: a social or psychological process pushed individuals towards a conservative viewpoint later in life. Others argued the effect was generational: the shared experiences of individuals from the same cohort happened to skew these voters Republican. Much ink was spilled attempting to disentangle the two. Crittendon (1962) emphasized age effects, while Cutler (1969) and Glenn and Hefner (1972) emphasized cohort effects.

Scholars soon discovered the problem with decomposing voter behavior into age, period, and cohort effects, the second of which refers to short-term influences of political attitudes that fail to leave a lasting impression. The effects are not identified because age, period, and cohort are collinear; a voter's age and cohort uniquely determine the period in which they vote (Converse, 1976; Glenn, 1976; Markus, 1983). Perfunctory attempts to estimate all three require model constraints that are difficult to interpret and cannot be validated from the data (Fienberg and Mason, 1979).

We resolve the age-period-cohort problem by directly modeling the impressions left by political events that researchers typically interpret as cohort effects. We use the Gallup presidential approval rating time series to instantiate these events for three reasons. First, the president is the most public and notable in American politics. The position is prominently associated with major political events, even when those events are unrelated to the presidency. Second, presidential elections are among the most salient events in American politics. By a wide margin, presidential turnout is higher than any other form of political participation. Lastly, the series continuously measures the public's evaluation of the president since the 1930s.

Because presidential approval ratings reflect the political events that determine presidential voting, we need only estimate the influence of those events at each age—along with a relatively small number of additional parameters discussed in the following sections. As a result, our model not only resolves the age-period-cohort problem, but, when fit to our massive dataset, quantifies generational trends with a precision unprecedented in the literature. Our three main findings are:

First, the political events that influence partisan preferences occur largely between the ages of 14-24, and a generation's

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<sup>1</sup>Reviews of the early literature include (Niemi and Sobieszek, 1977; Delli Carpini, 1989; Niemi and Hepburn, 1995), with Jennings and Niemi (1981) summarizing many of their substantial contributions. We briefly highlight how our approach compares to research in this area.

Burnham (1970) studies generational voting patterns over the long term, explaining system-wide shifts of roughly thirty-year increments. In contrast, our generations cover roughly fourteen-year increments, explaining the more rapid swing between liberal and conservative. The two definitions are best suited for studying their respective phenomenon; Burnham's theory does not explain rapid partisan swings between presidential administrations, while we do not model slower shifts, such as the gradual partisan shift of the South.

Beck and Jennings (1991) and Ostrom and Smith (1992) study the dynamics of presidential approval; a topic that remains relevant in our hyper-polarized era. Our work differs in that they model approval directly, while we use approval to model how voters choose candidates.

Beck and Jennings (1979) study the interaction between age and cohort effects in American politics, focusing on the period during the late 1960s and early 1970s when young voters were a major force in American politics. Our work follows their insight that “opportunities for political action ... vary with changes in the political stimuli across different periods.” Beck and Jennings (1982); Beck (1991) use panel data to study political socialization of young Americans. We again follow their idea that adult political attitudes are a product of individual and social inputs.

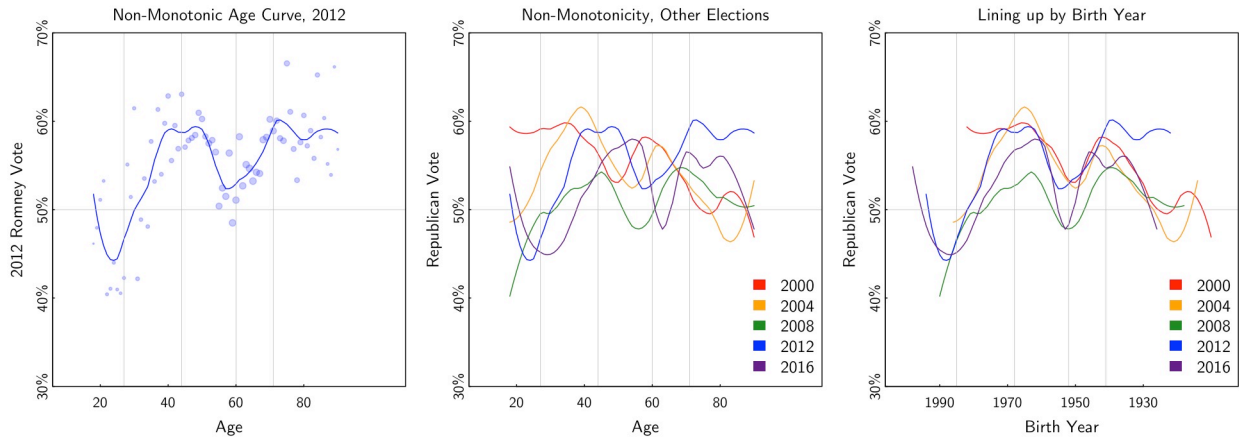


Figure 1: *Raw data and loess curves, indicating the relationship between age and presidential voting preferences among non-Hispanic white voters for the 2000-2016 elections. From the left: (1) The relationship is non-monotonic and quite peculiar in 2012; instead of a linear or even quadratic relationship, the curve changes directions multiple times. (2) Non-monotonicity characterizes other elections as well. No clear pattern is apparent from this graph alone. (3) The true relationship emerges when the curves are lined up by birth year instead of age. The peaks and valleys occur at almost identical locations, indicating a generational trend.*

preferred party is essentially locked-in by 40. This influence varies by race and region. It is strongest among non-Southern whites and relatively weak among minorities, suggesting considerable differences in the political socialization process.

Second, the impressions left by these events delineate five distinct generations. For example, consider white voters born in 1952 and socialized during the Kennedy and Johnson administrations. These voters are consistently 5-10 percentage points more likely to support Democratic presidential candidates than those born in 1968, who came of age during the presidencies of Carter, Reagan, and Bush I. We name these generations New Deal Democrats, Eisenhower Republicans, 1960s Liberals, Reagan Conservatives, and Millennials.

Third, period effects are important despite our focus on generations. But a simple model of period effects is insufficient for explaining voter preferences, even when voters are further divided by race and region. Our model explains significantly more macro-level variation, especially among non-Southern white voters. This suggests a single defining political event is less important in the formation of voter preferences than the cumulative impression left by a lifetime of events.

We present the details and additional findings in five sections: (1) We describe the data and motivate our model in the context of the age-period-cohort problem. (2) We present the technical details of our model. (3) We fit the model to the data and interpret the results. (4) We narrate presidential preference over the past half-century, using the fitted model to quantify how political events left differential impressions on five generations of American voters. (5) We conclude with a brief discussion.

## Data and Preliminary Evidence

We assemble a massive dataset from five sources: (1) the ANES cumulative dataset covering elections (1952-2016), (2) the Gallup presidential polling dataset from the Roper Center's iPoll database (1952-2016), (3) the Annenberg National Election Studies (2000, 2004, and 2008), (4) the Greenberg Quinlan Rosner Research internal campaign polls (2012 election cycle), and (5) the CNN/ORC and Pew polls (2016 election cycle). We only use responses collected during presidential election

years. There are 319,678 observations after removing incomplete records.<sup>2</sup>

Graphing the combined data provides strong—albeit preliminary—evidence of generational voting. To illustrate the reasoning behind our assessment and motivate the importance of our model, consider Figure 1, which displays the relationship between age and presidential vote choice for white respondents across all data sources.

The left panel combines the preference of voters in 2012 by age. That is, for each age group on the  $x$ -axis, the  $y$ -axis indicates the percent supporting the Republican candidate. The size of each bubble represents the number of voters surveyed. A best-fit curve is estimated using locally weighted regression (LOESS).

From the panel, it is clear that support for the 2012 Republican candidate, Romney, varied by age: The youngest white voters slightly supported Romney; voters around the age of 24 preferred Obama, the Democratic incumbent; Romney's vote grew steadily with age until 45, only to reverse direction until 60; it then climbed one last time to 70, before finally flattening. But the reason for this pattern is not obvious.

The center panel overlays curves for all presidential elections from 2000 to 2016. We remove the bubbles for clarity. As with the left panel, the patterns in each election are difficult to interpret. Moreover, there is no common trend across elections.

It is only in the right panel—when the data are combined by birth year (birth cohort) instead of age—that a common pattern emerges. The five curves align. Their peaks and valleys coincide, and, with the exception of the 2008 election, all curves are essentially on top of each other. This is especially true for voters born between 1940 and 1970, where the bulk of the data lie.

The common pattern establishes that voters share preferences with their birth cohort and maintain these preferences across elections. We reason this is evidence of generational voting: Voters from the same cohort live through the same interval of history; the cumulative impression left by the events of that interval produce a stable political identity, which explains the stable partisan preferences we observe in the right panel.

The weight of the evidence appears strong because of the simplicity of the explanation—the curve has two peaks around the birth years of 1941 and 1968 and one pro-Democratic valley around 1952, delineating five meaningful generations—and its consistency—the curve repeats over five elections, measured across multiple surveys conducted by different organizations, and unaltered by any complicated adjustment or statistical model. In comparison, the center panel suggests neither a simple nor consistent explanation.

Yet the evidence is preliminary because our reasoning does not explicitly account for non-generational explanations of vote choice. For example, political events during election years have been known to influence preferences monotonically across cohorts and create “uniform swings” (Ghitza and Gelman, 2013). We noticed a uniform swing earlier in the right panel, where the 2008 curve is lower for nearly every birth cohort.

Uniform swings suggest events, such as recessions, natural disasters, or war, can influence voters during the period in which they occur but not subsequent periods. It also stands to reason that life-cycle events, such as education, marriage, and retirement, can influence voters at the age in which they occur but not subsequent ages. We do not consider such period-specific and age-specific influences generational voting because they do not leave the lasting impression that defines a generation.

We build a model that includes both generational and non-generational determinants of voter preference in order to identify the events that define a generation and quantify their import. Our model avoids the well-known limitation of the traditional age-period-cohort model, which we briefly review in order to motivate our approach. An authoritative discussion of age-period-cohort models is given by Fienberg and Mason (1979).

The traditional age-period-cohort model for categorical data decomposes the log-odds additively into static age compo-

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<sup>2</sup>Variables of interest are presidential vote choice, race/ethnicity, sex, state of residence, and age (or equivalently birth year (birth cohort), defined as the year of the survey response minus age). Responses are not weighted. Throughout this paper, white refers to non-Hispanic white.

nents ( $\alpha$ ), period components ( $\beta$ ), and cohort components ( $\gamma$ ). Let  $\theta_{ap}$  denote the expected proportion of voters supporting the Republican candidate at age  $a$  during election period  $p$  with birth year (birth cohort)  $c = p - a$ . We assume without loss of generality that the age and period indices have been centered:  $\sum_a a = \sum_p p = 0$ . Then the traditional model is written

$$\text{logit}(\theta_{ap}) = \alpha_a + \beta_p + \gamma_{p-a} \quad (1)$$

If we knew the summands,  $\alpha_a$ ,  $\beta_p$ , and  $\gamma_{p-a}$ , we could indirectly determine the generational import of political events. We might identify two cohorts,  $c_1$  and  $c_2$ , differentially affected by those events and compute the difference,  $\gamma_{c_1} - \gamma_{c_2}$ . (Indeed, when we interpreted the curves in Figure 1, we compared the difference between cohorts.) However, the summands are not known, only the sum, and as it stands the system of equations given by (1) is indeterminate; the parameters  $\alpha_a$ ,  $\beta_p$ , and  $\gamma_{p-a}$  cannot be determined uniquely from  $\text{logit}(\theta_{ap})$  and are said to be unidentified.

We divide the identification problem into two cases for ease of explanation. Contrasting the two sheds light on what exactly can be learned from age-period-cohort data. The first case is routine in categorical data analysis. If some solution,  $\alpha'_a$ ,  $\beta'_p$ ,  $\gamma'_{p-a}$ , did exist, we could obtain an observationally equivalent second solution,  $\alpha''_a$ ,  $\beta''_p$ ,  $\gamma''_{p-a}$ , by adding and subtracting a constant of magnitude  $\delta$  to the right side of (1):

$$\begin{aligned} \text{logit}(\theta_{ap}) &= \alpha'_a + \beta'_p + \gamma'_{p-a} \\ &= \alpha'_a + \beta'_p + \gamma'_{p-a} \pm \delta \\ &= \alpha'_a + (\beta'_p + \delta) + (\gamma'_{p-a} - \delta) \\ &= \alpha''_a + \beta''_p + \gamma''_{p-a} \end{aligned}$$

This case poses no difficulty because  $\delta$  is the same across cohorts, and therefore the difference between cohorts remains the same:  $\gamma'_{c_1} - \gamma'_{c_2} = \gamma''_{c_1} - \gamma''_{c_2}$  regardless of  $\delta$ . We impose the restriction  $\sum_a \alpha_a = \sum_p \beta_p = 0$  to avoid this problem, justifying our choice on the basis that any other restriction, for example  $\alpha_0 = \beta_0 = 0$ , results in the same intercohort comparisons.

But even with this restriction, equation (1) is unidentified. A consequence of the linear relationship between age, period, and cohort,  $c = p - a$ , is that we can add and subtract  $(p - a)\delta$  to the right side of (1):

$$\begin{aligned} \text{logit}(\theta_{ap}) &= \alpha'_a + \beta'_p + \gamma'_{p-a} \\ &= \alpha'_a + \beta'_p + \gamma'_{p-a} \pm (p - a)\delta \\ &= (\alpha'_a - a\delta) + (\beta'_p + p\delta) + (\gamma'_{p-a} - (p - a)\delta) \\ &= \alpha''_a + \beta''_p + \gamma''_{p-a} \end{aligned}$$

This second case poses significant difficulty because  $(p - a)\delta = c\delta$  is not the same across cohorts. For any solution,  $\alpha'_a$ ,  $\beta'_p$ ,  $\gamma'_{p-a}$ , we can generate an observationally equivalent second solution,  $\alpha''_a$ ,  $\beta''_p$ ,  $\gamma''_{p-a}$ , whose difference,

$$\begin{aligned} \gamma''_{c_1} - \gamma''_{c_2} &= (\gamma'_{c_1} - c_1\delta) - (\gamma'_{c_2} - c_2\delta) \\ &= (\gamma'_{c_1} - \gamma'_{c_2}) + (c_2 - c_1)\delta \end{aligned} \quad (2)$$

can be made arbitrarily small or large by choosing  $\delta$  accordingly. Put simply, the data cannot distinguish between the

determinants that produce two different cohorts and the chance timing of age and period determinants.<sup>3</sup>

We could impose additional restrictions to force a unique solution, but, unlike the first case, we cannot justify our choice of restriction on the basis that all restrictions are equivalent. The fact that no perfunctory solution identifies the system of equations (1) is called the age-period-cohort problem.<sup>4</sup>

We resolve the age-period-cohort problem, not by restricting the cohort parameters that indirectly determine the generational import of political events, but by directly modeling the generational voting process that explains the pattern in Figure 1. We build a dynamic “running tally” model in which the cumulative impression left by political events—in addition to age and period determinants—influence the preferences of voters.<sup>5</sup>

Our running tally consists of two parts. We use the Gallup Organization’s long-running presidential approval rating time series, displayed in Figure 2, to measure the political events voters experience. We then weight this measure according to the age of the voter at the time the events took place. That is, we replace  $\gamma_{p-a}$  in equation (1) with  $\sum_{i=0}^a w_i x_{p-a+i}$  where  $x_{p-a+i}$  is the (observed) measurement of the political events when a voter from cohort  $c = p - a$  was age  $i$ , and  $w_i$  is the (unobserved) influence of the events at age  $i$ .

Unlike the static age-period-cohort model, our cohort parameter is dynamic and changes with  $a$ , and we therefore call it the generational parameter. Our model also accounts for the sex, race, and region of voters, the survey house that collected the data, and choice interactions. We present the technical details of our model in the following section.

One limitation of Gallup’s approval ratings is that, despite being one of the longest-running time series available for the study of American political behavior, it is “only” available from 1937 onward. Because this analysis examines the formation of preferences over a voter’s *entire* life cycle, and due to the importance of early life political socialization indicated in the literature, we discard observations for which we do not have presidential approval data over the respondents’ entire life span. That is, we drop respondents born before 1937, leaving 215,693 responses. The data are plotted by election year and year of birth in Figure 3. They cover the 1960-2016 elections and sixty-one birth-year cohorts (1937-1998), with at least 1,000 responses for any individual year.

## Statistical Model

We model the partisan preference of the survey respondents described in the previous section. We index each response by five identifiers: (1) the age of the respondent  $a = \{1, 2, \dots, 70\}$ , (2) the year of the response  $p = \{1960, 1961, \dots, 2016\}$ , (3) the race/region group of the respondent  $g = \{\text{non-Southern white, Southern white, and minority}\}$ , (4) the sex of the respondent  $s = \{\text{female, male}\}$ , and (5) the survey house that collected the response  $h = \{\text{Annenberg, Gallup, NES,}$

<sup>3</sup>It is important to note that not all cohort comparisons are unidentified. For example, relative differences can be estimated. By equation (2),

$$\begin{aligned} & (\gamma''_{c_1} - \gamma''_{c_2}) - (\gamma''_{c_2} - \gamma''_{c_3}) \\ &= (\gamma'_{c_1} - \gamma'_{c_2}) - (\gamma'_{c_2} - \gamma'_{c_3}) - (c_3 + c_1 - 2c_2)\delta \\ &= (\gamma'_{c_1} - \gamma'_{c_2}) - (\gamma'_{c_2} - \gamma'_{c_3}) \end{aligned}$$

for equally spaced cohorts,  $c_3 - c_2 = c_2 - c_1$ . But this difference in differences does not serve our purpose because it only establishes the relative influence of events.

<sup>4</sup>Although called the age-period-cohort problem, the linear relationship that produces this identification problem arises whenever exposure to a phenomenon of interest is not measured directly but approximated from the timing of a life event such as birth year, graduation, employment, or retirement. For example, consider the linear model with explanatory variables age, number of years married, and number of years not married. The problem also extends to interactions, which are not identified since the relationship  $c = p - a$  implies  $c^2 = p^2 - 2ap - a^2$ ,  $cp = p^2 - ac$ , and  $ca = pc - a^2$ .

<sup>5</sup>In the typical “running tally” model, voters choose their partisan identification by evaluating each party’s performance over their lifetime (Fiorina, 1981; Achen, 1992). The simplest versions give each evaluation equal weight regardless of age or recency. Several papers have generalized the model, for example see Gerber and Green (1998). In another example, independent of our work, Bartels and Jackman (2014) combine age-specific weights with period-specific shocks. Both parameters are estimated from the American National Election Study (ANES) cumulative dataset. While these parameters are not underidentified, see footnote 17, (Bartels and Jackman, 2014: pg 14), the model is statistically underpowered; the age-specific weights oscillate between negative and positive, and the uncertainty bounds are large with almost none statistically distinguishable from zero.

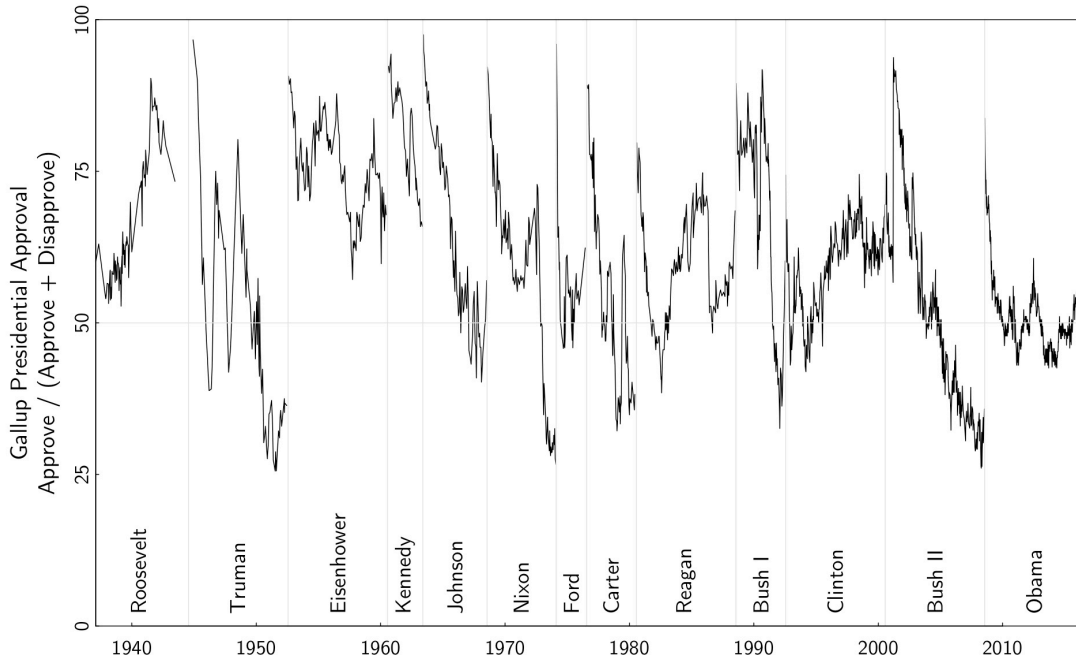


Figure 2: *The Gallup Organization's presidential approval rating time series, 1937-2016. The data reflects political events that influence voter's partisan preferences.*

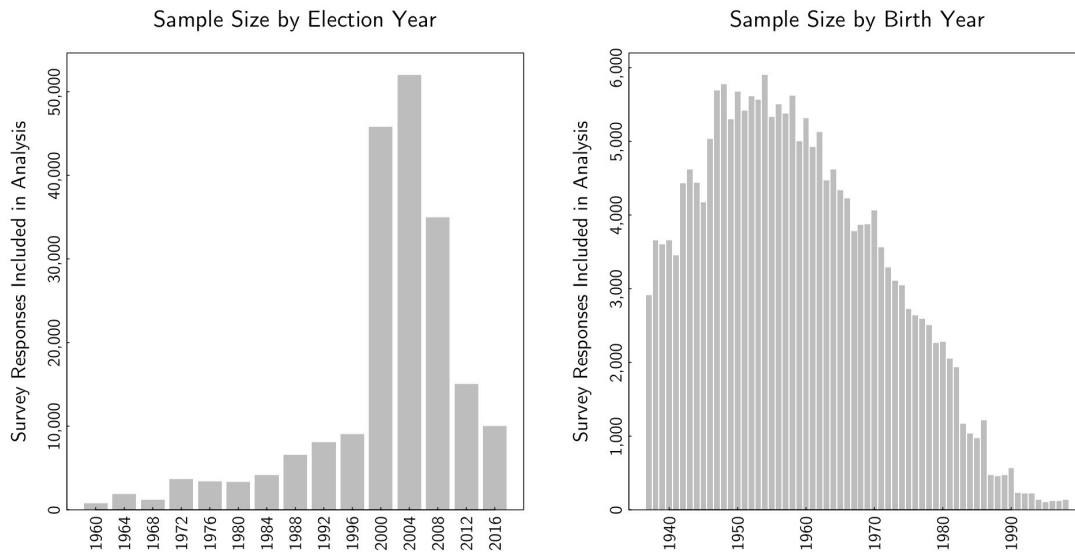


Figure 3: *After removing survey respondents born before 1937, the analysis includes 215,693 survey respondents in total, here displayed by election year and year of birth. The data, and thus the analysis, have a strong emphasis towards the most recent four elections, and may be interpreted as weighted towards the contemporary political climate. The data encompass generational cohorts defined by their individual birth year from 1937-1998, with at least 1,000 responses for each birth year until 1986.*

GQRR, CNN/ORC/Pew}.<sup>6</sup>

These identifiers partition the responses into mutually exclusive cells. For each cell  $j$ , we denote the age, period, group, sex, and source of the responses by  $a[j]$ ,  $p[j]$ ,  $g[j]$ ,  $s[j]$ , and  $h[j]$ .

Let  $y_j$  denote the number of respondents preferring the Republican candidate in cell  $j$ , and  $n_j$  the number preferring either the Republican or Democratic candidate. Undecided voters are discarded. We model

$$y_j \sim \text{Binomial}(n_j, \theta_j),$$

where  $\theta_j$  is the proportion of Republican presidential support within cell  $j$ .

Our primary goal is to quantify the *generational effect*: the extent to which  $\text{logit}(\theta_j)$  is explained by the cumulative impression left by political events. We use the Gallup presidential approval rating time series to instantiate these events as follows.

Let  $x_t$  denote the *Republican-directional* presidential approval rating in year  $t$ . The rating is calculated by (1) subtracting 50% from the Gallup presidential approval rating in the year  $t$ , and (2) multiplying the difference by  $-1$  if the sitting president was a Democrat. It is positive under two conditions: a Republican president had ratings above 50% or a Democratic president had ratings below 50%. Conversely, it is negative under a popular Democratic or an unpopular Republican president.

Respondents of cell  $j$  experience the rating  $x_{p[j]-a[j]+i}$  at age  $i$ . For example, respondents surveyed at  $a = 53$  in  $p = 2012$  were born in  $c = 2012 - 53 = 1959$  at  $i = 0$ . In 1960 ( $i = 1$ ), the average approval rating for Republican president Eisenhower was 71%, so  $x_{2012-53+1} = (71 - 50) = +21\%$ . In 1961 ( $i = 2$ ), the presidency flipped to Democratic president Kennedy, who had an average rating of 88%, yielding  $x_{2012-53+2} = -1 \times (88 - 50) = -38\%$ .<sup>7</sup>

The *generational effect* is defined as

$$\gamma_j = \Omega_{g[j]} \sum_{i=1}^{a[j]} w_i x_{p[j]-a[j]+i}$$

where  $w_i$  denotes the *age-specific weight* of the rating at age  $i$ , and  $\Omega_g$  denotes the scale of the age-specific weights for group  $g$ .

In addition to the generational effect, we define a *period effect* for each group,  $\beta_{pg}$ , and a period and age-weight interaction,  $\lambda_g w_a \beta_{pg}$ . The interaction accounts for the impressionability of respondents to political events at election time, and  $\lambda_g$  denotes the scale of the interaction for group  $g$ , similar to  $\Omega_g$  in the generational effect. Put together, these define the *election effect*,

$$\begin{aligned} B_j &= \beta_{p[j]g[j]} + \lambda_{g[j]} w_{a[j]} \beta_{p[j]g[j]} \\ &= (1 + \lambda_{g[j]} w_{a[j]}) \beta_{p[j]g[j]}. \end{aligned}$$

We also define an age effect  $\alpha_a$ , a house effect  $\eta_h$ , and the following linear-in-period sex effect

$$\delta_{sp} = \begin{cases} -\frac{1}{2}(\delta_0 + \delta_1 p) & \text{if female} \\ \frac{1}{2}(\delta_0 + \delta_1 p) & \text{if male} \end{cases}$$

<sup>6</sup>Our index includes non-election years because voters continuously form preferences even though they only express those preferences in election years. We also group all minority respondents together. Although we prefer to separate African Americans, Hispanic Americans, Asian Americans, etc., the data does not distinguish consistently between minority groups in early years.

<sup>7</sup>We set  $x_{p[j]-a[j]+i} = 0$  if  $i > a$ . We top-censor  $x$  at age 70 because few approval ratings are observed above that age.



The log-odds is the sum of the effects as in equation (1)

$$\text{logit}(\theta_j) = \alpha_{a[j]} + B_j + \gamma_j + \eta_{h[j]} + \delta_{s[j]p[j]}$$

We complete the model by smoothing the age weights,

$$w_i \sim \text{Normal}(w_{i-1}, 0.005),$$

and specifying normal distributions for  $\alpha$ ,  $\beta$ , and  $\eta$  with mean zero and standard deviations  $\sigma_\alpha$ ,  $\sigma_\beta$ , and  $\sigma_\eta$ . The scale parameters,  $\lambda$ , and  $\Omega$  are constrained to be positive.

We fit the model using Stan (Stan Development Team, 2013) and R (R Core Team, 2012). Stan runs a No U-Turn (NUTS) sampler (Hoffman and Gelman, 2014), an extension to Hamiltonian Monte Carlo (HMC) sampling (Duane et al., 1987), which is itself a form of Markov Chain Monte Carlo (*Equation of State Calculations by Fast Computing MacHines Author=Metropolis, Nicholas and Rosenbluth, Arianna W and Rosenbluth, Marshall N and Teller, Augusta H and Teller, Edward, Journal=The Journal of Chemical Physics, Volume=21, Number=6, Pages=1087–1092, Year=1953, Publisher=AIP Publishing, N.d.*). We generate 4 chains for 5000 iterations. The final 2500 iterations of each chain converge as indicated by post-modeling diagnostics such as Gelman-Rubin  $\hat{R}$  (Gelman et al., 2004). We ensure satisfactory posterior predictive model performance (Gelman et al., 2004) before using sample means (for estimates) and sample quantiles (for credible intervals) in the following section.

## Model Results

We interpret the fitted model with a series of graphs. In Figure 4 we examine the generational effect, Figure 5 the election effect, and Figure 6 the amount of variation explained by the model.

### Generational Effect

The left side of Figure 4 shows the estimated age-specific weights,  $w_i$ , along with 50% and 95% credible intervals. The weights quantify the formative years of political socialization with precision unprecedented in the literature: At a very young age, political events leave virtually no impression—the weight at age 1,  $w_1$ , is essentially zero. The weights then increase steadily, peaking around 14-24 and gradually decreasing thereafter. At the height of their influence, around the age of 18, events are nearly three times as meaningful as those later in life.

The importance of adolescence and early adulthood in the socialization process is supported by an enormous literature. For example, Erikson, MacKuen and Stimson (2002) also find political events have the largest impact at age 18-19 before declining. Yet despite the decline—and the fact that a generation’s preferred party is all but locked-in by 40—we find political events continue to influence voter preferences. The age-weights only return to zero around age 60.

No children were interviewed, leaving one to perhaps wonder how the model can determine the impressions left by childhood events. To understand how, consider a year in a respondent’s childhood, say the year the respondent was 14 years old. We know the age the respondent was interviewed and therefore the year in which the respondent was 14. We also know the political events of that year, as reflected in the presidential approval rating. Our model uses this data to “back out” the size of the impression left by the events the respondent experienced at age 14.

For example, a 45-year old who was interviewed in 2012 would have been 14 in 1981. President Reagan had an average approval of 66% in 1981. The fitted model estimates the weight 14-year-olds must give events instantiated by a 66% approval rating in order to explain the preference of voters 31 years later, in 2012.

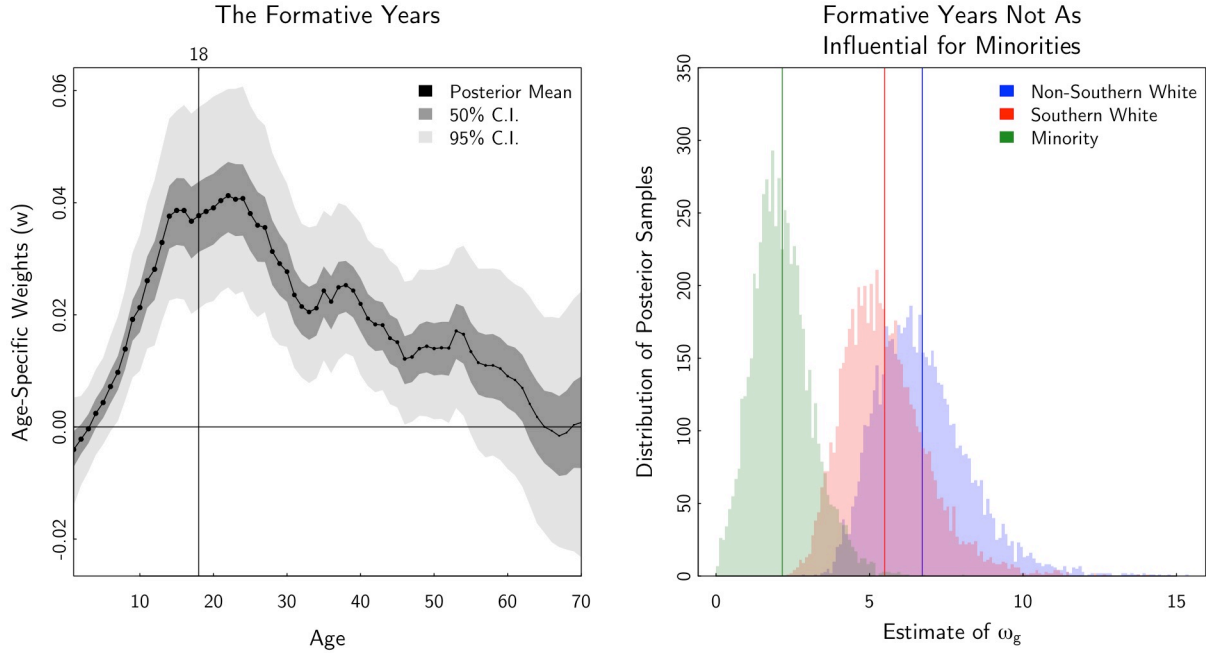


Figure 4: Estimates of the generational effect. (L) We find the 14-24 age range is most important for the formation of long-term presidential voting preferences. Political events before 14 have little impact. After 24, the age weights decrease. (R) These weights, and the political socialization process implied by them, are substantially more important for non-Hispanic whites than for minorities as a whole.

The right side of Figure 4 shows  $\Omega_g$ , the amount the age-weights are scaled to produce the generational effect for each group. The estimated generational effect is found to be over twice as large for non-Hispanic whites as for minorities as a whole, suggesting considerable differences in the political socialization process.

The difference could reflect the fact that African Americans are consistent Democratic voters, and Hispanic or Asian American immigrants may not have been in the United States during peak socialization to experience the political events captured by the Gallup series. In addition, the political participation of naturalized citizens has been shown to vary depending on their community (Pantoja, Ramirez and Segura, 2001).

Whatever the reason, the political socialization process observed with white voters is less evident with minority voters. A more rigorous investigation would separate minority subgroups, which, unfortunately, we are unable to do from the data.

## Election Effect

The left side of Figure 5 shows a time series plot of the estimated period effects,  $\beta_{pg}$ , along with 50% and 95% credible intervals. The effects vary by race/region group, reflecting 50 years of political polarization. Minorities are consistently more likely to vote Democratic, and Southern whites, Republican.

The right side shows the interaction between period and age-weight,  $\lambda_g w_a \beta_{pg}$ . The interaction allows us to determine whether the election effects are more pronounced during the formative years shown in Figure 4. However, interactions are difficult to interpret directly (Gelman and Hill, 2007). Instead we examine the following ratio, where the numerator is the first factor of  $B_j$ ,  $(1 + \lambda_g w_{18})$ , for an 18-year old voter (one of the most impressionable ages as determined by the peak of the age-weight curve), and the denominator is the corresponding factor,  $(1 + \lambda_g w_{70})$ , for a 70-year old voter (one of the least impressionable ages as determined by the nadir).

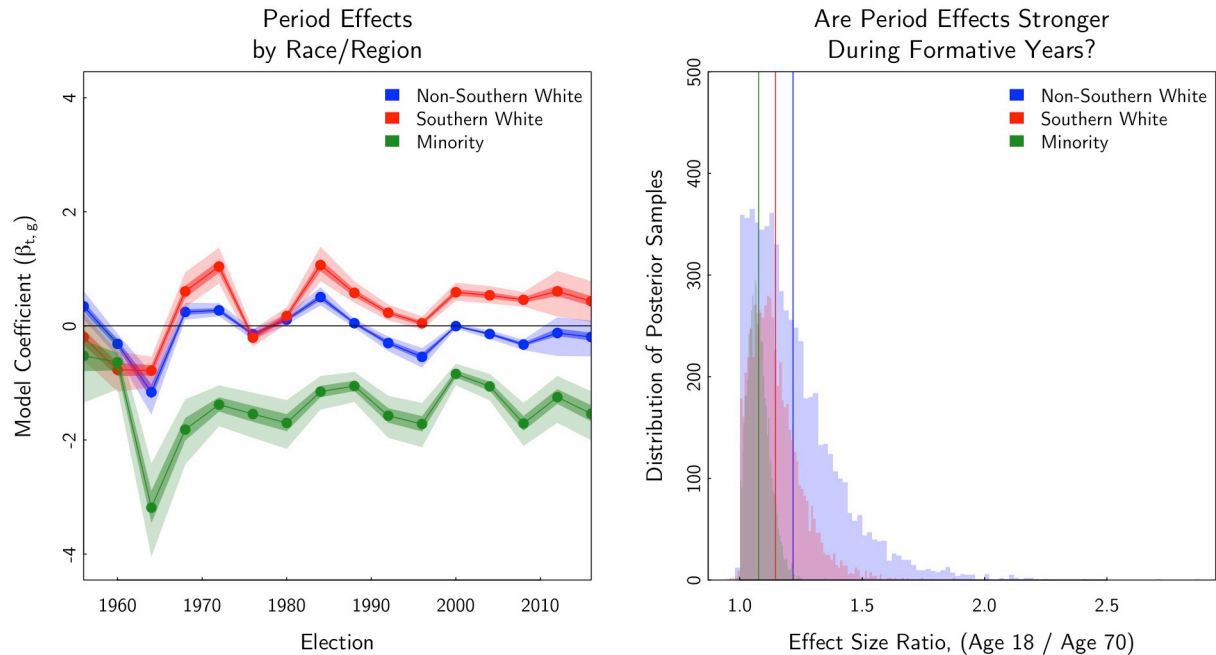


Figure 5: (L) Estimates of the period effect. Minorities are consistently more likely to vote for Democratic presidents, and Southern whites have steadily trended pro-Republican over the past 50 years. (R) Election effects are similar between young and old minority voters and in the South. The evidence is inconclusive for non-Southern whites.

We do not find clear evidence that the election effect varies according to the age-weights. For Southern whites and minorities, the mode of the ratio gathers at the boundary 1.0, implying no difference. For non-Southern whites, the effect has substantial mass between 1.0 to 1.4. That is, the model indicates that election effect for non-Southern whites are between 0% and 40% greater for young voters than old voters.

## Explanatory Power

Figure ?? compares the sample  $R^2$  of the fitted model against a simpler model with only period and race/region effects. The comparison is made overall and within each group. We use  $R^2$  because of its simplicity and near-universal recognition among researchers. However, we note that  $R^2$  is one of many possible measures of explanatory power, with other choices typically trading between reliability and interpretability. We weight  $R^2$  by the size of the  $j$  cells.

Overall, the model explains 91% of the variance in the data. Much of this variation, 89%, is also explained by the simpler model. However, that merely reflects the enormous difference in voting preferences between groups and across elections.

Within race/region groups, our model explains considerably more variation—although the improvement is not equal across all groups. For non-Southern whites, the fit increases nearly twenty percentage points, from 51 to 69%. For Southern whites, it improves a modest seven, from 47 to 54%. For minorities, there is little difference.

We conclude that our model accounts for a substantial portion of the variation in presidential voting over the last half century. It is a demonstrable improvement over a model with only period and race/region, suggesting a single defining political event is less important in the formation of voter preferences than the prolonged impression left by a lifetime of events.

## How Well Does the Model Explain Macro-Level Vote Choice?

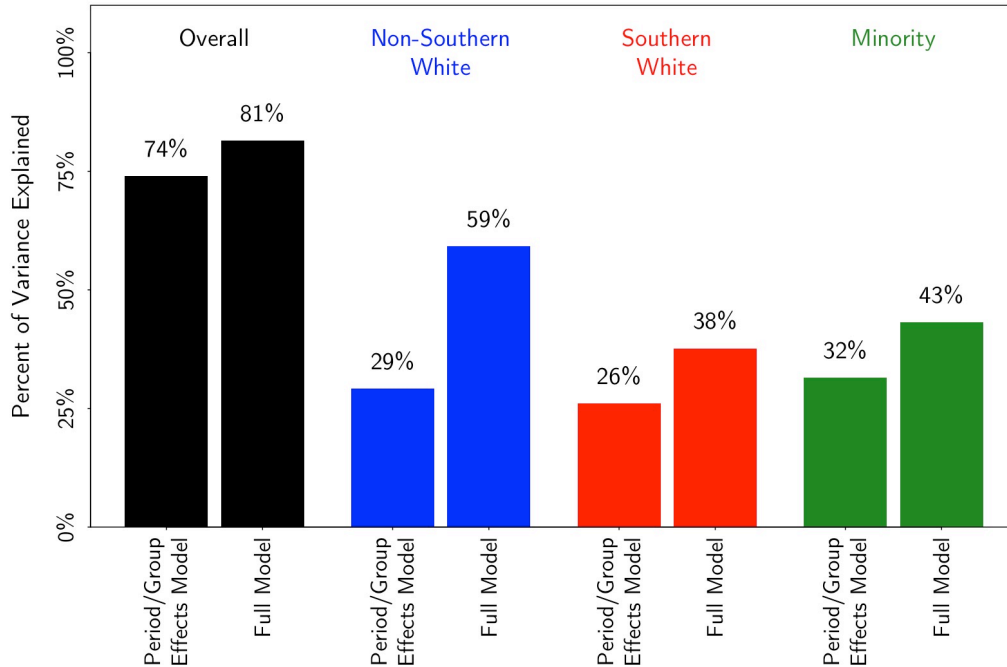


Figure 6: *The model accounts for 91% of the macro-level variance in voting trends over the past half century, more than the simpler model incorporating only period/group effects. The model fits considerably better within race/region groups, particularly among non-Southern whites.*

## Generations of Presidential Voting

We demonstrate how the fitted model aids the study of elections. We provide a narrative of the presidential approval time series, emphasizing how political events, generally associated with the presiding administration, formed the preferences of five distinct generations: New Deal Democrats, Eisenhower Republicans, 1960s Liberals, Reagan Conservatives, and Millennials. Each generation is epitomized by the birth years in which partisan preferences were the strongest: 1929 (pro-Democrat), 1941 (Republican), 1952 (Democrat), 1968 (Republican), and 1985 (Democrat).

These labels are for convenience and should not be taken too literally; generations are not the byproduct of a single year, but rather the result of sustained periods of partisan influence. The following figures plot model results for white voters. Under our model, the generational effects for minority groups are proportional. However, as discussed in the previous section, the evidence of generational voting is weaker for minority voters, and thus any generalizations made from the model are weaker.

### New Deal Democrats

Since the approval ratings begin in 1937, the model is limited in its description of the New Deal Democrats, who are epitomized by the 1929 birth year. Nevertheless, we use the general principles learned from the model in other generations to piece together how political events influenced this group.

New Deal Democrats include a large and diverse group, dominated by a single towering figure: Franklin Delano Roosevelt. As president, FDR guided the country through the Great Depression and World War II, and, with the New

Deal, laid the foundation for the modern American welfare state. He was enormously popular, winning four elections and serving for twelve years, more than any president in American history.

For the first half of this group, voters born between 1910 and 1920, their peak formative years were spent during the Great Depression and World War II. They experienced Republican president Hoover's inability to help a struggling United States, followed by economic recovery and the greatest war in world history—both under Democrat FDR.

To these voters, the United States became a leader of the free world under Roosevelt's watch. This left a strong impression that remains to the present day. Recall Figure 1, where these now elderly voters continue to have comparatively pro-Democratic preferences in the 2000-2016 elections.

For the second half of this group, voters born after 1930, their exposure to FDR was limited. Their formative years occurred after the country recovered from the Depression, and, for many, after World War II as well. Though they lived through the tail end of his presidency, during which FDR remained enormously popular, their peak years were spent with Truman at the helm. Truman had mixed and limited popularity over his two terms, ending his presidency at 36% approval. As a result, these voters' long-term voting preferences are mixed.

## Eisenhower Republicans

The approval ratings are available for the entire life span of the remaining generations. As a result, we can directly interpret the fitted model, which we do with the aid of the two panels in Figure 7.

The top panel shows the approval ratings, highlighted to emphasize the generational import of each time period: The ratings are colored red to blue, with red reflecting pro-Republican approval ratings, blue pro-Democratic, and shades of grey in between. The width and darkness of the line correspond to the estimated, age-specific weights  $w$ . Thus, the darkest and widest lines emphasize the peak formative years, when the events represented by the approval ratings were most influential.

The bottom panel shows the cumulative weighted approval ratings, which define the generational effect of the political events experienced up until the age indicated on the  $x$ -axis. The series starts at the grey line (age 0).

With this Figure, we examine the presidential preferences of the Eisenhower Republican generation, epitomized by voters born in 1941. These voters were too young to remember FDR's many accomplishments, instead entering their years of peak socialization in anti-Democratic and pro-Republican times; their earliest impressions were formed in 1951 when Truman, who had barely won reelection three years earlier, sent American troops into Korea. After the unconditional victory of World War II, Americans were unaccustomed to the apparent stalemate in Korea, and Truman's popularity plummeted.

When Eisenhower assumed office in 1953, his approval was a near unanimous 91%. While most presidential terms begin with high ratings (Erikson, MacKuen and Stimson, 2002), Eisenhower remained popular over his entire presidency. The heroic World War II general promised to end the Korean War during his campaign and quickly did so. Although he did not end the larger Cold War, as he desired, international conflicts were relatively minor over his tenure. The 1950s were a time of relative peace, prosperity, and progress.

The most prominent dip in Eisenhower's popularity came around 1957-1958. The country was in a recession, the Soviet Union had launched Sputnik and appeared to be winning the space race, and Eisenhower was forced to send federal troops to Little Rock to enforce a federal desegregation policy, indicative of national tensions over civil rights. But the dip was short lived, reaching a bottom point of 57% in March of 1958 and rebounding quickly back to the 70-80% range. Eisenhower left office with a 69% approval rating.

The Eisenhower Republican generation experienced 10 straight years of pro-Republican presidential evaluations, much within the peak years of socialization. The impact of this period on their long-term presidential voting preferences is apparent in the bottom panel of Figure 7. The curve ascends steeply, peaking at the end of the Eisenhower administration.

## Birth Year = 1941

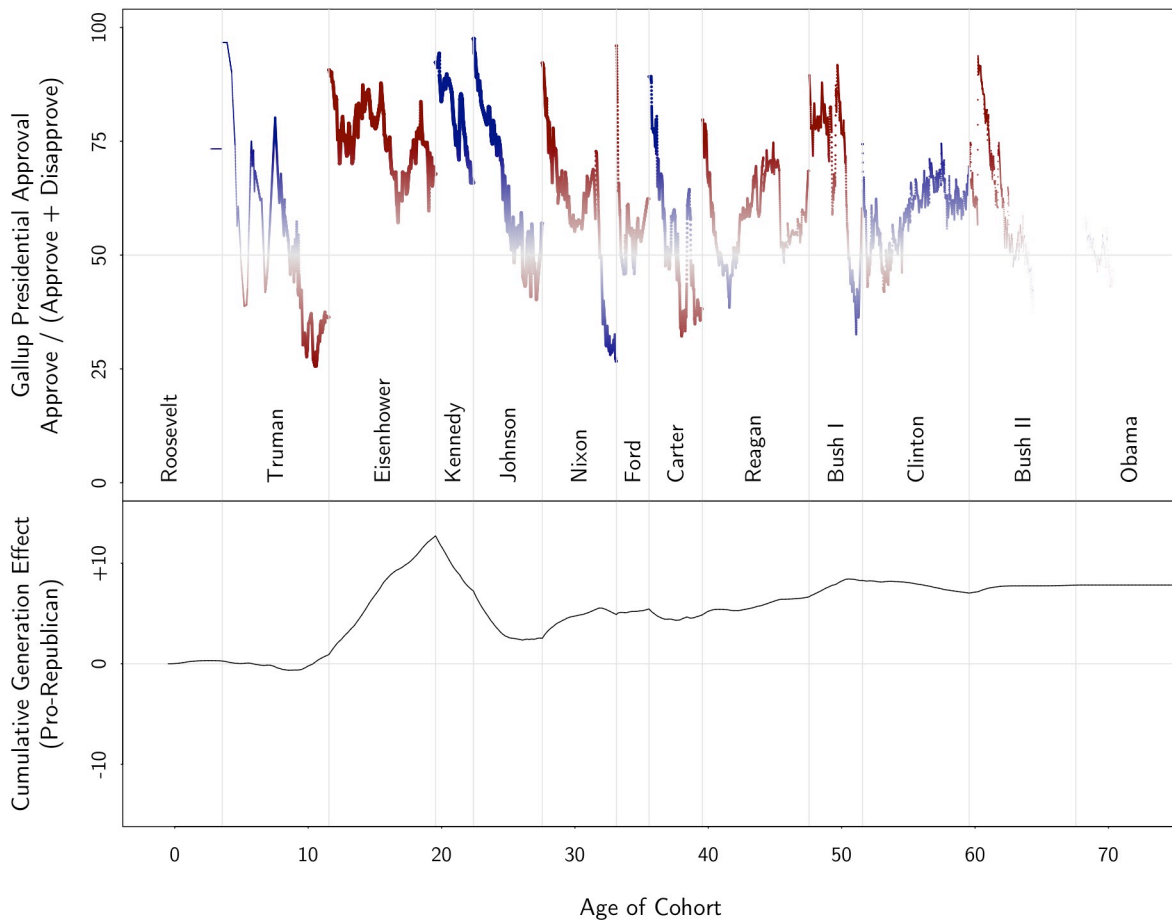


Figure 7: Presidential approval, and the cumulative generational effects, for Eisenhower Republicans born in 1941. The graph emphasizes peak years of socialization, according to age weights found by the model. Blue indicates pro-Democratic years, red for pro-Republican, grey in between. This generation missed most of the FDR years and was socialized through 10 straight pro-Republican years (Truman and Eisenhower). Their partisan voting tendencies were drawn back towards the neutral grey line by the pro-Democratic 1960s, and they reached a rough equilibrium by the end of the Nixon presidency.

Their preferences were then moderated by the Kennedy and Johnson years, reaching equilibrium by the end of the Nixon presidency.

### 1960s Liberals

The generation of the 1960s Liberals is epitomized by voters born in 1952. As can be seen in Figure 8, these voters came of age during the Kennedy, Johnson, and Nixon years.

Kennedy, like Eisenhower, began his presidency with immense popularity, at a 92% approval rating. The political mood of the country was at a liberal high-point (Stimson, 1991), and there was widespread optimism about the role of government. That optimism was reflected in Kennedy's bold "New Frontier" agenda, in which he committed to sending

## Birth Year = 1952

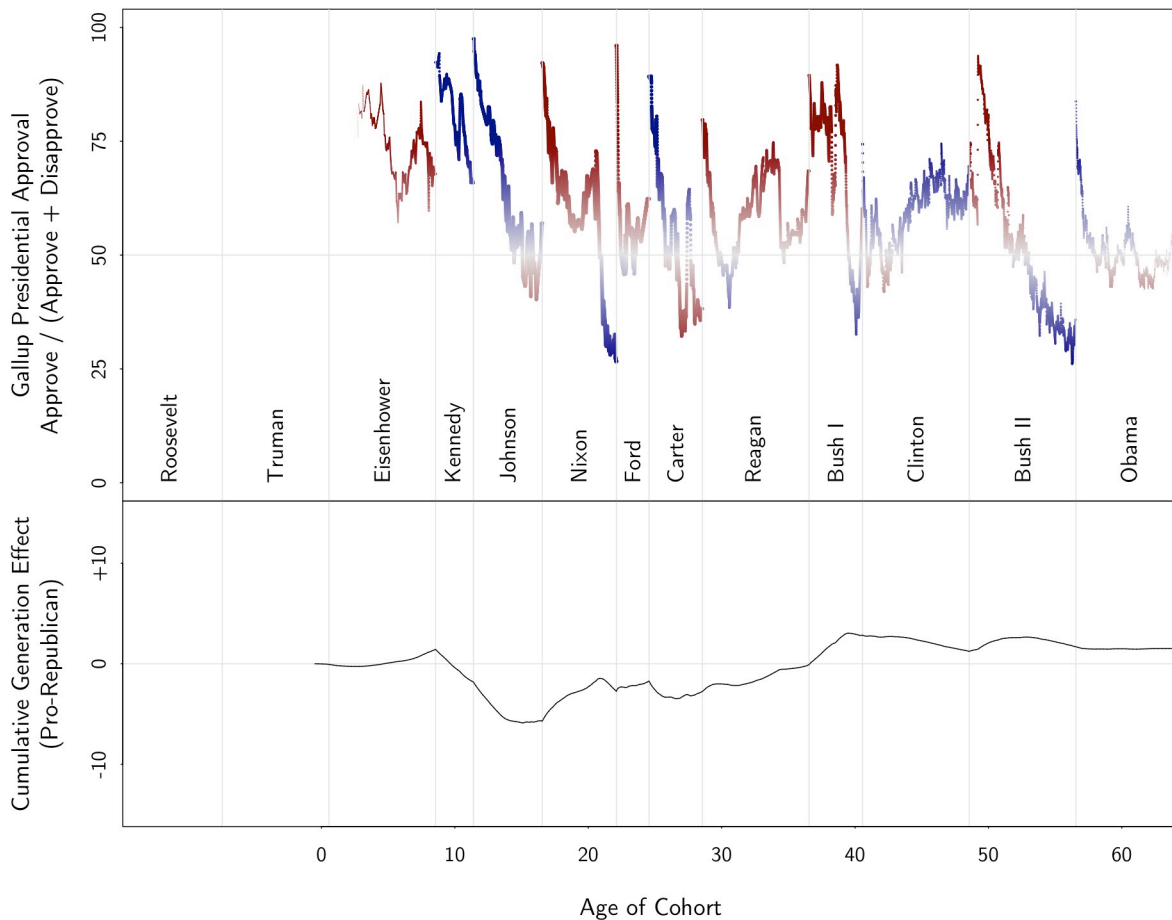


Figure 8: *The generation we refer to as 1960s Liberals are best epitomized by those born in 1952, whose presidential political events are emphasized here. Too young to be highly influenced by the Eisenhower years, they experienced an intense period of pro-Democratic sentiment during the 1960s. After 1968, however, roughly 25 years of near-consistent pro-Republican events neutralized their presidential voting preferences.*

a man to the moon by the end of the decade, and in his sweeping initiatives to combat poverty, expand medical care, increase educational aid, and progress the cause of civil rights.

Kennedy succeeded in passing a number of initiatives, but his presidency was overshadowed by a series of tumultuous, foreign policy events. He was at the helm during the failed Bay of Pigs invasion and the Cuban Missile Crisis. Though Kennedy averted war, many questioned his strength as a leader in the face of the Soviet Union. His approval ratings declined steadily over his three-year presidency with only a short positive burst following the Cuban Missile Crisis.

Right before Kennedy's assassination in November 1963, his approval ratings bottomed out at 66%. The assassination, however, resulted in an enormous popularity spike—the second pro-Democratic spike in less than a three-year time span. Perhaps for this reason, the 1960s Liberals remember Kennedy more for his charisma, his beautiful and sophisticated family, and his optimistic vision of the future.

When Johnson assumed the presidency, he was the second Democratic president to start in the 90% range, this time

at 97% approval, the highest in the series. In the name of the fallen president, and as the quintessential Washington insider, Johnson promoted his vision of a “Great Society”. He signed foundational legislation, such as the Civil Rights Act of 1964 and the Voting Rights Act of 1965. He established landmark programs, such as Medicare, Medicaid, food stamps, and Project Head Start. He expanded student loans and increased federal funding, including universities and the nongovernmental Corporation for Public Broadcasting. He protected the environment, regulating pollution through the Water Quality Act and Air Quality Act and establishing the national wilderness, rivers, and trails systems.

Johnson enjoyed immense popularity for an extended period of time, as reflected in his high approval ratings and landslide election victory over Barry Goldwater in 1964. These dramatic events socialized the 1960s Liberals generation unusually early, with a steep pro-Democratic shift from 1961-1966 (corresponding roughly to 9-14 years old)—well before the peak years of socialization (14-24). This shift was strong enough to influence their preferences for decades to come.

The Vietnam War and increasing racial and social tension in the late 1960s, however, marred Johnson’s presidency and legacy. By 1967, his approval ratings had fallen, and in 1968 the once powerful president decided against running for reelection.

In that election, Nixon played on the generation gap, speaking to the “silent majority” and explicitly denouncing the political concerns of the 1960s Liberals. Four years later, after the national voting age was lowered to 18, the generation gap reached its largest. White voters under the age of 25 (first-time voters in 1972) supported Nixon at 53%, compared to 70% for white voters 25 or older. This 17-point gap is the largest in the dataset, not exceeding 9 points in any other election.

The continuation of the Vietnam war under Nixon, when this generation reached draft age, and ultimately the Watergate scandal, helped keep the 1960s Liberals pro-Democratic until their 40s. Yet, the cumulative curve of Figure 8 shows that the 1960s Liberals never returned to their 1968 pro-Democratic highpoint.

## **Reagan Conservatives**

The generation of the Reagan Conservatives is epitomized, ironically, by the 1968 birth cohort—the year the 1960s Liberals hit their pro-Democratic highpoint. These voters were not alive for the popular, pro-Democratic Kennedy and Johnson years, and the Nixon and Ford presidencies had little impact, as shown in Figure 9. Their political socialization started with president Carter.

Carter was initially popular, but his ratings plummeted as adverse political events overtook his presidency. By the time he left office, an energy crisis, stagflation, and the Iran hostage crisis, among other events, left him with approval ratings in the 30-40% range.

Reagan captivated this generation with his optimistic vision of America as a shining city on a hill. Though his early years were defined by a lack of economic recovery and Republican defeats in the 1982 midterm elections, Reagan’s popularity dipped below 50% for only a short period. The recovery hit full swing shortly thereafter, and Reagan, whose campaign famously declared that it was “Morning in America” again, was reelected in a landslide.

The Reagan “Revolution” had a powerful impact on this generation, who, at 16 years old, were reaching their peak years of socialization. Despite the Iran-Contra scandal and ballooning deficits near the end of his second term, Reagan ended his presidency with a 68% approval rating.

Figure 9 suggests President Bush I’s presidency extended pro-Republican sentiment in ways that are perhaps underestimated in the collective public memory. From a foreign policy perspective, Bush was enormously successful. The fall of the Berlin Wall and the end of the Cold War came under his watch, and Operation Desert Storm demonstrated the power of American leadership in the post-Cold War era. As a result, Bush’s ratings rarely fell below 80% for over 2 years, only dipping below 50% right near the end of his term.

Ultimately, economic problems at home doomed his presidency. The Clinton campaign mocked, “It’s the Economy,



## Birth Year = 1968

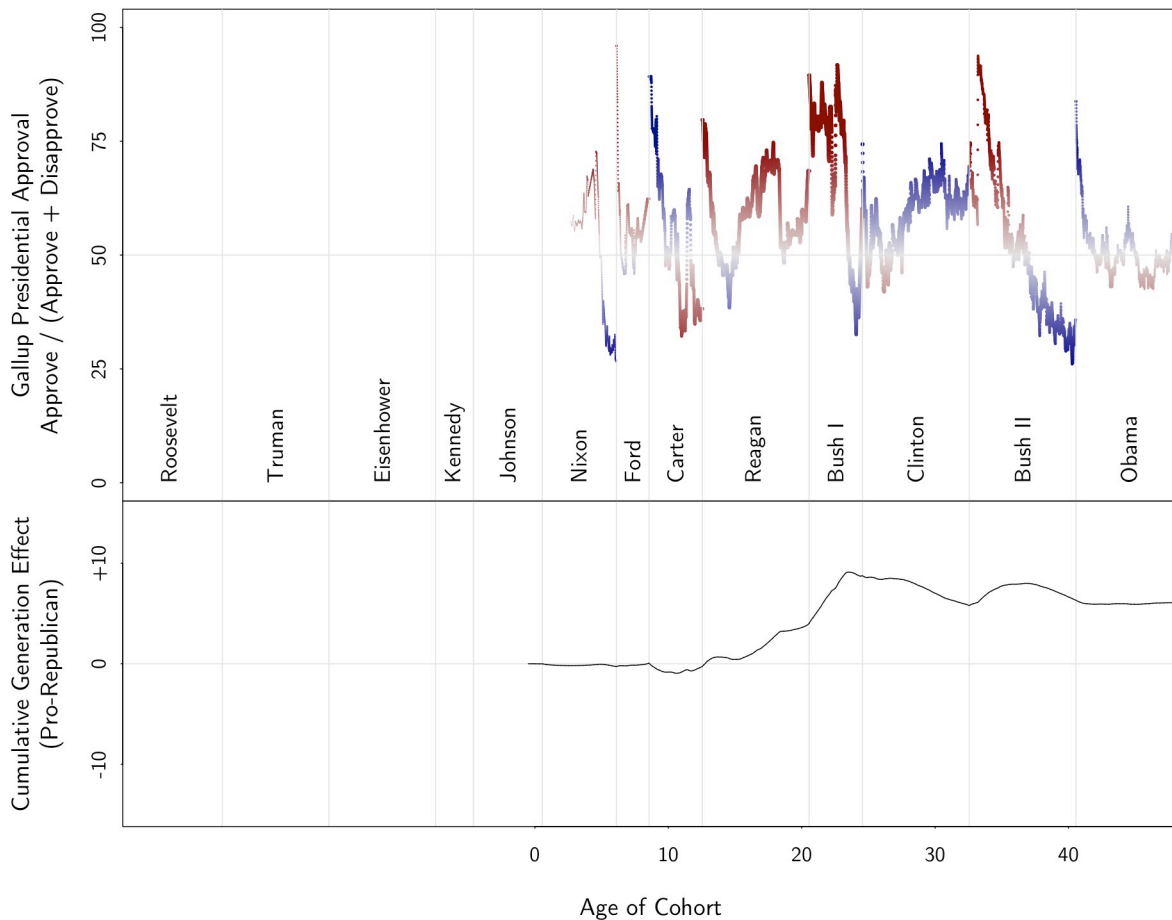


Figure 9: *The Approval series as seen by the generation we call Reagan Conservatives, best epitomized by those born in 1968. This generation missed the Kennedy and Johnson years entirely, and their peak socialization fell under the popular Republican presidents Reagan and Bush I. By the time the Democratic president Clinton reached his peak popularity in the late 1990s, they were already roughly 30 years old.*

Stupid,” winning the presidency in 1992 and ending over a decade of nearly continuous pro-Republican sentiment. The pro-Democratic Clinton years curbed this generation’s long term preferences, but the Reagan Conservatives were roughly 30 years old by the time Clinton reached the height of his popularity in the late 1990s, past the peak age of socialization.

### Millennials

For the last generation—the Millennials, epitomized by the 1985 birth year—we only observe 31 years of preferences. Nevertheless, the political events that have shaped their voting preferences are clear in Figure 10. If past generations are any guide, these impressions will continue to influence their preferences for the rest of their lives.

The Millennials did not experience the uncertainty of the Cold War or the foreign policy successes of the Reagan and Bush I administrations. The Clinton years were the first to influence their voting patterns.

## Birth Year = 1985

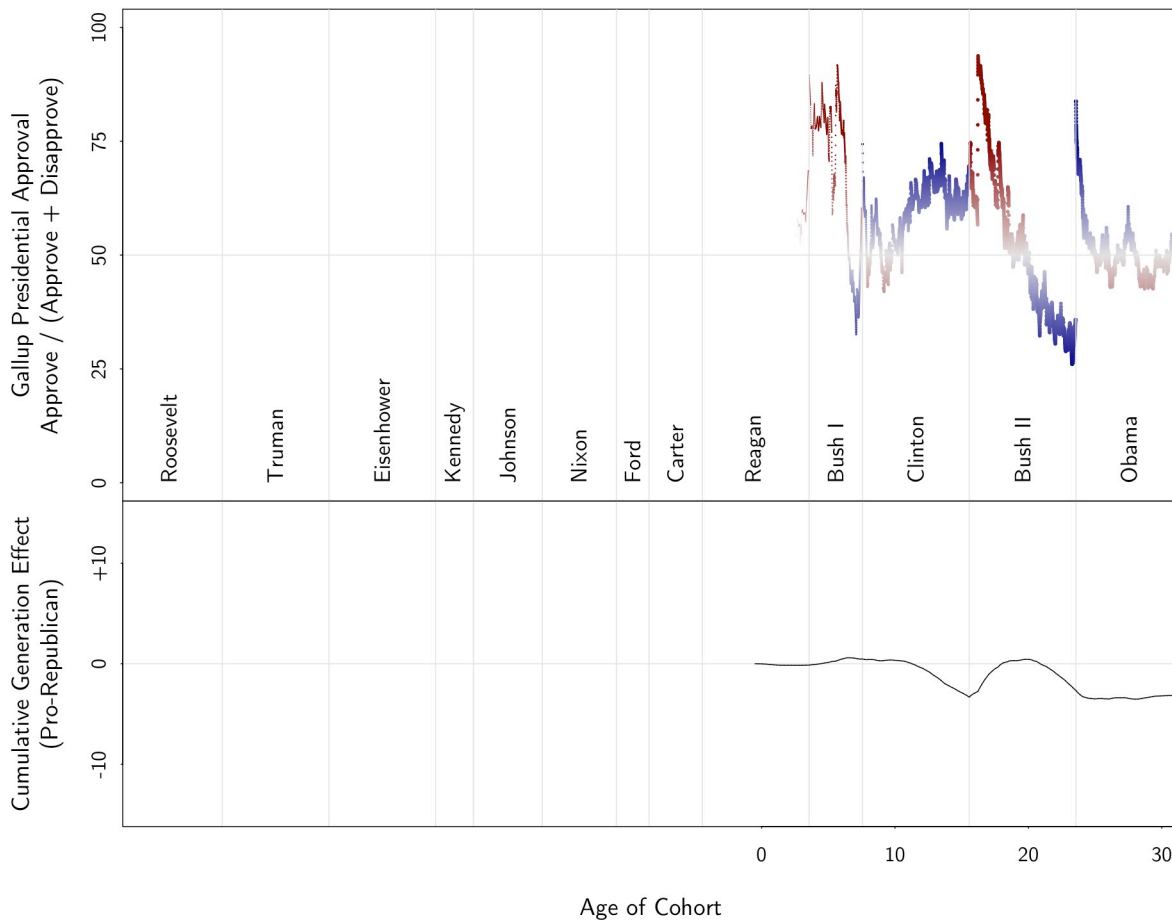


Figure 10: *The Approval series as seen by the last generation, the Millennials. Their experience had only lasted 31 years by the 2016 election, but the model indicates that these years should remain highly influential over the rest of their lives. Their formative years have been primarily characterized by the popular Democratic president Clinton and the unpopular Republican Bush II, resulting in their relatively strong pro-Democratic sentiment.*

Clinton's biggest political defeat, the Republicans' Contract with America, took place in 1994 when Millennials were around 9 years old. But as Millennials entered their peak socialization years, America had become the globe's lone superpower, and the country was experiencing tremendous economic growth. Clinton enjoyed positive approval ratings for roughly four straight years, and despite his impeachment, ended his presidency at 67% approval.

Republican Bush II took office in 2001, beginning one of the most turbulent presidencies in American history. After an initial popularity of 94% following the 9/11 terrorist attacks, his approval declined precipitously. His administration undertook costly and unpopular wars in two countries. Some supported the president's vision of America as a crusader for democracy, but many grew to oppose the war in Iraq, in particular. On the domestic front, Bush II's most notable accomplishment was his 2001 tax cuts, which created massive federal deficits. He ended his presidency amid the largest financial crisis since the Great Depression. Eleventh hour legislation, the Troubled Asset Relief Program (TARP), was unable to avert the crisis.

These events are reflected in his approval ratings. Bush II fell below 50% in 2004, barely winning reelection that year. He fell below 50% again in 2005, and his ratings stayed in negative territory for the remainder of his presidency—almost an entire four years, by far the longest stretch in the series. His approval hit its low point of 26% in October of 2008, in the midst of the financial crisis.

We conclude with Democratic president Barack Obama, who ends the series. Obama, like the other presidents, began with a high 76% rating—less than the 90% levels of earlier presidents, but in line with the start of the Clinton and Bush II presidencies. His popularity quickly declined, dropping to 50% in February 2010 and hovering around 50% for the remainder of his presidency.

The Millennials' preferences thus far reflect the popular Democrat Clinton and the deeply unpopular Republican Bush II. But consider the youngest voters, born in 1998 and 18 years old during the 2016 election. They were barely alive during Clinton's presidency and were only ten years at Obama's election, essentially missing both of these consequential time periods. Instead, they were socialized during the relatively even Obama years. Referring back to Figure 1, we can see that they trended Republican compared to their slightly older counterparts. However, their ultimate life-long voting patterns remain to be seen.

## The Changing White Electorate

We examine the white electorate as the changing composition of five generations. Figure 11 combines each of the generational curves from the previous sections on a single graph. However, instead of plotting each generation by its representative birth cohort, we broaden each generation to the scale of decades. The narrative remains the same though; narrow definitions of generations are not indicated by the data.

The changing width of each curve reflects the proportion of the electorate that each generation contributes at any given time: At the start of the series, the oldest generation comprises the entire electorate. As time marches on, they become a smaller and smaller portion, and by 2016 all five generations are represented.<sup>8</sup> The overall electorate is shown in black.

Before the 1960s, partisan preferences moved back and forth between Republican and Democrat, in response to the popularity of Roosevelt, Truman, and Eisenhower. The Kennedy/Johnson years pulled the electorate Democratic over the course of the 1960s. Then followed a long period of Republican ascendancy—slightly trending upward through the Nixon and Ford years, slowed in part by the entry of the 1960s Liberals.

The Reagan administration moved all generations upward. The New Deal Democrats were too old for a large change, but the remaining generations, especially the Reagan Conservatives, moved dramatically, with the black curve crossing the 50% boundary line in late 1984. The Reagan Conservatives were then moderated by the Clinton presidency, but not enough to shift the electorate as a whole. A Bush II spike followed 9/11, only to drop under his slow and steady decline.

Our model is relatively simple, but it explains a substantial amount of the voting character of the electorate. Figure 11 is driven entirely by approval ratings and age weights. It recreates the familiar “parallel lines” of public opinion, in which different groups exhibit responses proportionally to political events (Page and Shapiro, 1992). Though the fluctuations in partisan preference may seem small—the black curve spans only 10 percentage points altogether—they are large enough to determine an election and thus the political direction of the United States.

## Discussion

We build a generational model of American presidential voting. In our model, the political events voters experience leave lasting impressions that inform their partisan preferences. The size of the impression depends on the age of the voter at

<sup>8</sup>Instead of plotting each generation's *full* curve from age zero onward, we only plot the curves from their first election onward. We have also included *New Deal Democrats* and older voters in this graph, even though they were not included in the statistical model.

## The Changing White Electorate As A Function of Presidential Approval

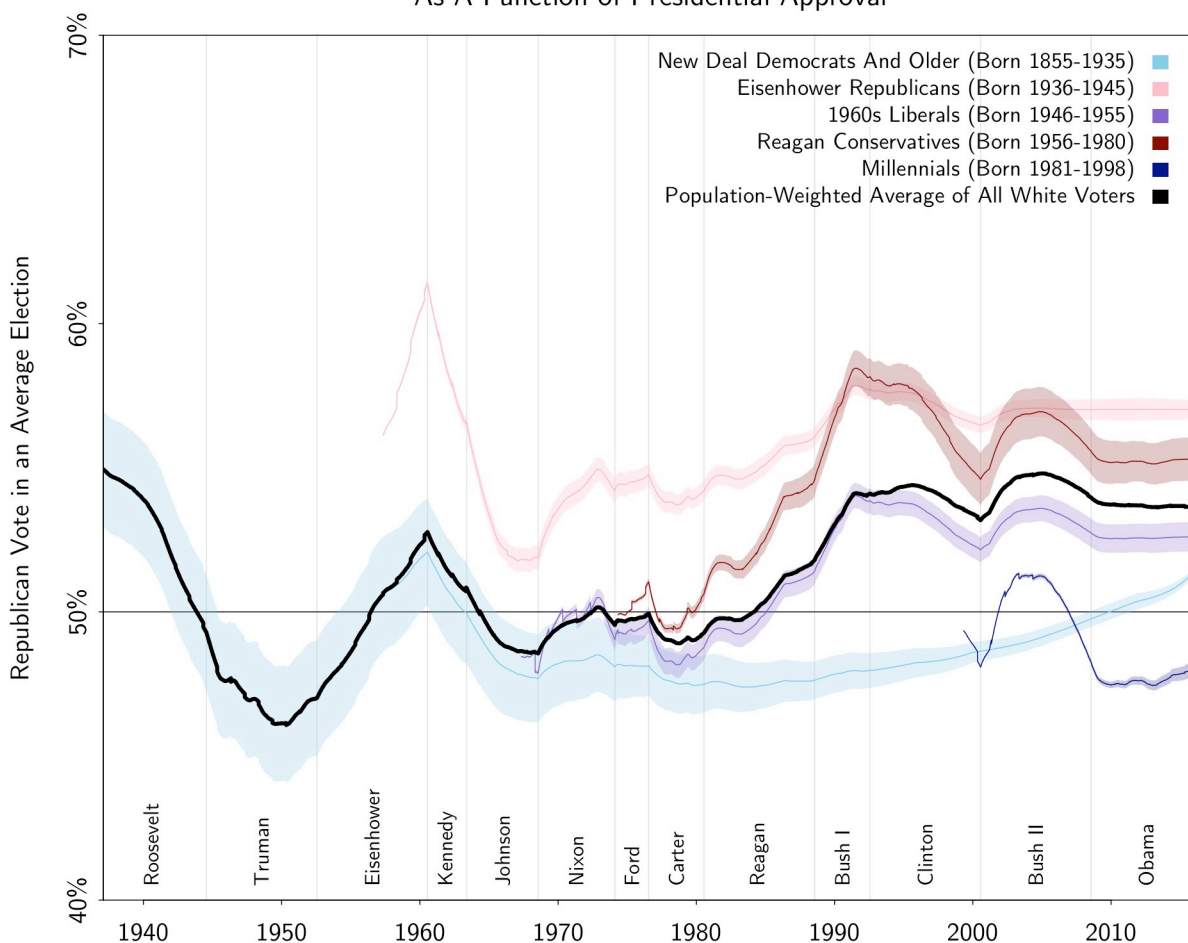


Figure 11: *The cumulative preferences of each generation is shown, along with the weighted summation of the full white electorate. The generations are loosely defined so that the entire electorate can be plotted at once. The width of each curve indicates the proportion of the white electorate that each generation reflects at any given time. The model—in this graph reflecting only the approval time series and the age weights—explains much of the voting tendencies of the white electorate over time.*

the time the event took place.

We demonstrate the fitted model is both predictive—explaining a substantial portion of voting trends over the last half-century—and interpretable—dividing voters into five meaningful generations. The predictivity and interpretability remain even after controlling for changes in cohort composition, such as age, race, region, and sex. We conclude the data strongly support generational voting.

Our analysis is at the macro-level in that we do not study specific voters or political events in detail, but rather the broad strokes of events across the electorate. We believe the quantification of macro-level trends is an important contribution in its own right; we illustrate in detail how the fitted model aids the study of elections. Nevertheless, we believe our work has two important implications for micro-level analysis.

First, while many of the events we identify with our model have been suggested in the literature, the length and size

of our dataset allow us to assess their importance with unprecedented precision. We find some events were so impactful, they left an impression on individuals we would not typically consider impressionable. For example, the events during the Kennedy and Johnson administrations defined the 1960s Liberals while they were still children. Researchers can further study these events using detailed surveys or quasi-experiments.

Second, the age-period-cohort problem arises in micro-level as well as macro-level analyses. It occurs whenever exposure to the phenomenon of interest is not measured directly but backed out from the timing of a life event such as birth year, graduation, employment, or retirement. Moreover, it occurs regardless of whether additional individual-level covariates are included or age, period, and cohort are treated as continuous measurements.

We believe our approach is an effective solution to the age-period-cohort problem, which continues to challenge researchers despite its discovery nearly a century ago. For example, consider a variant of the problem, which puzzled pollsters after the 2012 presidential election: In 2008, 55% of white voters aged 18-29 voted for then-Democratic candidate Obama. In 2012, that advantage flipped to 54% in favor of Republican candidate Romney. Why did this happen? Was this a temporary shift in the preferences of young voters? Or would young white voters support the Republican candidate in 2016?

Our model provides a clear answer. Heading into 2008, young, impressionable voters had only experienced the popular Clinton and unpopular Bush II years. The winds were in Obama's favor. By 2012, however, the years of poor Bush II performance that had swayed the young voters of 2008 were replaced by the more recent, mediocre ratings of Obama himself. The shift of young, white voters to the Republican Party was not temporary. In fact, our model predicted it in 2012, and the 2016 election confirmed this trend.

We could paint these events in a positive light for the Democrats. The year 2008 was special, similar to 1972, in that a strongly pro-Democratic cohort entered the electorate following a deeply unpopular Republican president. The impression left by the Clinton and Bush II years may be strong enough to keep an entire generation of voters pro-Democratic throughout their entire lifetime.

We conclude on this note. When we think about generations of presidential voting, it is important not to think about a single defining political event. Rather, generations are formed through prolonged periods of presidential excellence: FDR and the New Deal, Eisenhower, Kennedy and Johnson's Great Society, the Reagan/Bush conservative revolution, and the Clinton years. Each is characterized by long periods of high approval ratings. Each defined a generation by slowly and steadily winning over the electorate's most impressionable voters.

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