Unequal Incomes, Ideology and Gridlock: How Rising Inequality Increases Political Polarization*

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Abstract

Income inequality and political polarization have both increased dramatically in the United States over the last several decades. A small but growing literature has suggested that these two phenomena may be related and mutually reinforcing: income inequality leads to political polarization, and the gridlock induced by polarization reduces the ability of politicians to alleviate rising inequality. Scholars, however, have not credibly identified the causal relationships. Using newly available data on polarization in state legislatures and state-level income inequality, we extend previous analyses to the US state level. Employing a relatively underutilized instrumental variables identification strategy allows us to obtain the first credible causal estimates of the effect of inequality on polarization within states. We find that income inequality has a large, positive and statistically significant effect on political polarization. Economic inequality appears to cause state Democratic parties to become more liberal. Inequality, however, moves state legislatures to the right overall. Such findings suggest that the effect of income inequality impacts polarization by replacing moderate Democratic legislators with Republicans.

Keywords: polarization, income inequality, state legislatures, ideology
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1 Introduction

Political polarization is one of the most widely discussed transformations of the American political economy. The ideological distance between the two major political parties has risen substantially since the 1970s. This rise has coincided with a dramatic rise in income inequality over the same period. Because in the American system polarization tends to lead to gridlock and a decrease in the legislative capacity, the rise in political polarization has been blamed for a decline in the ability of governments to respond to the observed increase in inequality. Thus polarization may contribute to the propagation of inequality over time, even as polarization itself may itself be partly caused by increases in inequality.

Previous analyses of the potential relationship between income inequality and political polarization have credibly identified causal effects in either direction, despite the fact that there is a wealth of theory suggesting that there should be a causal relationship. Use of newly available data on state-level income inequality (Voorheis, 2014), state legislative political polarization (Shor and McCarty, 2011), and an under-utilized identification strategy (a variation of Boustan et al. 2013) allows us to identify the causal effect of state income inequality on state legislative political polarization.

We find that income inequality has a statistically significant, positive, and quantitatively large causal effect on political polarization. We find substantial heterogeneity in this main effect, however. Previous work has documented that polarization in the US Congress is strongly asymmetric in the postwar era; the median of the Republican party has moved further to the right than the median of the Democratic party has moved to the left.[1] In contrast, we find evidence for a different asymmetry: within-state inequality has a statistically significant effect on the median position of the Democratic party, but we find weaker evidence of an effect on the Republican party median. We explain this seemingly counter-intuitive result by extending the analysis to consider how income inequality affects the partisan balance of the legislature. We find that income inequality shifts the median ideology within

[1] See Hare et al. (2012).

state legislatures to the right, and increases the share of seats held by Republicans. This is consistent with the effect of income inequality on polarization working primarily through a composition effect, where moderate Democrats are replaced by Republicans, resulting in a more liberal Democratic party.

We supplement our state-level analysis by investigating the cross-sectional correlation between individual legislator ideology and income inequality at the state legislative district level and the correlation between legislator ideology and inequality across state legislative districts. Using estimates of within-district and between-district income inequality from the one-year files of the American Community Survey (ACS) from 2005-2011, we find that greater *within*-district income inequality seems to push Republican legislators to the right, while greater *between*-district inequality seems to push Democratic legislators to the left.

Section 2 briefly surveys the relevant literature on inequality and polarization. Section 3 describes our data and identification strategy for estimating causal effects of state-level income inequality on legislative polarization. We present and discuss our empirical results as well as a series of robustness checks, in Section 4. Section 5 turns to the question of whether income inequality correlates with legislator ideology at the individual level. We conclude with directions for future research and some potential policy implications.

2 Previous Literature

Researchers generally agree that the U.S. Congress has polarized significantly over the past several decades. Based on the most frequently used measures of congressional polarization, those derived from the DW-NOMINATE measures of congressional ideology (Poole and Rosenthal 1997), the recent rise in congressional polarization began in the mid-to-late 1970s.

The causes of rising polarization, however, generate intense debate. Several potential explanations for this increase in political polarization have been examined using both qualitative and quantitative methods. But the literature has been far more successful in ruling-out

potential causes than for offering a well-supported causal story(Barber and McCarty, 2015). For example, despite the widespread popular opinion among pundits that gerrymandering causes polarization, the best current evidence does not support this contention (McCarty, Poole and Rosenthal, 2009). The same is true for the common argument that the use exclusively partisan primaries to nominate legislative candidates is an important source of polarization. (McGhee et al., 2014).

A prominent set of hypotheses for rising polarization focuses on the coincident rise of income and wealth inequality since the 1970s.[2]. Not only have polarization and inequality risen in tandem over the past forty years, but their respective measures declined together during the first part of the 20th Century before leveling off after World War II. McCarty, Poole and Rosenthal (1997) were the first to an observe a strong correlation between the time series for income inequality and political polarization over the long run. This correlation has been further explored by McCarty, Poole and Rosenthal (2006). Although this pattern is striking, it does not necessarily indicate whether the correlation represents a causal effect, nor does it reveal in which direction any causality might run. Duca and Saving (2012) and Duca and Saving (2015) extend this time-series-based analysis via a more rigorous treatment of the time-series properties of the data on polarization and inequality. Of course, researchers who model the effect of inequality on polarization using only cross-sectional data (e.g. Garand 2010, Gelman, Kenworthy and Su 2010) have a similarly difficult task in attempting to identify causal effects.[3]

Despite the challenges to identification faced by empirical analyses of the relationship between inequality and polarization, the observed correlation between inequality and polarization has been recognized as a "stylized fact" about the contemporary American political economy. A small but growing number of theoretical models seek to explain such a relationship. Recent examples include Ma (2014) and Feddersen and Gul (2014). One implication

[2]See Piketty and Saez 2003 and Piketty 2014

[3]McCarty, Poole and Rosenthal (2006) build a circumstantial case for a causal relationship using arguments and data beyond the time series. But there is no smoking gun.

of the model by Feddersen and Gul (2014) is that income inequality simultaneously moves the median ideology of a legislature to the right while increasing political polarization.

Political polarization has been linked to a number of negative policy consequences. Polarization increases gridlock and reduces the ability of legislatures to enact policies (McCarty 2007). This is especially salient for the political system in the United States, which requires legislation to pass through multiple veto points before it can be enacted as policy, a status-quo bias with potentially negative consequences in the faces of changing circumstances. Many states, too, require super-majorities for the passage of certain important bills (such as annual state budgets or tax increases). Polarization may thus serve as a mechanism for "political reinforcement" (Barth, Finseraas and Moene 2014). Increases in political polarization may then, in turn, reduce the capacity of legislators to (a) enact policies which might constrain further increases in inequality (e.g. increases in the minimum wage, strengthening union bargaining power) or (b) engage in redistribution to directly reduce inequality in disposable incomes or (c) modernize and reform welfare state institutions (Hacker 2005). The positive feedback effect of income inequality on political polarization may thus lead to further increases in income inequality. The possibility of such a feedback loop—from inequality, to polarization, to further inequality—provides strong motivation for a careful study of these relationships, but also suggests very real empirical challenges for identifying causal effects at any given link in this chain.

The states provide an ideal observational setting for studying polarization due to the vast increase in statistical power inherent in studying 50 states as opposed to a single Congress. Until recently, scholars have been unable to measure whether or not similar trends in polarization are present there, given a lack of roll call data and a method to measure ideology on a common scale. Shor and McCarty (2011), however, have recently developed measures of state legislator ideology which can be used to measure party positions and polarization over time for the fifty states.

3 Data and Identification Strategy

3.1 Inequality Data

Until very recently, reliable data on income inequality in the United States has been available only at the national level. It is difficult to measure income inequality at sub-national geographies due to censoring in the publicly available micro-data on individual incomes. Individual-level income micro-data are available from two sources in the United States: IRS tax returns and responses to Census Bureau surveys (chiefly the Currently Population Survey). These micro-data on incomes are either geographically censored for privacy purposes (as is the case with the public-use IRS files) or too sparsely distributed to produce credible estimates (as is the case for the CPS for geographies smaller than metropolitan areas). Additionally, censoring of top incomes by the Census Bureau complicates estimation of inequality even for geographies that have adequate coverage (e.g. states and MSAs.)

Aside from these data quality issues, the different data sources are not equally suited to the calculation of different inequality measures. The IRS tax-return data are extremely rich but cover only the population of tax return filers, not the full population of income earners. Filing rates increase with income, so this means that the IRS data are ill-suited to make statements about the entire income distribution.[4] The IRS micro-data also describe a relatively limited definition of income—taxable income accruing to "tax units." Census Bureau micro-data, on the other hand, are nationally representative samples of the entire US population, not just tax filers. Census Bureau data are therefore better able to recover estimates of income inequality in the population of all income earners. Additionally, the Census Bureau micro-data contain rich detail about household structure and non-taxable income sources. It is then possible to use a definition of income (i.e. pre-tax, post-transfer, size-adjusted household income) that more closely aligns with potential consumption than

[4]For this reason the literature that utilizes IRS tax return data (e.g. Piketty and Saez 2003) focuses almost exclusively on top income shares as a measure of income inequality as opposed to functionals which are sensitive to the entire distribution (such as the Gini, Theil and Atkinson indexes).

does the income definition in the IRS tax-return data.

A substantial literature has sought to leverage the conceptual advantages of using Census Bureau income data while addressing its chief drawback—censoring (by the Census Bureau) and under-reporting (by individual respondents) of top incomes. Voorheis (2014) is the first study in this literature to provide a state-level data set of income inequality measures using Census Bureau micro-data that addresses both censoring and potential under-reporting. This correction is performed by modeling the right tail of the income distribution as following a Generalized Beta II (GB2) distribution. Censored (topcoded) incomes and incomes above the 97.5th percentile are replaced by draws from the fitted GB2 distribution in a multiple imputation process. Jenkins et al. (2011) show that this method can closely match inequality trends estimated using uncensored, confidential CPS data, and Voorheis (2014) shows that this method can match the levels and trends in state-level top income shares estimated using public-use IRS data. The Voorheis data set includes a number of measures of income inequality, although here we use only the Gini coefficient. These data are available from 1977 through 2013.

3.2 Polarization and Ideology Data

Empirical spatial models of roll-call votes have become commonplace in political science. These models assume that legislators have single-peaked preferences along a latent dimension that is often interpreted as ideological. Under the assumption that legislators vote for their most preferred outcomes, statistical procedures can recover their most-preferred outcome or their *ideal point*. Intuitively, legislators who typically vote together will have ideal points that are close together, and legislators who rarely vote together will have ideal points that are far apart. However, ideal point measures of ideology are only comparable for legislators who vote on a common set of roll calls. This implies that ideology measures can be estimated only for a single legislative body.[5] Hence, it has been difficult to develop ideology measures for

[5]Making comparisons over time is facilitated by the overlapping memberships of succeeding legislatures.

state legislators that are comparable across states, since legislative agendas differ radically and there may be no common roll calls.

Shor and McCarty (2011) provide a solution to this problem, however, by using the Project Vote Smart National Political Awareness Test (NPAT), an annual survey of federal and state legislative candidates that has been fielded since the mid-1990s as a way to bridge across legislatures.[6] Using these data, Shor and McCarty (2011) are able to put all state legislators on a common scale, and hence to estimate ideology scores for state legislators which are comparable both over time and across states.

Shor and McCarty (2011) provide two data sets of interest for this study. The first data set contains estimates of individual legislator ideal points for almost all legislators who held office from 1993-2014. These data are cross-sectional, providing a single average measure capturing the ideology of each legislator which is constant over the course of his or her legislative career. Consequently, changes in chamber-level ideology are generated only from legislator turnover, and not from changes in individual legislator ideology over time.[7] A second data set aggregates the data to the state-chamber level to produce estimates of the median ideal point of each party and the overall median ideology for the chamber. We measure polarization is as the difference between the median ideal points of the Democratic and Republican parties within a legislative chamber.[8]

All states except Nebraska have bicameral legislatures, so we must aggregate scores from two chambers to obtain a state-level measure. We use a measure proposed by Shor and McCarty (2011) that averages the polarization measures from the two chambers in each state. Similarly, we use the average, across the two chambers, of the two Democratic and Republican party medians to capture asymmetric polarization effects. Using other bicameral

[6]The NPAT has subsequently been renamed the "Political Courage Test," although the survey methodology and questions remain the same. This survey has been used by other scholars to characterize candidate ideology. See, for example, Ansolabehere, Snyder and Stewart (2001*b*,*a*). More information about the survey is available at: `http://votesmart.org/about/political-courage-test`

[7]The assumption that within-legislator movement is small is empirically well documented. See, for example, Poole (2007).

[8]One idea underlying this measure is that leaders are elected by majority rule and thus have an incentive to push the policy of the median party member. Other measures exist, as well.

measures, such as those based on pooling legislators across chambers, does not meaningfully change our results.

To complement the two main state-level data sets, we obtain state-level demographic and aggregate economic data from the CPS and BEA national income and product Accounts (NIPA) tables. These measures include population density, state real personal income, racial composition (the proportions black and Hispanic), education (proportion of the population with a college degree), poverty rates, median income, median age, the proportion of the population under 25 and over 55, and union membership rates. We return to the individual legislator ideology data from Shor and McCarty (2011) in Section 5.

3.3 Identification Strategy and Empirical Model

Our data covers state-level inequality, state-level polarization, and state demographics for the period of 1993 to 2013.[9]

Our basic model is

$$Polar_{i,t} = \alpha + \beta INEQ_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \tag{1}$$

where $X_{i,t}$ is a vector of time-varying state-specific covariates. Let the error term be described by

$$\epsilon_{i,t} = \alpha_i + e_{i,t} \tag{2}$$

where α_i is a state-specific component, and $e_{i,t}$ is the remaining state-year error. Then we could control for any unobserved but non-time-varying heterogeneity by transforming equation 1 into a first-difference model:

$$\Delta Polar_{i,t} = \beta_{OLS} \Delta INEQ_{i,t} + \gamma \Delta X_{i,t} + \Delta e_{i,t} \tag{3}$$

[9]The number of observations (890) is less than 1050 (50 states for 21 years) because of some missing observations for ideology and polarization for some states in some years. Missing values occur when a state does not make roll call vote data available for a particular year. We treat these instances as missing-at-random.

If there are time-period-specific shocks that affect all states, so that the error term is described instead by:

$$\epsilon_{i,t} = \alpha_i + \alpha_t + e_{i,t} \tag{4}$$

then we might control for unobserved state- and time-specific heterogeneity by estimating a model with state and year fixed effects:

$$Polar_{i,t} = \alpha_i + \alpha_t + \beta_{OLS} INEQ_{i,t} + \gamma X_{i,t} + e_{i,t} \tag{5}$$

Note, however, that estimating either equation 3 or equation 5 via OLS will not generally recover the true effect of income inequality on polarization, since there is likely time-varying endogeneity between income inequality and political polarization.

There are three sources of endogeneity bias that may occur. First, there could be non-random locational sorting of households into more-polarized or less-polarized states based on income. If this locational sorting does vary systematically with income, polarization may mechanically affect state-level income distributions. The direction of this effect is uncertain, however. Whether this process increases or decreases measured inequality over time depends on the relative sizes of the flows at the bottom and top of the income distribution. Second, the causal effect could work in the other direction. More-polarized legislatures, compared to less-polarized legislatures, may enact (or fail to enact) policies that affect the income distribution (either increasing or decreasing inequality). However, such policy effects may be less important in practice at the state level, since almost all tax-and-transfer redistribution occurs at the federal level. Finally, there may be measurement error bias if income inequality is mismeasured. If any of these effects are present, then the apparent effect of income inequality on polarization revealed by estimating either equation 3 or equation 5 via OLS will be biased. The direction of the bias is uncertain, however, since policy effects will inflate the estimates, measurement error will bias estimates towards zero, and the direction of any locational sorting bias is uncertain.

We propose an instrumental variables estimation strategy that is robust to all three sources of bias outlined above. We adapt an instrument proposed by Boustan et al. (2013) and use the GB2 multiple imputation approach from Voorheis (2014) to address censoring and under-reporting in the micro-data. The instrument is constructed by "freezing" the baseline income distribution in each state at some initial year, and then simulating the income distributions for each subsequent year based on nationwide trends in income growth at each decile. This instrument is one example of so-called "Bartik-style" instruments.[10] The identifying variation in this type of instrument comes from the variation in the initial level of income inequality across states. The identifying assumption of this simulated instrumental variables strategy amounts to an assertion that the initial level of income inequality is unrelated to subsequent changes in the outcome variable (in our case, political polarization or other measures of ideology).

We construct our instrument as follows. We select the 1990 income distribution as the baseline for each state. We have also experimented with other years in the range 1988-1992. We settle on 1990 as the baseline year since it produces the strongest instrument (i.e. the instrument with the largest first-stage F-test statistic).[11] We estimate average incomes for each decile in this initial year, using the Voorheis (2014) GB2 imputation method. We estimate the growth rates of the average incomes of each decile of the *nationwide* income distribution for each year from 1990 through the end of our estimating sample (2013), again using the GB2 imputation method to calculate average decile incomes for each year.

We then simulate state-level income distributions for each year between 1993 and 2013 as follows. We assign each state decile in the initial year to the matching nationwide decile. We then simulate state-level income distributions for each year by assuming each state decile grows at the matching nationwide decile's growth rate for that year. Finally, we construct our instrument for income inequality by calculating the Gini coefficient using the simulated

[10] **?** summarizes the theory and practice of using Bartik-style instruments in a variety of settings.

[11] Table A4 illustrates that using different starting years in the calculation of the simulated instrument does not meaningfully change the point estimates of the main result.

decile incomes in each year.

Using the simulated Gini instrument, we can then estimate the effect of income inequality on polarization by two-stage least squares. In our preferred specification, we estimate a model in first-differences with state-specific trends:

$$\text{First Stage: } \Delta Ineq_{i,t} = \alpha_i \times t + \theta \Delta Pred\_Ineq_{i,t} + \Gamma \Delta X_{i,t} + \nu_{i,t} \tag{6}$$

$$\text{Second Stage: } \Delta Polar_{i,t} = \alpha_i \times t + \beta_{2SLS} \Delta \widehat{Ineq}_{i,t} + \gamma \Delta X_{i,t} + e_{i,t} \tag{7}$$

We also estimate models with state and year fixed effects as a robustness check:

$$\text{First Stage: } Ineq_{i,t} = \delta_i + \delta_t + \theta Pred\_Ineq_{i,t} + \Gamma X_{i,t} + \nu_{i,t} \tag{8}$$

$$\text{Second Stage: } Polar_{i,t} = \alpha_i + \alpha_t + \beta_{2SLS} \widehat{Ineq}_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \tag{9}$$

We can interpret β_{2SLS} as the causal effect of income inequality on polarization. X_{it} is a vector of time-varying covariates, including state real personal income, the proportion of the state's population that is black or Hispanic, log median income, the proportion of the population with a college degree, population density, the unemployment rate, median age, the proportion of the population over 55 years of age, the proportion of the population under 25 years of age, and the unionization rate. We additionally include the proportion of total state legislators (upper and lower chambers) representing majority-minority districts.[12] This is an important potential confounder, since these districts are both more common in states with high levels of inequality, and are more likely to elect Democrats to the left of the party median.

Our identification strategy requires that our instrument affects inequality (i.e. instrument relevance) and affects polarization only through its effect on actual income inequality (i.e. the exclusion restriction). Instrument relevance can be directly tested by performing inference

[12]We define a district as majority-minority if the proportion of total population who are black or Hispanic is greater than 50%.

on the first stage regression. Figure A1 shows a scatter plot of the calculated Gini coefficient for the actual data against the simulated Gini instrument, and Table A3 shows the first stage estimation results. The first-stage F-test statistic is well above the rule-of-thumb cutoff of ten, and the first-stage coefficient on the instrument is statistically significant and positive, as expected. Note that the first-stage F-test statistic is slightly below the usual cutoff in the fixed effects specification without state-specific trends. The model is exactly identified, however, so this should not cause too much concern (Angrist and Pishke 2009).

Our instrument is, by design, uncorrelated with any within-state variation over time in political polarization or legislative ideology except through its effect on within-state variation in income inequality. As noted above, the identifying assumption of our empirical strategy amounts to an assumption that initial state income inequality is unrelated to future changes in political polarization. This assumption is directly testable. Figure A3 shows scatterplots comparing initial income inequality to subsequent year-to-year changes in the four main outcome variables (polarization, average chamber ideology, average Democratic ideology and average Republican ideology). In all cases, the slope of the line of best fit is close to zero (formally, the slope is not statistically significantly different from zero at conventional levels). Thus we argue that the identifying assumption of our simulated instrumental variables identification strategy are satisfied, and hence β_{2SLS} can thus be interpreted as the causal effect of income inequality on political polarization (or other measures of ideology).

4 Empirical Results

4.1 Aggregate State Polarization

We first consider the effect of inequality on state-level polarization, measured by the distance between the median ideal points of the Democratic and Republican parties. We then disaggregate this effect by examining the influence of inequality on each of the two separate party medians. Income inequality may also affect the overall median ideology of the legislature

overall in addition to the distance between parties. We thus consider how inequality might affect the overall median ideal points of legislative chambers within each state, as well as the partisan balance of legislative chambers, as measured as the proportion of seats held by Republicans in each chamber. As noted earlier, we aggregate across upper and lower chambers to arrive at a single number for polarization and ideology within each state. Table 1 demonstrates the aggregation process using data from California in 2000 as an example.

Table 1: Aggregating Polarization Across Chambers (California, 2000)

	Lower Chamber	Upper Chamber	State Average
Rep Median	1.23	1.34	1.29
Dem Median	-1.33	-1.37	-1.35
Polarization	2.56	2.71	2.64

Table 2 presents our main result, showing the effect of income inequality on state polarization using our preferred first-difference specification. The top panel shows the results from our IV model, while the bottom panel shows the results from a naive OLS specification. There are three pairs of columns in each table of results. The first column in each pair describes a model that includes no state-specific linear trends, while the second column in each pair include these trends. All columns include the same set of time-varying control variables, and all standard errors are clustered at the state level. The first pair of columns in Table 2 report results estimated using the entire sample, and the final pair of columns report estimates for the period subsequent to 2008.

The IV point estimates for each specification are larger in absolute value than the OLS estimates, and more precisely estimated. Our preferred first-differences specification, for each sample or subsample of the data, includes state-specific linear trends (columns 2 and 4). Using this specification, the effect of inequality on polarization is positive: 0.856 in the full sample, and 3.21 in the post-2008 sub-sample. To contextualize these effect sizes, a one-standard-deviation (0.041) greater degree of state income inequality would correspond to a change in polarization that is larger by 0.034 (using the estimate from the full sample) or by 0.13 (using the estimate from the post-2008 sub-sample). The average *annual* change in

state polarization in the full sample is 0.019, average cumulative change in polarization over 1993-2013 is about 0.54, and the average cumulative change in polarization from 2008-2013 is about 0.19. Thus a one-standard-deviation change in income inequality over the period 1993-2013 could account for about 6.5% of the total increase in polarization, but during the period 2008-2013, a one-standard-deviation increase in inequality could account for more than a tenfold larger increase in polarization.

Table 2: First-difference Models, Average State Polarization

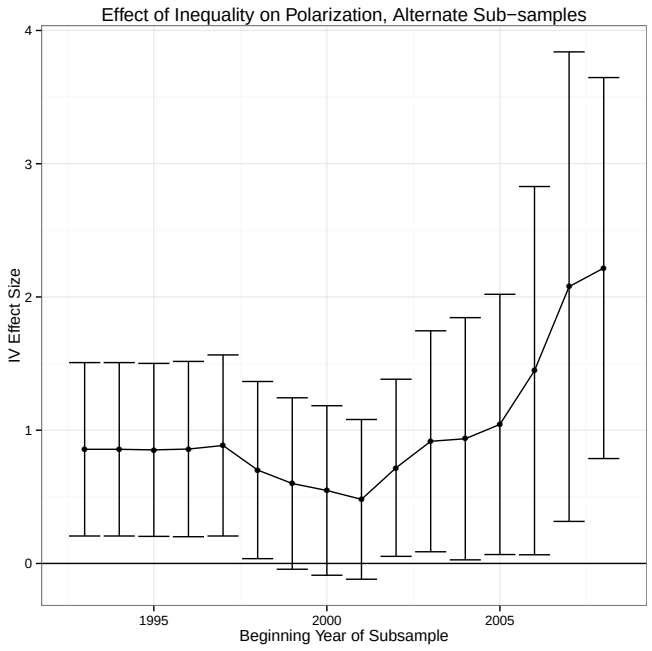
	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results: Gini	0.845**	0.857**	2.237***	3.275**
	(0.378)	(0.394)	(0.786)	(1.564)
OLS Results: Gini	0.053	0.051	0.356*	0.646*
	(0.065)	(0.067)	(0.188)	(0.336)
Observations	822	822	200	200
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	No	Yes	No	Yes

The results presented in Table 2 somewhat arbitrarily consider sub-samples after the year 2008. More generally, we find a pattern of an increasing influence of income inequality on polarization over time. To explore this, we estimate a series of first-difference models for our aggregate polarization measures. Starting at the initial year of the sample (1993), we successively delete additional years of data from the beginning of the sub-sample, to examine how the estimated effect changes over time.[13] Figure 1 depicts the point estimates of our parameters of interest, as well as cluster-robust 90% confidence intervals. The horizontal axis shows the first year of each estimating sample. The point estimates are largely stable

[13]An alternate, more parametric approach—allowing the effect of inequality to systematically vary over time by including interactions with a time trend—yields substantially the same result: the effect of inequality is increasing over time.

through about 2005, although the point estimates of the effect size are actually somewhat smaller for sub-samples which start between 2000 and 2004. For sub-samples starting after 2005, the point estimates are substantially larger, and continue to increase as the subsample includes fewer years at the beginning of the sample. The effect size for the subsample after 2009 is more than twice as large as the full sample estimate, albeit with standard errors about twice as large as well. We should note that the confidence intervals around the point estimates for each subsample are overlapping. The pattern of increasing estimated effects in later subsamples is suggestive, but not dispositive of a stronger relationship between income inequality and political polarization over time.

Figure 1: Sub-sample Heterogeneity in the effect on average polarization



In addition to timewise heterogeneity in the effect of state-level income inequality on political polarization, we investigate whether there is heterogeneity in the effect according to partisan control. We consider two ways of coding each state as "Democratic" or "Republican." First, we code each state based on whether the average proportion of seats held by Republicans was less than or greater than 0.5, respectively. The first two columns of Table

3 report estimates from the "Democratic states" and "Republican states" subsamples using our preferred specification. We can see that the point estimates of the effect of inequality on polarization are larger and more precisely estimated in the subsample of "Democratic" states.

However, this classification includes both states which have elected Democratic majorities throughout the sample period (i.e., California) as well as states that have "re-aligned", switching from Democratic majorities in the beginning of the sample to Republican majorities in the latter part of the sample (i.e., Mississippi). We therefore estimate models using an alternate stratification, this time coding "Democratic" and "Republican" states based on whether the average proportion of seats held by Republicans after 2010 is less than or greater than 0.5. The final two columns in Table 3 report results from this stratification, with estimates for the "Current Democratic" subsample in third column, and estimates for the "Current Republican" subsample in the final column. In this classification, the estimated effect of income inequality on political polarization is substantially larger for states controlled by Republicans in 2010, and is not statistically significantly different from zero for Democratic states. The results in Table 3 suggest that it may be possible that the effect of income inequality on political polarization is concentrated in states that realigned during our sample period.

To summarize our estimation results concerning the effect of income inequality on aggregate measures of state political polarization, we find that the effect is universally positive, and almost always statistically significantly different than zero, for a variety of models. The instrumental variables strategy appears to perform well, and we are therefore relatively confident about interpreting the estimated effects as causal. For our preferred specification—a first-difference model with state-specific linear trends—the estimated effect is stronger for the later years of the sample, and for states controlled by Republicans after 2010.

Table 3: Effect of Inequality on Polarization, Stratified by Partisan Control

	Average Rep.	Average Dem.	Current Rep.	Current Dem.
	(1)	(2)	(3)	(4)
Gini	0.747	1.007**	1.271**	0.262
	(0.678)	(0.485)	(0.628)	(0.477)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	Yes	Yes	Yes	Yes
First Stage F	275.31	101.9	46.85	450.23
Observations	424	398	493	319

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust SE in parentheses

4.2 Party Medians

Our main result suggests that income inequality increases the distance between the median ideology of the two main political parties within state legislatures. This effect could occur in a number of different ways. Income inequality might move both parties symmetrically away from the political center. Alternately, the effect may be asymmetric, where one party becomes more extreme at a faster rate than the other. To differentiate between these possibilities, we estimate models using the median ideology of each state party as the dependent variable. By convention, positive values on the ideology scale reflect right-of-center positions and negative values reflect positions that are left of center. A positive coefficient estimate, therefore, implies that inequality moves the party median to the right and a negative estimated effect implies that inequality moves the party median to the left. If income inequality moves both parties symmetrically away from the center, we would expect a positive estimated effect on Republican party median ideology and a negative estimated effect on Democratic party median of roughly the same absolute magnitude. On the other hand, if there is an asymmetric effect, then the estimated effect of inequality on ideology for one party will be substantially larger in absolute value.

Table 4: First-difference Models, Democratic Party Median

	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results: Gini	-0.493^{*}	-0.500^{*}	-1.381^{**}	-1.910^{*}
	(0.276)	(0.290)	(0.576)	(1.089)
OLS Results: Gini	-0.040	-0.040	-0.222^{*}	-0.421^{*}
	(0.048)	(0.052)	(0.119)	(0.237)
Observations	822	822	200	200
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	No	Yes	No	Yes

Table 4 reports the key parameter estimates for the effect of income inequality on Democratic Party median ideology from first difference models with and without state-specific trends. Essentially identical patterns of relative effect sizes and statistical significance emerge as in the aggregate polarization case. Specifically, the OLS estimates of the key parameters appears to be small and insignificant, while the estimated effects in the IV model are large and statistically different from zero at the 5% significance level. As expected, the sign of the coefficient is negative which implies that income inequality moves the Democratic party median to the left. Again, we observe that the effect sizes for the later part of the sample appear to be much larger. In fact, for our preferred specification with state-specific trends, the point estimate of the effect of inequality on the Democratic party median is nearly four times as large for the sub-sample after 2008 (as is the estimate from the full sample), although the confidence intervals again overlap. The point estimates suggest that a one-standard-deviation (4.1 Gini points) increase in inequality moves the Democratic party median to the left by 0.02 using the full sample estimate, and by 0.08 using the estimate from the post-2008 sub-sample. The average cumulative change in Democratic party medians over 1993-2013 is -0.32.

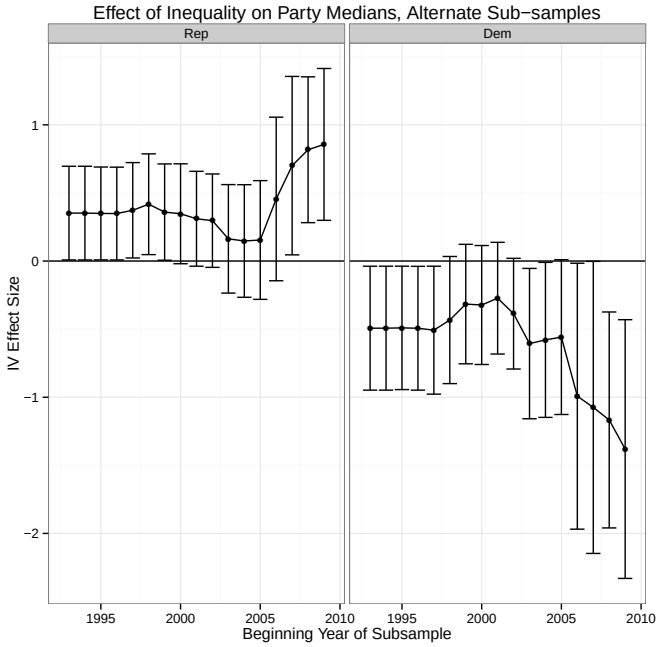
Table 5: First-difference Models, Republican Party Median

	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results: Gini	0.352*	0.357	0.856**	1.365**
	(0.208)	(0.217)	(0.338)	(0.621)
OLS Results: Gini	0.013	0.011	0.133	0.225
	(0.038)	(0.037)	(0.147)	(0.211)
Observations	822	822	200	200
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	No	Yes	No	Yes

Table 5 reports results from first-difference models using the median ideology of state-level Republican parties as a dependent variable. The IV point estimates of the effect sizes are larger in magnitude than the OLS effect sizes for all specifications and samples, but there is little evidence that these effects are statistically different from zero for the full sample. Only the effect for the IV model without state-specific linear trends is statistically significant at the 10% significance level. Even in this case, the point estimate of the effect size is much smaller than the estimated effect size for the Democratic party median. Note that the effect of inequality on the Republican party median is larger and statistically significant for the sub-sample after 2008, for models both with and without state-specific trends. Again, we observe that the point estimate is nonetheless smaller than the point estimate of the effect of inequality on the Democratic party medians. Similar results hold using the fixed effects specification, as shown in Tables A5 and A6. Given the size of the standard errors, however, we take this as being suggestive but not necessarily dispositive of an asymmetric effect of inequality on party medians.

As with the first-difference models for aggregate political polarization, there is substantial heterogeneity across sub-samples. The estimated effect of income inequality on party

Figure 2: Sub-sample timewise heterogeneity in the effect on Party Medians



ideology increases for later sub-samples: the effect of income inequality on state average Democratic party medians is nearly four times as large for the period after 2008 as it is for the full sample, beginning in 1993. Figure 2 repeats the progression in 1, reporting the effect of income inequality on Democratic and Republican party median, estimated with different samples (varying the start year from 1993-2009). Income inequality moves the Democratic party further to the left and the Republican party further to the right as time goes on. However, the confidence intervals around the effect for Republican party medians include zero for most sub-samples starting before 2007. For all sub-samples, the effect size is larger for the Democratic party median than for the Republican party median, again suggesting an asymmetric effect.

4.3 Chamber Medians and Partisanship

Income inequality appears to affect the median ideology of parties, and the ideological distance between them. Now we assess the extent to which income inequality affects the median ideology of the entire legislature. To this end we estimate models using the previous specifications but with the state median ideology as a dependent variable. State median ideology is calculated as the average across chambers of the median ideology score within each chamber, for each state in each year. Table 6 reports estimates for these models. As with the previous results, the IV point estimates are larger for sub-samples after 2008. The effects are statistically significant for all sub-samples and alternate specifications with the exception of the post-2008 sub-sample where state-specific trends are included. The point estimates of the effect of income inequality on state median ideology are much larger in size than the effect of inequality on polarization (shown in Table 2). The evidence that inequality moves the average chamber median to the right is strong.

Table 6: First-difference Models, Chamber Median

	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results: Gini	2.549**	2.597**	5.970**	8.044
	(1.060)	(1.117)	(2.984)	(5.613)
OLS Results: Gini	−0.063	−0.033	0.051	1.057
	(0.121)	(0.135)	(0.752)	(1.316)
Observations	822	822	200	200
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	No	Yes	No	Yes

That income inequality causes the median ideology of state legislative chambers to move to the right may result from two distinct mechanisms. This effect might be the consequence

of (a) both parties moving to the right, or of (b) changes in the partisan balance of the legislature where more Republicans are elected, replacing Democrats. Possibility (a) is ruled out by the previous results where we find that inequality moves Democrats to the *left*. So we explore the possibility that income inequality changes the partisan balance of legislatures by increasing the proportion of seats held by Republicans. We estimate similar models as in the previous analysis but using the proportion of seats in state legislatures held by Republicans as the outcome variable. Table 7 summarizes the results of this analysis, again including results from sub-samples after 2008. Here the results are broadly in line with the results from Table 6—income inequality increases the *share* of seats held by Republicans, often substantially. The full sample estimate of the effect in the model that includes state-specific trends is 0.851. This estimate implies that a one-standard-deviation increase in income inequality increases the Republican seat share by an average 3.4 percentage points. As with all previous results, the point estimates of the effect sizes for the post-2008 sub-sample are substantially larger, by a factor of about two.

Table 7: First-difference Models, Proportion Republican

	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results: Gini	0.843^{***}	0.851^{***}	1.531^{***}	2.065^{*}
	(0.233)	(0.247)	(0.531)	(1.114)
OLS Results: Gini	-0.010	-0.005	0.201^{*}	0.476^{*}
	(0.030)	(0.033)	(0.117)	(0.265)
Observations	822	822	200	200
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	No	Yes	No	Yes

4.4 Additional Robustness Checks

Table 8 presents results from fixed-effects models for the effect of income inequality on each of our dependent variables of interest: political polarization, Democratic and Republican Party Median ideology and chamber median ideology. The fixed effect sizes are substantially larger than the estimated effects from the baseline first difference models, although the signs are all in agreement. Note that the fixed effects models have relatively weak first stages. As observed in previous results, the size of the effect on Democratic party medians is larger than the effect on Republican party medians, and only the Democratic party median effect is statistically different from zero.

Table 8: Effect of Inequality on Ideology/Polarization, Fixed Effects Models

	Polarization	Dem. Median	Rep. Median	Chamber Median
	(1)	(2)	(3)	(4)
Gini	5.899*	−3.851*	2.048	10.576
	(3.229)	(2.107)	(1.940)	(7.145)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	No	No	No	No
First Stage F	6.67	6.67	6.67	6.67
Observations	890	890	890	890

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust SE in parentheses

The previous models have all assumed that the effect of income inequality on political polarization or ideology are constant within the estimating sample. Since legislators are assumed to have a constant ideology over their careers (unless they switch parties), the political polarization or median ideology within a state can change in two ways: due to regularly held elections, or due to party switches and retirements that lead to special elections. States generally hold legislative elections every 2 or 4 years, so the change in polarization or ideology is usually larger in "on-years", when legislative elections occur, than in "off-years."

To account for this, we extend previous models by allowing the effect of income inequality to vary across "on-years" and "off-years." We do this by interacting the main variable of interest – the state Gini coefficient – with an indicator variable for whether the year is an on-year or off-year. In our IV setting, this leads to two endogenous variables and two first stage equations:

$$\begin{aligned}
\text{First Stage 1: } \Delta Ineq_{i,t} \times I\left(on\right) &= \alpha_i \times t + \theta_1 \Delta Pred_Ineq_{i,t} \times I\left(on\right) \\
&+ \theta_2 \Delta Pred_Ineq_{i,t} \times I\left(off\right) + \theta_3 I\left(on\right) + \Gamma \Delta X_{i,t} + \nu_{i,t} \\
\text{First Stage 2: } \Delta Ineq_{i,t} \times I\left(off\right) &= \alpha_i \times t + \theta_1 \Delta Pred_Ineq_{i,t} \times I\left(on\right) \\
&+ \theta_2 \Delta Pred_Ineq_{i,t} \times I\left(off\right) + \theta_3 I\left(on\right) + \Gamma \Delta X_{i,t} + \nu_{i,t}
\end{aligned}$$

$$\Delta Polar_{it} = \alpha_i t + \beta_1 \Delta \widehat{Ineq \times I\left(on\right)}_{it} + \beta_2 \Delta \widehat{Ineq \times I\left(off\right)}_{it} + \beta_3 I\left(on\right) + \gamma \Delta X_{it} + e_{it} \quad (10)$$

Table 9 summarizes the main estimation results for these models for the full estimating sample. Each column reports the coefficients of interest estimated from equation 10 above for one of the main dependent variables of interest – column 1 reports the effect of inequality on polarization, column 2 on the Democratic Party Median, column 3 on the Republican Party median and column 4 on the average chamber median. The on-year effects of income inequality on polarization, the Democratic party median and chamber median ideology are qualitatively similar to the baseline results above. For these three dependent variables, the effects in off-years are much smaller, and in the case of chamber median ideology, the effect in off years may even work in the opposite direction, although none of the off-year effects are statistically significantly different from zero. The effect of inequality on the Republican party median exhibits the opposite pattern, however: the effect size in off-years is much larger in magnitude (and the estimated effect in on-years is actually negative, although not

Table 9: Effects of Income Inequality on Polarization/Ideology, Systematically Varying off-year effects

	Polarization	Dem. Median	Rep. Median	Chamber Median
	(1)	(2)	(3)	(4)
Gini*onyear	0.643	−0.683*	−0.040	5.209**
	(0.519)	(0.414)	(0.338)	(2.387)
Gini*offyear	0.146	0.110	0.255	−0.279
	(0.291)	(0.204)	(0.183)	(0.726)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	Yes	Yes	Yes	Yes
First Stage 1 F	22.38	22.38	22.38	22.38
First Stage 2 F	30.4	30.4	30.4	30.4
Observations	822	822	822	822

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust SE in parentheses

significantly different from zero.)

As with the baseline results, even when allowing for systematically differences in on-years and off-years, there is substantial heterogeneity in the effect of inequality on polarization and ideology over time. Figure A5 in the appendix repeats the exercise of estimating equation 11 using shrinking subsamples, with the dependent variables being (clockwise from upper-left) polarization, chamber median ideology, Democratic and Republican party medians as dependent variables. For each dependent variable except the Republican party median, the absolute magnitude of the effect generally increases over time, with larger effect sizes and absolute increases in legislative election years than in off-years. The effect of income inequality on the median ideology of state Republican parties displays the opposite pattern: the effect increases over time for off-years, and becomes statistically significant within the latter part of the sample.

There is additional heterogeneity in the effect of inequality on polarization/ideology by partisan control. Table 10 summarizes results from systematically-varying on-year and off-

year effects models estimated only on the subset of states which were on average controlled by Republicans in the last four years of the sample. (This is the same subsample as Table 3, columns 3-4). As in the previous analysis, we find that the effect of income inequality on polarization/ideology is concentrated in states which are controlled by Republicans at the end of the sample; there is no statistically significant effect of income inequality on polarization nor any other measure of ideology in states controlled by Democrats. However, we find that income inequality moves the Democratic party median to the left, and the chamber median to the right, in states controlled by Republicans at the end of the sample. This effect, in line with our previous results, seems to be occurring through composition changes due to legislative elections rather than resignations and special elections.

Table 10: Effects of Income Inequality on Polarization/Ideology, Systematically Varying off-year effects, Republican States

	Polarization	Dem. Median	Rep. Median	Chamber Median
	(1)	(2)	(3)	(4)
Gini*onyear	0.880*	−0.813*	0.067	7.196**
	(0.506)	(0.449)	(0.279)	(3.584)
Gini*offyear	0.627	−0.002	0.626	0.496
	(0.732)	(0.484)	(0.477)	(1.804)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	Yes	Yes	Yes	Yes
First Stage 1 F	83.22	83.22	83.22	83.22
First Stage 2 F	52.19	52.19	52.19	52.19
Observations	493	493	493	493

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust SE in parentheses

Our measure of "average" party ideology has thus far been the ideology of the median member of the party caucus within a state-chamber. This can be justified by the fact that parties choose party leaders by majority vote, and hence the preferences of the median caucus member will rule. However, a party's median ideology will not be sensitive to changes in the

tails of the party ideology distribution. Hence if income inequality affects the distribution of legislator ideology primarily in the tails, then this would not necessarily be reflected in the previous results based on median ideology. Our final series of robustness checks will assess whether income inequality affects ideology in the tails of the party ideology distribution in two ways: first, we will consider whether income inequality affects the mean ideology scores of parties, chambers and the distance between party means, and we will consider whether inequality affects specific quantiles of the party ideology distribution.

Table 11: Effects of Income Inequality on Mean Ideology

	Polarization	Dem. Mean	Rep. Mean	Chamber Mean
	(1)	(2)	(3)	(4)
Gini	0.963^{***}	-0.548^{***}	0.415^{**}	1.224^{***}
	(0.315)	(0.210)	(0.166)	(0.382)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	Yes	Yes	Yes	Yes
First Stage F	79.64	79.64	79.64	79.64
Observations	822	822	822	822
Note:				*p<0.1; **p<0.05; ***p<0.01
				Cluster Robust SE in parentheses

Table 11 summarizes results from models using party/chamber *means* as dependent variables. Each columns reports results from our preferred instrumental variables specification, with state-specific linear trends but without systematically varying on-year and off-year effects. The first column reports results of the effect of inequality on the distance between party means, the second on Democratic party mean ideology, the third on Republican party mean ideology, and the final column on chamber mean ideology. The results are consistent with the previous median-based results. If anything, the results for party *means* are more precisely estimated. Income inequality has a statistically significant effect on the distance between party means and on the mean ideology of state legislatures. Income inequality appears to affect the average ideology of both parties, although consistent with previous

results, the point estimate of the effect of inequality on the Democratic party mean is larger in absolute value than is the effect on the Republican party mean.[14]

Table 12: Effects of Income Inequality on Moderate/Extreme Ideology

	Dem. Moderate	Dem. Extreme	Rep. Moderate	Rep Extreme
	(1)	(2)	(3)	(4)
Gini	-0.677^{***}	-0.332	0.401^{**}	0.594^{***}
	(0.248)	(0.211)	(0.184)	(0.223)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	Yes	Yes	Yes	Yes
First Stage 1 F	79.64	79.64	79.64	79.64
Observations	822	822	822	822

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust SE in parentheses

One result which has remained constant through a variety of specifications and estimating samples is the seeming asymmetry between the effect of income inequality on the ideologies of the two parties. Income inequality appears to move Democrats to the left, and there is mixed evidence that it moves Republicans to the right. There is also evidence that inequality moves the overall ideology of the legislature to the right. To further investigate these two results, we consider the effect of income inequality on the tails of the party ideology distribution. Table 12 summarizes results of models estimated using different quantiles of the party ideology distribution as dependent variables, using our preferred specification. The "moderate" wing of the Democratic and Republican parties will be captured by the 80th and 20th percentile ideology score respectively, conversely the "extreme" wings will be captured by the 20th and 80th percentiles[15]. The first column shows results of inequality on the moderate wing

[14]If we allow for systematically varying effects, as in Table A7 in the appendix, then the asymmetry is more pronounced. The effect of income inequality on Democratic party means is larger in absolute value than the effect on Republican party means, and only the effect on Democratic party means is statistically different from zero.

[15]Since more left wing ideology scores are more negative, the left tail (e.g. 20th percentile) is the extreme wing, and the right tail (e.g. 80th percentile) is closer to the ideological center.

of the Democratic party, the second column on the extreme wing of the Democratic party, the third column on the moderate wing of the Republican party, and the fourth on the extreme wing of the Republican party. Income inequality has a statistically significant and negative impact on moderate Democrats (indicating that it moves the moderate wing of the Democratic party to the left.) The point estimates of the on-year effect are consistent with the effect of inequality on Republican ideology primarily moving the extreme wing to the right, although neither effect is statistically different from zero.

4.5 State Summary

Our main results concerning the effect of inequality on measures of polarization and ideology in state legislatures can be summarized as follows. We find robust evidence that income inequality moves the median ideology of Democrats to the left. There is also some evidence that income inequality moves Republicans to the right, perhaps working through non-election-year changes in composition. Income inequality also moves the overall median ideology of state legislatures to the right by increasing the share of seats held by Republicans. The net result is that income inequality causes an increase in political polarization while simultaneously shifting the overall median ideology of state legislatures to the right. These results are consistent with inequality having a particularly strong negative electoral effect on moderate Democrats to the benefit of Republicans (who may or may not be moderate relative to the Republican party median), leaving behind a more liberal Democratic party. On net, however, the entire legislature moves rightward, and becomes more heavily Republican. At some point, formerly Democratic legislatures switch to Republican control and policy can be expected to move even further to the right, especially if the governor is a Republican.

The specific form of the change in political polarization induced by changes in inequality has interesting implications. It is consistent with a mutually reinforcing process, where increases in inequality lead to other changes which further exacerbate income inequality in

the future. Increases in income inequality now make future increases in inequality more likely through two channels. First, income inequality moves the chamber median to the right, which decreases the chances that legislatures will enact redistributive policies to decrease inequality. Second, the increase in political polarization induced by income inequality makes gridlock more likely, which decreases the likelihood that state legislatures will be able to respond to increases in income inequality even in circumstances in which they might otherwise be inclined to do so.[16]

5 Individual Legislator Ideology

So far we have presented evidence that income inequality has a large, statistically significant and positive effect on the level of political polarization. We now turn from the aggregate analysis of party and chamber medians to an analysis of the ideology of individual legislators. Moving to the level of the individual legislator allows us to explore more carefully the differential effect of inequality on Democratic and Republican ideological positions. However, we will no longer be able to make strong causal claims, because the data on individual ideology are essentially cross-sectional. Nonetheless, even interpreted as correlations, and not causal effects, these results can enhance our understanding of the aggregate results presented above.

5.1 Data and Empirical Model

The aggregate state-level polarization and ideology measures used in the panel data analyses above are themselves derived from a data set of ideology scores for individual legislators, prepared by Shor and McCarty (2011). These data have been subsequently updated and expanded by the authors, and now contain ideology scores for most legislators who served from 1993 through 2015. An important limitation of these data is that legislators are assumed not to evolve in terms of their ideologies over the course of their careers, and hence each

[16]For example, since minimum wage laws are almost always defined in nominal dollars, real, inflation-adjusted minimum wages can fall substantially without policy changes.

legislator has just a single fixed ideology score. This means that the identification strategy used above for the aggregate ideology measures cannot be used for the individual measures, since it would require within-legislator variation in ideology. We can nonetheless proceed by collapsing all of the available data to averages over each legislator's career, and model the relationship between inequality and ideology in the pooled cross-section.

Our results for aggregate polarization have suggested that there is a positive effect of within-state income inequality on political polarization (and perhaps on the median ideology of each party.) We have used the Gini index in the previous analysis as a measure of income inequality, although we could have used, for example, the Theil index with broadly similar results. The Theil index is defined as

$$T = \frac{1}{N} \sum_{i=1}^{N} \frac{x_i}{\overline{x}} \times \ln \frac{x_i}{\overline{x}} \tag{11}$$

and has the useful property that it can be additively decomposed into within-group and between-group components. So for m groups, each of which captures a share of total income w_j,

$$T = \sum_{j=1}^{m} w_j T_j + \sum_{j=1}^{m} w_j \frac{\overline{x}_j}{\overline{x}} \tag{12}$$

Here, the first term captures inequality within each of the m groups, and the second term captures the inequality *between* the m different groups. When thinking of the effect of income inequality on the ideology of individual legislators, it is logical to work within the framework of a decomposable inequality index rather than the Gini, which does not share this property.[17] Legislator ideology could be influenced both by the income distribution within the legislator's district, and by the differences in income between the legislator's district and other districts in the state.

These two components can give us an indication about the mechanisms underlying the

[17] As Lambert (2001) shows, the Gini coefficient can be decomposed into three terms: within-group inequality, between group inequality and changes in inequality due to re-ranking, but the between-group and within-group Gini will not sum to the overall Gini in general.

effect of income inequality on political polarization. In our setting, state legislative districts are the sub-groups of interest. The within-district component of income inequality captures the relative importance of wealthy constituents—an increase in within-district inequality means that they have potentially greater political power, perhaps expressed via campaign contributions, or even merely via social ties. Between-district inequality, on the other hand, can be viewed as capturing demands for redistribution—an increase in between-district inequality means that there is greater disparity between rich and poor districts.[18]

The Voorheis (2014) data allow us to examine the relationship between inequality and polarization (or party medians) at the state level, but are not suited to the task of analyzing individual legislators' ideology. The only source of publicly available micro-data suitable for calculating income inequality in the US at the level of state legislative districts is the American Community Survey. We estimate annual income inequality (measured by the Gini and Theil coefficients) as follows. We first estimate Public-use Microdata Area (PUMA) income inequality measures using income microdata from the ACS 1-year files.[19] We then calculate population-weighted average inequality for each state legislative district using a crosswalk file from the Missouri Census Research Center's GEOCORR utility. This averages over all of the PUMAs that overlap with each state legislative district. Using the ACS 1-year files we are able to estimate state legislative district inequality for each year between 2005 and 2011.[20] We are also able to estimate between-district inequality measured as the Theil index calculated using district mean incomes, as in equation 11.

We assign inequality to legislators as follows. We start with every legislator in the Shor and McCarty data set elected who served in a state legislature at any time in the period 2005-2011. For each legislator, we assign the average level of within-district and between-district inequality across those years specific to the legislator's tenure. This assignment means that

[18]Within-district inequality may also capture some demands for redistribution, although the between district component represents inequality that can only be remedied at the state rather than local levels.

[19]PUMAs are the smallest geographies identified in the public use ACS files. Each PUMA has a population between 100,000 and 200,000.

[20]The 2012 1-year files change the geographic boundaries of PUMAs in a way that may induce a structural break in the data.

there is within-state-chamber variation in between-district inequality, even though there is no explicit time dimension to the data. We repeat a similar process to assign average levels of the demographic control variables to each legislator. Our data set then contains the the average level of inequality and the average demographics corresponding to the tenure of each legislator during his or her legislative career.

Consider a flexible model to describe the relationship between inequality and legislator ideology, allowing for heterogeneous effects across the two parties:

$$Ideo_i = \alpha_s + \beta_1 D_i \times Ineq_i^w + \beta_2 R_i \times Ineq_i^w + \beta_3 D_i \times Ineq_i^b + \beta_4 R_i \times Ineq_i^b + \Gamma X_i + e_i \quad (13)$$

where i indexes legislators, D_i is a dummy variable equal to 1 if the legislator is a Democrat and zero otherwise, R_i is a dummy variable equal to 1 if a legislator is Republican and zero otherwise. $Ineq^b$ is between-district inequality, and $Ineq^w$ is within-district inequality. The α_s are the fixed effects. We will investigate a number of fixed-effects specifications, including state fixed effects, state-chamber fixed effects, and state-by-chamber-by-party fixed effects. All specifications include a dummy variable for party affiliation, so that both the intercept and slopes varying across parties.

5.2 Empirical Results

We begin by first considering a constrained version of the model in equation 13 where only within-district inequality affects legislator ideology (i.e. we constrain $\beta_3 = \beta_4 = 0$). Table 13 summarizes estimates of of this model using alternative fixed effects specifications. The first column estimates a model without fixed effects; columns 2-4 present estimates of models with state and party fixed effects, state-by-chamber and party fixed effects, and state-by-chamber-by-party fixed effects respectively. In the first model, within-district inequality moves both parties to the right, with roughly similar effect sizes. Controlling for state and state-chamber fixed effects does not qualitatively change this result, although it does reduce

the effect size. However, when we control for state-by-chamber-by-party fixed effects, the effect for Democrats becomes negative, and is no longer statistically significant.

Similarly, we can examine the effects of between-district inequality on individual legislator ideology by setting $\beta_1 = \beta_2 = 0$ in equation 13 above, thereby omitting the within district terms.[21] Table 14 reports the results from this class of models, again estimated with alternative fixed effects specifications. In the first model without fixed effects, between-district inequality moves both parties to the left. However, once we control for state-by-chamber-by-party fixed effects, we find that there is no significant effect of between-district inequality on Republican legislators, but there is a significant effect on Democrats.

Table 13: Effect of Within District Inequality, alternate FE

	NPAT Common Space Score			
	(1)	(2)	(3)	(4)
$R_i \times Ineq^w$	1.120^{***}	0.822^{**}	0.831^{**}	0.714^{***}
	(0.137)	(0.388)	(0.338)	(0.160)
$D_i \times Ineq^w$	0.980^{***}	0.727^{***}	0.732^{***}	-0.037
	(0.124)	(0.256)	(0.214)	(0.165)
Other Controls?	Yes	Yes	Yes	Yes
Fixed Effects?	None	State	State-Chamber	State-Chamber-Party
N	11,988	11,988	11,988	11,988
Adjusted R^2	0.814	0.838	0.839	0.888

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Combining these two exercises, we estimate unconstrained versions of equation 13 with different fixed effects specifications in Table 15. As expected by theory, the results from a model with both within and between district inequality terms are not very dissimilar from the models with either within or between district inequality terms. When controlling for state-

[21] Note that by the decomposability property of the Theil index, the between and within components are orthogonal, so we do not need to worry about omitted variable bias, at least in theory.

Table 14: Effect of between District Inequality, alternate FE

	Dependent variable:			
	NPAT Common Space Score			
	(1)	(2)	(3)	(4)
$R_i \times Ineq^b$	-1.343^{***}	3.719	-3.115	1.660
	(0.435)	(3.260)	(5.162)	(8.106)
$D_i \times Ineq^b$	-4.755^{***}	1.512	-5.428	-15.467^{***}
	(0.476)	(3.111)	(4.269)	(4.903)
Other Controls?	Yes	Yes	Yes	Yes
Fixed Effects?	None	State	State-Chamber	State-Chamber-Party
Observations	11,988	11,988	11,988	11,988
Adjusted R^2	0.815	0.838	0.839	0.888
Note:				*p<0.1; **p<0.05; ***p<0.01

by-chamber-by-party fixed effects, which soak up the most unobserved heterogeneity of the four specifications, we obtain our key result: between district inequality moves Democrats to the left, while within-district inequality moves Republicans to the right.

Table 15: Effect of within and between District Inequality, alternate FE

	NPAT Common Space Score			
	(1)	(2)	(3)	(4)
$R_i \times Ineq^b$	-1.132^{***}	3.547	-3.490	1.609
	(0.435)	(3.254)	(5.083)	(7.934)
$D_i \times Ineq^b$	-4.253^{***}	1.525	-5.615	-15.049^{***}
	(0.479)	(3.092)	(4.149)	(4.803)
$R_i \times Ineq^w$	0.985^{***}	0.803^{**}	0.813^{**}	0.714^{***}
	(0.137)	(0.383)	(0.331)	(0.161)
$D_i \times Ineq^w$	0.852^{***}	0.702^{***}	0.712^{***}	-0.017
	(0.124)	(0.263)	(0.220)	(0.163)
Other Controls?	Yes	Yes	Yes	Yes
Fixed Effects?	None	State	State-Chamber	State-Chamber-Party
N	11,988	11,988	11,988	11,988
Adjusted R^2	0.816	0.838	0.839	0.889

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

6 Conclusion

We have examined the relationship between income inequality and political polarization in a number of different contexts. By moving to the state level, and by adopting an instrumental variables empirical strategy that discards variation due to non-random sorting across state lines and corrects for measurement error, we are able to recover estimates of the effect of inequality on polarization that can legitimately be interpreted as causal. Our results from models examining the effect of income inequality on aggregate polarization within state legislatures align with previous studies of an equivalent national-level relationship (McCarty, Poole and Rosenthal, 2006). Using an instrumental variables identification strategy, we find that within-state income inequality has a significant, positive and quantitatively large effect on within-state legislative political polarization. These results are robust to a number of different specifications and sub-samples. Furthermore, we find the effect substantially increases in magnitude in more recent years, and seems to be concentrated in states which have become "Red States" by the end of the sample.

We examine how income inequality affects the distance between party ideologies. We consider how income inequality also affects the median ideological positions of individual parties and the legislature as a whole. This allows us to characterize the form of inequality-induced increases in polarization. Although we cannot always formally reject symmetry in the effect of inequality on party medians , our results suggest of a larger effect of inequality on Democratic party medians. When allowing for systematically different effects in on-years and off-years, we find that any effect of inequality on Republican party medians seems to occur in off-years, working through retirements or defections. However, we find that income inequality moves the median of the entire legislature to the right, and increases the proportion of seats held by Republicans. These results are consistent with income inequality affecting polarization by "flipping" moderate districts from Democratic to Republican control, and which are roughly the same districts highlighted by Rodden et al. (2015) as being important for explaining polarization.

We also examine the effect of income inequality on individual legislator ideology, allowing us to explore further the inequality-polarization relationship. Income inequality *between* districts and inequality *within* districts differentially affect legislators of the two parties. Within-district inequality shifts Republican positions but not those of Democrats, and the opposite is true for between-district inequality, which moves Democrats but not Republicans. This suggests different mechanisms for the two components of inequality—between-district inequality may affect ideology through demands for redistribution, while within-district inequality may affect ideology through shifting the ideology of large campaign contributors to the right, as theorized by Feddersen and Gul (2014).

Together, these results deepen our understanding of the relationship between income inequality and political polarization. Our findings are consistent with a political reinforcement mechanism for the propagation of inequality—increases in income inequality move the entire legislature to the right, while at the same time increasing political polarization. This diminishes both the appetite and ability of state legislatures to engage in redistribution, which in turn further increases income inequality.

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A Additional Tables and Figures

Table A1: Summary Statistics, Dependent Variables

Statistic	Mean	St. Dev.	Min	Max
Polarization	1.402	0.483	0.206	3.040
Median Ideology	0.038	0.561	−1.382	1.119
Dem. Median	−0.727	0.387	−1.673	0.194
Rep. Median	0.674	0.338	−0.395	1.624

Table A2: Summary Statistics, Independent Variables

Statistic	Mean	St. Dev.	Min	Max
Gini	0.475	0.041	0.361	0.634
Median Income	54,563.030	8,346.758	36,574	78,632
Pop. Dens.	190.112	253.333	1.057	1,199.802
Union Membership	0.066	0.032	0.012	0.148
Union Coverage	0.008	0.003	0.001	0.030
Latino	0.094	0.098	0.004	0.466
Black	0.102	0.097	0.000	0.412
Native American	0.014	0.026	0.000	0.176
Asian	0.038	0.078	0.001	0.705
Other Race	0.013	0.024	0.000	0.219
Married	0.426	0.024	0.354	0.486
Divorced	0.142	0.017	0.080	0.196
Native Born	0.910	0.065	0.710	0.994
Noncitizen	0.047	0.035	0.001	0.192
Over 55	0.230	0.035	0.084	0.336
Under 25	0.362	0.029	0.290	0.493
College Degree	0.186	0.041	0.084	0.314
In Poverty	0.124	0.034	0.045	0.255
Attending School/College	0.035	0.010	0.011	0.074
Median Age	35.818	2.566	26	43
Population	6,068,207.000	6,684,287.000	488,167	38,332,521
Unemployment Rate	5.501	1.930	2.300	13.800

Figure A1: First Stage: Simulated vs. Actual State Gini

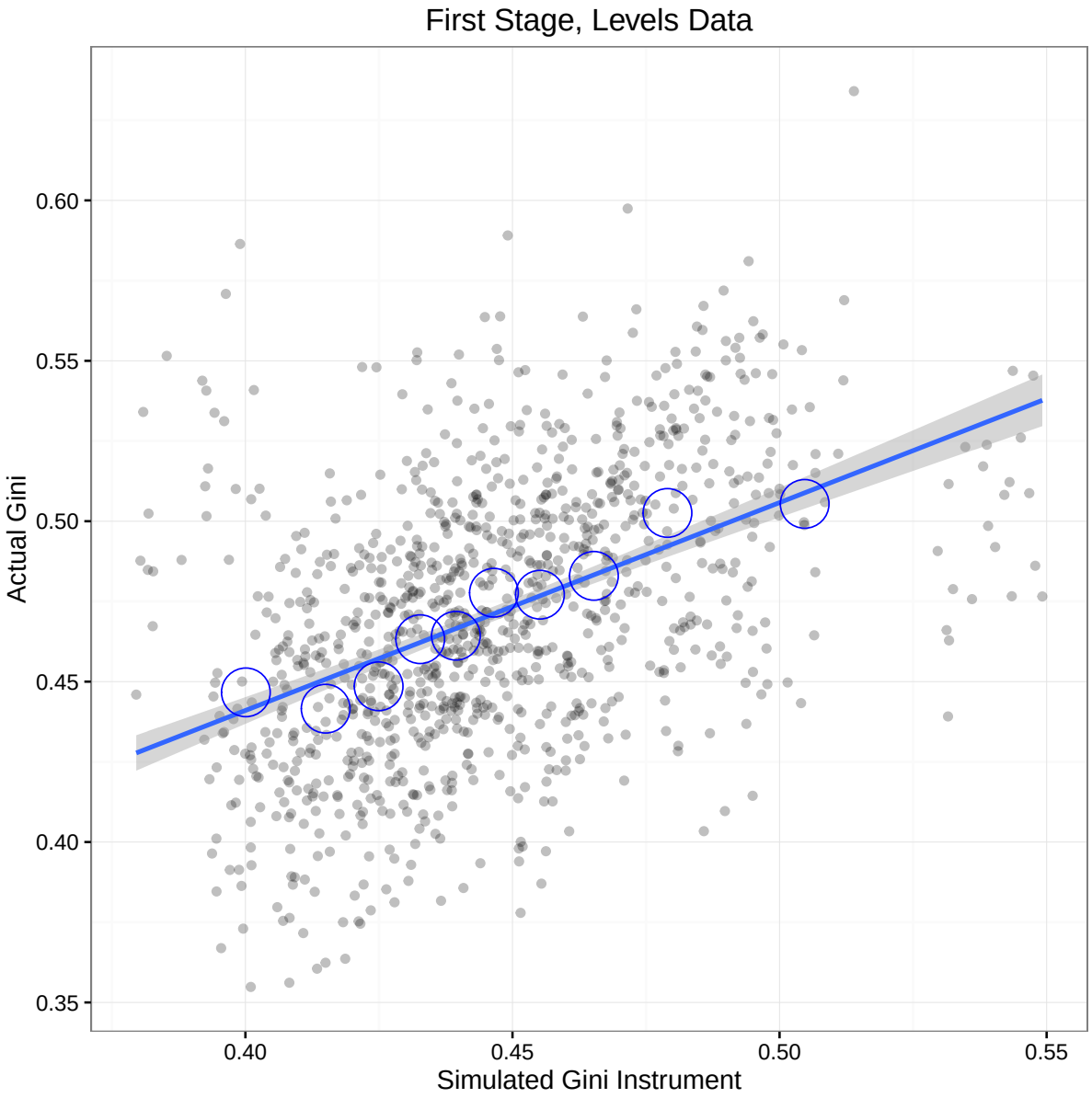


Figure A2: First Stage: Simulated vs. Actual State Gini

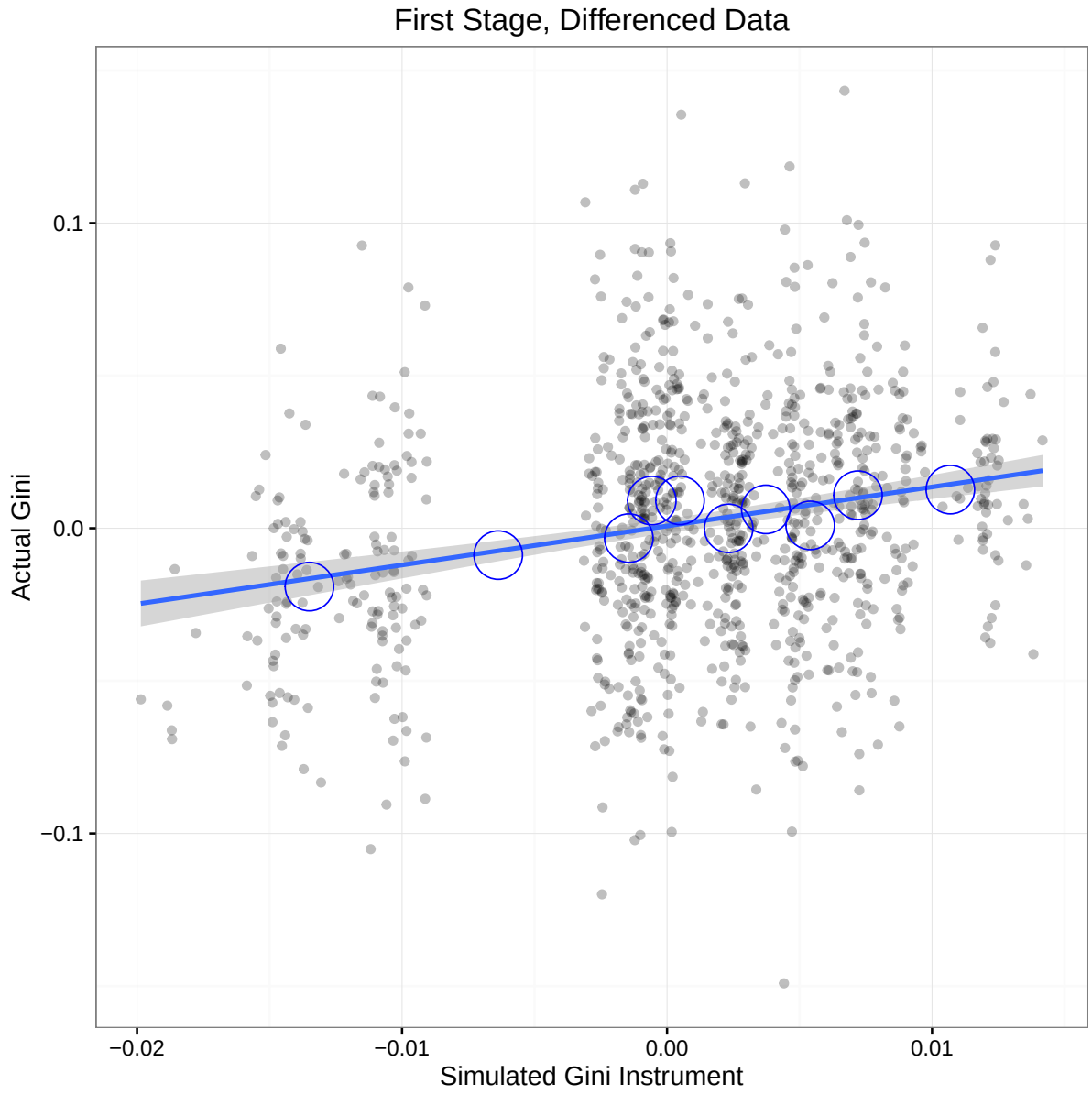


Table A3: First Stage Estimation Results

	Dependent variable:			
	Gini			
	First Diff.		Fixed Effects	
	(1)	(2)	(3)	(4)
log(Med. Inc.)	-0.086^{***}	-0.096^{***}	-0.046^{*}	-0.088^{***}
	(0.033)	(0.035)	(0.024)	(0.027)
Pop. Dens.	0.00002	-0.001	-0.0002	-0.0004
	(0.001)	(0.001)	(0.0001)	(0.0003)
Union Mem.	-0.318	-0.310	-0.095	-0.325
	(0.326)	(0.332)	(0.215)	(0.293)
UR	-0.004^{***}	-0.004^{***}	-0.003^{**}	-0.003^{**}
	(0.001)	(0.001)	(0.001)	(0.001)
Simulated Gini	1.263^{***}	1.256^{***}	2.119^{**}	3.192^{***}
	(0.208)	(0.216)	(1.049)	(0.948)
Control Variables?	Yes	Yes	Yes	Yes
State-specific Linear Trend?	No	Yes	No	Yes
First Stage F	89.12	79.64	6.67	27.37
Observations	822	822	890	890
Note:				*p<0.1; **p<0.05; ***p<0.01

Table A4: Effect of Inequality on Average State Polarization, Alternate Instruments

	Dependent variable:				
	comp_diffs				
	1988	1989	1990	1991	1992
	(1)	(2)	(3)	(4)	(5)
'Gini(fit)'	0.855^{**}	0.846^{**}	0.844^{**}	0.845^{**}	0.868^{**}
	(0.396)	(0.384)	(0.378)	(0.385)	(0.393)
First Stage F	64.92	67.15	72.71	70.2	65.17
Observations	822	822	822	822	822
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure A3: Testing Identifying Assumptions: Initial Inequality is Unrelated to Subsequent Changes in Ideology/Polarization

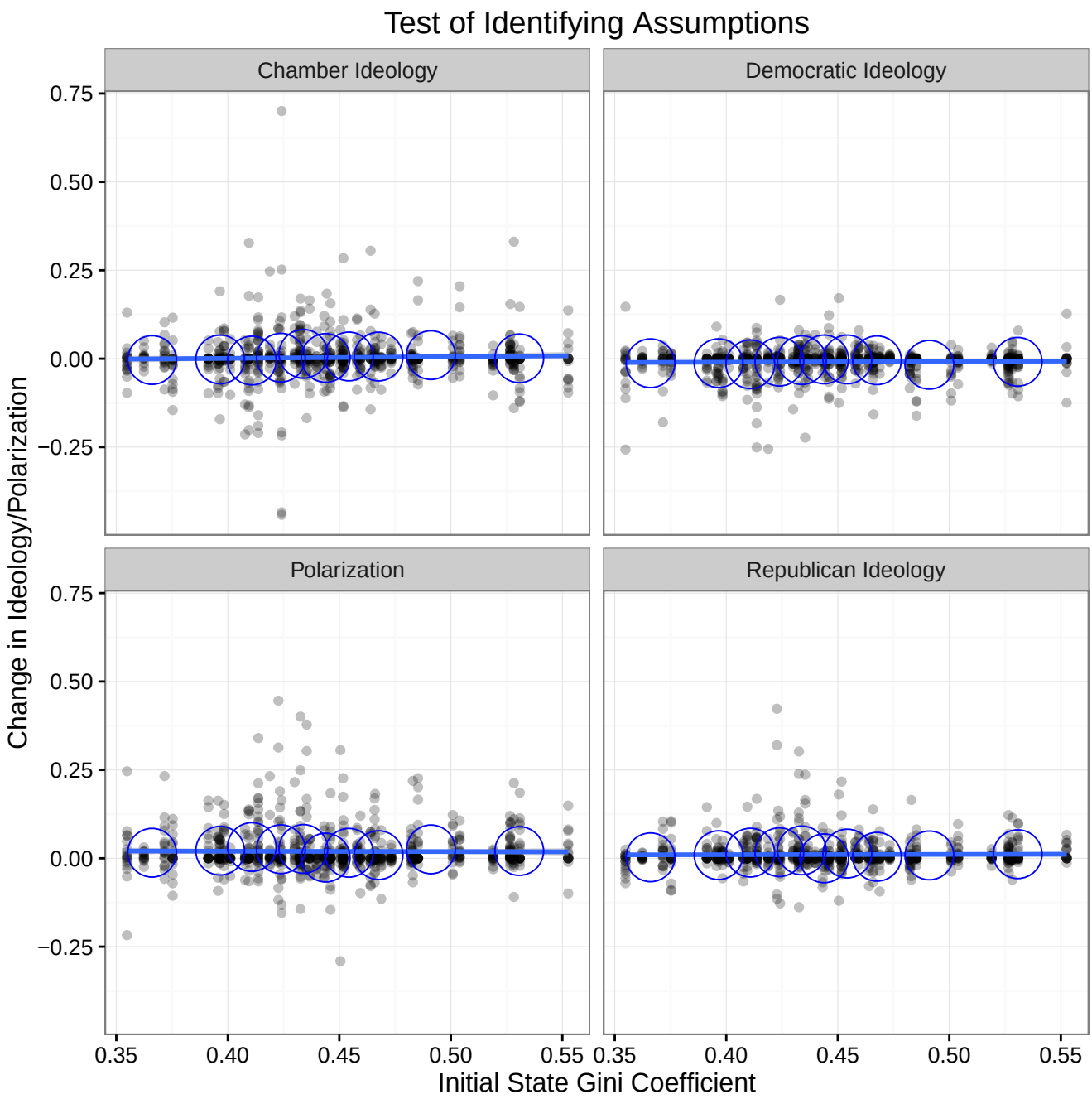


Figure A4: Average Change in Party Medians

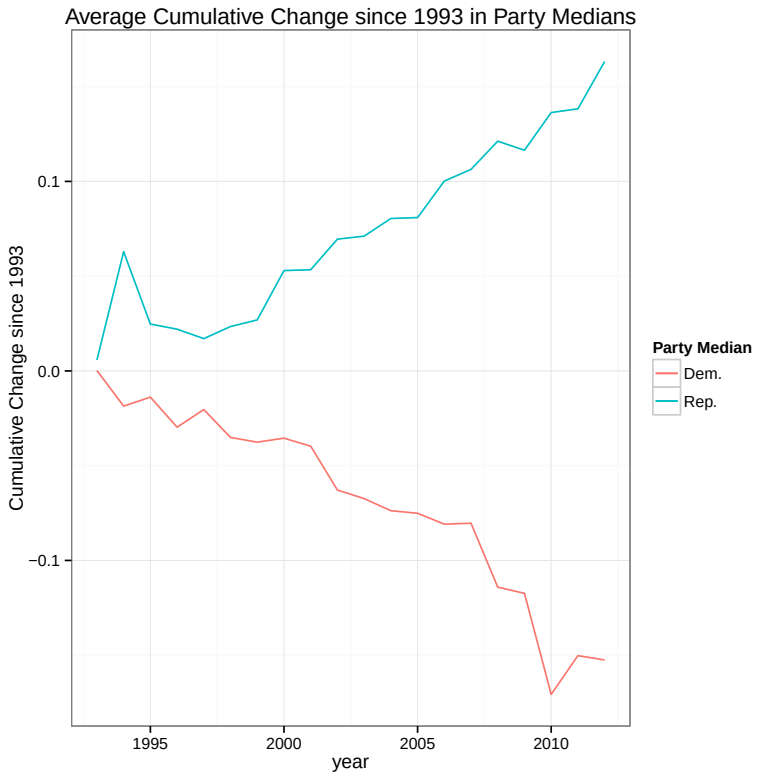


Table A5: Fixed Effects Models, Democratic Party Median

	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results				
Gini	−3.851*	−0.298	0.959	1.036
	(2.107)	(0.774)	(2.246)	(1.488)
OLS Results				
Gini	−0.056	−0.051	−0.048	−0.100
	(0.117)	(0.053)	(0.117)	(0.216)
Observations	890	890	217	217
Control Variables?	Yes	Yes	Yes	Yes
State-specific Linear Trend?	No	Yes	No	Yes

Table A6: Fixed Effects Models, Republican Party Median

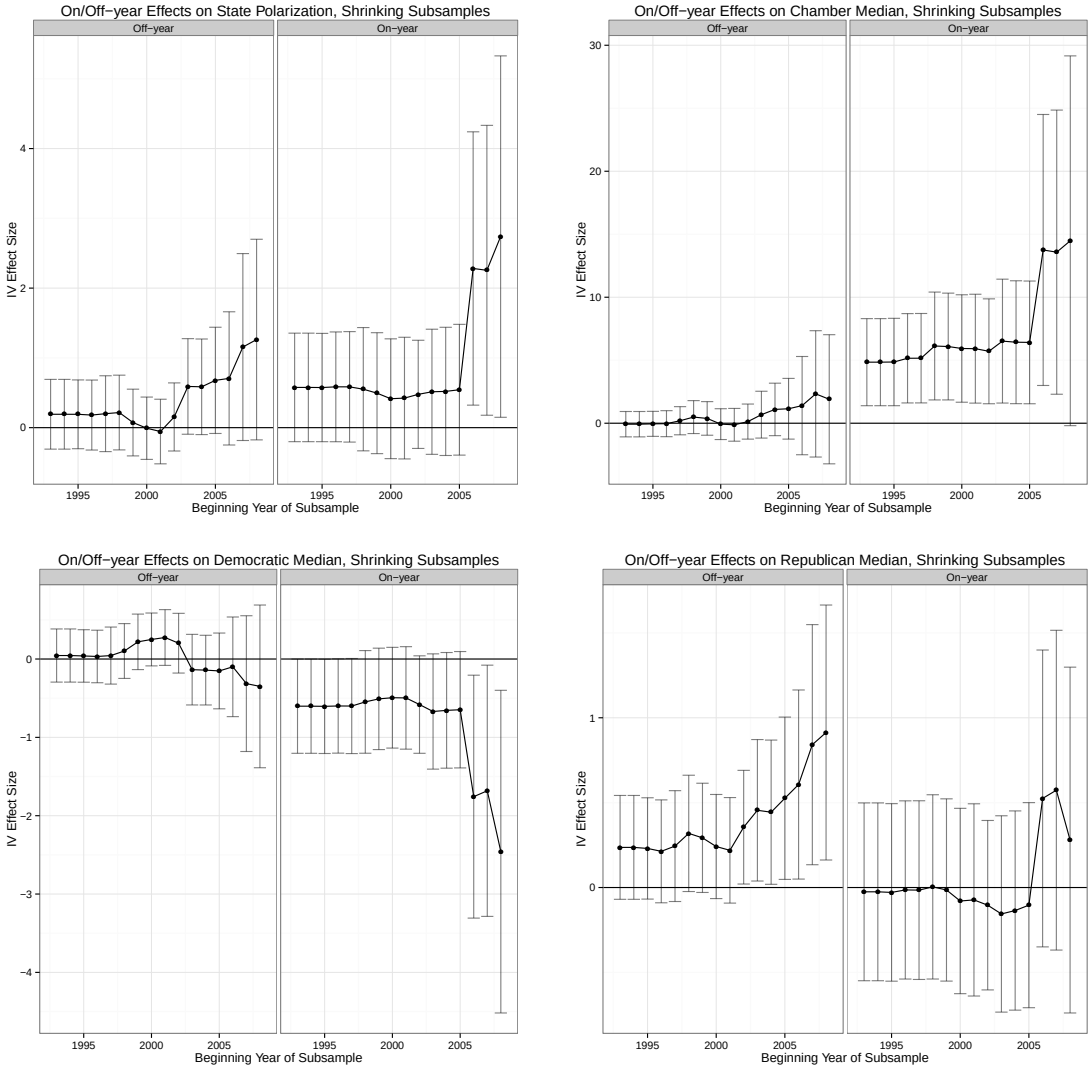
	Full Sample		After 2008	
	(1)	(2)	(3)	(4)
IV Results				
Gini	2.048	1.804**	−1.220	−0.176
	(1.940)	(0.829)	(2.373)	(0.913)
OLS Results				
Gini	−0.060	0.049	−0.006	0.044
	(0.109)	(0.068)	(0.175)	(0.236)
Observations	890	890	217	217
Control Variables?	Yes	Yes	Yes	Yes
State-specific Linear Trend?	No	Yes	No	Yes

Table A7: Effects of Income Inequality on Mean Ideology, Systematically Varying off-year effects

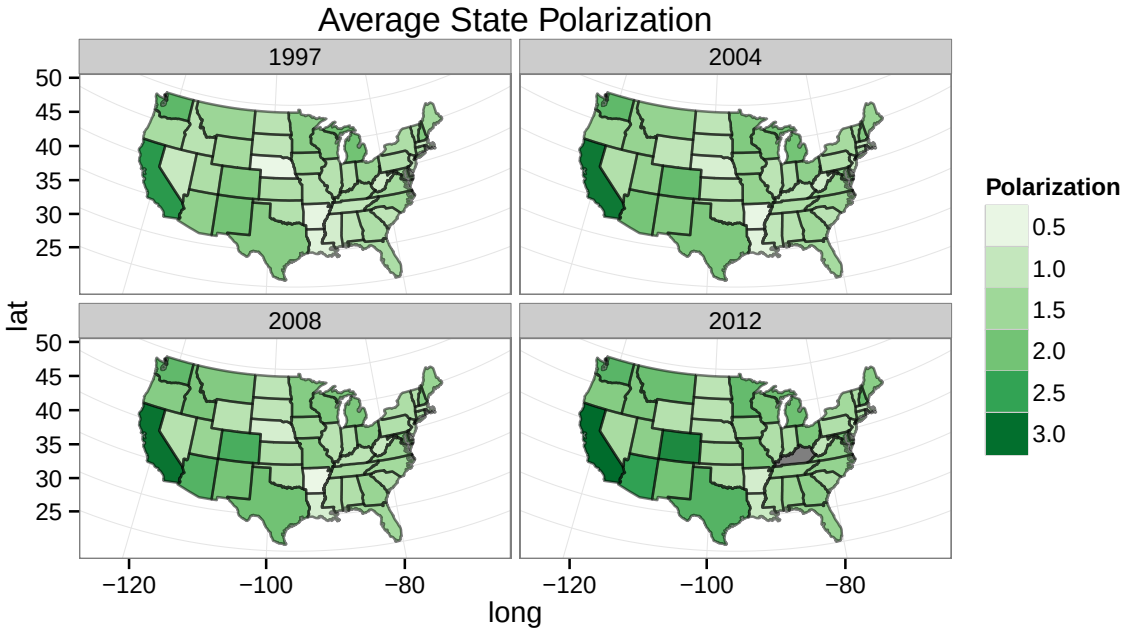
	Polarization	Dem. Mean	Rep. Mean	Chamber Mean
	(1)	(2)	(3)	(4)
Gini*onyear	0.837**	−0.635**	0.202	2.333***
	(0.422)	(0.277)	(0.287)	(0.829)
Gini*offyear	0.094	−0.045	0.049	−0.181
	(0.266)	(0.163)	(0.170)	(0.258)
Control Variables?	Yes	Yes	Yes	Yes
Linear Trend?	Yes	Yes	Yes	Yes
First Stage 1 F	22.31	22.31	22.31	22.31
First Stage 2 F	30.28	30.28	30.28	30.28
Observations	822	822	822	822

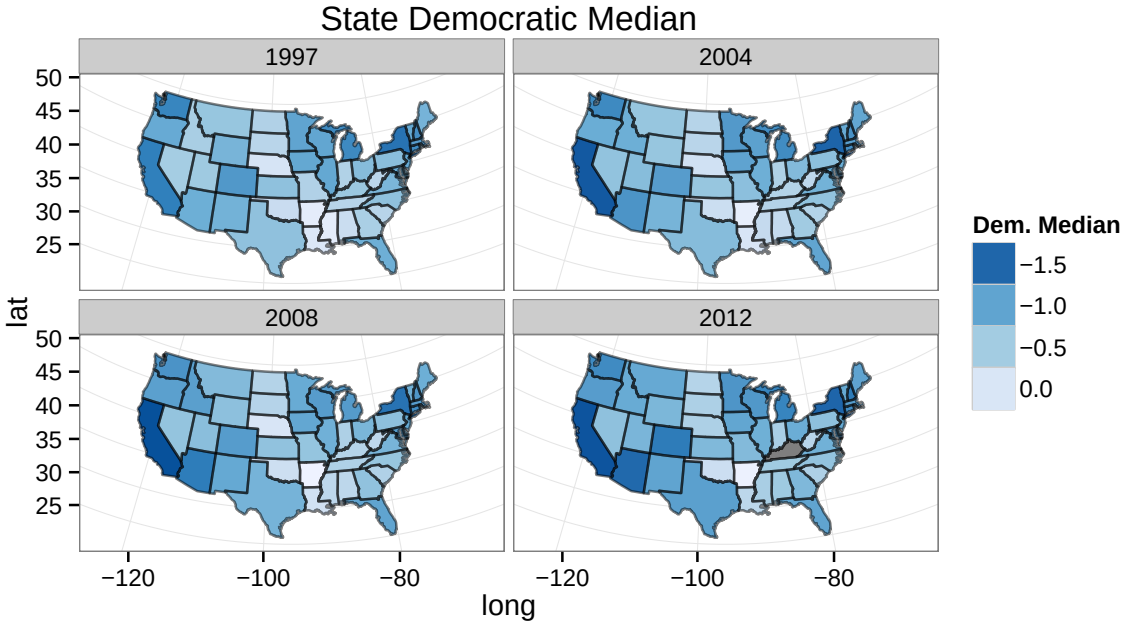
Note: *p<0.1; **p<0.05; ***p<0.01
Cluster Robust SE in parentheses

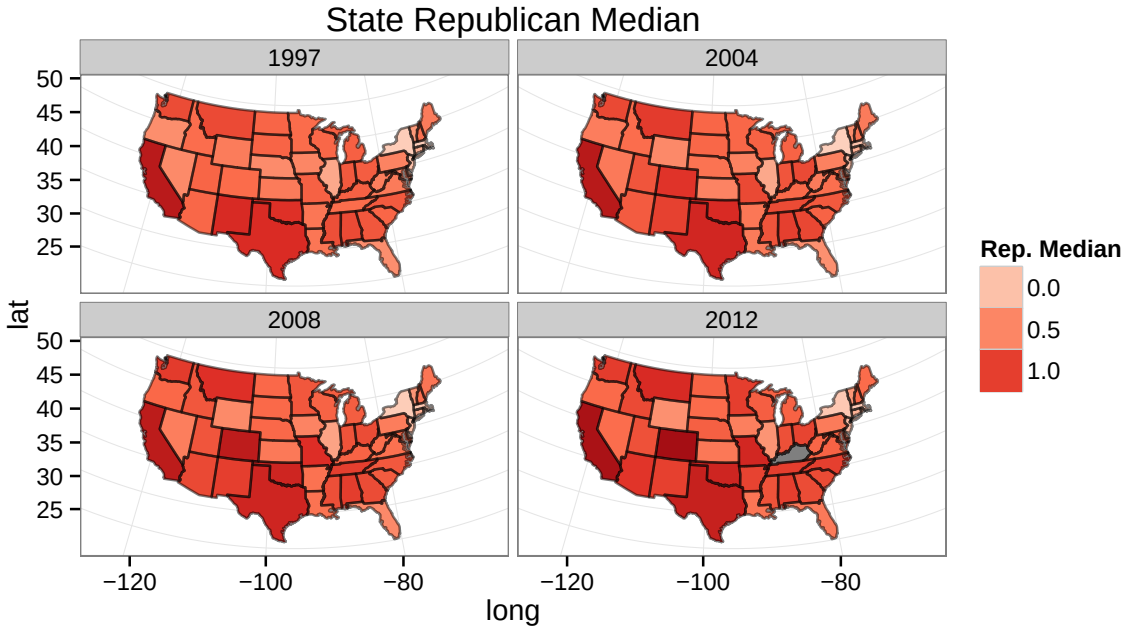
Figure A5: Sub-sample timewise heterogeneity, off-year effects

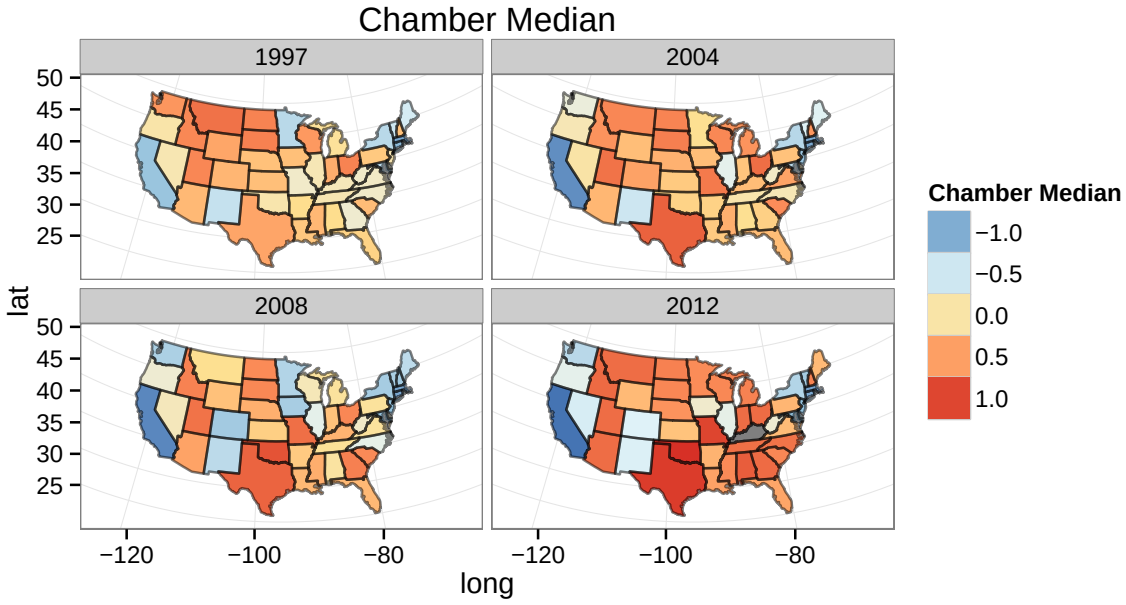


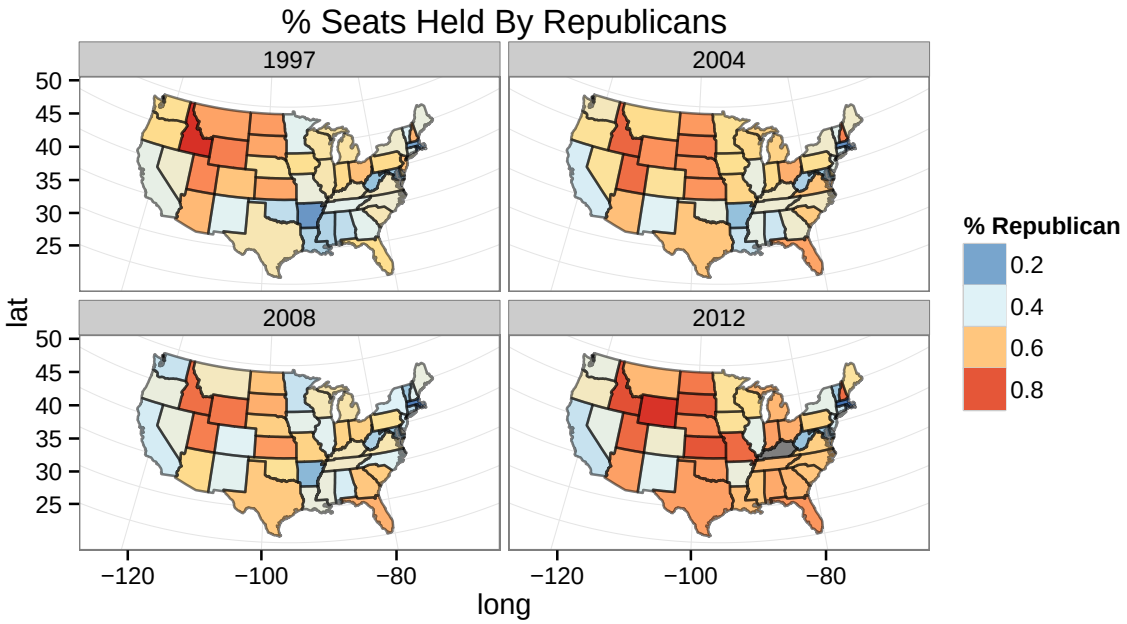
B Maps

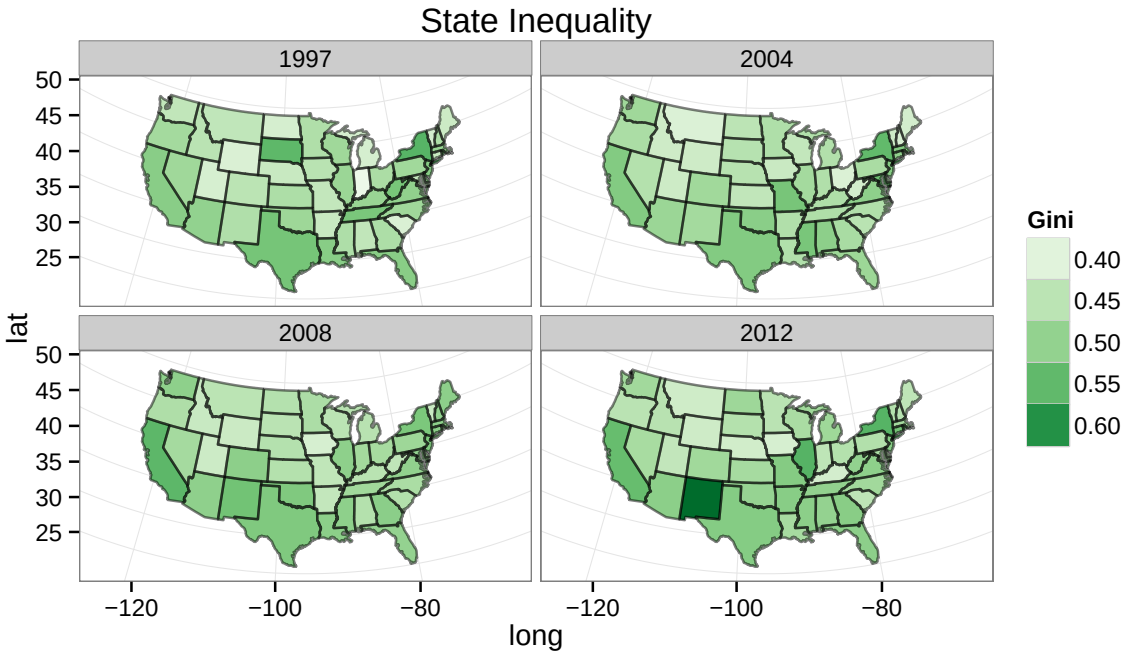

Average State Polarization
1997
2004
2008
2012
lat
long
50
45
40
35
30
25
−120
−100
−80
Polarization
0.5
1.0
1.5
2.0
2.5
3.0


State Democratic Median
1997
2004
2008
2012
lat
long
50
45
40
35
30
25
−120
−100
−80
Dem. Median
−1.5
−1.0
−0.5
0.0


State Republican Median
1997
2004
2008
2012
lat
long
50
45
40
35
30
25
−120
−100
−80
Rep. Median
0.0
0.5
1.0


Chamber Median
1997
2004
2008
2012
lat
long
50
45
40
35
30
25
−120
−100
−80
Chamber Median
−1.0
−0.5
0.0
0.5
1.0


% Seats Held By Republicans
1997
2004
2008
2012
lat
long
50
45
40
35
30
25
−120
−100
−80
% Republican
0.2
0.4
0.6
0.8


State Inequality
1997
2004
2008
2012
lat
long
50
45
40
35
30
25
−120
−100
−80
Gini
0.40
0.45
0.50
0.55
0.60