Congressional Politics and Redistribution

by

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(Under the direction of David B. Mustard and Robert Grafstein)

Abstract

This dissertation consists of three essays that examine congressional politics. In the first essay, I explore the implications of using models of direct democracy to examine questions of political economy in countries with represenative democracy systems. I find that there are two main factors that cause the policy outcomes of a representative democracy system to deviate from direct democracy outcomes: the distribution of preferences across the general population of voters, and second is the degree to which legislative districts are "gerrymandered". In the second essay, I examine the implications of the party cartel model of congressional policy making (Cox & McCubbins 2005) on the level of redistributional social welfare spending in the United States. I find that for each $1,000 increase in median district income for the median member of the majority party, each redistributional Budget Authority sub-function decreases by an average of $489 million (for a total decrease of $3.91 billion overall). In the third essay, I examine the implications of making existing single period game theoretic models of Congress dynamic. When the existing models are made dynamic and status quos are allowed to be inherited across time periods, different equilibrium predictions are made for each of the models, than those commonly attributed to them. The party cartel model begins to predict median outcomes and the pivotal politics model predicts outcomes that are significantly different from the location of the median member of the chamber. Overall, these three essays describe flaws in the current models of congressional policy-making and income redistribution and point toward possible solutions as well.

INDEX WORDS: economics, political science, congress, computational models, redistricting, gerrymandering, direct democracy, representative democracy, redistribution

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Dedication

This dissertation is dedicated to my wife and daughter. They both kept me grounded and sane throughout this entire process.

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Chapter 1

Introduction

This dissertation consists of three essays that examine congressional politics. Two of the three essays describe the implications of congressional politics for income redistribution. In the first essay (Chapter 2 in this dissertation), I investigate the implications of using models of direct democracy to examine questions of political economy in countries with represenative democracy systems. Representative democracy translates the preferences of the electorate into policy outcomes. Individual voters do not directly vote on policy; rather, their elected representatives create and establish policy. How well does representative democracy translate the preferences of the electorate into policy? Is there any systematic bias in a representative democracy system? I examine the policy implications of a representative democracy system itself absent these other effects. To explore this question, I have formulated a series of computational models that calculate policy outcomes of both a direct democracy and a representative democracy system. The results allow me to isolate any systematic deviation between the two systems. I find that there are two main factors that cause the policy outcomes of a representative democracy system to deviate from direct democracy outcomes. The first is the distribution of preferences across the general population of voters. The second is the degree to which legislative districts are "gerrymandered". When population preferences are normally distributed and there is little gerrymandering of districts, there is little difference between the policies predicted under representative democracy and direct democracy. However, when the preferences in the population are calibrated using the distribution of income in the U.S. and a moderate degree of gerrymandering is allowed, then the representative and direct democracy outcomes diverge substantially.

In the second essay (Chapter 3), I examine the implications of the party cartel model of congressional policy making on the level of redistributional social welfare spending in the United States. The party cartel model predicts an inverse relationship between the level of spending on social welfare programs and median family income of the district that the median member of the majority party represents. Specifically, the higher the median district income of the median member of the majority party, the smaller the amount of social welfare spending Congress will allocate. To test this hypothesis, I estimate a random coefficients model using time series cross sectional data on congressional Budget Authorization for redistributional social welfare spending. I find that for each $1,000 increase in median district income for the median member of the majority party, each redistributional Budget Authority sub-function decreases by an average of $489 million (for a total decrease of $3.91 billion overall). Therefore, the party cartel model appears to be a significant predictor of the level of income redistribution in the U.S.

In the third essay (Chapter 4), I examine the implications of making existing single period game theoretic models of Congress dynamic. Each of the two dominant congressional models achieves its equilibrium predictions for each policy at time t from a game that takes place in a single Congress. When the existing models are made dynamic and status quos are allowed to be inherited across time periods, different equilibrium predictions are made for each of the models, than those commonly attributed to them. The party cartel model (which is often characterized as predicting that outcomes will be at or near the median member of the majority party) begins to predict median outcomes. Conversely, the pivotal politics model (which is often characterized as being more majoritarian) predicts outcomes that are significantly different from the location of the median member of the chamber.

1.0.1 The New Instutionalism

This dissertation is a part of the larger literature within social science broadly classified as the “new institutionalism”. New institutionalism stresses that often the institutional rules under which decisions are made have a substantial impact on the policies that are implemented. Chapter 3 argues that the institutional rules of Congress have a substantial impact on the level of income redistribution in the U.S.. Models that neglect this institutional detail will miss an important part of the story when trying to uncover why the size of government has grown to the extent that it has in the United States, and yet, has not grown as quickly as those in western european countries.

Chapters 2 and 4 further stress that the method by which we model institutions can substantially affect our ability to understand the true impact of institutional rules. Traditional models of income redistribution assume that the median voter of the population's ideal point with respect to redistribution is translated into policy. This assumption neglects the fact that the actual institutions which set redistribution policy are the Congress and the president. As will be shown in Chapter 2 this assumption is not benign. When one incorporates a simple representative system, in which voters vote for representatives rather than policy, the possibility that the median member of the population's ideal level of redistribution will be translated into policy becomes a very special case relying on several restrictive assumptions about the method of drawing districts as well as the policy production process within the representative legislature.

Chapter 4 focuses in on two of the dominant models of congressional politics and the claims about the evolution of policy over time that are routinely made with them. The claim that under the party cartel model, policy will over time be pulled toward the ideal point of the median member of the majority party turns out to be false, unless one assumes that there is no institutional memory in the legislature. Similarly, the dynamic claims associated with the pivotal politics model also rely on the assumption that all status quos are possible at any given point in time.

1.0.2 The Need for Better Models

Taken together, in these three essays, I point out limitations of the current congressional policy making models. The findings here suggest that models of policy formation must take the institutional details of the policy formation process into account. Leaving out the fact that redistributional policy is set by a representative legislature turns out to bias the results of traditional models of income redistribution. Similarly, scholars often err when making claims about the dynamic evolution of policy with static game theoretic models. There is a need for fully dynamic models of congressional politics.

Chapter 2

Using Models of Direct Democracy for Cases of Representative Democracy.

2.1 Introduction

Representative democracy translates the preferences of the electorate into policy outcomes. Individual voters do not directly vote on policy; rather, their elected representatives create and establish policy. How well do the mechanisms of representative democracy translate the preferences of the electorate into policy? Is there any systematic bias in a representative democracy system? There are several lines of research that examine the degree to which various components of a representative democracy system might move policy outcomes away from those policies preferred by a majority of the population. Research on special interest groups examines how groups lobby to move policy toward their ideal points and away from the electorate's (Ainsworth 2002, Grossman & Helpman 2001). Another line of research examines how intra-legislative dynamics and the interplay between legislatures and executives may influence policy outcomes.[1] There is work in the congressional literature that emphasizes the role of parties in influencing policy outcomes (Cox & McCubbins 2005, Aldrich 1995). This chapter has a different focus. I examine the policy implications of a representative democracy system *itself* absent these other effects.[2] To explore this question, I have formulated a series of computational models that generate policy outcomes of both a direct democracy and

[1]See for example Weingast & Marshall (1988), Cox & McCubbins (2005) and Krehbiel (1998).

[2]It should be noted that there are possibly "distortions" in the direct democracy outcome itself. If the voting population is not a random sample of the entire populace, then the policy outcomes of direct democracy may not conform to the preferences of the median member of the population. For more on this, see Boix (2003) p.172-200.

a representative democracy system. The results show that it takes only a moderate level of gerrymandering (with respect to income) to generate representative democracy policy outcomes that deviate significantly from the direct democracy outcome.

The findings are important because a direct democracy model is often used as the model of policy formation in social science research. This modeling convention is common within the political economy literature, beginning with Romer's (1975) work on the political determination of the parameters of an income tax. Modeling representative democracy systems using direct democracy was firmly established in the literature with Meltzer & Richard's (1981) model of the "rational" size of government. The Meltzer and Richard model assumes a direct democracy median voter model of policy making. The further below the mean income that the median voter finds themselves, the more redistribution they prefer. The model assumes that the policy making system translates the preferences of the median voter into policy in an unbiased way. However, when one introduces some of the basic machinery of representative democracy, such as single member districts, the preferences of the median voter may not always be reflected in the policy outcome.

A brief example will help illustrate the phenomenon. Assume that the entire voting population consists of 9 voters with policy preferences with respect to the level of income redistribution on the line [0,100]. Their policy preferences are {25, 32, 33, 44, 49, 51, 56, 66, 67}. Suppose these voters are divided into three congressional districts. Table (A.1) shows assignment of the voters to three districts. The median of each of the districts is also displayed.

Each district elects a representative to the legislature whose policy preferences correspond to the ideal point of the median voter in that district. This mini-congress contains 3 members with ideal points at 33, 44 and 56. If the legislature uses a majority rule and open rule system, the policy outcome will be 44. Now compare this result to a typical model of direct democracy. Using a majority rule system, the policy outcome would be 51.[3] The magnitude of

[3]This also assumes single peaked preferences.

this difference and some of the conditions under which it occurs will be explored throughout this chapter.

The implications of this deviation can be best seen when examined in light of a substantive issue. Meltzer and Richards' "Rational Theory" of the size of government, the preferences of the voters, with respect to income redistribution, are derived from their relative position in the income distribution. The median voter in the income distribution has an income below the mean. Meltzer and Richard use a direct democracy model, and a majority rule decision rule is applied. The level of redistribution is set at the median voter's ideal point. As seen in the example, this does not always occur in a representative system; the median voter's ideal point does not always become the policy. Rather, the direct democracy median voter votes for a representative to represent his or her district (as do all the other voters). The direct democracy median voter may not even be the median voter within their own district (like the voter at 51 in the example). Further, the elected representative from this median voter's district may not be at the median of the legislature. If the policy outcomes from the representative democracy model differ substantially from the direct democracy approach, then models like Meltzer and Richards' may benefit from including more institutional detail. In the remainder of this chapter I seek to explore some of the conditions that can lead to the type of deviation seen in this example. What are the determinants of the deviation of the direct democracy and representative democracy policy outcomes? What institutional features and preference distributions would cause the direct democracy outcome and the representative democracy outcome to diverge? The computational results demonstrate that under certain stylized distributions of preferences and degrees of gerrymandering, the direct democracy and representative democracy outcomes diverge substantially. However, empirically it is difficult to find real deviations. This may be due to fact that the sufficient conditions for deviation found in the models are not present in the U.S.

Using the ideal point of the median member of the population as the prediction of a policy outcome was probably never intended to represent reality. Rather, it was used as a simplifying assumption. This assumption lends a great deal of parsimony to the models using it. However, it may be clouding their predictions. The Meltzer and Richards' model has been found to predict policy outcomes that differ substantially from those empirically observed (Holsey & Borcherding 1997, Gouveia & Masia 1998).[4] One source of the model's failure may be the assumption of a direct democracy policy formation rule.

The chapter proceeds as follows: first, I review previous work examining the deviation of representative democracy outcomes from direct democracy outcomes. Next, I provide more examples of research analyzing representative democracies that use a direct democracy model of policy formation. I then formally present two computational models based on stylized preference distributions (uniform and normal). After discussing the results of these models I present implications for a particular policy area, income redistribution. I then discuss a set of empirical results and present their implications for the findings of the computational models.

2.2 Literature

I will briefly review the existing literature that deals with the causes of divergence between the policy outcomes predicted by direct democracy and those observed in representative democracy. Additionally, I will discuss several papers that assume a direct democracy policy formation process while examining a representative democracy.

2.2.1 Causes of Divergence

Black's (1948) Median Voter Theorem[5] assumes that, under certain assumptions, electorally motivated candidates will represent the preferences of the median voter. When using the

[4]It should be noted that Meltzer and Richards' own empirical test of their theory finds evidence that supports their hypothesis (1983). Tullock (1983) claims that their empirical results are spurious.

[5]This theorem is often attributed to Downs (1957). Indeed the framework which gives rise to the theorem is often called the "Downsian" model. The theorem pre-dates Downs' work by almost a decade. It should also be noted that Black's model is simply the application of Hotelling's (1929) work on spatial location of firms.

theorem as a policy formation model, researchers are implicitly assuming that the direct democracy outcome and the representative democracy outcome are the same. This does not follow from the theorem. The same forces that drive outcomes toward the median in the voting population also drive representatives toward the median of their legislative districts and outcomes in a legislature toward the legislative median. There is no *a priori* reason to expect that the population median (direct democracy) and the legislative median (representative democracy) will be the same.

There are works that examine the deviation of legislative outcomes from the preferences of the electorate. Wittman (1977), Calvert (1985), and Alesina (1988) cite policy-oriented candidates as the source of such divergence. Erikson, MacKuen & Stimson (2002) argue that the policy-oriented goals of legislators is tempered by the public's "policy mood." Legislators must weigh their approximation of this "policy mood" against their own (often more extreme) preferences.[6]

Beasley and Cote's "citizen candidate model" (1997, 1998) takes a different approach to explaining the deviation of representative democracy outcomes from direct democracy outcomes.[7] Representatives are elected by the voting population as a whole, and for any number of "citizen candidates" greater than one, they find that the policy outcome deviates from a median (direct democracy) outcome. This deviation is not a central concern of their work. Their model also does not take into account any affect of the filtering of preferences through legislative districts.

2.2.2 The Use of Direct Democracy Models of Policy Formation

How prevalent are models dealing with representative democracies that assume a direct democracy policy formation process? Within the political economy literature they are quite

[6]Erikson, MacKuen and Stimson argue that "people who think about public controversies for a living are more likely to arrive at relatively extreme positions than is the amateur electorate."

[7]Beasley and Cote refer to this as the Downsian model. They are referring to a median voter model of the general population, which is equivalent to a direct democracy model of policy formation.

common. The aforementioned models by Romer (1975), Roberts (1977), and Meltzer & Richard (1981) were the first. In addition, the direct democracy model of policy making has been used to examine several other policy areas. Boadway & Wildasin (1989) use a direct democracy median voter model to analyze the determination of the level of social security. Perotti (1993) uses a median voter direct democracy policy making process in a two period non-overlapping generations model to examine the effects of redistribution on human capital investment. Mayer (1984) uses a direct democracy majority rule model to examine the formation of tariffs, with voters aligned along a single dimension according to their ownership of the factors of production.

2.3 The Computational Models

Instead of using a purely mathematical approach to solving this problem I have taken a computational approach. There is no reason that the models could not have been formulated using generalized proofs. However, rather than proving that there is one sufficient set of parameters that can generate a deviation between representative and direct democracy, I am able to explore the entire parameter space of the models. In this case there are three parameters that can vary across and within the models. I am able to examine every possible combination of these three parameters. Taking one (or two or three) parameter vectors and solving for the deviation of the representative and direct democracy outcome would suffer from the "curse of dimensionality".[8] The model would only be telling us something about the particular vectors of parameters chosen. There are 3 parameters in this model. The first has 3 possible values, the second has 435 possible values and the third has 50. This means that there are 65,250 possible versions of the model. Following the prescription put forth by de Marchi (2005) for overcoming the "curse of dimensionality", rather than picking one or a few of these vectors I compute them all.[9]

[8] This is a concept first put forth by Bellman (1961).

[9] Even with the powerful computers available today each model took over a week to run.

Each of the first two models represents the underlying distribution of voters in a different way (uniform and normal). In each model, a single dimensional policy space $X \in \Re^1$ on the interval [0,100] is assumed. The interval reflects the set of feasible alternatives. Each of the voters in the model v_i has an ideal point with symmetric[10] and single peaked utility. This implies that they prefer alternatives closer to their ideal point to alternatives further away. Voters are assumed to vote sincerely for their preferred alternative. In the Mayhewian tradition, I have assumed that the representatives are single minded seekers of re-election (Mayhew 1974) and have no policy preferences of their own. Representatives also vote for alternatives closest to their ideal point when choosing a policy.[11] There is no uncertainty for the voters or representatives in any of the models.

This set of assumptions may seem overly restrictive. In seeking to explain the divergence between the direct democracy and representative democracy outcomes due to the representational mechanism itself, it is necessary to rule out utility functions that are not well behaved as the source of the divergence. Allowing for utility functions that violate these assumptions would make it easier, not harder, to find divergence between the two systems. In addition, factors such as lobbying and other special interest pressure are not included in the models.[12]

The goal of this exercise is to determine the conditions under which the mechanics of a representative system will produce policy outcomes that differ from outcomes generated by a direct democracy system. There will be three parameters that vary across the models. The first parameter is the distribution of policy preferences among the population. The second is the process used to assign voters to legislative districts, and the last is the number of districts into which the population is divided.

[10] $U(x + l) = U(x - l) \ \forall l$.

[11] Allowing policy motivated candidates is possible; however, it would make it much easier to find divergence.

[12] The effect of these pressures on the deviation of the direct democracy and representative democracy outcomes is likely mixed. In some cases, these pressures may serve to bring the representative democracy outcome closer to the direct democracy outcome, and, in some cases, these pressures may exacerbate the difference.

2.3.1 Distribution of Preferences

Each of the models will use a different distribution of voter preferences. The uniform (Figure A.1a) and normal (Figure A.1b) distributions will serve as the baseline models. In the absence of any information about the true distribution of preferences, these distributions seem like reasonable choices. When I apply the models to income redistribution policy, I will use a more empirically informed distribution of preferences.

2.3.2 District Formation Process

In order to explore the degree to which gerrymandering may affect the deviation of the representative and direct democracy outcomes, a district formation process is constructed. In the baseline case, voters are assigned to districts randomly. However, Congressional districts are not drawn randomly, and their construction is subject to the political process. Political parties attempt to construct districts in order to maximize the representation of voters predisposed to vote for them (Cox & Katz 2002). Parties do this by creating legislative districts that have a solid majority of "their" voters and then filling the remainder of the district with other voters (Erikson 1972, Owen & Grofman 1988). To model the effect that gerrymandering has on the deviation of direct and representative democracy outcomes each of the three models is run over a continuum of district formation rules ranging from "no gerrymandering" to "extreme gerrymandering". In the "no gerrymandering" case, voters are assigned to legislative districts in a random manner. In the "extreme gerrymandering" case, the districts are built as to maximize the influence of one of the parties in the legislature. The direction of gerrymandering will benefit the liberal party (the one who prefers more redistribution).[13] The results from this continuum of district formation rules can give some insight into the effect of gerrymandering on policy outcomes.

[13] The normal and uniform distributions are symmetric, and therefore a version of the models with a conservative bias (less redistribution) is unnecessary.

2.3.3 Number of Legislative Districts

The number of legislative districts may affect how far the direct democracy outcome deviates from the representative democracy outcome. In order to explore the effect of the number of districts on the deviation of direct and representative democracy outcomes, each of the three models is run for all possible numbers of districts between 1 and 435.

2.3.4 The Model

1. A population of voters $\boldsymbol{v}$ is created.
2. The population of voters is then split into D districts using a gerrymandering algorithm (described in detail later).
3. The districts "elect" a representative using majority rule. $r_i = \text{median}(d_i)$ is elected as the representative.
4. The set of representatives is assembled into a legislature: $\boldsymbol{l} =< r_i ... r_D >$, and vote on the policy.
5. Using a "majority rule" voting rule, the representative democracy outcome is: $p_{rd} = \text{median}(\boldsymbol{l})$.
6. Steps 2-5 are run for 1,000 iterations, and the average policy outcome is found $\bar{p}_{rd}$
7. The direct democracy policy outcome is calculated as: $p_{dd} = \text{median}(\boldsymbol{v})$

The Gerrymandering Algorithm

Each of the models is run over a continuum of parameters for the degree of gerrymandering in the model. This is operationalized by designating 50%+1 of the districts as the "minimum winning coalition" for the legislature. For the "extreme gerrymandering" case, 51% of voters in each of the minimum winning coalition districts are partisans. The remainder of the voters in those districts are randomly assigned. In addition, the remainder of districts are constructed by randomly assigning voters. The degree of gerrymandering is determined by how many partisans are packed into the minimum winning coalition districts. The "no gerrymandering" case is simply random assignment of voters to these districts. In the other cases, the districts are rigged with increasing severity, in order to give one of the parties an advantage.

The annotated psuedocode for this algorithm is as follows (the actual code is presented in Appendix 1):

1. Determine how many districts constitute a minimum winning coalition in the legislature based on the current parameters of the model.

   C=roundedup(D/2)

2. Determine how many voters will be in each district given the current parameters of the model.

   S=N/D

3. Determine how many voters are needed to "control" a district.

   K=ceil(S/2)

4. The number of voters needed to control the minimum winning coalition in the legislature is the product of the two values found above.

   F=C*K

5. Now I create the districts. For each of the minimum winning coalition districts (C), I draw $g * K$ voters from the liberal side of the distribution of voters.

   (a) g here represents the degree of gerrymandering in the current model. For the "no gerrymandering" case, $g = 0$. In the next case after "no gerrymandering", $g = 1/100$, and in the next, $g = 2/100$ and so on. For the "extreme gerrymandering" case, $g = 50/100$, half of the voters in each of the minimum winning coalition districts are partisans.

6. The remainder of the voters in the minimum winning coalition districts are assigned by random draws from the distribution of voters.

7. The remainder of districts (the non minimum winning coalition districts) are created using random assignment.

An example of the gerrymandering algorithm appears in Figure (A.2).

In this example, there is a set of twelve voters who are allocated among three districts. Following the algorithm, the number of voters needed to execute a "perfect" gerrymander is found (K=4). In the no gerrymander case, the voters are all allocated randomly. In the moderate gerrymander scenario, for each of the minimum winning coalition districts, one ($g * K = 25/100 * 4 = 1$) of the voters in each district is purposefully selected from the K section of the distribution of voters. In the "perfect gerrymander" scenario, for each of the minimum winning coalition districts, two ($g * K = 50/100 * 4 = 2$) of the voters in each district is purposefully selected from K. For a given N and D the variable g in the gerrymandering algorithm dictates how many of the voters in a given minimum winning coalition district are from one of the extremes.

Uniform Model

The Uniform model uses a uniform distribution of voter preferences $\sim U[0, 100]$. The direct democracy model returns the median of the distribution of voters, which is 50. The results of the representative democracy model can be seen in figures (A.3a) and figure (A.3b).

In figure (A.3a) we can see that the policy predicted by the representative democracy model is greatly affected by the level of gerrymandering in the system. Figure (A.3b) graphs the differences between the direct democracy outcome of 50 and the representative democracy policy predictions.

To better illustrate the effect of gerrymandering and the number of districts and separately, several cross sections are taken from the graph above. First, the effect of gerrymandering is examined. The cross sections in figures (A.4a), (A.4b), (A.4c) and (A.4d), look at the effect of gerrymandering on the system for 25, 100, 200 and 435 districts respectively.

Each figure also includes a confidence interval based on the maximum and minimum values found for each instance of the model.[14] The results demonstrate that for all but the lowest levels of gerrymandering, the representative democracy generates a higher policy outcome than is generated by the direct democracy model.

To examine the effect of the number of districts, I take cross sections at three levels of gerrymandering. Figure (A.5) shows the effect in the presence of low ($g = 2$), medium (g=25) and high (g=50) levels of gerrymandering).

The number of districts seems to have little effect on the policy outcome for any of the levels of gerrymandering. As D becomes large the difference between d and d+1 becomes infinitesimally small. The median of the median moves very little for a sufficiently large D. The "jagged" nature of the graphs are due to the representative democracy outcome "jumping" as the legislature size switches from even to odd numbers (Dougherty & Edward 2007). The "jumping" becomes less pronounced as the number of districts increases.

The effects of gerrymandering and the number of districts on the representative democracy outcome are summarized in Table (A.2).

Going across the rows in the table it is clear that there is very little movement in the representative democracy policy outcome. The difference between the representative democracy and direct democracy outcome also changes little looking across a row. This reflects what was seen in Figure (A.5). Looking down the columns, a different pattern emerges. Taking the 435 district case, we see that for low levels of gerrymandering the representative democracy outcome begins close to the direct democracy outcome. However, for moderate levels of

[14]Recall that each permutation of the model was run 1000 times, and the value reported as the representative policy outcome is the mean of these 1000 iterations. The maximum and minimum values reported are the maximum and minimum values found in these 1000 iterations.

gerrymandering the policy moves a full 6 points (100 point scale) from the direct democracy outcome. For extreme levels of gerrymandering the policies diverge a full 10 points from the direct democracy case. These results correspond to the results seen in Figure (A.4).

Normal Model Results

The Normal model uses a normal distribution of voter preferences $\sim Normal(\mu = 50, \sigma^2 = 9.5)$. As with the Uniform model, the direct democracy model returns the median of the distribution of voters, which is 50. The overall results of the representative democracy model can be seen in Figure (A.6a) and Figure (A.6b).

In figure (A.6a) we can see that, as with the uniform model, the policy outcome is greatly affected by the level of gerrymandering in the system. The number of legislative districts again proves to have little impact on the outcome. The difference between the direct and representative democracy policy outcomes is graphed in Figure (A.6b).

Again, several cross sections of the three dimensional graph are presented to examine the effects of the number of districts and the degree of gerrymandering separately. The cross sections in figure(A.7) look at the effect of gerrymandering on the system for 25, 100, 200 and 435 districts.

As with the cross section from the Uniform model, each figure also includes a confidence interval based on the maximum and minimum values found for each instance of the model. Again, for all but the lowest levels of gerrymandering, we find that the representative democracy generates a higher policy outcome than is generated by the direct democracy model.

To examine the effect of the number of districts, I again take cross sections at three levels of gerrymandering. Figure (A.8) shows the effect in the presence of low, medium and high levels of gerrymandering.

The results of the Normal model are similar to those from the Uniform model. The number of districts seems to have little effect on the policy outcome for any of the levels of gerrymandering. The effects of gerrymandering and the number of districts on the representative democracy outcome are summarized in Table (A.3).

Looking down the columns, the effect of gerrymandering is seen, although the results are less pronounced than in the Uniform model. For the 435 district case at low levels of gerrymandering, the representative democracy outcome is close to the direct democracy outcome (a difference of .1). For moderate levels of gerrymandering, the policy moves one point from the direct democracy outcome. Lastly, for extreme levels of gerrymandering, the policies diverge about 2.5 points from the direct democracy case. These results correspond to the results seen in Figure (A.7). Going across the rows in the table, it is clear that, just as in the uniform case, the number of districts has little effect on the representative democracy policy outcome. This reflects what was seen in Figure (A.8).

2.4 Income Redistribution

The above results are general and a bit abstract. What would the results look like if the models are used to look at a particular policy area? As previously discussed many formal models of redistribution use a median voter direct democracy framework. This policy area seems like a good choice for applying the model. All of the assumptions of the previous two models remain, save one. In this version of the model, empirical data is used to calibrate the distribution of preferences. Many models of redistribution that use a direct democracy policy formation process assume that voters' policy preferences are determined by their location in the income distribution.[15] If this assumption is retained, then a more empirically informed distribution of preferences is possible. To this end, I construct a distribution of preferences calibrated from the U.S. income distribution. Data on the U.S. income distribution was obtained from the U.S. Census Bureau's Current Population Survey for 2006.[16] In keeping with the literature (specifically the Meltzer and Richard framework), voters with

[15]Among these are the aforementioned Meltzer and Richard model.
[16]Table HINC-06

more income prefer less redistribution, and voters with less income prefer more redistribution. The resulting distribution of preferences can be seen in Figure (A.9).

The gerrymandering algorithm remains the same; however, this distribution of preferences is not symmetric. As such, the effect of a conservative party (less redistribution) controlled gerrymandering algorithm will not be the mirror image of a process controlled by the liberal party (more redistribution). In order to take this into account, the gerrymandering algorithm is run both ways. First, the liberal party controls the creation of the districts (this is the analog of the gerrymandering used in the previous two models). Then the model is run with the conservative party controlling the process.

Liberal Gerrymander Results

The direct democracy model predicts a policy outcome of 83.47. The predictions of the representative democracy models can be seen in Figure (A.10a) and Figure (A.10b).

In figure (A.10a) we can see that, as with the previous models, the policy outcome is greatly affected by the level of gerrymandering in the system. The number of legislative districts again has very little impact on the outcome. The difference between the direct and representative democracy policy outcomes is graphed in Figure (A.10b).

Cross sections of the three dimensional graph are again presented to examine the effects of the number of districts and the degree of gerrymandering separately. The cross sections in figure(A.11) look at the effect of gerrymandering on the system for 25, 100, 200 and 435 districts.

As with the previous cross sections, each figure also includes a confidence interval based on the maximum and minimum values found for each instance of the model. For all but the lowest levels of gerrymandering, we find that the representative democracy generates more redistribution than is generated by the direct democracy model.

To examine the effect of the number of districts, I again take cross sections at three levels of gerrymandering. Figure (A.12) shows the effect in the presence of low, medium and high levels of gerrymandering.

The number of districts seems to have no effect on the policy outcome for any of the levels of gerrymandering. A more detailed look at the effects of gerrymandering and the number of districts on the representative democracy outcome is presented in Table (A.4).

Looking down the columns, the effect of gerrymandering is seen. For the 435 district case at low levels of gerrymandering, the representative democracy outcome is already a full point higher than the direct democracy outcome. For moderate levels of gerrymandering, the representative policy is 4 points higher from the direct democracy outcome. Lastly, for extreme levels of gerrymandering, the policies diverge about 5.5 points. These results correspond to the results seen in Figure (A.11). Going across the rows in the table, it is clear that, just as in all the previous cases, the number of districts has little effect on the representative democracy policy outcome. This reflects what was seen in Figure (A.12).

Conservative Gerrymander Results

The direct democracy model policy outcome remains the same as in the liberal gerrymandering case,83.47. The predictions of the representative democracy models can be seen in Figure (A.13a) and Figure (A.13b).

In figure (A.13a) we can see that, as with the previous models, the policy outcome is greatly affected by the level of gerrymandering in the system. However, this time the gerrymandering leads to less redistribution than the direct democracy model predicts. The number of legislative districts again has very little impact on the outcome. The difference between the direct and representative democracy policy outcomes is shown in Figure (A.13b).

Cross sections of the three dimensional graph are presented to examine the effects of the degree of gerrymandering[17]. The cross sections in figure(A.14) look at the effect of gerrymandering on the system for 25, 100, 200 and 435 districts.

Each figure includes a confidence interval based on the maximum and minimum values found for each instance of the model. For all but the lowest levels of gerrymandering, we find that the representative democracy generates a lower level of redistribution than is generated by the direct democracy model. A more detailed look at the effects of gerrymandering and the number of districts on the representative democracy outcome is presented in Table (A.5).

For the 435 district case at low levels of gerrymandering, the representative democracy outcome is identical to the direct democracy outcome. For moderate levels of gerrymandering the representative policy is 2.2 points lower (less redistribution) from the direct democracy outcome. Lastly, for extreme levels of gerrymandering, the policies diverge about -5 points. These results correspond to the results seen in Figure (A.14). Going across the rows in the table, it is clear that, just as in all the previous cases, the number of districts has little effect on the representative democracy policy outcome.

2.5 Empirical Implications

The results of these computational models are in and of themselves interesting for social choice reasons. Changing the preference aggregation mechanism from one of direct democracy majority rule to representative democracy majority rule has the potential to significantly change the policy chosen. What are some of the empirical implications of these models? How likely are we to see the conditions that led to the policy deviation found in the models? Direct democracy models are often used as the model of policy formation in social science research. If the conditions for policy deviation are found empirically, then models like Meltzer and Richards' would benefit from including aspects of the representative democracy system in

[17]The district effect cross sections are omitted here, as they are similar to all the others in the chapter. The Table (A.5) still reports the values for the district effect

their models. In order to approach this question empirically, I will adopt a similar framework as Meltzer and Richard. I will make the assumption that a voter derives his or her preferences about income redistribution from his or her position in the income distribution. I will explore three different empirical implications of the computational models. The first will be to examine Congressional districts and see what the level of "gerrymandering" is within them with respect to income. Secondly, I will look at the impact of the number of districts on the deviation by looking at state legislatures. Lastly, I will compare the national median income in the population as a whole with the median income of the median Congressional district within the U.S. House of Representatives.

2.5.1 "Gerrymandering"

All three of the models demonstrate that the level of gerrymandering in a system can affect the degree to which the direct democracy and representative democracy outcomes deviate from one another. What level of "gerrymandering"[18] do we see with respect to income in U.S. congressional districts? In order to examine this, I look at the overall percentage of congressional districts that are primarily made up of voters drawn from one side of the income distribution (both high and low).[19] For the 108th Congress, 225 of 435 congressional districts have a majority of voters who's income falls below the national median family income). This of course implies that 210 of 435 districts have over half of their voters falling above or equal to the median family income. Figure (A.15a) shows the districts by the proportion of voters which fall below the national median income. There are enough districts that have half their voters coming from the lower half of the income distribution to form a minimum winning coalition in Congress.

[18]It is not necessary for Congressional districts to have been intentionally drawn with respect to income. However, income is often correlated with other factors that parties do use when gerrymandering. Additionally, Tiebout sorting could lead to districts that appear to be gerrymandered (Kollman, Miller & Page 1997).

[19]U.S. Census tract level data on Family Income for the district boundaries for the 108th Congress are used.

Another way to think about the degree to which congressional districts are gerrymandered with respect to income is to examine the variance (standard deviation) of income within each district. Figure (A.15b) shows the districts by the standard deviation of income within each one.[20] The standard deviation of income within districts is on average \$16,047.01. This is quite high considering that the median national family income for this time period is \$50,046. This is evidence that many districts may be "gerrymandered" with respect to income.

2.5.2 "Number of Districts"

The number of legislative districts does appear to have a small effect on the deviation of the representative and direct democracy outcomes in each of the models. In order to test the empirical implication of this model, a data set of state legislatures was assembled. The data is at the state legislative district level and is compiled from the U.S. census bureau.[21] The following ordinary least squares regression was run.

$$Difference = \beta_0 + \beta_1 Districts + \epsilon \tag{2.1}$$

Here *Difference* is the difference between a state's median family income and the median income in the median legislative district. The state's median family income is a proxy for the preferences of the voter who would obtain their ideal point under direct democracy. The median family income of the state's median legislative district is a proxy for the voter who would obtain their ideal point under representative democracy. The *Districts* is the number of legislative districts that a state legislative chamber has. In Table (A.6), the results are presented for three specifications of this model. The first is a basic bivariate OLS; the second uses a Huber-White Heteroskedastic Robust Covariance Matrix to calculate the standard errors; and lastly the model is run with state level dummy variables to control for any unobserved heterogeneity that may be present in a state's districting process that may be correlated with both *Districts* and *Difference*.

[20]Census tract level data for 108th Congress.

[21]Data is from the 2000 Census using current state legislative boundaries and 1999 dollars.

2.5.3 Median of the Medians

Another empirical test of the implications of the computational models would be to simply compare the national median family income and the median family income of the median congressional district. National median family income serves as a proxy for the preferences of the median voter, whose ideal point would become policy under direct democracy. Median family income of the median congressional district serves as a proxy for the preferences of the median Congressman, whose ideal point would become policy under a representative democracy. In table A.7, the national median family income and the median family income of the median congressional district are reported. There seems to be little difference in these values for most of the years examined. If these proxies are indeed good measures of voters' preferences for redistribution (as Meltzer and Richard assume), then the level of redistribution under our representative system does not deviate from the level that would be seen under direct democracy.

2.6 Discussion

The focus of this essay was exploring some of the conditions under which the policy outcome from a representative democracy system would deviate from that of a direct democracy system, owing to the system itself. After formulating a series of computational models it appears that the degree to which legislative districts are gerrymandered with respect to preferences about the policy is a major determinant of policy deviation. Household income was used as a proxy for voter's preferences with respect to redistribution. The most interesting finding is that even when the majority of voters are in favor of redistribution, if districts are constructed with a sufficient level of conservative gerrymandering, the policy outcome under representative democracy will favor far less redistribution than the policy outcome under direct democracy.

When using income as a proxy for voter's preferences for redistribution, there is some empirical evidence that a sufficient level of "gerrymandering" may be present to cause policy divergence. There also appears to be some empirical support for the weak effect that the number of districts has on policy divergence. When looking at the U.S. overall, the median congressional district has a median family income that is not significantly different from the median family income for the country as a whole. If the models here are correct this suggest that in the U.S. there is not a sufficient level of gerrymandering with respect to income.

2.7 Future Research

This chapter has assumed that the pivotal actor in the legislature is the median member and that policy is set at this member's ideal point. For the U.S. case, there are a number of models of policy making that contain more institutional detail. The distributive/committee model (Shepsle & Weingast 1987) (Weingast & Marshall 1988) holds that the median of the "relevant" committee is the member. The partisan model (Cox & McCubbins 2005) (Aldrich & Rohde 2000) assumes that it is the median of the majority party who is the important actor in Congress. Lastly the informational model (1996, 1998) model finds members at the 3/5ths and 2/3rds members in the legislature to be pivotal. It is unclear at the outset if this intuitional detail will cause more or less deviation of the representative and direct democracy outcomes. If, for example, the median of the majority party is closer to the median of the electorate as a whole than is the median of the chamber then deviation of the representative democracy outcome will not be as great. On the other hand, if the median of the majority party is even further form the median of the electorate than is the chamber median then the deviation will be even greater.

Chapter 3

A Congressional Theory of the Size of Government

3.1 Introduction

For this project, I combine the party cartel theory of congressional policy making (Cox & McCubbins 2005) with Meltzer and Richard's (1981) theory of income redistribution. I use a congressional district's median income as a proxy for a member of Congress' ideal point with respect to income redistribution, and I use redistributional categories of Federal Budget Authority as a measure of income redistribution. I find that for every $1,000 increase in median district family income for the median member of the majority party, the level of income redistribution falls by $489 million.

This is the first research to directly examine the effect of the institutional rules of Congress on income redistribution. The traditional Meltzer and Richard model assumes a direct democracy median voter model of policy making. In creating such a parsimonious model, Meltzer and Richard may be making two errors. The first error is in their assumption of direct democracy. Voters do not vote directly on policy in the U.S. Instead, they vote for a representative who then votes on policy. Even if it is assumed that the representative from each congressional district represents the median voter from that district, and the median member of the legislature sets policy, there is no reason to believe that the policy that would be chosen by the median voter in the population will correspond to the policy enacted by the median member of the legislature. It is not always the case that the median of the median will be the median. In chapter 2, I find that the degree to which congressional districts are gerrymandered with respect to income can cause the policy preferred by the median voter and the policy preferred by the median member of Congress to diverge (Ragan 2008).

The second area of concern with the Meltzer and Richard model is that most modern models of the U.S. congressional system do not simply assume the median member of Congress sees their ideal point become policy. Once one takes into account the institutional structure of Congress, the level of redistribution can depend crucially on intra-chamber and intra-branch dynamics. In order to incorporate these institutional features, I extend the Meltzer and Richard approach to modeling the "size of government." In place of the direct democracy median voter as the policy maker, I substitute the party cartel model of congressional policy making.

The results may give us some insight into two puzzles in the political economy literature. The first is, "What accounts for the growth in the size of government in the United States?" Social welfare spending has risen from 4% of gross domestic product (GDP) in 1929 to 21% in 2002[1]. Researchers who have empirically tested Meltzer and Richard's model have found mixed results. In Meltzer and Richard's own test of their theory (Meltzer & Richard 1983), they find that a one percent change in the ratio of mean to median income changes total redistribution[2] by 1.5 billion dollars. Gouveia & Masia (1998) tested an extended version of the Meltzer and Richard model using panel data from the 50 states, and they find that there is little evidence to support the predictions of the Meltzer and Richard model.[3] The second puzzle is,"Why do we see different patterns of redistribution in the U.S. versus other Western Democracies?." At a more practical level, this research may help us determine whether a common modeling simplification in political economy is really an oversimplification.

[1] "Social Security Bulletin, Annual Statistical Supplement" (1981, 2002) "Represents program and administrative expenditures from federal, state and local public revenues and trust funds under public law. Includes workers compensation and temporary disability insurance payments made through private carriers and self-insurers. Includes capital outlay and some expenditures abroad".

[2] Redistribution is Meltzer and Richard's measure of the size of government.

[3] See Benabou (1996) for a review of articles which test the Meltzer and Richard model.

3.2 Literature Review

I draw upon two distinct literatures for this chapter. The first is the political economy literature dealing with the "size of government." The second is the congressional politics literature examining the influence of political parties on policy outcomes.

3.2.1 Rational Size of Government

The "size of government" literature is primarily concerned with explaining the growth in the size of federal spending. Researchers in this area typically investigate the growth of social welfare programs that redistribute income. These models contain a "Robin Hood" story of the poor using the ballot to take resources from the rich. The Meltzer and Richard "Rational Size" model uses a stylized model of policy formation in order to generate the level of redistribution in their theory. Their model uses a direct democracy framework in which voters express their preferences for redistribution directly by voting rather than through their vote for a representative. Voters' preferences for redistribution are determined by their location in the income distribution. Voters who find themselves below the mean income prefer higher taxes and transfers to their end of the distribution. Conversely, voters who are above the mean income prefer lower taxes and transfers from their end of the distribution.[4] Income distributions are skewed to the right, and accordingly the median voter's income is below the mean income. Meltzer and Richard use a straightforward application of Black's median voter theorem (1948) and claim that we should expect to see relatively high levels of redistribution. This incentive to "soak the rich" is only tempered by the realization of the median voter that upper distribution voters will work less if taxes become too high, thereby reducing transfers. The prediction of the Meltzer and Richard model is that *the greater the distance between the median and mean income, the greater the amount of redistribution.* The Meltzer and Richard model is still used in many models of income redistribution. For a

[4] Meltzer and Richard assume that "Any voting rule that concentrates votes below the mean provides an incentive for redistribution of income financed by (net) taxes on incomes that are (relatively) high".

survey of more current work on redistribution that uses similar policy models, see Persson & Tabellini (2000, ch. 6). There is a missing piece in this "Size of Government" puzzle, and it is that the process by which the preferences of voters become law is subject to highly partisan influences. The recent $819 billion "American Recovery and Reinvestment Act of 2009" passed the House without a single Republican voting in favor. The appropriations and budgeting process has become increasingly partisan, with many bills passing on party line votes (Schick & LoStracco 2000). The "size of government" literature black boxes the political process; however, in this chapter, I seek to substitute a model of congressional politics for this black box.

3.2.2 Congressional Models and Policy Outcomes

Most researchers examining the implications of congressional policy models are primarily interested in comparing the predictive power of the several competing models of congressional politics. Aldrich (1995), Aldrich & Rohde. (1998), Groseclose, Levitt & Snyder Jr (1999), Krehbiel (1998), Binder (1999), Brady & Volden (2005) and Cox & McCubbins (2005) all use various tests of some of the more indirect implications of models of congressional politics. There are, as of yet, only two papers that directly test the implications of models of congressional politics on actual policy outcomes. Aldrich, Gomez & Merolla (2005) examine the predicted effect of each of the major models of congressional policy making on the appropriations process. They find (using the conditional party government model (Aldrich & Rohde 2000)) that the location of the median member of the majority party has a substantial impact on federal appropriations and that party influence alone accounts for $1.3 trillion in federal appropriations from 1969 to 1994. Anderson (2008) examines the effect of congressional politics on federal budget categories. She finds that none of the models of congressional politics can empirically demonstrate a link between members' ideal points and policy outcomes.

3.3 Theory

In this chapter, I replace the median voter of the population as the de facto policy setter in the Meltzer and Richard model with the median member of the majority party in Congress, based on the party cartel model of congressional policy making (Cox & McCubbins 1993, Cox & McCubbins 2005). This theory includes the importance of agenda setting in congressional policy making. For a bill to reach the floor of the House, a majority of the majority party must allow it on the agenda. This means that the median member of the majority must consent, if a bill is to be considered by the entire House. The median member is able to exert "negative agenda control." That is, he or she blocks any legislation from consideration by the floor that would make the majority party worse off if passed.

The party cartel model is single dimensional, and assumes that each policy is considered one issue at a time.[5] The theory assumes that all bills that the median member of the majority party allows to reach the floor of the House will be considered under an open rule.[6] As such, all bills that reach the floor are amended to the ideal point of the median member of the house (F) and subsequently pass. Given this, the majority party must decide whether they prefer the status quo or the ideal point of the median member (F). In the party cartel model, the preference of the majority party is represented by the location of the median member of the majority party (M). There is a region of the policy space called the "blockout zone." If the status quo policy for a particular issue falls within this region, then the majority party will block all legislation on that issue. The blockout zone consists of all alternatives falling between M and 2M-F.[7] Figure C.3a illustrates the blockout zone when M is to the right of F and Figure C.3b illustrates the blockout zone when M is to the left of F.

Cartel theory predicts that, (1) no issue on which the status quo is preferred to the floor median by the median of the majority party will be scheduled for a vote, and (2) no bill

[5] p.38 of Cox & McCubbins (2005)

[6] Under an open rule, the bill can be amended.

[7] The notation here follows Cox & McCubbins (2005). Since the extremes of the policy space are not defined, a more precise expression of the blockout zone would be $M \pm |M - F|$.

opposed by a majority of the majority party's members ever passes. Hence, the median of the majority party must vote "yea" for a bill to pass.[8] Clearly, the location of the median member of the majority party (M) is an important determinant of policy outcomes. I will retain the assumption from Meltzer and Richard's model that individuals vote based on their position in the income distribution. Further, I will assume that members of Congress reflect the preferences of the median voter in their district. These two assumptions are not all that far fetched. As it turns out, the income of the median voter in a district is a strong predictor of how a member votes on roll call votes (McCarty, Poole & Rosenthal 2006).

Given these assumptions, what does the party cartel theory predict regarding income redistribution? Unfortunately, as of yet there is no reliable way to map status quos and legislator ideal points into the same policy space.[9] Given this limitation, the location of the median member of the majority party is used as a proxy for the location of policy outcomes (Aldrich, Gomez & Merolla 2005, Anderson 2008). Given this proxy, I put forth the following hypothesis: *The higher the median district income of the median member of the majority party, the lower the level of income redistribution in the U.S.*

3.4 Empirical Tests

The data set consists of yearly data from 1953 to 1998 (t) for eight Budget Authority categories (i). Picking an empirical specification for this sort of time-series cross-sectional data requires careful consideration. With longitudinal data where i is much larger than t, researchers typically use one of several well understood estimators like fixed effects, random effects or Arellano-Bond (1991). All of these techniques get their asymptotic properties (consistency) from their large cross section. Here, however, the cross sections are short (i=8) and the time series are longer but not very long (t=45). The cross-sections are far too short for any probability limits to be met, so these estimators could produce inconsistent estimates for

[8]For proofs of these two predictions, see p.42 of Cox & McCubbins (2005).

[9]Peress (2008) includes a summary of why this problem is so technically difficult, as well as a proposed solution.

this data set. Traditionally, researchers used a "feasible generalized least squares" know as the the Swamy-Hsiao method (Swamy 1968) (Hsiao 2003). Beck & Katz (2004, 2007, 2008) find that the Swamy-Hsiao method has poor small sample properties, and they recommend the use of a random coefficient model (RCM) (Western 1998, Pinheiro & Bates 2000, Hsiao 2003) for time-series-cross-sectional data where the time dimension (t) is significantly larger than the cross sectional dimension (i).

The random coefficient model works well for situations in which each category of the cross-section is not identical, yet is not entirely unique. Using an estimator like ordinary least squares (OLS) individually on each category would likely lead to a consistent but inefficient estimate. Conversely, a fully pooled ordinary least squares regression would not be consistent but would be efficient.[10] The random coefficient model blends these two estimators using a weighted average. The technique shrinks back the estimates that would be found in a category by category OLS estimation toward the estimates that would be found in a fully pooled OLS estimation. The degree of the shrinkage is based on the amount of uncertainty in the estimates the random coefficient model makes. The more uncertain the estimates are, the more the random coefficient model shrinks the category-by-category (consistent, but inefficient) estimates back to the pooled (inconsistent but more efficient) estimates. This shrinking allows the RCM to find the best linear unbiased predictor for the data. Thus, in the class of $E(\beta_i) = \beta$ predictors, it has the lowest error loss. If the partial effects of the variables are different for each category of budget authority but not completely unrelated, then RCM will be an improvement (it will have lower RMSE) over category-by-category estimation or fully pooled models (Beck & Katz 2007). RCM will not find unit heterogeneity across the Budget Authority categories if it does not exist, and there is no danger in accidentally using it if heterogeneity is not present. The random coefficient model allows the data to tell us how heterogeneous the budget authority categories are rather than assuming it ex-ante. This heterogeneity is estimated as Γ in equation (3.1) and is a variance-covariance matrix

[10]The "fixed-effects" estimator is simply pooled ordinary least squares with a dummy variable for each cross-sectional category

between the βs from a category-by-category OLS estimation. It is estimated from the set of all positive definite matrices. RCM can also be thought of as a linear model like OLS, but with a complicated error term (See appendix B.1).

Using a time series (1953-1998) of several categories of redistributional Budget Authority data and median district income as a proxy for members' preference for redistribution, the following random coefficient model was estimated:

$$\begin{aligned} \text{Budget}_{i,t} &= \beta_{0,i} + \beta_{1,i}\text{Median of Majority}_{i,t} + \beta_{2,i}\text{Population}_{i,t} + \beta_{3,i}\text{Poverty}_{i,t} \\ &\quad + \beta_{4,i}\text{Mandatory}_{i,t} + \beta_{5,i}\text{GDP}_{i,t} + \beta_{6,i}\text{Budget}_{i,t-1} + \epsilon_{i,t} \\ &\quad \text{Where: } \boldsymbol{\beta}_i \sim N(\boldsymbol{\beta}, \Gamma) \\ &\quad i = 1, ..., 8 \text{ and } t = 1, ..., 45 \end{aligned} \tag{3.1}$$

The dependent variable is the *level of income redistribution.* This is measured using federal Budget Authority data for eight Office of Budget and Management sub-functions. Budget Authority is the legal authority for Federal Agencies to make obligations that result in outlays. Three of the sub-functions – Unemployment Compensation[11], Food and Nutrition Assistance[12], and Other Income Security[13]– are mandatory spending categories. The level of spending for these sub-functions is governed by program law rather than the annual appropriations process. Changes in these programs generally redirect the slope of the trajectory of spending. The remaining five categories –Community Development[14], Regional Development[15], Training and Employment[16], Social Services[17] and Housing Assistance[18] – are all discretionary sub-functions. The level of spending in these categories is governed by

[11]Federal unemployment insurance.

[12]Food Stamps, WIC, and milk programs.

[13]Cash assistance, Social Security Insurance, Aid to Families with Dependent Children/Temporary Assistance to Needy Families and Earned Income Tax Credit.

[14]Housing and Urban Development, slum clearance, and urban redevelopment.

[15]Farmers Home Administration, Rural and depressed area development.

[16]Job training and employment and dislocated worker training grants.

[17]Block grants for social services and rehabilitation services.

[18]Subsidized housing, public housing and rental assistance.

the annual congressional appropriations process. Spending across these eight categories in a given year serves as the cross-sectional dimension of observation.[19] Figures B.3 and B.4 display the levels of spending for each of the Budget Authority Categories.

The main independent variable is the *median district income of the median member of the majority party*.[20] This variable for each member of Congress is measured using the median family income of the member's Congressional district.[21] In the Meltzer and Richard framework, the poorer voters are, the more redistribution they want. My proxy takes this assumption and adds that members of Congress vote on redistribution policy in line with their district's preference. McCarty, Poole & Rosenthal (2006) find that in terms of 1st dimension DW-NOMINATE scores[22], "An increase in family income of two standard deviations is associated with a .225 shift to the right, larger than the shift associated with reducing the percentage of African Americans by the same two standard deviations." A district's median family income is strongly correlated with the way in which a member votes. It follows that members' votes for redistribution would likely be highly correlated with district median family income. For years in which the Democrats held a majority in Congress, the median member of the majority party is the median Democrat in the chamber, and vice versa for years in which the Republicans held a majority in the House. In Figure B.5, the median family income for the median republican district is plotted with a red dotted line, and the median Democrat district family income is plotted with a blue line. The solid black line indicates the median family income of the median district of the majority party. For all years in the data set, the median Republican district is consistently richer than the median

[19] All Budget Authority Data compiled by True (2007) from Office of Budget and Management Data.

[20] Another empirical specification using the size and location of the blockout zone is presented in the Appendix.

[21] Income data comes from Census data compiled by (Adler 2003), and directly from the Census Bureau.

[22] DW-NOMINATE is an ideal point estimation technique that assigns members of Congress a two-dimensional ideal point based on their voting record. The first dimension score ranges from -1 to +1 and is largely thought to represent liberal (-1) to conservative (+1) preferences on economic matters (Poole & Rosenthall 1997). For more information on NOMINATE see www.voteview.com.

Democratic district. The average difference between the median of the Republicans and the median of the Democrats ranges from $1,157 to $3,601, and the mean is $2,198.

The first control variable is the *population of the United States.* As the population grows, the number of dollars allocated to income redistribution will rise. Second, the *poverty rate of the United States* is included.[23] As the poverty rate rises, the amount of income redistribution in mandatory redistribution will rise.[24] There may also be heightened pressure to increase Budget Authority for discretionary redistribution. A dummy variable is included for the *mandatory Budget Authority* categories. As mentioned before, the levels of Budget Authority in these categories are not directly set; rather, Congress sets the formula to determine who is eligible for the program. The *Gross Domestic Product* of the U.S. is included to control for the overall size of the economy. Finally, a lag of the dependent variable is included to control for serial correlation in Budget Authority across years.

3.4.1 Results

Recall that my main hypothesis is: *The higher the median district income of the median member of the majority party, the lower the level of income redistribution in the U.S.* This hypothesis was tested using the random coefficient model estimation from equation (3.1), and results are presented in Table B.1.[25] I find that for each $1,000 increase in the median district income of the median member of the majority party, the level of income redistribution falls by an average of $489 million for each Budget Authority category. This translates into a $3.91 billion overall decrease in total redistributional Budget Authority. A hypothetical

[23] The poverty rate comes from the Census Bureau.

[24] Another empirical specification using the unemployment rate (from the Bureau of Labor Statistics) rather than the poverty rate is presented in the Appendix.

[25] The sub-function by sub-function results are displayed in Table (B.4) in the Appendix. The results of this estimation are consistent but inefficient. Looking across the sub-function categories, the estimated partial effect of the location of the median member of the majority party has a similar magnitude and sign as the effect found in the random coefficient model for the sub-functions relating to food, income support, regional development, and job training. For unemployment, social services, and housing, the effect is of the same sign (negative), but the effect is much larger than the estimate from the random coefficient model. The effect on community development is actually of the opposite sign than the random coefficient model estimate. However, the result is not statistically significant.

switch in party control from the Republicans to the Democrats would result in a \$1.07 billion decrease, on average, for each redistributional Budget Authority sub-function. The switch from the Democrats to the Republicans as the majority party in the House in 1994 resulted in a \$4047.47 increase in the median district income of the median member of the majority party. The results here would predict a \$1.95 billion decrease for each category, ceteris paribus.

3.4.2 Testing Meltzer and Richard

In order to examine the predictive power of the party cartel model with the traditional Meltzer and Richard theory, I estimate the same random coefficient model seen in Equation 3.1, but replace the median family income of the median member of the majority party's district with the distance between mean and median family income of the entire nation. Recall that Meltzer and Richard use Black's median voter theorem (1948) as their policy making apparatus. Their prediction is: *"the greater the distance between the median and mean income, the greater the amount of redistribution."* Figure (B.6) displays the difference between mean and median income for the years in the data set.

To test Meltzer and Richard's prediction, I estimate the following random coefficient model:

$$\begin{aligned}
\text{Budget}_{i,t} &= \beta_0 + \beta_1 \text{Difference Mean and Median}_{i,t} + \beta_2 \text{Population}_{i,t} + \beta_3 \text{Poverty}_{i,t} \\
&\quad + \beta_4 \text{Mandatory}_{i,t} + \beta_5 \text{GDP}_{i,t} + \beta_6 \text{Budget}_{i,t-1} + \epsilon_{i,t} \\
&\quad \text{Where: } \boldsymbol{\beta}_i \sim N(\boldsymbol{\beta}, \Gamma) \\
&\quad i = 1, ..., 8 \text{ and } t = 1, ..., 45 \qquad (3.2)
\end{aligned}$$

The difference between Mean and Median income is statistically significant, but the partial effect is the opposite of that predicted by Meltzer and Richard. For every \$1000 that median and mean family income deviate, the level of redistribution falls by an average of

-2.74 billion dollars. This comports with the findings of Gouveia & Masia (1998) who find no evidence for the deviation of mean and median income affecting income redistribution at the state level.

3.5 Implications

In light of the failure of the traditional Meltzer and Richard (1981) model of income redistribution to stand up to empirical tests (Benabou 1996), I use this chapter to explore the effects of Congressional politics on income redistribution. This is done by combining the party cartel theory of congressional policy making (Cox & McCubbins 2005) with the spirit of Meltzer and Richard's model. Where Meltzer and Richard assume a direct democracy median voter model of policy making, I substitute the median member of the majority party in the U.S. House of Representatives. The location of the median member of the majority party appears to be more effective at accounting for the growth in the size of government in the United States than does the location of the median member of the population. Without a comparative data set, it would be premature to address the different patterns of redistribution seen in the U.S. versus other western democracies. The results do suggest, however, that the intricacies of a legislative system can have a real impact on policies such as income redistribution. The inclusion of Congress as the policy making procedure adds an important piece of the puzzle to the "size of government" literature. Researchers in political economy should strongly consider including such institutional details in their models and empirical tests.

Chapter 4

The Implications of Inherited Status Quos for Models of Congress

4.1 Introduction

In this chapter, I explore the implications of making two of the dominant models of congressional politics dynamic. Both the "party cartel" model of Cox & McCubbins (2005) and the "pivotal politics" model of Krehbiel (1998) and Brady & Volden (2005) achieve their equilibrium predictions about policy, given a status quo and set of members' ideal points, from a one shot sequential game. Usually all alternatives in the policy space are considered as possible candidates for the status quo policy. Of course, at period t+1, it is impossible for many of the alternatives in the policy space to be a status quo given what happened in period t. When the existing models are allowed to inherit status quos across time periods, very different long run predictions are made for each of the models than are implied by the one shot Nash equilibrium. The dominant models have no institutional memory and therefore the temporal predictions often made using them turn out to be incorrect in many cases. A simple example using a basic median voter spatial model will illustrate the phenomenon.

In Figure C.1a, there are N voters in the chamber who all have complete, transitive, and single-peaked preferences. The ideal point of the median voter in the chamber is notated with an F (the "floor median"). The x-axis represents all the possible status quos, and in the first period, any alternative could be the status quo. The y-axis measures the policy outcome for each of the possible status quos. The 45 degree dotted line is provided for reference and represents the hypothetical result of every status quo prevailing. The solid line shows which policies would actually obtain under pairwise majority rule under an open rule. Under an open rule, the policy outcomes are a straightforward application of the median voter theorem

(Downs 1957, Black 1958). This means that heading into period 2, there is only one status quo–the ideal point of the median voter in period 1. In period 2, there is no reason to consider what would happen if all possible alternatives in the space were the status quo.[1] The only possible status quo is the ideal point of the median voter in period 1. Figure C.1b displays period 2 considering only the *possible* status quos. Not surprisingly, since the distribution of voters is the same, F does not move, and the policy outcome remains the same. If we ignored the inheritance of status quos, then the prediction for policy outcomes would again look like Figure C.1a.

The point here may seem subtle, but as I will demonstrate, for the more complicated congressional models, the implications are stark. Unlike the median voter model in which the predictions of the single congress and multi-period models are the same (the ideal point of the median voter becomes the policy), the congressional models exhibit different long run behaviors when one only considers policies that could have survived to a given period as possible status quos. The models behave in ways that run counter to the inferences routinely drawn by the creators and adherents of the single shot models. For example, the party cartel model, which is normally characterized as predicting outcomes that will be at or near the median member of the majority party, actually does so only in the short run and only under a limited set of cases. Once inheritance of status quos is allowed, the party cartel model begins to predict policies that are at, or close to, the median of the chamber. In Figure C.2a,Tthe ideal point of the median voter in the chamber is again notated with an F, and the median member of the majority party is notated with an M. As before the solid line shows which policies would actually obtain under pairwise majority rule under an open rule. Under an open rule, one of two things happens for each possible status quo. Either the status quo is defeated by a proposal at the floor median or the status quo prevails. This means that heading into period 2, there are far fewer possible status quos than there were in period 1.There is no reason to consider in period 2 what would happen if all possible alternatives

[1]Here, and throughout the chapter, a period represents one Congress considering an issue under an open rule which allows multiple amendments.

in the space were the status quo. The only possible status quos are those from $2F - M$ to F. Figure C.2b displays period 2 considering only the *possible* status quos. If we ignored the inheritance of status quos, then the prediction for possible policy outcomes would again look like Figure C.2a. I will demonstrate that this difference will begin to have large implications when the distribution of ideal points within Congress changes from one Congress to the next. A similar phenomena happens with respect to the pivotal politics model, which is generally considered to be stable around the ideal point of the floor median over time, actually only predicts in this way under a limited set of conditions. If the Congress itself sees a sufficient degree of ideological movement (during a "realignment" period, for example), then policies are eventually moved to the median.

The general problem here is that scholars are making predictions about a dynamic system with a large degree of path dependence using a static model that cannot consider the path of the policy. This leads to a faulty impression of the tendencies of the system. To address this issue, the chapter proceeds as follows. First, I present short summaries of the pivotal politics and party cartel models. Then I discuss the computational models used to make each model dynamic. Next, I present and interpret the results of each of the models. Finally, I make general conclusions about the findings, with an eye toward future research.

4.2 Critiques of Canonical Models

This is, of course, not the first research to point out limitations of one of the dominant congressional models. In fact, an entire cottage industry has grown up within the legislative politics field consisting of papers critiquing the party cartel and pivotal politics models and their underlying theories. The debate focuses on the role of political parties in shaping policy within Congress. The party cartel model assumes that the median member of the majority party is an important veto player and will block any issue from reaching the floor if he or she prefers the status quo policy for that issue to the ideal point of the median member of the entire house. This "negative agenda control" follows from members' desire to protect their party's brand name in order to increase their electoral prospects (Cox & McCubbins 1993, Cox & McCubbins 2005). Conversely, the pivotal politics model assumes that there are multiple veto players, and that they receive their power based not on their party affiliation (or location within their party), but from the institutional rules that govern the Congress (Krehbiel 1998). These two "families" have waged a pitched battle across the pages of the many political science journals, with the primary point of contention being the role of political parties in Congress.

Critics of the party cartel model claim that empirical evidence for party influence on policy is weak at best (Schickler & Rich 1997, Krehbiel 1998). Further, Smith (2007) notes that the use of negative agenda control does not necessarily follow from members' desire to protect their party's record in light of electoral prospects. The pivotal politics model is primarily criticized for ignoring the incredible agenda setting power that the majority party possesses in the House and the influence over policy such agenda control would have. In this chapter, I do not criticize these models along the typical "parties versus preferences" battle lines. I take both models at their word about the role of parties and instead demonstrate that the claims made by adherents of each model do not actually follow from the models once status quos are allowed to be inherited across time periods.

4.3 Dynamic Predictions from Static Models

The results that follow would be of little relevance if the single shot models of congressional politics were only used to make predictions about the policy one should expect in any single Congress given a status quo and set of members' ideal points. For the purposes of this chapter I am taking the models at face value for any given period. The results here are relevant because scholars routinely use the party cartel and pivotal politics models to make predictions about how policy will evolve *over time*.

4.4 The Computational Models

In this section, I explain the basics of the party cartel and pivotal politics models as well as lay out the pseudo code used for the simulations.[2] Before describing the models, I describe the different treatments to which the simulations are subjected, and provide the pseudo code for each. The treatments differ with respect to how the ideal points for each Congress are changed between Congresses. For the purposes of the simulation I am agnostic as to what is causing the changes in the distributions. It could be that individual members' ideal points are changing, that members are being replaced by new members whose ideal points are different, or some combination of those two things. Even if members "die in their ideological boots" as Poole & Rosenthall (1997) claim, the overall distribution of ideal points undoubtedly changes from Congress to Congress.

4.4.1 Treatments

Each of the simulations is subjected to 4 different treatments that differ with respect to how the distribution of ideal points is changed after each Congress and whether status quos are inherited across Congresses. Each treatment and its corresponding psuedo code is described below.

No Change in the Distribution of Ideals and No Inheritance

This treatment serves as the baseline to which the other models can be compared. Ideal points are not perturbed (step 4a in party cartel and step 4a in pivotal politics) and status quos are not inherited across time periods. That is, at each time period t, all alternatives in the space are considered possible status quos, regardless of what happened in period $t-1$. This treatment simply replicates the static model for each time period.[3]

[2] Actual R code is included in Section C.2.

[3] This means that for this baseline case, duplicate policies are not dropped from the set of all status quos in step 4c in the party cartel model and step 4b in the pivotal politics model.

No Change in the Distribution of Ideals with Inheritance

In this treatment, status quos are inherited across time periods so that the only policies considered as possible status quos in period t are those that were policy outcomes in period $t-1$. Ideal points are not, however, changes in step 4a in the party cartel model or step 4a in the pivotal politics model.

Random Perturbations of Ideals with Inheritance

In this treatment, status quos are inherited across time periods. In step 4a in the party cartel model and step 4a in the pivotal politics model, the ideal points of the members are perturbed randomly. $\mathcal{Z}$ is the set of all ideal points and $z_i t$ is an individual member's ideal point at time t:

1. z_{it} is z_{it-1} + a random draw from $U[(-1 - z_{it-1}), (-z_{it-1} + 1)]$.

For example, a member for whom $z_{it-1} = -.5$ would have an ideal point in period t that is -.5 plus a random draw from a uniform distribution bounded by .5 and 1.5, pushing it left or right anywhere in the space. A member for whom $z_{it-1} = .5$ would have an ideal point in period t that is .5 plus a random draw from a uniform distribution bounded by -1.5 and .5, also pushing the member left or right in the space.

First Dimension DW-NOMINATE Scores with Inheritance

In this treatment, status quos are inherited across periods. Instead of perturbing the generated ideal points as was done in each of the other treatments, I use actual 1st dimension DW-NOMINATE scores for the 40th to the 110th Congress. These scores also range from -1 to 1 as did the generated scores, so the results are generally comparable to those from the other treatments.

4.4.2 Party Cartel Model

Party cartel theory includes the importance of agenda setting in congressional policy making. In the modern Congress, there are several key positions from which members can control the agenda of the House of Representatives. These positions, such as the Speaker of the House and the Chairman of the Rules and Appropriations Committees, are held by loyal (usually senior) members of the majority party. These loyal members use their positions to exert "negative agenda control." That is, they block any legislation from consideration by the floor that would make the majority party worse off if passed.

Party cartel theory assumes that all bills reach the floor of the house under an open rule.[4] As such, all bills that reach the floor are amended to the ideal point of the median member of the house (F) and subsequently pass. Given this, the majority party must decide whether they prefer the status quo or the ideal point of the median member of the floor (F). In the party cartel model, the preference of the majority party is represented by the location of the ideal point of the median member of the majority party (M). There is a region of the policy space called the "blockout zone." If the status quo policy for a particular issue falls within this region, then the majority party will block all legislation on that issue. The blockout zone consists of all alternatives falling between M and $2M$-F. Figure C.3a illustrates the blockout zone when M is to the right of F, and Figure C.3b illustrates the blockout zone when M is to the left of F.

In the static case, party cartel theory predicts that, (1) no issue on which the status quo is preferred to the ideal point of the floor median (F) by the median of the majority party will be scheduled for a vote, and (2) no bill opposed by a majority of the majority party's members ever passes. Hence, the median of the majority party must vote "yea" for a bill to pass. Clearly, the location of the ideal point of the median member of the majority party (M) is an important determinant of policy outcomes in the party cartel model.

[4]Under an open rule, the bill can be amended.

In this chapter, I claim that the party cartel model has inherent limitations in its usefulness for making dynamic predictions about congressional politics. Cox & McCubbins (2005) claim that over time policy should move "toward the majority party". Making dynamic claims about policy using the static party cartel model is not limited to theoretical predictions; researchers often use the location of the median member of the majority party as an important component in empirical studies, as well(Cox & McCubbins 2005, Aldrich, Gomez & Merolla 2005, Snowberg, Wolfers & Zitzewitz 2007, Anderson 2008, Ragan 2009). The claim here is not that the static predictions of the party cartel model are incorrect. For any Congress there is a status quo, a floor median and a median member of the majority party. Given these, party cartel model will predict a policy outcome. The claim is that the *dynamic* predictions often attributed to the cartel theory, do not in fact follow from the party cartel model.

The simulation for this model proceeds as follows. Member i will be notated by the subscript i. Member i's ideal point is x_i, and member i's party is p_i. Ideal points are on the [-1,1] interval, and party = 1 if the member is a Republican and 0 if the member is a Democrat.

1. The set of possible status quos (Q) is defined as the set of discrete increments of .01 along the [-1,1] interval.

2. The ideal points for 435 members are drawn from a continuous uniform distribution $U[-1, 1]$.[5] The set of all 435 ideal points will be referred to as $\mathcal{X}$.

3. Members are assigned to a party based on the following rule:

    (a) A member x_i is assigned a probability of being a Republican based on how far to the right his or her ideal point is. For example, a member with an ideal point at -1 has no chance of becoming a Republican, a member with an ideal point of 0

[5]I should note that the same set of initial ideal points are used across the two models as well as across the different treatments applied to each model.

has a 50-50 chance of being a Republican, and a member with an ideal point of 1 has a 100% chance of being a Republican. The formula used is as follows:

$$p(\text{Republican})_i = (.5 * (x_i)) + .5 \tag{4.1}$$

(b) Each member is then assigned a party using a random draw from a binomial distribution weighted according to the member's probability of being a Republican. Members for whom a 1 is drawn are Republicans and members for whom a 0 is drawn are Democrats. The set of the Republicans' ideal points is $\mathcal{R}$ and the set of Democrats' ideal points is set $\mathcal{D}$.

4. The following steps then occur for each of the 70 sequential "Congresses" in the model.

   (a) If $t > 1$, the members' ideal points are altered according to the treatment being used for that run of the model.[6]

   (b) If $t > 1$, the members are reassigned a party according to step 3 above.

   (c) If $t > 1$ Any duplicate elements of (Q) are dropped from the set so that only unique status quos are considered. For example, after the first period many of the status quos are defeated and moved to the same point (usually m). There is no reason to keep multiple values of m in $\mathcal{Q}$.

   (d) The majority party is determined. If $size(\mathcal{R}) > size((D))$, it is the Republicans; otherwise, it is the Democrats. The set of ideal points held by the members of the majority party is $\mathcal{M}$.

   (e) The median member of the majority party is found: $M = median(\mathcal{M})$.

   (f) The median member of the 435 members is found: $F = median(\mathcal{X})$.

[6]The treatments are detailed in Section 4.4.1.

(g) Now the policy is found for each of the possible status quos q_j in the policy space[7] (the elements of $\mathcal{Q}$).

i. If $|M - q_j| \leq |M - F|$, then the status quo prevails and remains the policy. If not, then the location of the median member in the chamber becomes the policy.

(h) The resulting policies, one for each element in $\mathcal{Q}$, are then stored as a set $\mathcal{P}_t$.

(i) $\mathcal{P}_t$ becomes the new $\mathcal{Q}$, and if $t < 70$, the algorithm returns to step 4.

4.4.3 Pivotal Politics Model

The pivotal politics model (Krehbiel 1996, Krehbiel 1998) begins with the assumption that political parties have no independent effect on policy outcomes in Congress. Unlike the party cartel model, this leaves no special role for the median member of the majority party. Rather, there are several other agents whose locations are critically important to the eventual location of the policy. These agents owe their importance to the interaction of the existing institutional rules embodied in the Constitution as well as to the rules of each chamber. The first pivotal member is the *median member of the chamber* (m). Since the Congress is a majoritarian institution for amending votes and other procedural matters, it is assumed in the pivotal politics model that any bill that reaches the floor is amended to the location of the ideal point of the median member of the chamber before it faces the status quo in a final vote. The next two pivotal members are the left and right *filibuster pivots* (f_l and f_r). These are members of the Senate who can block any proposal by refusing to vote for cloture. The next pivotal agent is *the president*(p). The president, of course, can veto any alternative passed by the chamber. The last pivotal member is known as the *veto pivot* (v).

[7]For the case where $M < F$, mathematically the policy looks like this:

$$p = \begin{cases} M & q_j < 2M - F \\ q_j, & 2M - F < q_j < F \\ M, & q_j > F \end{cases}$$

This is the member of the chamber whose vote would allow the chamber to override the veto of the president. This member will always be on the same side of the median as the president in the 1/3rd position from the end. Figure (C.4) displays three different possible orderings of the pivotal members in an issue space.

The predicted policy in a pivotal politics model (x) is a subgame perfect equilibrium that depends on the location of f,v,p and, most importantly, the status quo policy (q). As with the party cartel model, I claim that the pivotal politics model is limited in its usefulness for making dynamic predictions. Krehbiel (1998) himself says that "...real world dynamics and various forms of uncertainty seem to have a lot to do with the shortcomings we see in the basic pivotal politics theory." Just as with the party cartel model, many empirical researchers also use some of the dynamic claims made by Krehbiel (1998) and others in the pivotal politics camp as a proxy for congressional policy. For example, Aldrich, Gomez & Merolla (2005), Anderson (2008) and Ragan (2009) all use the location of the ideal point of the median member of the floor to characterize the policy predictions of pivotal politics.

The simulation for the pivotal politics model proceeds as follows. Member i will be notated by the subscript i. The member's ideal point is y_i, and his/her party is p_i. Ideal points are on the [-1,1] interval, and party = 1 if the member is a Republican and 0 if the member is a Democrat.

1. The set of possible status quos (Q) is defined as the set of discrete increments of .01 along the [-1,1] interval.

2. The ideal points for 435 members are drawn from a continuous uniform distribution $U[-1,1]$.[8] The set of all 435 ideal points will be referred to as $\mathcal{Y}$.

3. The president's ideal point is drawn from a continuous uniform distribution $U[-1,1]$ and is notated as p.

[8] I again note that the same set of initial ideal points are used across the two canonical models as well as across the different treatments applied to each model.

4. The following steps then occur for each of the 70 sequential "Congresses" in the model.

   (a) If $t > 1$, then the members' and president's ideal points are altered according to the the treatment being used.

   (b) If $t > 1$ Any duplicate elements of (Q) are dropped from the set so that only unique status quos are considered. For example, after the first period many of the status quos are defeated and moved to the same point (usually m). There is no reason to keep multiple values of m in $\mathcal{Q}$.

   (c) The median member of the 435 members is found: $m = median(\mathcal{Y})$.

   (d) The two filibuster pivots are found:

      i. The elements of $\mathcal{Y}$ are sorted minimum to maximum. $f_l = y_{174}$ and $f_r = y_{261}$.

   (e) The possible veto pivots are found:[9]

      i. The elements of $\mathcal{Y}$ are sorted minimum to maximum. $v_l = y_{145}$ and $v_r = y_{290}$.

   (f) The location of p will determine which of the pivotal members' consent is needed to defeat the status quo. To simplify things the pivot to the right of m is redefined as the right pivot r, and the pivot to the left of the median is redefined as the left pivot.

      i. If $p < v_l$ then $l = v_l$

      ii. If $v_l < p < f_l$ then $l = p$

      iii. If $f_l < p$ then $l = f_l$

      iv. If $p < f_r$ then $r = f_r$

      v. If $f_r < p < v_r$ then $r = p$

      vi. If $v_r < p$ then $r = v_r$

[9] Although two possible veto pivots are found here, only the one on the same side of m as p will be "pivotal" for a given distribution of ideal points.

(g) Now the equilibrium policy is found for each of the *possible* status quos q_j in the policy space[10] (all the elements of $\mathcal{Q}$).

i. The first two cases are straightforward:

A. If the status quo is between the right and left pivots, $l < q_j < r$, then the status quo prevails $p = q_j$.

B. If the status quo is "far" to the left or right of the policy space, $q_j < 2l - m$ or $q_j > 2r - m$, then the ideal point of the median voter becomes the policy, $p = m$.

ii. The last two cases involve the policy being somewhere between the relevant pivot's ideal point and the ideal point of the median member of the chamber:

A. If $2l - m < q_j < l$, then the policy is $2l - q_j$

B. If $r < q_j < 2r - m$, then the policy is $2r - q_j$

(h) The resulting policies, one for each element in $\mathcal{Q}$, are then stored as a set $\mathcal{P}_t$.

(i) $\mathcal{P}_t$ becomes the new $\mathcal{Q}$ and if $t < 70$, the algorithm returns to step 4.

4.5 Results

4.5.1 Party Cartel Model

The results of the party cartel simulations for each of the different treatment effects are as follows.

[10]Mathematically, the policy looks like this:

$$p = \begin{cases} m, & q_j < 2l - m \\ 2l - q_j, & 2l - m < q_j < l \\ q_j, & l < q_j < r \\ 2r - q_j, & r < q_j < 2r - m \\ m, & 2r - m < q_j \end{cases}$$

No Movement of Ideals and No Inheritance

This first treatment serves as a baseline case. As can be seen in Figures C.5 and Figure C.6 , the simulation simply replicates the predictions from period 1 across all 70 periods. This gives the reader a baseline to which the other party cartel simulations can be compared. It also serves to confirm that the simulation faithfully replicates the party cartel model.

No Movement of Ideals with Inheritance

The results of the simulations that perturb the ideal points after each period with a right bias can be seen in Figures C.7 and C.8. Due to the open rule, after the first period, all status quos that are not in the block out zone are defeated by the ideal point of the floor median. The status quos in the block out zone prevail. This set of status quos then prevails all the way to the end of the model, because the distribution of ideal points does not change.

Random Perturbations with Inheritance

The results of the simulations that perturb the ideal points after each time period randomly without any bias can be seen in Figures C.9 and C.10. This simulation suggests that movement of ideal points sufficient to change control of the chamber from one party to another is all that is needed to cause the party cartel model to predict policy at the ideal point of the floor median rather than at the ideal point of the median member of the majority party. As in several of the other treatments, initially status quos outside the block-out zone are moved to the floor median's ideal point, and those status quos that began inside the initial block-out zone prevail. However, after several periods of nothing but random jostling of ideal points, all the initial status quos move at or very close to the floor median's ideal point. This again is contrary to the predictions commonly associated with the party cartel theory, in that policies are much closer to the ideal point of the median member of the chamber than they are to that of the median member of the majority party.

DW-NOMINATE Scores with Inheritance

The final treatment effect applied to the party cartel simulation uses 1st dimension DW-NOMINATE scores rather then the generated set of ideal points used in the other treatments. The results of the simulations can be seen in Figures C.11 and C.12. Because the 40th Congress had a floor median and majority party median whose ideal points were very close together, the initial blockout zone is small. As seen in the other treatments, initially status quos outside the block-out zone are moved to the floor median's ideal point, and those status quos that began inside the initial block-out zone prevail. After several periods, all the initial status quos move to be at or very close to the floor median. This again is contrary to the predictions commonly associated with the party cartel theory.

4.5.2 Pivotal Politics Model

The results of the pivotal politics simulations for each of the different treatment effects are as follows.

No Movement of Ideals and No Inheritance

This first treatment for the pivotal politics simulations serves as a baseline for comparison. As can be seen in Figure C.13 and Figure C.14, the simulation simply replicates the predictions from period 1 across all 70 time periods. This treatment provides confirmation that the simulation faithfully replicates the pivotal politics model, as well.

No Movement of Ideals with Inheritance

The results of the simulations that perturb the ideal points after each period with a right bias can be seen in Figures C.15 and C.16. Owing to the open rule, after the first period all status quos that are in the gridlock interval prevail. Those that are to the left of 2m-l and to the right of 2m-r are defeated by the ideal point of the floor median. The remaining status quos are defeated by proposals that move them into the gridlock interval.[11] This new set of status quos then prevails all the way to the end of the model, because the distribution of ideal points does not change.

Random Perturbations with Inheritance

The results of the simulations for the pivotal politics model in which the ideal points are perturbed after each time period randomly without any bias can be seen in Figures C.17 and C.18. Here, some of the initial status quos are eventually defeated. However, because the gridlock interval only shrinks and expands randomly, without any movement toward the extremes of the policy space, many of the initial status quos eventually prevail throughout the entire simulation.

DW-NOMINATE Scores with Inheritance

The final treatment effect applied to the pivotal politics model simulation uses 1st dimension DW-NOMINATE scores rather than the generated set of ideal points used in the previous treatments. The results of these simulations appear in Figures C.19 and C.20. As in the right and left bias treatments, some of the initial status quos are able to prevail in this treatment. However, once party control changes, the resulting flip in the gridlock interval moves all the policies to the ideal point of the median member of the chamber. Throughout the rest of the simulation, the policy stays at the ideal point of the current median member of the chamber until it is moved by one of the veto pivots.

4.6 Discussion

What general conclusions can be drawn from the results of the simulations? For the party cartel model, it is clear that as long as there is relative stability of the ideal points, it will be difficult for policies in the block-out zone to be moved to the ideal point of the floor median.

[11]The results mimic those described in footnote 10

However, as the distribution of ideal points changes from Congress to Congress, the set of status quos from period 1 that could possibly prevail into the next period becomes vanishingly small. In most of the simulations, this happened very quickly, and policies converged onto the ideal point of the floor median after 2 or 3 periods in most cases. This obviously runs counter to the claim of many of the adherents to the party cartel model that policy, over time, will be pulled toward the ideal point of the median member of the majority party. It certainly calls into question the use of the ideal point of the median member of the majority party as the predicted long run location for policy in empirical work. The gap between the claims associated with the pivotal politics model and those found here is not as large as the one found for the party cartel theory. However, in the simulations, we do see that there is again a relationship between the amount of movement in ideal points and the degree to which status quos from the first period can survive into the future. These results indicate that static models are insufficient for predicting policy over time. There is a need for a dynamic model of congressional politics that allows status quos to be inherited across time periods in order to make more accurate predictions about where policy will move over time given the previous path of the policy.

Chapter 5

Conclusion and Future Research

In this dissertation, I find that current congressional policy making models are inadequate for use in a representative democracy system. First, using a set of computational models simulating outcomes under direct and representative democracy, I find that the degree to which legislative districts are gerrymandered with respect to preferences about the policy is a major determinant of policy deviation. Even when the majority of voters are in favor of redistribution, if districts are constructed with a sufficient level of conservative gerrymandering, the policy outcome under representative democracy will favor far less redistribution than the policy outcome under direct democracy.

Second, by combining the party cartel theory of congressional policy making (Cox & McCubbins 2005) with the spirit of Meltzer and Richard's model of redistribution, I find that the location of the median member of the majority party appears to be more effective at accounting for the growth in the size of government in the United States than does the location of the median member of the population. This suggests that the intricacies of a legislative system can have a real impact on policies such as income redistribution.

Finally, using a dynamic simulation of the two dominant models of Congressional politics, I find that, for the party cartel model, as the distribution of ideal points changes from Congress to Congress over time, the set of status quos from period 1 that could possibly prevail into the next period becomes vanishingly small. This obviously runs counter to the claim of many of the adherents to the party cartel model that policy, over time, will be pulled toward the ideal point of the median member of the majority party. For the pivotal politics model, I find that there is a relationship between the amount of movement in ideal points and the degree to which status quos from the first period can survive into the future. These results indicate that static models are insufficient for predicting policy over time.

The findings here are consistent with the "new institutionalist" view that often the institutional rules under which decisions are made dictate the policies that are implemented. The institutional rules of Congress can have a substantial impact on the level of income redistribution, and research that neglects this detail will likely miss an important part of the explanation as to the growth in the size of government, which has been a central research question for the last 20 years in political economy. I also find that the method by which we model institutions like Congress can substantially affect our ability to understand the true impact of institutions. The actual institutions that set redistribution policy are the Congress and the president. In Chapter 2, I find that assuming this away by using a median voter model is not benign. Voters vote for representatives, not policy. Only by using a set of fairly restrictive assumptions about the method of drawing districts will the median voter of the population and the median member of the legislature prefer the same level of income redistribution. Adherents of the two dominant models of congressional politics routinely make claims about the evolution of policy over time based on the results of their static one period models. These claims turn out to be true only if there is no institutional memory in the legislature. When one introduces path dependence to the models, very different predictions are obtained.

All three essays point to shortcomings in the way that policy generation is currently modeled in political economy and congressional politics. There is a need for models of income redistribution that better take into account the details of the legislative process. There is also a need for dynamic models of congressional politics that allow status quos to be inherited across time periods in order to make more accurate predictions about where policy will move over time given the previous path of the policy. Much of my current and future work involves building agent based models of congressional politics that see the policy as the result of a complex adaptive system. Such a model is flexible enough to take into account all of the concerns raised in this dissertation.

The policy making process is dynamic, and contains heterogeneous agents interacting in a non-linear fashion. The members and voters adapt to new information, creating both positive and negative feedback through elections and policy decisions themselves. Such a system is a prime candidate to be modeled as a complex adaptive system. In such systems, analyzing the affect of any one variable on another, or even several variables on another, without considering the feedback in the system and underlying heterogeneity of preferences among agents, will likely lead to theoretical predictions that are biased, overly simplistic, or only applicable to a highly restricted set of cases. My goal is to unify the dominant congressional models into one overarching model, as each model no doubt contains many essential components to the study of Congress. The new overarching model will allow me to examine many of the major questions within the congressional literature (i.e., parties versus preferences, the electoral connection, progressive ambition, incumbency and quality challengers) at a systemic level rather than examining each issue as a micro phenomena within Congress. This macro level approach to studying Congress enables us to move past the limitations of "ceteris paribus" and comparative statics, to a framework in which we can allow many parameters to move simultaneously. This approach will allow us to investigate questions that, until now, existing formal models have been unable to address. For example, we may be able to determine whether the electoral pressure on members of Congress serves to enhance or constrain the ability of parties to shape policy outcomes.

Another benefit of this approach is that it lends itself to a hybridization between the worlds of behavioral and institutional American politics. For example, we may be able to investigate questions such as: what is the affect of a change in the policy mood of the mass electorate on policy in light of electoral pressure, party pressure, and the institutional rules of the Congress itself?

With such a model in place, it is my hope to return to the issue of income redistribution and update the Meltzer and Richard framework, which is still the dominant lens through which political economists view income redistribution and the "size of government."

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Appendix A

Chapter 2

A.1 Tables for Chapter 2

Table A.1: Example Districts

	District 1	**District 2**	**District 3**
	33	44	67
	25	32	49
	51	66	56
Median	33	*44*	56

Table A.2: Results of the Uniform Model

		25 Districts	**100 Districts**	**200 Districts**	**435 Districts**
Low Gerrymandering	Direct	50.06	50.06	50.06	50.06
	Representative	50.68	50.22	50.56	50.93
	Difference	0.62	0.15	0.49	0.87
	(Min,Max)	(49.98,51.28)	(49.44,50.85)	(49.86,51.41)	(50.26,51.72)
	Std. Dev.	0.32	0.29	0.31	0.29
Medium Gerrymandering	Direct	50.06	50.06	50.06	50.06
	Representative	58.71	55.44	56.01	56.18
	Difference	8.65	5.38	5.94	6.11
	(Min,Max)	(56.83,59.7)	(53.53,56.76)	(54.48,57.16)	(55.45,57.03)
	Std. Dev.	0.49	0.62	0.44	0.31
Extreme Gerrymandering	Direct	50.06	50.06	50.06	50.06
	Representative	65.68	59.05	60.39	60.73
	Difference	15.62	8.99	10.33	10.66
	(Min,Max)	(64.7,66.61)	(57.58,60.7)	(58.28,62.73)	(59.57,61.94)
	Std. Dev.	0.41	0.61	0.95	0.55

Table A.3: Results of the Normal Model

		25 Districts	100 Districts	200 Districts	435 Districts
Low	Direct	50.06	50.06	50.06	50.06
Gerrymandering	Representative	50.06	50.15	50.07	50.16
	Difference	0	0.08	0.01	0.1
	(Min,Max)	(49.91,50.26)	(49.99,50.29)	(49.9,50.28)	(49.97,50.33)
	Std. Dev.	0.07	0.07	0.08	0.07
Medium	Direct	50.06	50.06	50.06	50.06
Gerrymandering	Representative	52.01	51.38	51.35	51.42
	Difference	1.95	1.31	1.29	1.36
	(Min,Max)	(51.74,52.25)	(51.07,51.83)	(51.05,51.64)	(51.17,51.66)
	Std. Dev.	0.11	0.14	0.1	0.08
Extreme	Direct	50.06	50.06	50.06	50.06
Gerrymandering	Representative	53.73	52.31	52.33	52.56
	Difference	3.67	2.25	2.27	2.49
	(Min,Max)	(53.48,54)	(51.79,52.73)	(51.91,52.96)	(52.3,52.81)
	Std. Dev.	0.11	0.18	0.2	0.12

Table A.4: Results of the Income Calibrated Model with Liberal Gerrymandering

		25 Districts	100 Districts	200 Districts	435 Districts
Low	Direct	83.47	83.47	83.47	83.47
Gerrymandering	Representative	84.3	84.3	83.52	85.19
	Difference	0.83	0.83	0.05	1.71
	(Min,Max)	(84.3,84.3)	(84.3,84.3)	(83.47,84.3)	(85.12,85.54)
	Std. Dev.	0	0	0.19	0.15
Medium	Direct	83.47	83.47	83.47	83.47
Gerrymandering	Representative	87.07	86.03	85.94	87.54
	Difference	3.6	2.56	2.47	4.07
	(Min,Max)	(86.78,87.6)	(85.54,86.78)	(85.12,85.95)	(87.19,87.6)
	Std. Dev.	0.39	0.19	0.09	0.15
Extreme	Direct	83.47	83.47	83.47	83.47
Gerrymandering	Representative	89.26	87.24	86.93	88.94
	Difference	5.79	3.77	3.46	5.47
	(Min,Max)	(89.26,89.26)	(86.78,88.02)	(85.95,87.6)	(88.43,89.26)
	Std. Dev.	0	0.18	0.31	0.29

Table A.5: Results of the Income Calibrated Model with Conservative Gerrymandering

		25 Districts	**100 Districts**	**200 Districts**	**435 Districts**
Low Gerrymandering	Direct	83.47	83.47	83.47	83.47
	Representative	84.3	83.49	83.47	83.47
	Difference	0.83	0.02	0	0
	(Min,Max)	(84.3,84.3)	(83.47,84.3)	(83.47,83.47)	(83.47,83.47)
	Std. Dev.	0	0.12	0	0
Medium Gerrymandering	Direct	83.47	83.47	83.47	83.47
	Representative	81.1	81.76	81.14	81.27
	Difference	-2.37	-1.71	-2.33	-2.2
	(Min,Max)	(80.99,82.64)	(80.99,82.64)	(80.99,82.64)	(80.99,81.82)
	Std. Dev.	0.3	0.4	0.31	0.27
Extreme Gerrymandering	Direct	83.47	83.47	83.47	83.47
	Representative	78.11	80.33	79.5	78.41
	Difference	-5.36	-3.14	-3.97	-5.06
	(Min,Max)	(77.69,78.51)	(79.34,80.99)	(78.51,80.17)	(77.69,79.34)
	Std. Dev.	0.4	0.4	0.47	0.47

Table A.6: Effect of Number of Districts on Difference between Legislative and State Medians.

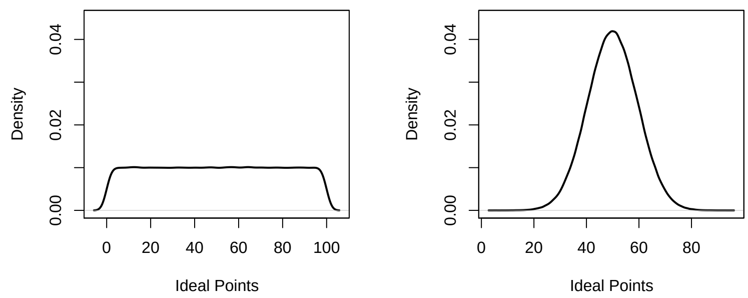
	OLS	**Huber-White OLS**	**Huber-White OLS**
Districts	-7.67 ∗	-7.67∗	-4.84∗
(t)	(-2.49)	(-3.00)	(-2.44)
Intercept	-611.48∗	-611.49∗	-1830.14∗
(t)	(-2.54)	(-2.66)	(-4.83)
State Dummies	No	No	Yes‡
N	102	102	102
Adj, R^2	0.05	0.05	0.65

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% ‡ : 24 of 50 are significant at 5%

Table A.7: Comparing the National Median Family Income to the Median Family Income in the Median Congressional District

Congress	**83rd**	**88th**	**93rd**	**98th**	**103rd**	**108th**
Census	1950	1960	1970	1980	1990	2000
Median of Median	3047	5518.5	9555	19739	34105	49168
National Median	2619	5,660	9,586	19707	35225	50,046
Difference (Dollars)	428	-141.5	-31	32	-1120	-878
Percent Difference	16.34	-2.5	-0.32	0.16	-3.18	-1.75

A.2 Figures for Chapter 2



(a) Uniform (b) Normal

Figure A.1: Distribution of Voters

An example of the gerrymandering algorithm appears in Figure (A.2).

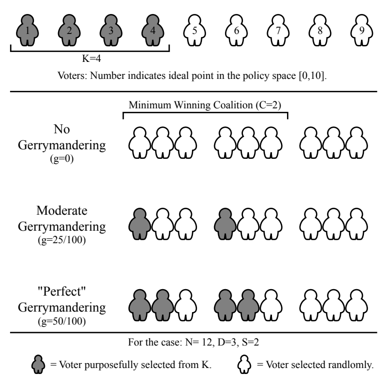
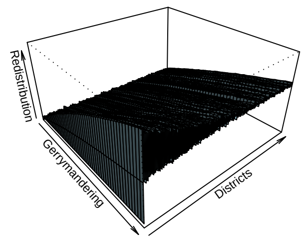
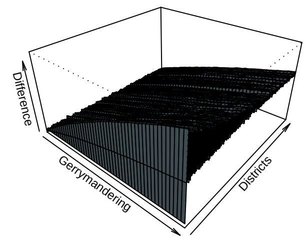


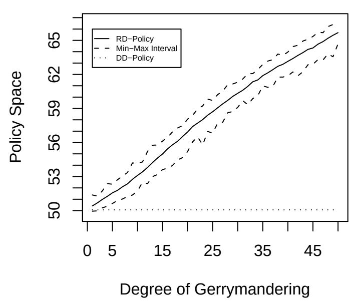
Figure A.2: Example of Gerrymandering Algorithm



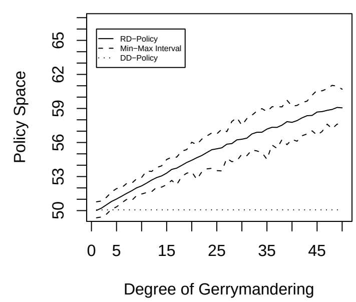


(a) Rep. Dem. Policy (b) Deviation of Rep. and Direct

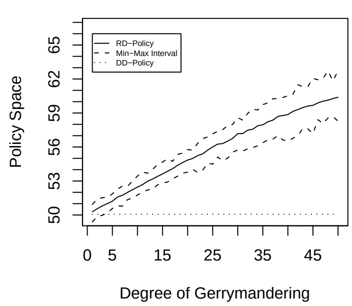
Figure A.3: Uniform Model Results



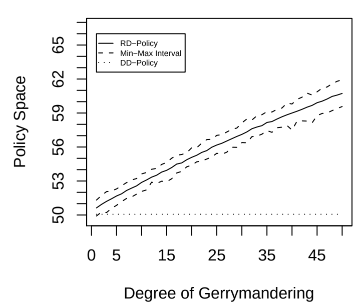
(a) 25 Districts



(b) 100 Districts

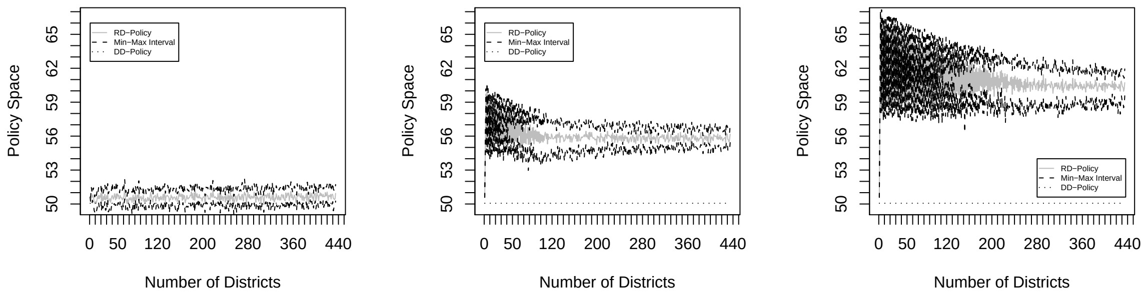


(c) 200 Districts



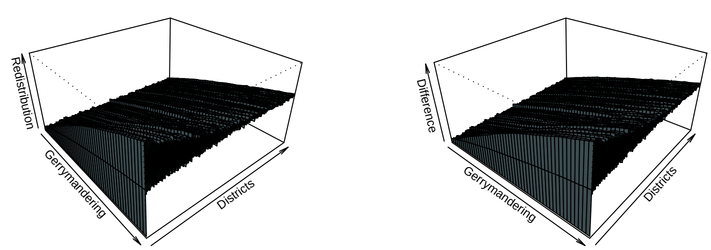
(d) 435 Districts

Figure A.4: Effect of Gerrymandering on Uniformly Distributed Voters



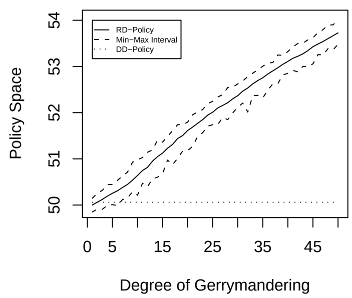
(a) Low Gerrymandering (b) Medium Gerrymandering (c) High Gerrymandering

Figure A.5: Effect of the Number of Districts on a Uniform Distribution of Voters

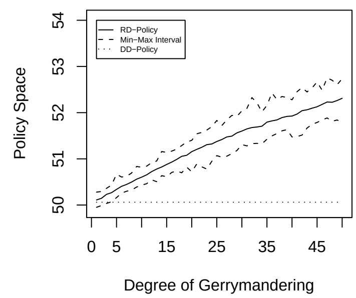


(a) Rep. Dem. Policy (b) Deviation of Rep. and Direct

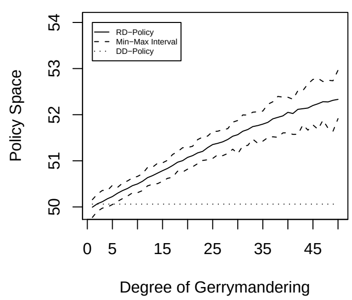
Figure A.6: Normal Model Results



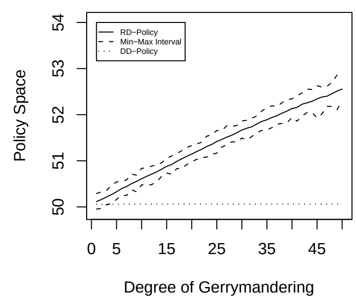
(a) 25 Districts



(b) 100 Districts

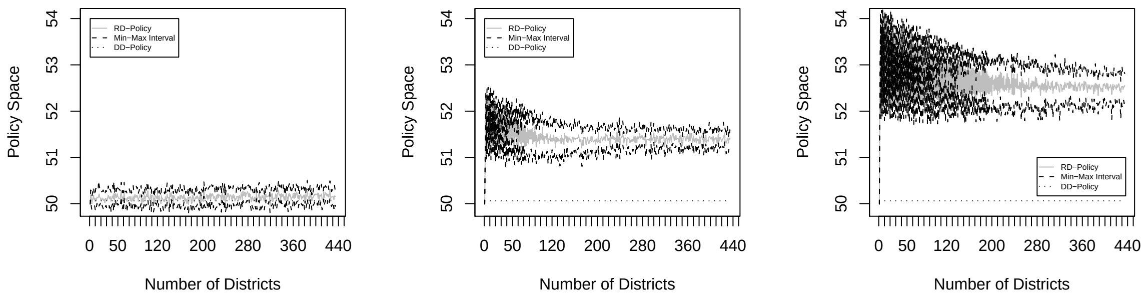


(c) 200 Districts



(d) 435 Districts

Figure A.7: Effect of Gerrymandering on Normally Distributed Voters



(a) Low (b) Medium (c) High

Figure A.8: Effect of the Number of Districts on a Normal Distribution of Voters

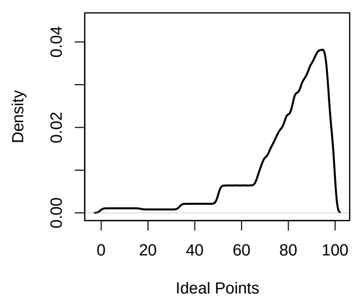
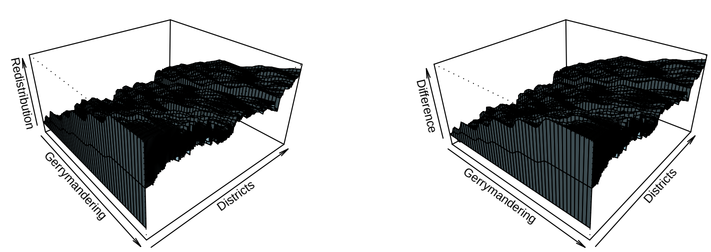
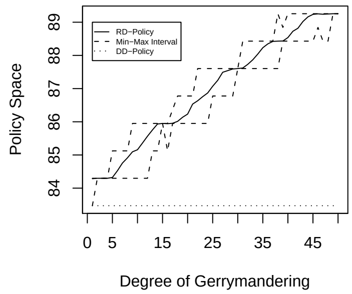


Figure A.9: Distribution of Voters

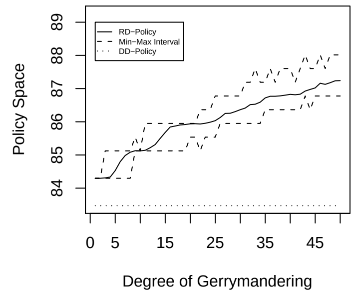


(a) Rep. Dem. Policy (b) Deviation of Rep. and Direct

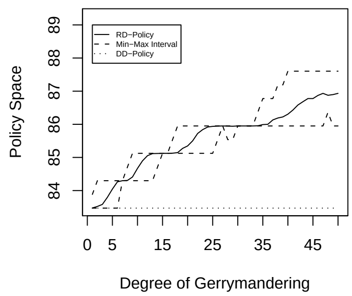
Figure A.10: Liberal Gerrymander Model Results



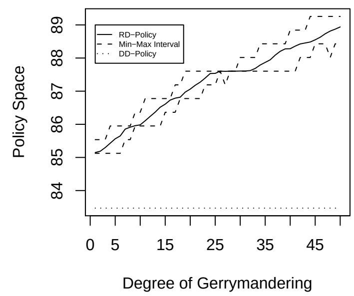
(a) 25 Districts



(b) 100 Districts

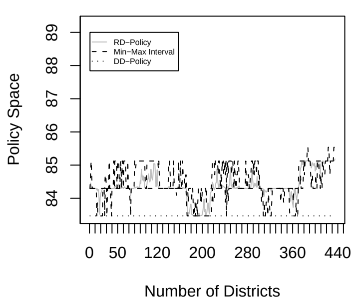


(c) 200 Districts

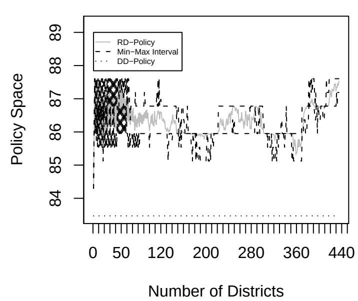


(d) 435 Districts

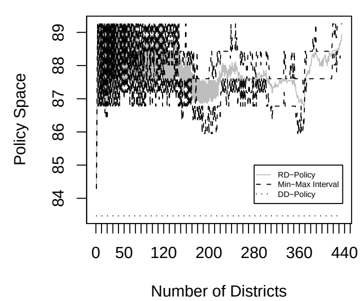
Figure A.11: Effect of Liberal Gerrymandering on Income Calibrated Voters



(a) Low

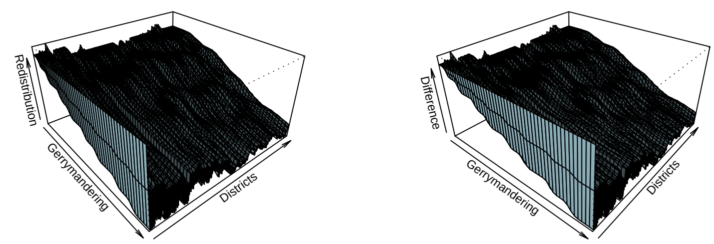


(b) Medium



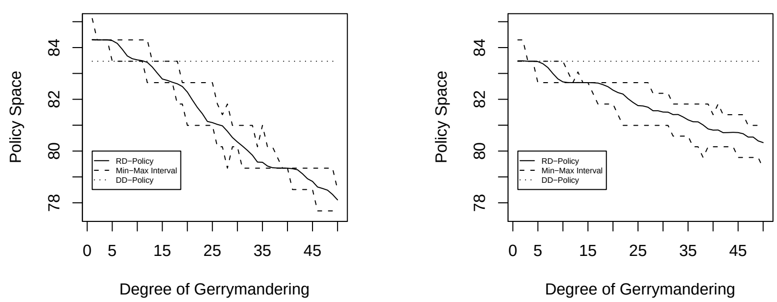
(c) High

Figure A.12: Effect of the Number of Districts on a Income Calibrated Voters

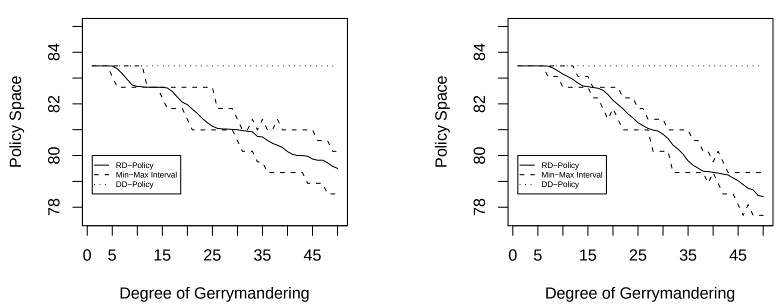


(a) Rep. Dem. Policy (b) Deviation of Rep. and Direct

Figure A.13: Conservative Gerrymander Model Results

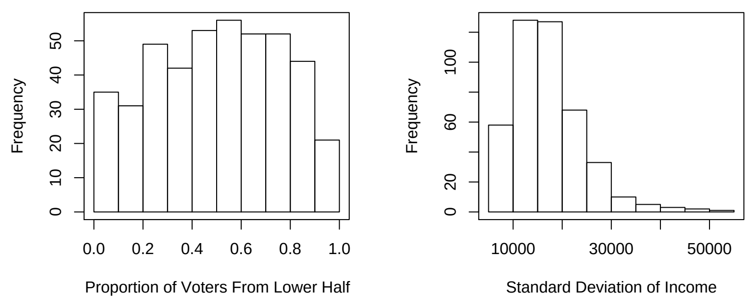


(a) 25 Districts (b) 100 Districts



(c) 200 Districts (d) 435 Districts

Figure A.14: Effect of Conservative Gerrymandering on Income Calibrated Voters



(a) (b)

Figure A.15: Empirical Measures of Income Gerrymandering

A.3 Sample R Code for Chapter 2

```
# DEFINE VARIABLES AND VALUES
    # Number of loops in the simulation
    L <- 1000
    # Number of voters in the population
    N <- 43500
    # Number of legislative districts:
    D <- 435
    # Steps of Gerrymandering (needs to be even)
    gSteps <- 100
    gDenom <- (gSteps/2)

# SET UP MATRICES TO HOLD THE RESULTS OF THE ANALYSIS. #
    #Matrix of RD policies
    RDpolicyMatrix <- matrix(NA,gDenom,D)
    #Matrix of Mins from calculation of RD policy
    RDpolicyMins <- matrix(NA,gDenom,D)
    #Matrix of Maxs from calculation of RD policy
    RDpolicyMaxs <- matrix(NA,gDenom,D)
    #Matrix of SDs from calculation of RD policy
    RDpolicySDs<- matrix(NA,gDenom,D)

# LOOP OVER THE NUMBER OF DISTRICTS
    #Set up a vector to hold policys for each loop
    policyd <- vector(mode="integer",gDenom)
    policydMins <- vector(mode="integer",gDenom)
    policydMaxs <- vector(mode="integer",gDenom)
    policydSDs <- vector(mode="integer",gDenom)
    #LOOP
    for (d in 1:D){
    #To avoid fractional people the number of voters
    must be adjusted slightly each iteration
    rawS <- (N/d)
    s <- floor(rawS)
    v <- s*d
#Create the vector of voters
    voters <- rnorm(v, mean=50, sd=9.5)
    voters <- sort(voters, decreasing = TRUE)
    #The direct democracy outcome can now be calculated
    DDpolicyMatrix <- matrix(median(voters),gDenom,D)

# LOOP OVER THE DEGREE OF GERRYMANDERING
    #Set up vector to hold the congress for each degree of Gerrymandering
    congressg <- vector(mode="integer", d)
    #Loop
```

```
    for (g in 1:gDenom){
    divPoint <- ceiling((d*s)/2)
    minWinCo <- ceiling(d/2)
    LHSize <- ceiling((g*s)/gSteps)

#SIMULATION LOOPS
    #Set up vector to store the policy from each iteration
    policyl <- vector(mode="integer",L)
    # LOOP
    for (l in 1:L){

# BUILD THE DISTRICTS AND CREATE A CONGRESS WITH A LOOP
    #Set up a vector to be each district
    districti <- vector(mode="integer",s)
    #LOOP for minWin districts
    for (i in 1:minWinCo){
    districti[1:LHSize] <- sample(voters[1:divPoint],LHSize,replace=FALSE)
    districti[(LHSize+1):s] <- sample(voters,(s-LHSize),replace=FALSE)
    #Elect the members of the legislature and place them in the Legislature
    congressg[i] <- median(districti)

} # ends the minWin districts loop

    #LOOP for the remaing districts
    for (i in (minWinCo+1):d){
    congressg[i] <- median(sample(voters,s,replace=FALSE))

} # ends the "other" districts loop

policyl[l] <- median(congressg)

} # ends the simulation loop

# Summary Statics for the policies generated by the simulation
policyd[g] <- mean(policyl) policydMins[g] <- min(policyl)
policydMaxs[g] <- max(policyl) policydSDs[g]   <- sd(policyl)

} # ends the loop over g

    RDpolicyMatrix[,d] <- policyd
    RDpolicyMins[,d] <- policydMins
    RDpolicyMaxs[,d] <- policydMaxs
    RDpolicySDs[,d] <- policydSDs

} # ends the loop over d
```

Appendix B

Chapter 3

B.1 RCM as a Linear Model with a Complicated Error Term

It is rare for those who normally use classical statistics to think about drawing a parameter like Γ out of a distribution. However, as Beck & Katz (2007) show, RCM can be recast as a linear model with a complicated error term.

$$\text{Since: } \boldsymbol{\beta}_i = \boldsymbol{\beta} + \boldsymbol{\nu}$$

$$\text{and: } \boldsymbol{\nu} \sim N(0, \boldsymbol{\Gamma})$$

$$y_{i,t} = \mathbf{x}_{i,t}\boldsymbol{\beta} + \{\mathbf{x}_{i,t}\boldsymbol{\nu}_i + \epsilon_{i,t}\}$$

B.1.1 Baseline Empirical Estimates

In this section, I present several baseline empirical estimates that may be of interest to the reader when evaluating the results of the random coefficient model presented in the body of the chapter. Recall that the estimates from a random coefficient model are a weighted average of pooled OLS and a sub-function by sub-function OLS. A pooled OLS estimated for the same data as the RCM in the body of the chapter looks like this:

$$\begin{aligned} \text{Budget}_{i,t} &= \beta_0 + \beta_1 \text{Median of Majority}_{i,t} + \beta_2 \text{Population}_{i,t} + \beta_3 \text{Poverty}_{i,t} \\ &\quad + \beta_4 \text{Mandatory}_{i,t} + \beta_5 \text{GDP}_{i,t} + \beta_6 \text{BudgetLag}_{i,t} + \epsilon_{i,t} \\ &\quad i = 1, ..., 8 \text{ and } t = 1, ..., 45 \end{aligned} \tag{B.1}$$

The results are displayed in Table (B.3). In this pooled specification, the location of the median member of the majority party has the same sign and a similar magnitude to that found with the RCM specification from Equation 3.1. However, the results are not statistically significant at the 95% confidence level. As mentioned in the body of the chapter, the coefficient here is likely inconsistent because it does not take into account the heterogeneity of effects across the different budgetary sub-functions.

A sub-function by sub-function OLS estimated for the same data as the RCM in the body of the chapter looks like this:

$$\begin{aligned}\text{Budget for sub-function s}_{t,s} \;=\; & \beta_0 + \beta_1\text{Median of Majority}_{t,s} + \beta_2\text{Population}_{t,s} + \beta_3 \\ & \text{Poverty}_{t,s} + \beta_4\text{Mandatory}_{t,s} + \beta_5\text{GDP}_{t,s} + \beta_6\text{BudgetLag}_{t,s} \\ & +\epsilon_{t,s} \\ & t = 1, ..., 45 \text{ and s} = \{\text{Unemployment, Food,} \\ & \text{Other Income Support, Community Development,} \\ & \text{Regional Development, Job Training,} \\ & \text{Social Services, Housing}\} \qquad \text{(B.2)}\end{aligned}$$

The results are displayed in Table (B.4). The results of this estimation are consistent but inefficient. The standard errors are wrong because they are not taking advantage of the full structure of the data. Looking across the sub-function categories, the estimated partial effect of the location of the median member of the majority party has a similar magnitude and sign as the effect found in the random coefficient model for the sub-functions relating to food, income support, regional development, and job training. For unemployment, social services, and housing, the effect is of the same sign (negative), but the effect is much larger than the estimate from the random coefficient model. The effect on community development is actually of the opposite sign than the random coefficient model estimate. However, the result is not remotely statistically significant.

B.1.2 Alternative Empirical Specifications

In this section, I present several alternative empirical specifications to the one presented in the chapter. For each, the Party Cartel model is still used as the theoretical motivation. What differs is the operationalization of the main variables and/or the addition of alternate controls. The first uses a different measure of the location of the median member of the majority party, and the second attempts to create a measure of the demand for redistribution that better mirrors Meltzer & Richard (1981) by looking at the size of the difference between the median family income of the median house district represented by the majority party and the national mean family income. Finally, a specification with controls for the location of the median member of the Senate and the President is included.

Location of the median member: In the body of the chapter, a member of Congress' preference for income redistribution is proxied for using the median family income of their district. An alternative would be to use an ideal point estimated from all roll call votes like DW-NOMINATE Common Space scores. These scores run from -1 (extremely liberal) to +1 (extremely conservative), and first dimension DW-NOMINATE scores are generally regarded by scholars as a liberal-conservative scale with respect to economic policy[1] (Poole & Rosenthal 2001). For this specification, I use DW-NOMINATE to find the ideological position of the median member of the majority party. Figure (B.7) shows the location of the median member of the majority party as measured by DW-NOMINATE scores. The hypothesis here is the same as that of the main specification in the body of the chapter: *The higher the median district income of the median member of the majority party, the lower the level of income redistribution.*

[1] Poole & Rosenthal (2001) state that "In most periods, the first dimension captures, roughly speaking, the conflict between rich and poor."

Using this operationalization of the location of the median member of the majority party, the following random coefficient model is estimated as:

$$\begin{aligned}
\text{Budget}_{i,t} &= \beta_{0,i} + \beta_{1,i}\text{Median of Majority NOMINATE}_{i,t} + \beta_{2,i}\text{Population}_{i,t} \\
&\quad + \beta_{3,i}\text{Poverty}_{i,t} + \beta_{4,i}\text{Mandatory}_{i,t} + \beta_{5,i}\text{GDP}_{i,t} + \beta_{6,i}\text{Budget}_{i,t-1} + \epsilon_{i,t} \\
&\quad \text{Where: } \boldsymbol{\beta}_i \sim N(\boldsymbol{\beta}, \Gamma) \\
&\quad i = 1, ..., 8 \text{ and } t = 1, ..., 45 \qquad \text{(B.3)}
\end{aligned}$$

The results of the random coefficient model estimation from equation (B.5) are presented in Table B.1. None of the estimates are statistically significant at the 95% confidence level. The location of the median member of the majority party is statistically significant at the 94% confidence level. For every .1 increase in the median district income of the median member of the majority party, the level of income redistribution falls by an average of approximately \$550 million for each Budget Authority category. This translates into a \$4.4 billion overall decrease in total redistributional Budget Authority. The results are of similar substantive size to the results using the median family income of the median member of the majority party. This supports the finding of (McCarty, Poole & Rosenthal 2006) that district income and member's NOMINATE scores are highly correlated.

A Different Approach to Measuring Party Cartel: In the body of the chapter I followed much of the existing literature that attempts to directly measure the effect of congressional policy making by assuming that it is the location of the median member of the majority party that directly affects the level of income redistribution[2]. In this section, rather than simply examining the median family income of the district represented by the median member of the majority party, I look at the difference between the median family income of the district represented by the median member of the majority party and mean family income for the entire U.S. Figure (B.1) displays the difference between median family income of the median district represented by the majority party and median income for the years in the data set.

[2]A few recent examples are Aldrich, Gomez & Merolla (2005) and Anderson (2008).

Recall that Meltzer & Richard (1981) predict that, *"the greater the distance between the median and mean income, the greater the amount of redistribution."* For this specification, I modify their prediction by examining the median of the majority party, so that the prediction becomes: *"the greater the distance between the family income of the median district represented by the majority party and national mean family income, the greater the amount of redistribution."*

The difference between Mean and Median of the Majority party family income is not statistically significant, and the partial effect is the opposite of that predicted by Meltzer and Richard. For every $1000 that median and mean family income deviate, the level of redistribution falls by an average of $392 hundred million.

Alternate Control for Increases in Mandatory Programs: Poverty may not be sensitive enough to adequately control for the automatic increases in mandatory social welfare programs that occur when the economy is doing poorly. Using the unemployment rate, rather than the poverty rate, the following random coefficient model is estimated in the following way:

$$\begin{aligned} \text{Budget}_{i,t} &= \beta_{0,i} + \beta_{1,i}\text{Median of Majority}_{i,t} + \beta_{2,i}\text{Population}_{i,t} \\ &\quad + \beta_{3,i}\text{Unemployment}_{i,t} + \beta_{4,i}\text{Mandatory}_{i,t} + \beta_{5,i}\text{GDP}_{i,t} + \beta_{6,i}\text{Budget}_{i,t-1} + \epsilon_{i,t} \\ &\quad \text{Where: } \boldsymbol{\beta}_i \sim N(\boldsymbol{\beta}, \Gamma) \\ &\quad i = 1, ..., 8 \text{ and } t = 1, ..., 45 \end{aligned} \tag{B.4}$$

The results (B.7) are presented in Table B.7. The location of the median member of the majority party is statistically significant at the 95% confidence level. For each $1,000 increase in the median district income of the median member of the majority party, the level of income redistribution falls by an average of $77 million for each Budget Authority category. The results are of a substantially smaller size compared to the results using the poverty rate.

B.1.3 A More Institutionally Informed Specification

In this section, I present the results of an analysis of the effect of congressional politics on income redistribution using a several variables that attempt to control for institutional features of congressional politics not captured by the party cartel model. The party cartel model is a House centric model, and there is no explicit role for the Senate in the model. There is also no specific role for the President of the United States. This omission seems strange in light of the fact that all Budget Authority must pass both the House and the Senate as well as be signed by the President.[3] In order to control for any possible effect on the level of redistribution the Senate and President may have, this specification includes two additional controls. The first is a dummy variable that equals 1 when the median family income for the entire United States is less than the median family income of the district represented by the median member of the majority party in the House of Representatives and 0 otherwise. If the median voter in the population wants as much or more redistribution than the median member of the majority party (as proxied by family income), then we would expect to see higher levels of redistributional Budget Authority. The same holds true for the median member of the Senate. As such, I have included another dummy variable that is 1 when the median member of the Senate has a constituency with a lower median family income than does the median member of the majority party in the House. The resulting specification can be seen in Equation (B.5), and the results are displayed in Table (B.8).

$$\begin{aligned}
\text{Budget}_{i,t} &= \beta_{0,i} + \beta_{1,i}\text{Median of Chamber}_{i,t} + \beta_{2,i}\text{Population}_{i,t} + \beta_{3,i}\text{Poverty}_{i,t} \\
&\quad + \beta_{4,i}\text{Mandatory}_{i,t} + \beta_{5,i}\text{GDP}_{i,t} + \beta_{6,i}\text{President Left}_{i,t-1} \\
&\quad + \beta_{7,i}\text{Med. Senate Left}_{i,t-1} + \beta_{8,i}\text{Budget}_{i,t-1} + \epsilon_{i,t} \\
&\quad \text{Where: } \boldsymbol{\beta}_i \sim N(\boldsymbol{\beta}, \Gamma) \\
&\quad i = 1, ..., 8 \text{ and } t = 1, ..., 45 \qquad \text{(B.5)}
\end{aligned}$$

[3] A rival model to the party cartel model that does include explicit roles for the Senate and the President is the Pivotal Politics model of Krehbiel (1998).

The location of the median member of the majority party is no longer statistically significant at the 95% confidence level when the institutional dummies are included. This could be due to the high level of multicolinearity between several of the right hand side variables. The two new dummy variables are highly correlated, and there are only rare years in which either the national median income or the median income of the median state are lower than the median family income of the district represented by the median member of the House of Representatives.

B.2 Tables for Chapter 3

Table B.1: Random Coefficient Model Estimation of the Effect of the Location of the Median Member of the Majority Party on the Level of Redistributional Budget Authority

	Coefficent	Standard Error	p-value
(Intercept)	-14716.896	18342.396	0.422
Median of Majority	-0.489	0.240	0.042
Lag DV	0.725	0.037	0.000
Population	0.000	0.000	0.514
Poverty	537.829	546.451	0.325
Mandatory	1986.830	1530.099	0.241
GDP	1.371	1.761	0.436
$\sigma_{\beta 1} = 0.1946107$,	$\sigma_{intercept} = 3738.878$,	$\sigma_{\epsilon} = 8997.538$	

Table B.2: RCM with Difference Between Mean Family Income and Median Family Income on Redistributional Sub-functions.

	Coefficent	Standard Error	p-value
(Intercept)	20123.660	20130.842	0.318
Mean Inc. - Median Inc.	-2.740	0.699	0.001
Lag DV	0.711	0.037	0.000
Population	0.000	0.000	0.152
Poverty	311.292	540.608	0.565
Mandatory	1789.265	1521.991	0.284
GDP	.982	2.503	0.001

Table B.3: Pooled OLS Results for main specification.

	Coefficent	Standard Error	p-value
(Intercept)	-6623.000	18640.000	0.723
Median of Majority	-.351	.233	0.133
Lag DV	.805	.033	0.000
Population	.000	.000	0.827
Poverty	447.500	559.600	0.424
Mandatory	2618.000	10084.000	0.016
GDP	1.390	1.805	0.441

Table B.4: Equation by Equation Results for main specification.

Coefficent (p-value)	Intercept	Median of Majority	Lag DV	Pop.	Pov.	GDP
Unemployment	**-130300***	**-1.517***	.2731	**.0010***	1181	-6.302
	(.003)	(.008)	(.095)	(.004)	(.233)	(.072)
Food	-22350	**-.422***	**.844***	.001	-165.3	-.063
	(.101)	(.021)	(.000)	(.067)	(.688)	(.966)
Other Inc. Support	**-.001***	**-.694***	**.763***	**.001***	-600.2	.002
	(.034)	(.003)	(.000)	(.016)	(.245)	(.999)
Com. Dev.	**-5015**	.158	.203	.001	208.7	-4.486
	(.047)	(.565)	(.228)	(.054)	(.765)	(.058)
Reg. Dev.	**-42930***	**-.470***	.1405	.001	218.9 3	-2.275
	(.014)	(.023)	(.404)	(.011)	(.624)	(.129)
Job Training	**-42090***	**-.498***	.189	**.001***	102.7	-2.234
	(.0182)	(.0190)	(.259)	(.012)	(.820)	(.141)
Soc. Serv.	-2547	-2.080	**.5447***	.0000	1965	9.065
	(.980)	(.140)	(.001)	(.998)	(.523)	(.360)
Housing	-36260	-1.464	**.531***	.0000	3666	5.846
	(.701)	(.242)	(.001)	(.911)	(.188)	(.503)

Table B.5: Random Coefficient Model Estimation of the Effect of the Location of the Median Member of the Majority Party (NOMINATE) on the Level of Redistributional Budget Authority

	Coefficent	Standard Error	p-value
(Intercept)	9324.696	21081.420	0.659
Median of Majority	-5499.305	2863.668	0.056
Lag DV	0.787	0.033	0.000
Population	0.000	0.000	0.342
Poverty	752.116	552.153	0.174
Mandatory	2834.304	1407.983	0.091
GDP	3.042	2.120	0.152

Table B.6: RCM with Difference Between Mean Family Income and Median Family Income of the Median District Represented by the Majority Party on Redistributional Sub-functions.

	Coefficent	Standard Error	p-value
(Intercept)	3555.797	22623.359	0.875
Mean Inc. - Median Inc.	-0.392	0.284	0.169
Lag DV	0.756	0.036	0.000
Population	0.000	0.000	0.745
Poverty	330.152	602.771	0.584
Mandatory	2010.366	1458.682	0.217
GDP	1.822	1.913	0.341

Table B.7: Random Coefficient Model Estimation of the Effect of the Location of the Median Member of the Majority Party (Income) on the Level of Redistributional Budget Authority, Using Unemployment Rate as a Control.

	Coefficent	Standard Error	p-value
(Intercept)	-35260.45	21374.834	0.100
Median of Majority	-0.77	0.283	0.007
Lag DV	0.74	0.037	0.000
Population	0.00	0.000	0.106
Unemployment	-1028.75	546.066	0.060
Mandatory	2000.72	1505.602	0.232
GDP	-0.06	1.915	0.973

Table B.8: Random Coefficient Model Estimation of the Effect of the Location of the Median of the Chamber on the Level of Redistributional Budget Authority with Institutional Controls

	Coefficent	Standard Error	p-value
(Intercept)	-32361.89	24731.073	0.191
Median of Majority	-0.71	0.435	0.106
Lag DV	0.72	0.037	0.000
Population	0.00	0.000	0.254
Poverty	776.76	576.431	0.178
Mandatory	1972.67	1527.281	0.244
GDP	0.28	2.170	0.898
Pres. Left of Med. of Maj.	-4178.10	4698.110	0.374
Senate Med. Left of Med. Maj.	5540.18	1571.358	0.000

B.3 Figures for Chapter 3

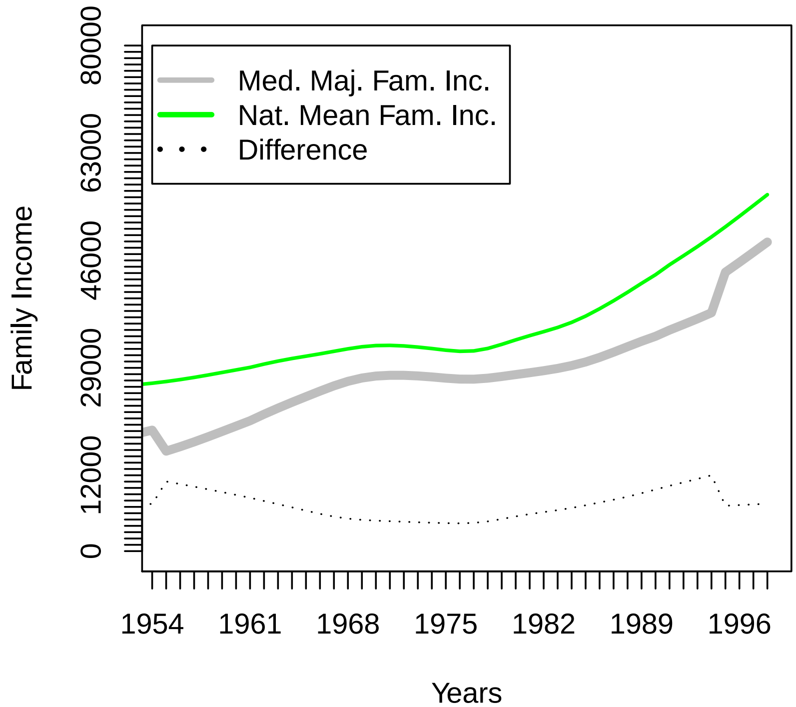


Figure B.1: Difference Between the Median Family Income of the Median District Represented by the Majority Party and National Mean Family Income

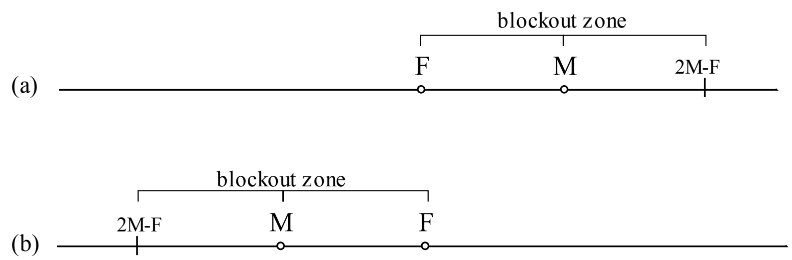


Figure B.2: Examples of Party Cartel Blockout Zones

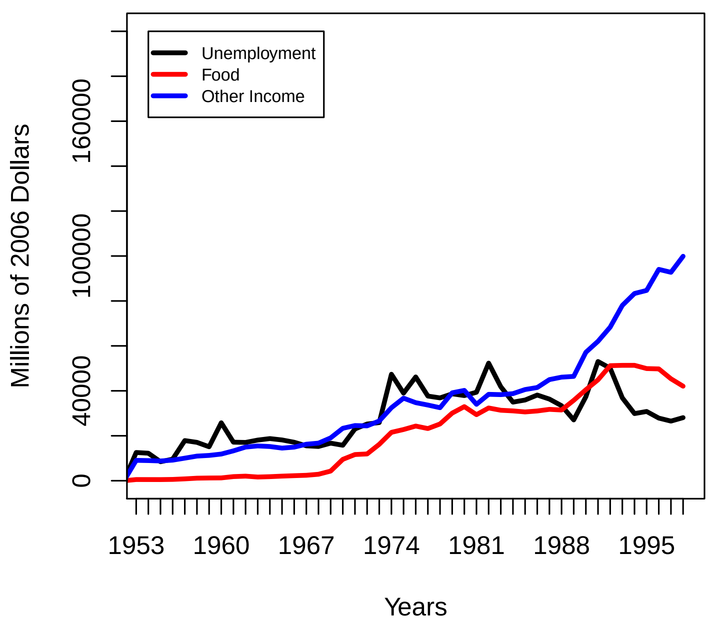


Figure B.3: Budget Authority for Mandatory Income Redistribution Sub-functions.

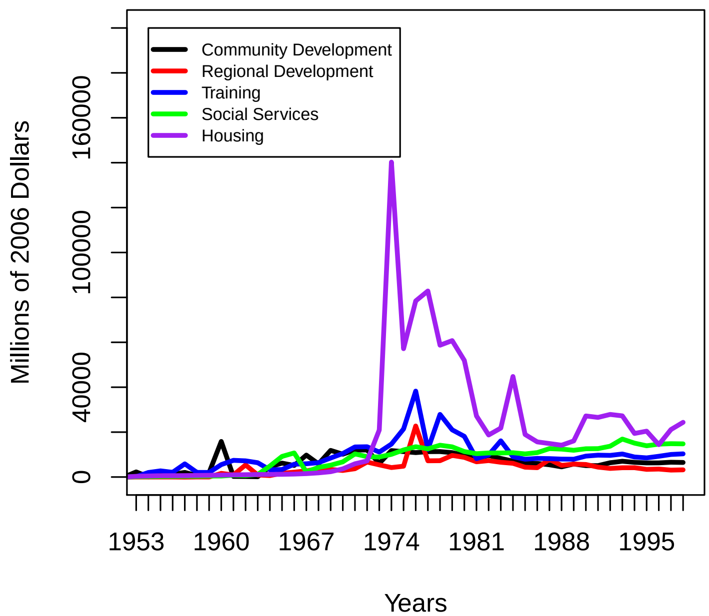


Figure B.4: Budget Authority for Discretionary Income Redistribution Sub-functions.

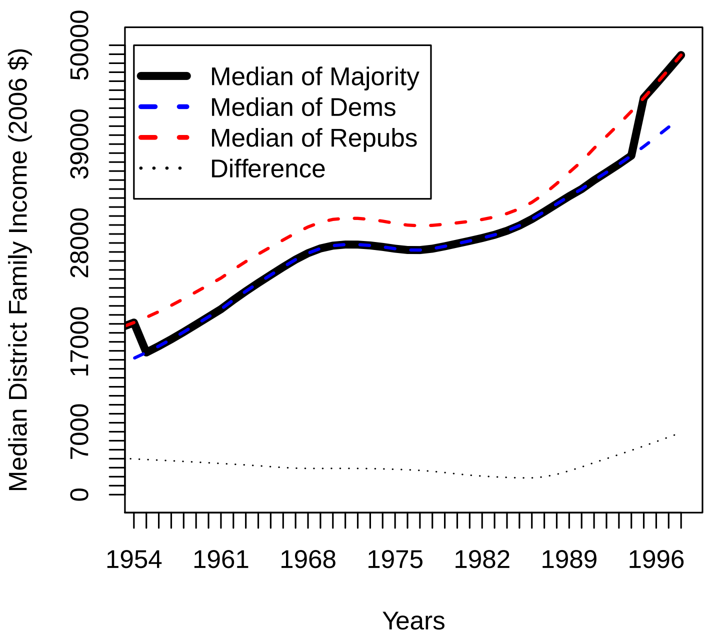


Figure B.5: Location of the Median Member of the Majority Party with Respect to Median District Family Income.

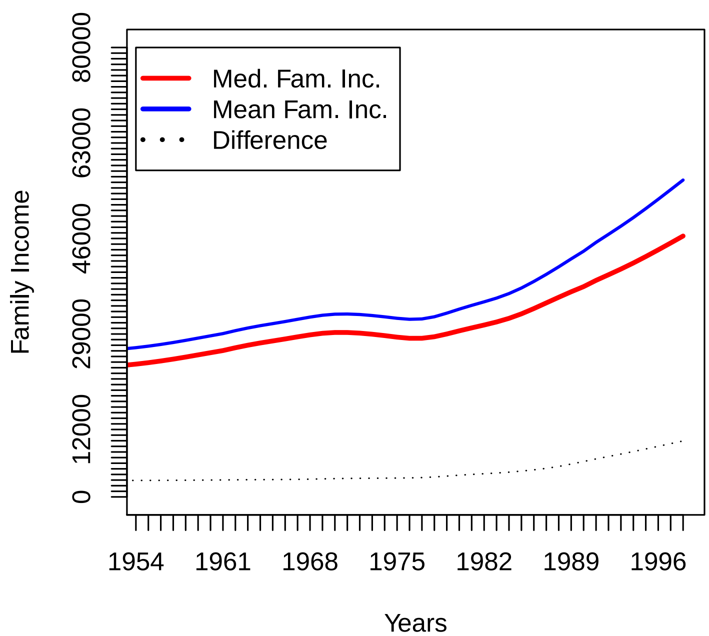


Figure B.6: Difference Between Mean Family income and Median Family Income

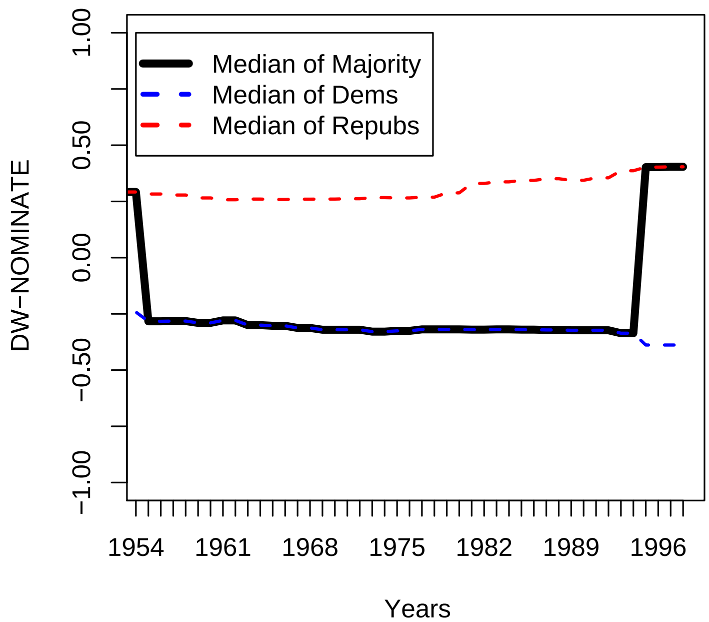
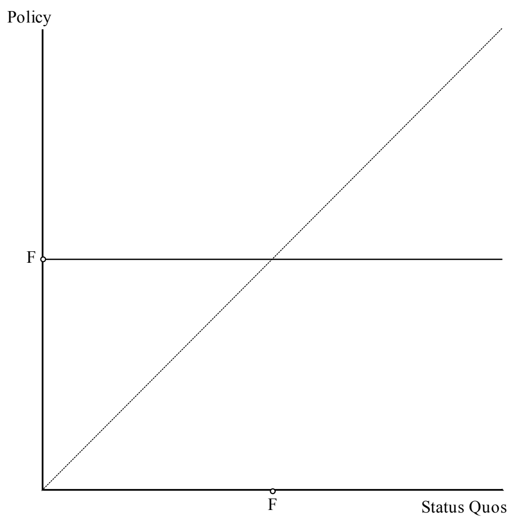


Figure B.7: Location of the Median Member of the Majority Party Using DW-NOMINATE Common Space Scores.

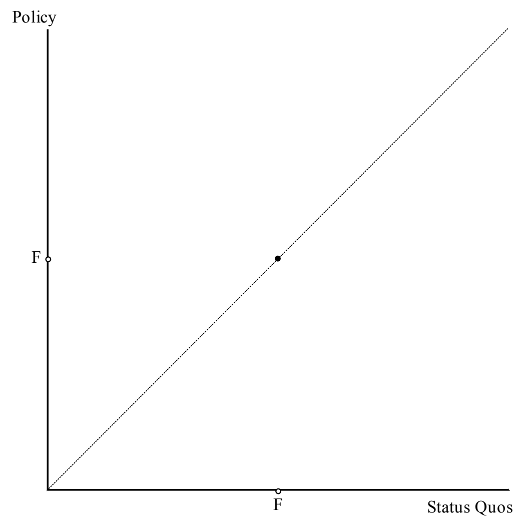
Appendix C

Chapter 4

C.1 Figures for Chapter 4

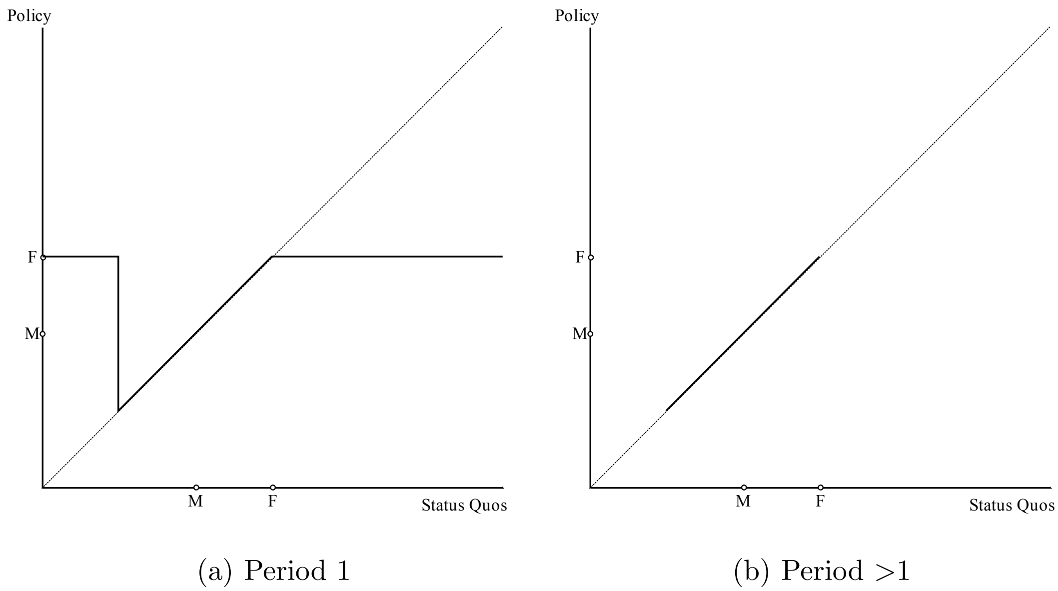


(a) Period 1



(b) Periods >1

Figure C.1: Simple Median Voter Example: The 45 degree dotted line is provided for reference and represents the hypothetical result of every status quo prevailing. The solid line shows which policies would actually obtain under pairwise majority rule under an open rule.



(a) Period 1 (b) Period >1

Figure C.2: Party Cartel Example: The 45 degree dotted line is provided for reference and represents the hypothetical result of every status quo prevailing. The solid line shows which policies would actually obtain under pairwise majority rule under an open rule.

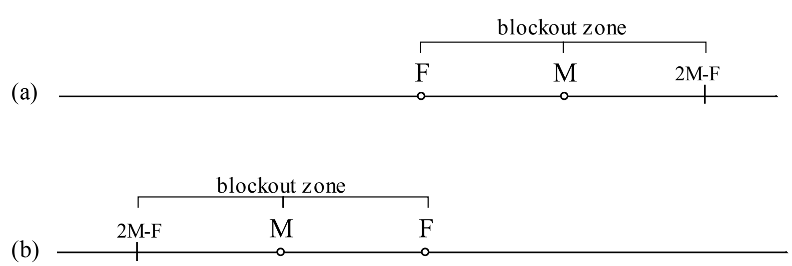


Figure C.3: Examples of Party Cartel Blockout Zones

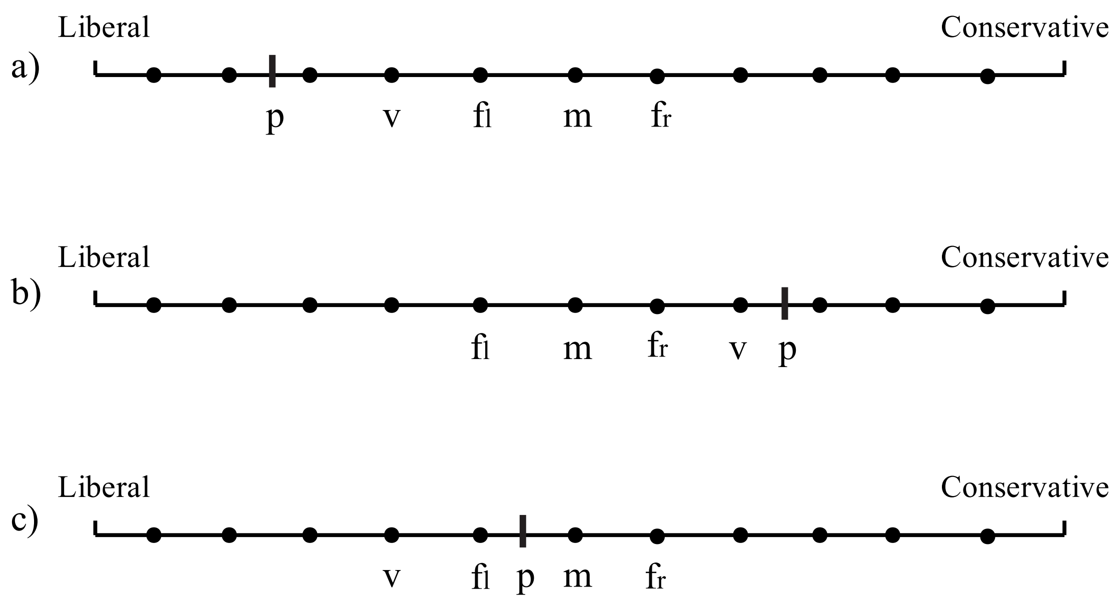


Figure C.4: Examples of the Pivotal Politics Model

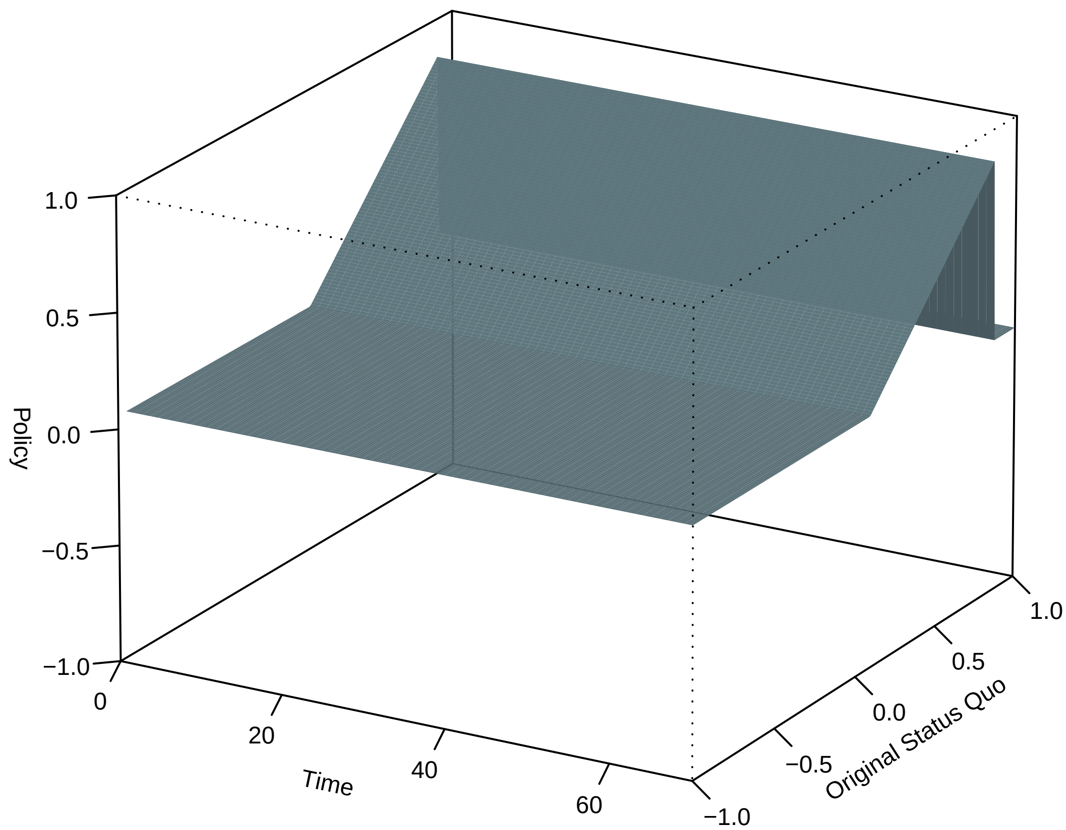
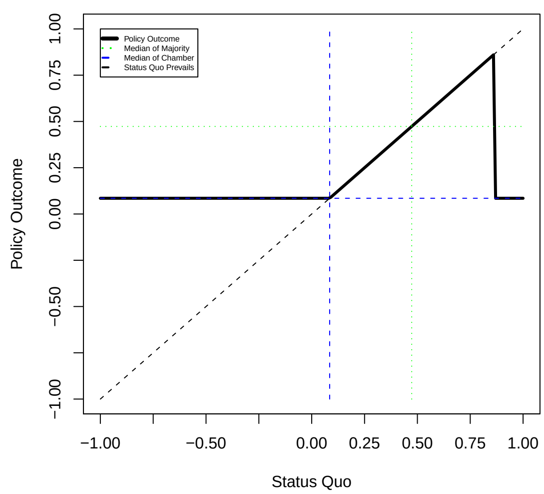
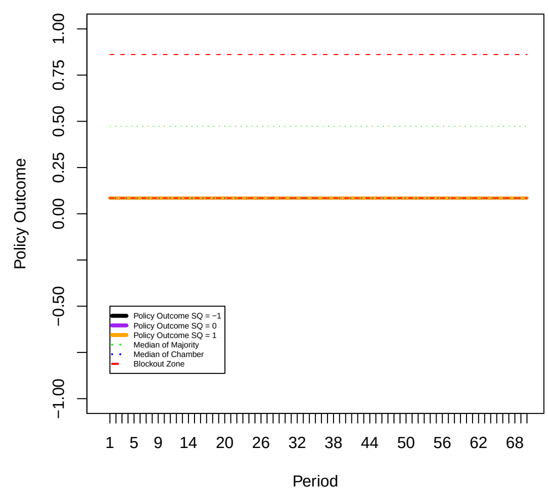


Figure C.5: Policy Outcomes Across Time and Possible Status Quos for the Party Cartel Model with No Perturbations of Ideals and No Inheritance of Status Quos.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.6: Policy Outcomes for Party Cartel Model with No Perturbations of Ideal Points and No Inheritance of Status Quos.

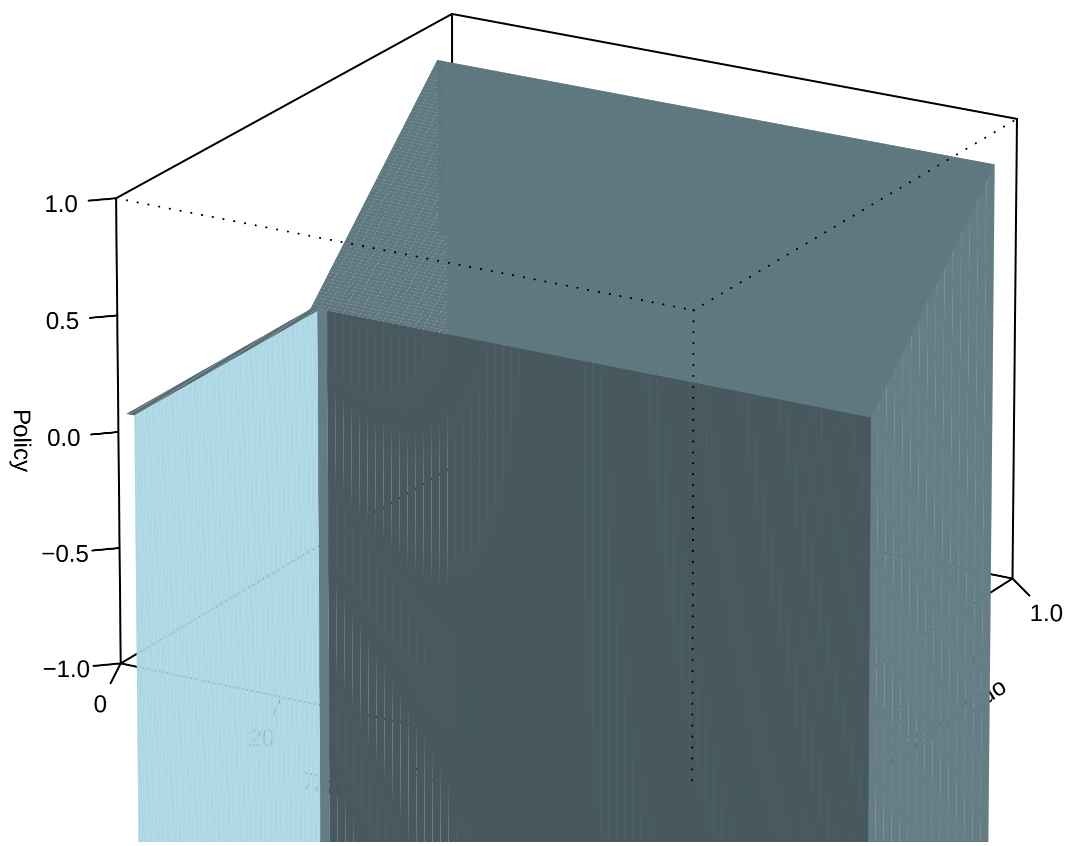
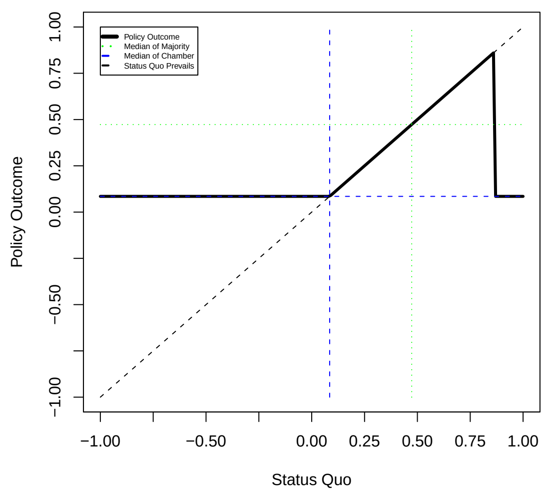
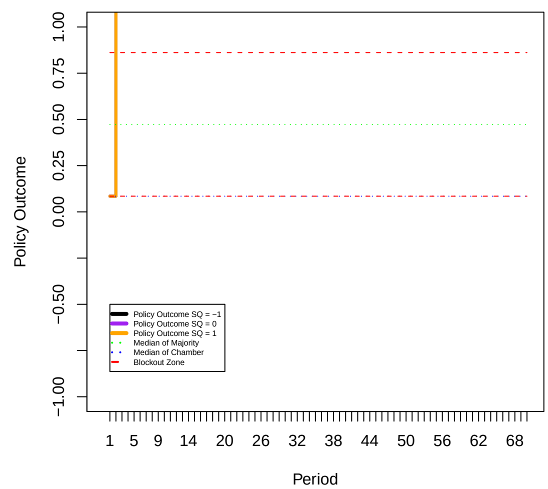


Figure C.7: Policy Outcomes Across Time and Possible Status Quos for the Party Cartel Model with No Perturbations of Ideal Points.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.8: Policy Outcomes for the Party Cartel Model with No Perturbations of Ideal Points.

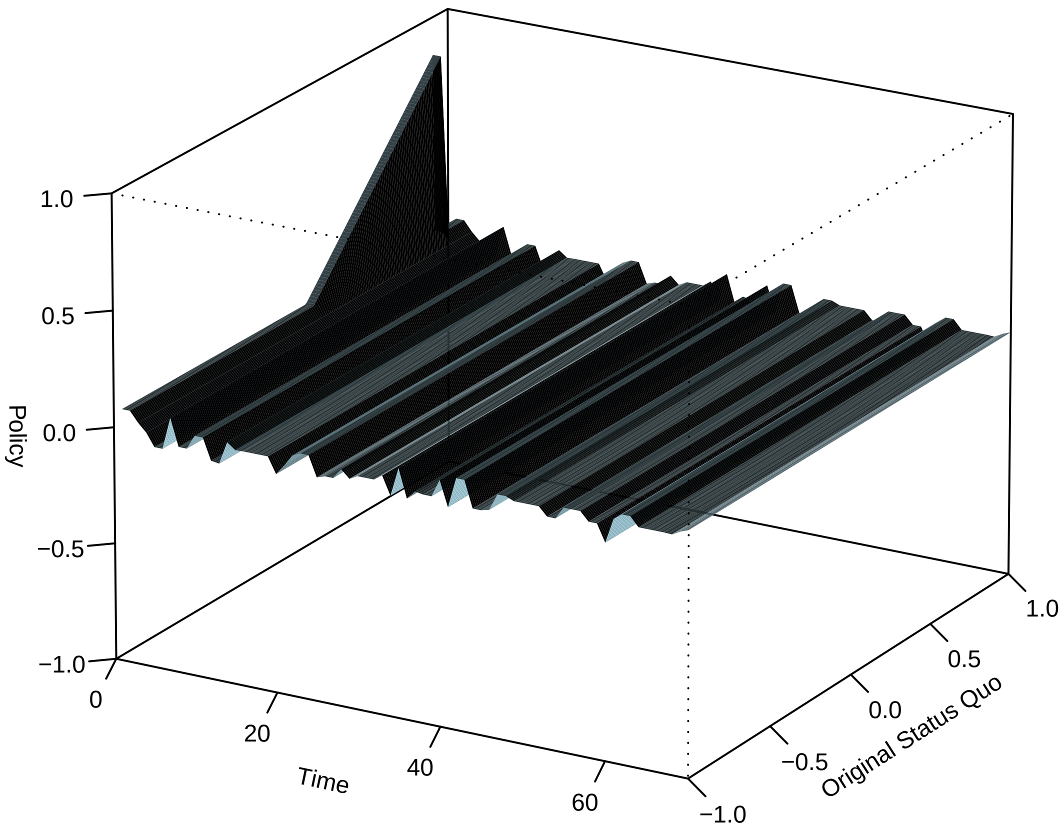
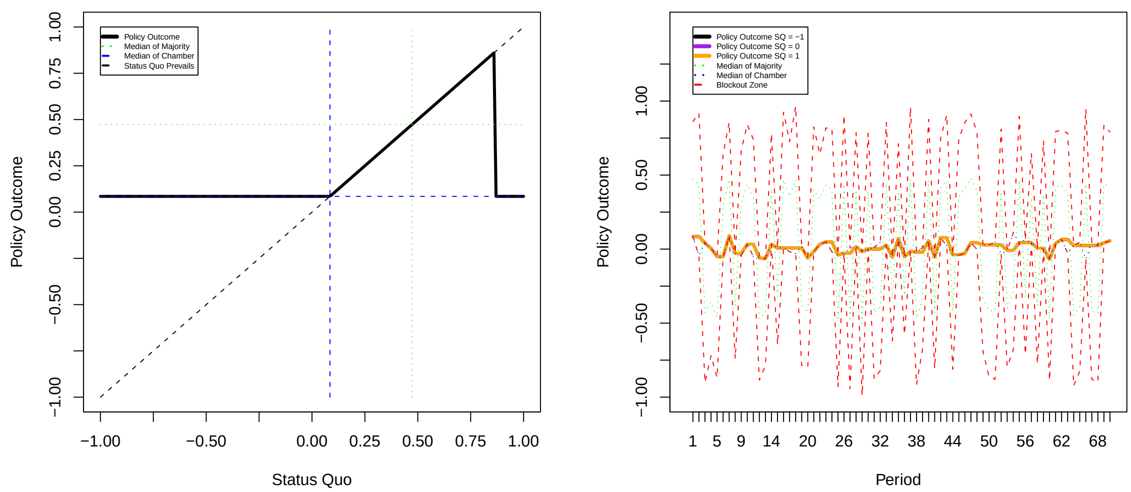


Figure C.9: Policy Outcomes Across Time and Possible Status Quos for the Party Cartel Model with Random Perturbations of Ideal Points.



(a) Period 1 across all Possible Status Quos.

(b) Policy Across Time for two Initial Status Quos.

Figure C.10: Policy Outcomes for the Party Cartel Model with Random Perturbations of Ideal Points.

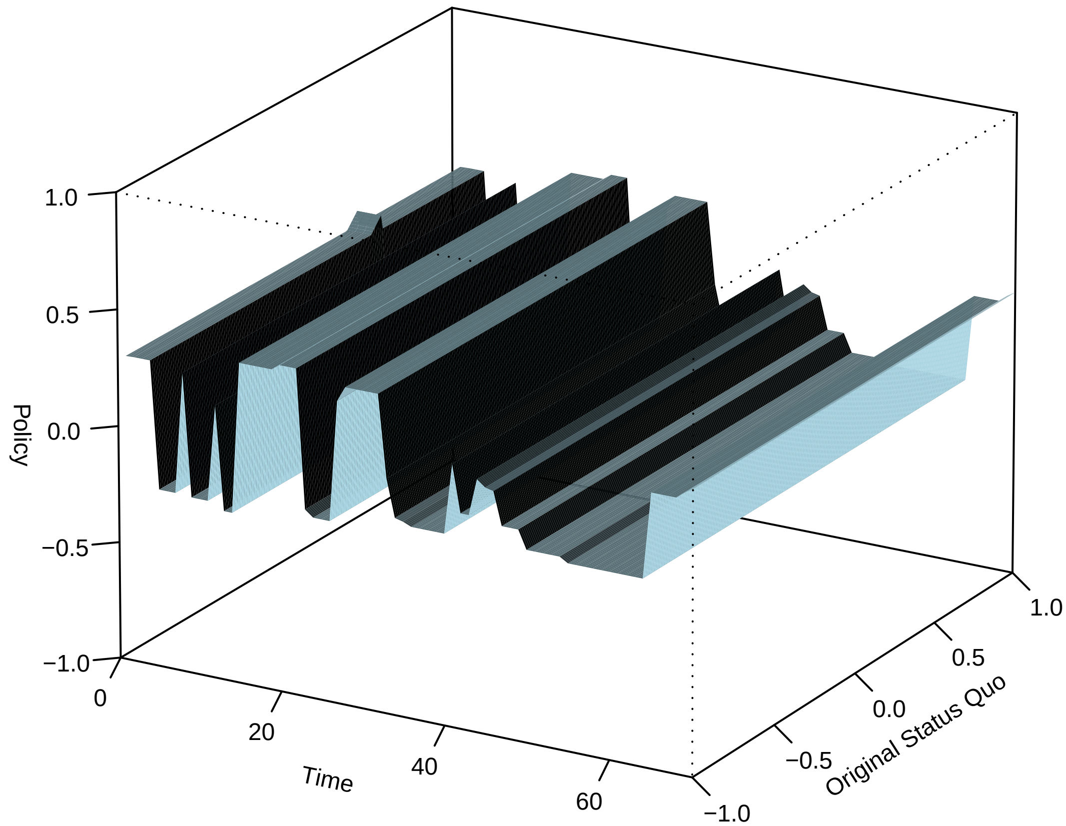
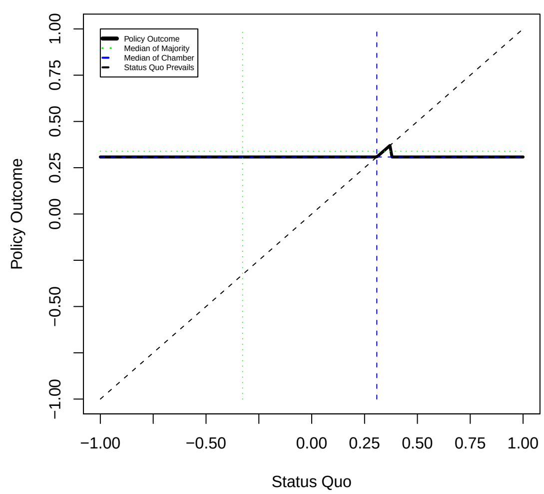
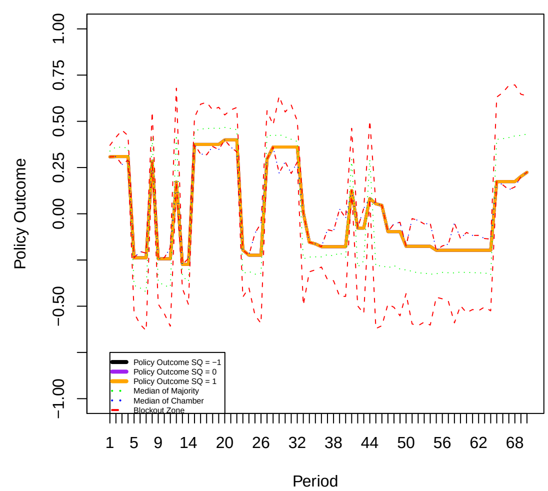


Figure C.11: Policy Outcomes Across Time and Possible Status Quos for the Party Cartel Model with 1st Dimension DW-NOMIMATE Common Space Scores.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.12: Policy Outcomes for the Party Cartel Model with 1st Dimension DW-NOMIMATE Common Space Scores.

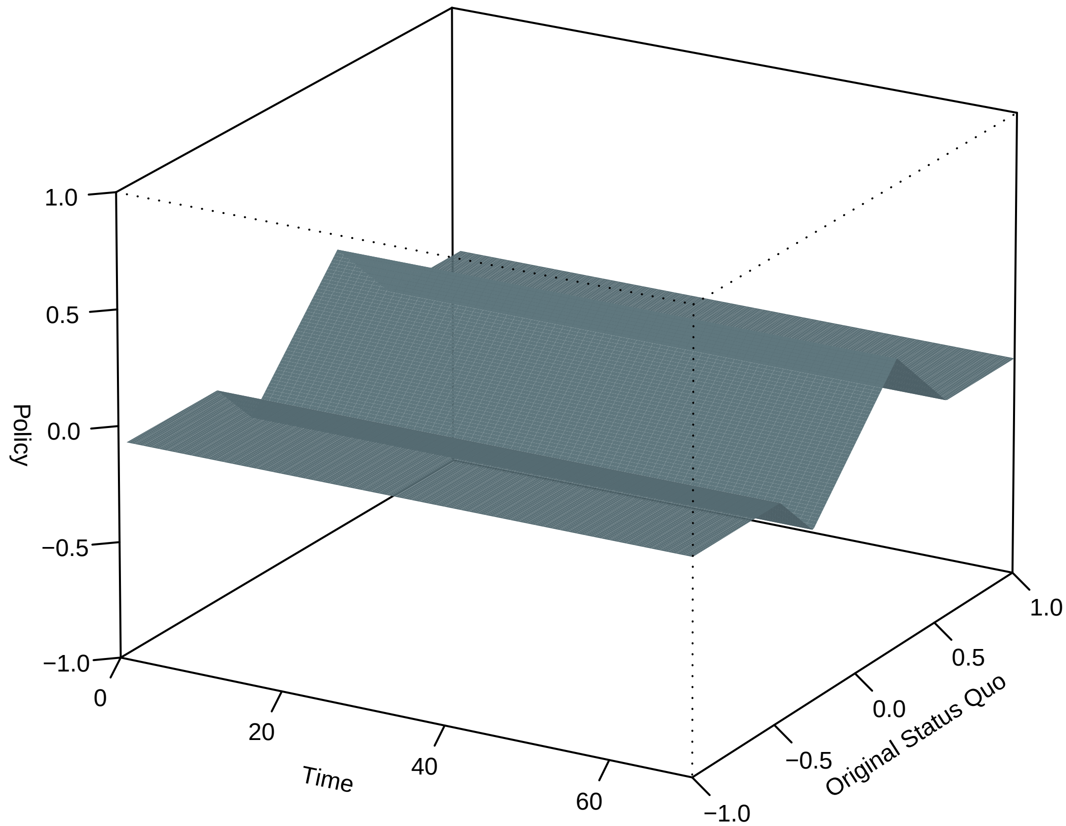
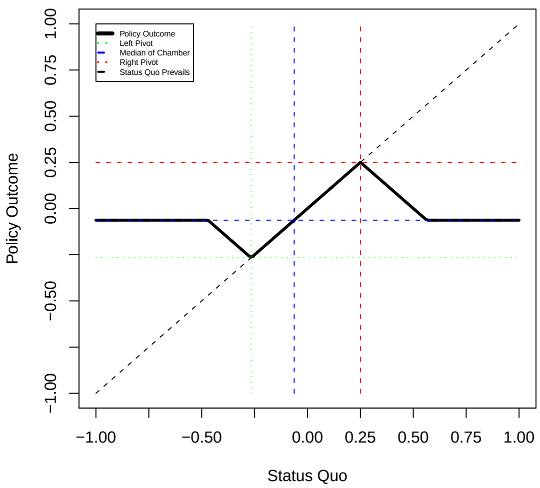
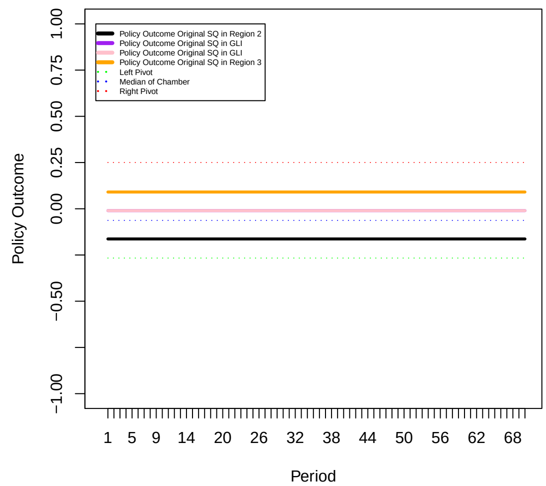


Figure C.13: Policy Outcomes Across Time and Possible Status Quos for the Pivotal Politics Model with No Perturbations of Ideal Points and No Inheritance of Status Quos.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.14: Policy Outcomes for the Pivotal Politics Model with No Perturbations of Ideal Points and No Inheritance of Status Quos.

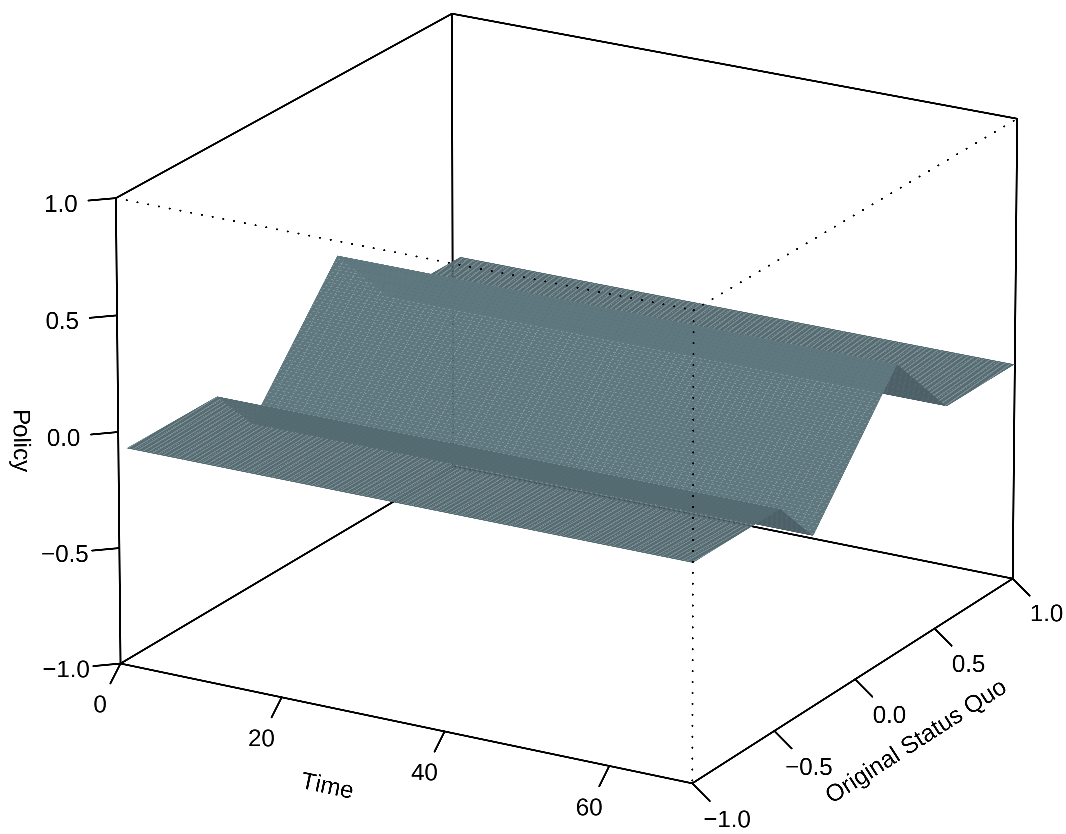
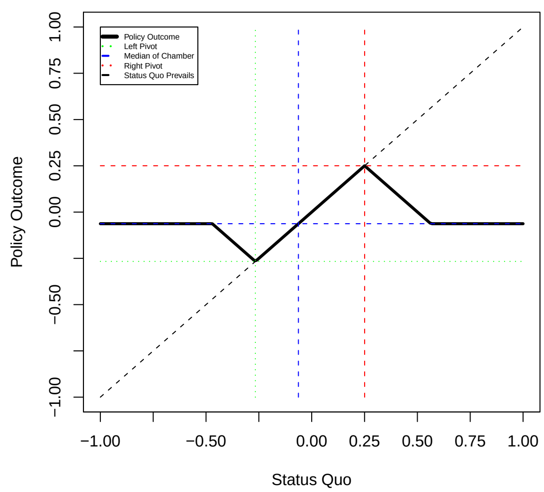
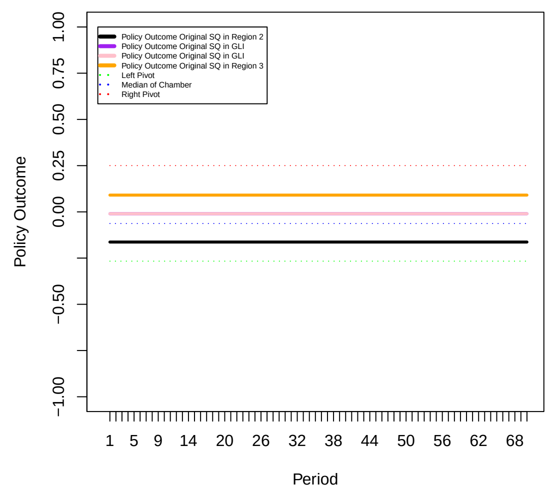


Figure C.15: Policy Outcomes Across Time and Possible Status Quos for the Pivotal Politics Model with No Perturbations of Ideal Points.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.16: Policy Outcomes for the Pivotal Politics Model with No Perturbations of Ideal Points.

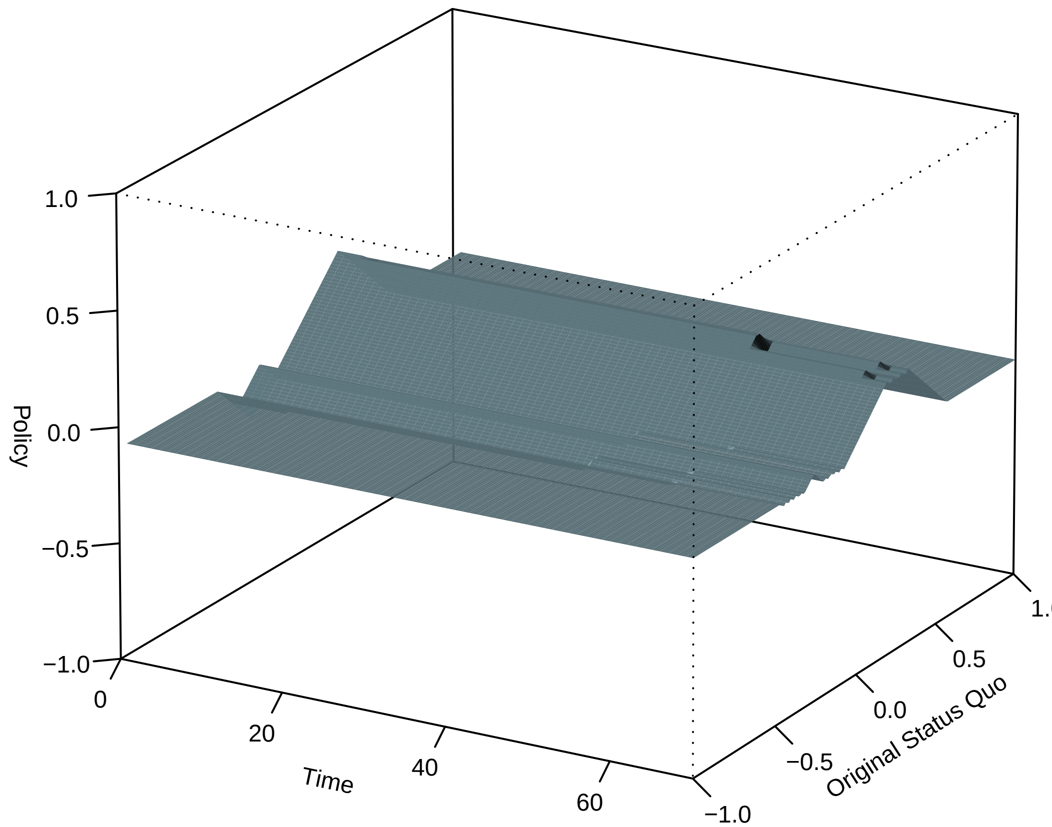
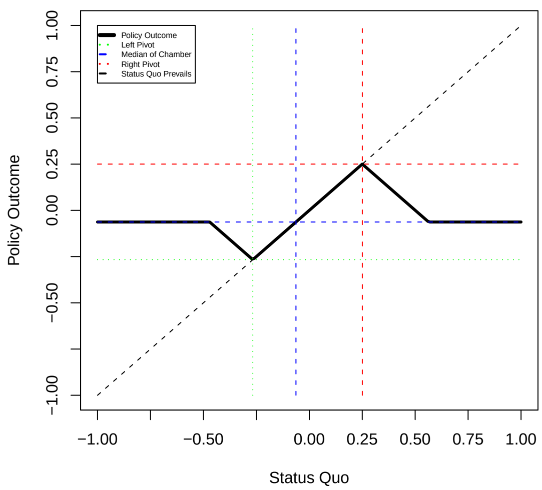
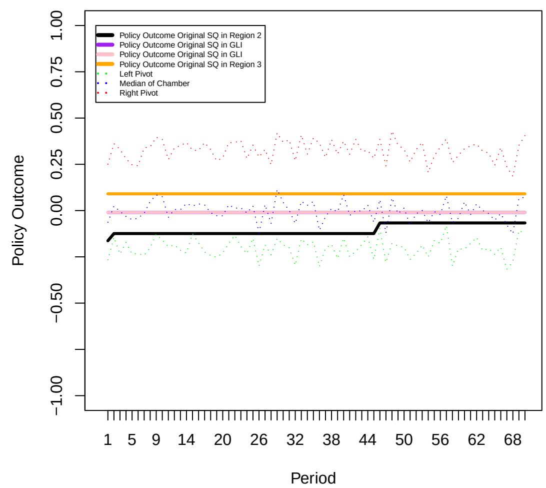


Figure C.17: Policy Outcomes Across Time and Possible Status Quos for the Pivotal Politics Model with Random Perturbations of Ideal Points.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.18: Policy Outcomes for the Pivotal Politics Model with Random Perturbations of Ideal Points.

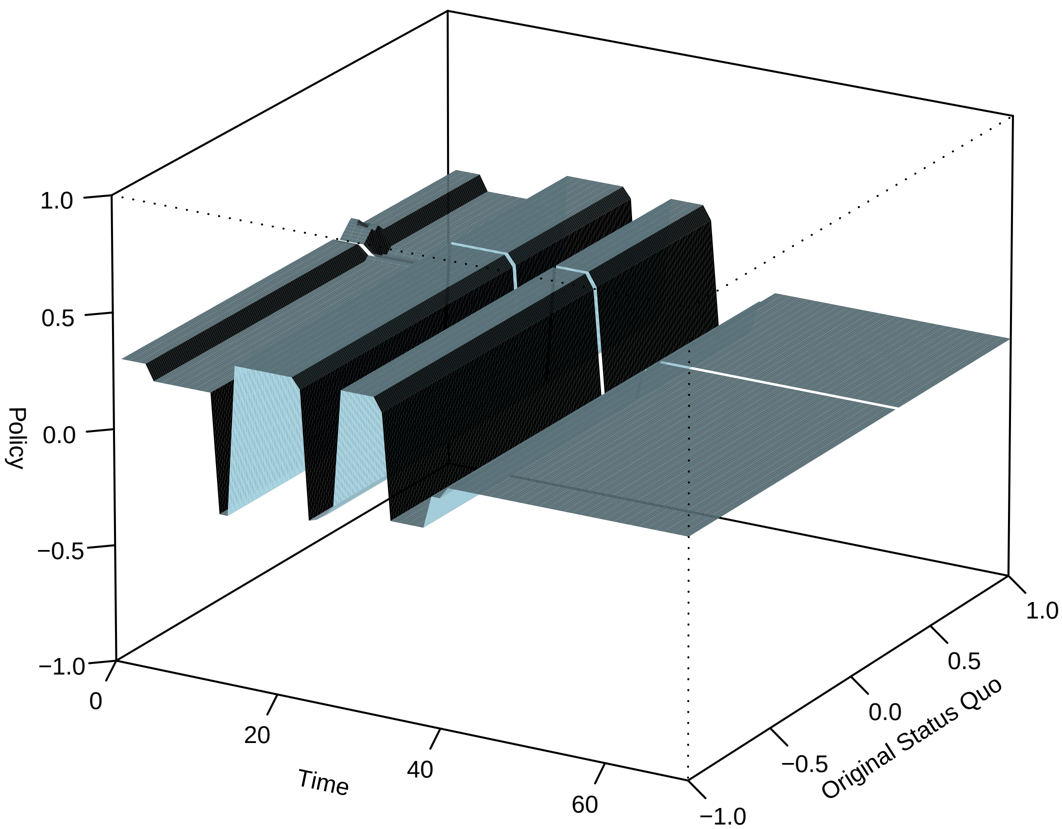
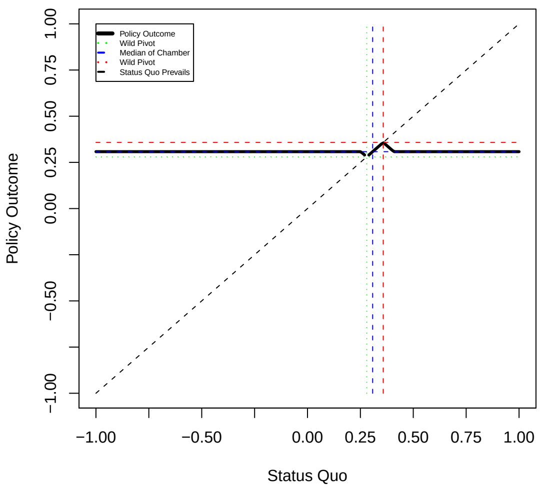
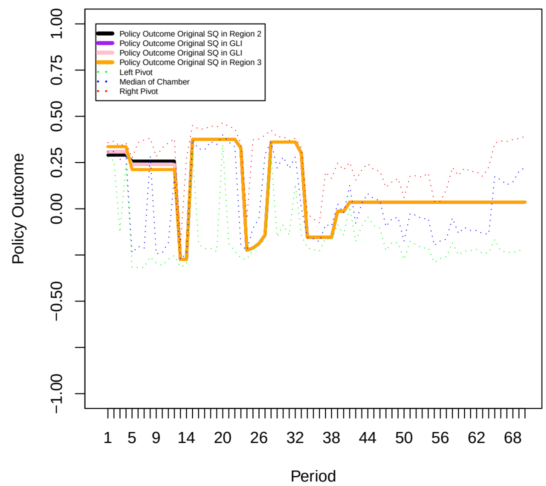


Figure C.19: Policy Outcomes Across Time and Possible Status Quos for the Pivotal Politics Model with 1st Dimension DW-NOMIMATE Common Space Scores.



(a) Period 1 across all Possible Status Quos.



(b) Policy Across Time for two Initial Status Quos.

Figure C.20: Policy Outcomes for the Pivotal Politics Model with 1st Dimension DW-NOMIMATE Common Space Scores.

C.2 R Code for Chapter 4

C.2.1 Set Up Code: Globals and Administrative Functions

```
mySweep <- c(.010*-100:100)
plotSweep <- c(.10*-10:10)
sweepMatrixA <- matrix(mySweep,length(mySweep),length(mySweep))
sqSweep <- as.vector(matrix(mySweep,1,length(mySweep)*length(mySweep)))
propSweep <- as.vector(matrix(t(sweepMatrixA),1,length(mySweep)*length(mySweep)))
```

Set Number of Periods

```
periods <- 70
```

A Vote

```
oneDimVote <- function(ideals, sq, proposal) {
distSQ  <- abs(ideals-sq); distProposal  <- abs(ideals-proposal)
vote <- ifelse(distSQ<distProposal,0,1)
vote
}
```

Assign Parties

```
assignParty <- function(ideals){
probARepub <- (.5*(ideals))+.5
party <- rbinom (n=length(probARepub), size=1,prob=probARepub)
}
```

C.2.2 Party Cartel Model

```
partyCartelOneDimSingle <- function(ideals,party,sq,proposal){
medCham <- median(ideals,na.rm=TRUE)
medMaj <- ifelse(sum(party,na.rm=TRUE)<(length(ideals)/2),
     median(subset(ideals, party != 1),na.rm=TRUE),
     median(subset(ideals, party == 1),na.rm=TRUE))
bzlRaw <- ifelse(medMaj < medCham,(2*medMaj)-medCham,medCham)
bzrRaw <- ifelse(medMaj < medCham,medCham,(2*medMaj)-medCham)
bzl <- ifelse(bzlRaw<(-1),-1,bzlRaw)
bzr <- ifelse(bzrRaw>1,1,bzrRaw)
policy <- ifelse(abs(medMaj-sq)<abs(medMaj-medCham),sq,medCham)
```

```
outPolicy <- t(matrix(policy,201,201))
list(medMaj=medMaj,medCham=medCham,policy=outPolicy,bzl=bzl,bzr=bzr)
}
```

C.2.3 Pivotal Politics Model

```
pivotalPoliticsOneDimSingle <- function(ideals,sq,proposal,pres){
medCham <- median(ideals,na.rm=TRUE)
lVPivot <- sort(ideals)[ceiling(length(ideals)*(1/3))]
rVPivot <- sort(ideals) [floor(length(ideals)*(2/3))]
vPivot <- ifelse(pres<medCham,lVPivot,rVPivot)

lFPivot <- sort(ideals)[ceiling(length(ideals)*(2/5))]
rFPivot <- sort(ideals) [floor(length(ideals)*(3/5))]
fPivot <- ifelse(pres<medCham,rFPivot,lFPivot)

glLRaw <- ifelse(pres < lVPivot,lVPivot,NA)
glLRaw <- ifelse(lVPivot<pres & pres<lFPivot,pres,glLRaw)
glLRaw <- ifelse(lFPivot<pres,lFPivot,glLRaw)

glRRaw <- ifelse(pres<rFPivot,rFPivot,NA)
glRRaw <- ifelse(rFPivot<pres & pres<rVPivot,pres,glRRaw)
glRRaw <- ifelse(rVPivot<pres,rVPivot,glRRaw)

lPivot <- ifelse(glLRaw<(-1),-1,glLRaw)
rPivot <- ifelse(glRRaw>1,1,glRRaw)

policy <- ifelse(sq<((2*lPivot)-medCham) | ((2*rPivot)-medCham)<sq,medCham,NA)
policy <- ifelse(lPivot<sq & sq<rPivot,sq,policy)
policy <- ifelse(((2*lPivot)-medCham)<sq & sq<lPivot,((2*lPivot)-sq),policy)
policy <- ifelse(rPivot<sq & sq<((2*rPivot)-medCham),((2*rPivot)-sq),policy)

outPolicy <- t(matrix(policy,201,201))
list(vPivot=vPivot,fPivot=fPivot,medCham=medCham,policy=outPolicy,lPivot=lPivot,rPivot=rPivot,
}
```

C.2.4 The Treatments

These are the functions used to perturb the ideal points of the members between each Congress.

Random

```
perturbRand <- function(oldIdeals) {
ideals <- oldIdeals+(runif(length(oldIdeals),(-1-oldIdeals),(-oldIdeals+1)))
}
```

C.2.5 Party Cartel with Random Perturbations of Ideal Points

This is a complete example of what one of the treatments as applied to the party cartel model looks like.

```
policyMultiGenRand <- matrix(NA,periods,length(mySweep))
medChamMultiGenRand <- matrix(NA,periods,length(mySweep))
medMajMultiGenRand <- matrix(NA,periods,length(mySweep))
bzlMultiGenRand <- matrix(NA,periods,length(mySweep))
bzrMultiGenRand <- matrix(NA,periods,length(mySweep))
theIdeals <- membersIdeal
theParties <- membersParty
theSqSweep <- sqSweep
thePropSweep <- propSweep
for (i in 1:periods){
outPeriod <- partyCartelOneDimSingle(theIdeals,theParties,theSqSweep,thePropSweep)

policyMultiGenRand[i,] <- outPeriod$policy[100,]
medChamMultiGenRand[i,] <- outPeriod$medCham
medMajMultiGenRand[i,] <- outPeriod$medMaj
bzlMultiGenRand[i,] <- outPeriod$bzl
bzrMultiGenRand[i,] <- outPeriod$bzr

theIdeals <- perturbRand(theIdeals)
theParties <- assignParty(ideals=theIdeals)
theSqSweep <- c(t(outPeriod$policy))
}
```

C.2.6 Pivotal Politics with Random Perturbations of Ideal Points

This is a complete example of what one of the treatments as applied to the pivotal politics model looks like.

```
policyMultiGenRand <- matrix(NA,periods,length(mySweep))
medChamMultiGenRand <- matrix(NA,periods,length(mySweep))
presMultiGenRand <- matrix(NA,periods,length(mySweep))
```

```
vPivotMultiGenRand <- matrix(NA,periods,length(mySweep))
fPivotMultiGenRand <- matrix(NA,periods,length(mySweep))
lPivotMultiGenRand <- matrix(NA,periods,length(mySweep))
rPivotMultiGenRand <- matrix(NA,periods,length(mySweep))

theIdeals <- membersIdeal
theSqSweep <- sqSweep
thePropSweep <- propSweep
thePres <- pres
for (i in 1:periods){
outPeriod <- pivotalPoliticsOneDimSingle(theIdeals,theSqSweep,thePropSweep,thePres)

policyMultiGenRand[i,] <- outPeriod$policy[100,]
medChamMultiGenRand[i,] <- outPeriod$medCham
presMultiGenRand[i,] <- outPeriod$pres
vPivotMultiGenRand[i,] <- outPeriod$vPivot
fPivotMultiGenRand[i,] <- outPeriod$fPivot
lPivotMultiGenRand[i,] <- outPeriod$lPivot
rPivotMultiGenRand[i,] <- outPeriod$rPivot

theIdeals <- perturbRand(theIdeals)
theParties <- assignParty(ideals=theIdeals)
theSqSweep <- c(t(outPeriod$policy))
}
```

Complete code for all models available for download on my website.