Essays on Fiscal Policy and Elections

by

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Bachelor of Arts, Economics
Swarthmore College, 1992

Submitted to the Department of Economics
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Economics

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

February 2003

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Abstract

The chapters included here investigate the general relation between fiscal policy and elections. Chapter 1 provides a general summary of the 3 main chapters. Chapter 2 examines local and non-local public expenditures and how the two are linked through the political process. Emphasis is placed on the role of voter composition within localities in order to look at the effects of suburbanization on expenditures. Chapter 3 examines the validity of the median voter result when turnout is allowed to depend on policy platforms. With endogeneous turnout there may be multiple equilibria or a motivation to pull policy platforms away from the median and towards the mode of the voter distribution. Chapter 4 examines the link between presidential elections and the economy. Democratic election victories are often followed by a booming economy when compared to Republican victories. The instrument by which the president may influence the economy, however, is difficult to find. This chapter investigates the role of fiscal policy in explaining the impact of elections. It finds only a limited role for fiscal policy in the linkage from elections to the economy.

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Chapter 1

Introduction to the Chapters

The chapters included in this thesis investigate the general relation between fiscal policy and elections. This introduction provides a general summary of the 3 main chapters. Chapter 2 examines local and non-local public expenditures and how the two are linked through the political process. Emphasis is placed on the role of voter composition within localities in order to look at the effects of suburbanization on public expenditures. Chapter 3 examines the validity of the median voter result when turnout is allowed to depend on policy platforms. With endogenous turnout there may be multiple equilibria or a motivation to pull policy platforms away from the median and towards the mode of the voter distribution. Chapter 4 examines the link between presidential elections and the economy. Democratic election victories are often followed by a booming economy when compared to Republican victories. The instrument by which the president may influence the economy, however, is difficult to find. This chapter investigates the role of fiscal policy in explaining the impact of elections. It finds only a limited role for fiscal policy in the linkage from elections to the economy.

"Voting for Publicly Provided Goods: Local and Non-local Interactions"

In 1902, 58% of public expenditure was done at the local level, versus 8% at the state level and 34% at the national level. Since then, there has been a dramatic rise in the share of total government spending as a percentage of gross domestic product, as well as a shift away from expenditure at the local level. In 1998, the local share dropped to 29% while the state share has grown to 22% and the federal share has increased to 49%. While there is a relatively
clear normative theory on the division of spending across governmental levels, positive political explanations are not as prevalent. A model of multi-level government provision of goods is developed to examine the role of politics and voter characteristics on spending outcomes. The amount of government provision is determined by majority rule, and the median voter is decisive at each government level. Individuals differ by income and/or by their share of the cost of the publicly provided good that they must bear. If individuals differ only by the share of the good’s cost and if the mean of the distribution of voters’ cost is greater than the median, a set of local communities characterized by homogeneous voters will have a lower level of local provision than a set of communities characterized by heterogeneous voters. This lower level of local provision is associated with a higher level of non-local provision. When individuals differ by income as well, the level of non-local provision is again higher in the case of homogeneous localities for at least half of these localities, but the change in the total local provision will depend upon the cost elasticity of public expenditures.

“Policy Formulation a la Mode: Platform Setting with Endogenous Turnout”

In the framework of the median voter theorem, an ideologically driven candidate can fully alter policy when running against a vote-maximizing opponent. When turnout is allowed to depend on the relative positioning of the ideal points of the candidates relative to the voter, this result need not hold. This paper develops a model of turnout in which voters are assumed to abstain due to “indifference,” “identification” and “alienation.” The politician faces a trade-off when moving her platform toward her opponent’s: the total number of potential voters aligning themselves with the candidate increases, but the set of voters change. Depending upon the distribution of voters across the policy space, this may or may not lead to a net increase in the vote share. The main implications of this model are that the inclusion of platform dependent turnout (1) significantly alters the electoral landscape faced by the candidates, (2) causes the modal voter to have a significant impact on the policy outcome, (3) may lead to multiple platform equilibria, (4) lessens the effect of ideological candidates on platforms when running against a vote-maximizing opponent.
"Politics, Policy, and the Economy: A Puzzle"

The interaction of politics, policy, and the economy has long been a focus of research. Whether or not politics and the electoral cycle have significant influences on the private economy and how this influence is wielded is a central question in this interaction. This paper investigates a puzzle evident in much of the literature—the party of the president appears to be an important determinant of economic outcomes, but the channel of influence is unclear. The paper first provides evidence demonstrating the puzzle. A general framework for analyzing the influence of politics on an economic system is then developed. The framework is used to further examine the issue and to assess the importance of a fiscal policy channel. While the analysis shows a possible role for fiscal policy, and tax policy in particular, in an explanation of the channel of influence, the overall puzzle still remains.

1.1 Acknowledgments

I am grateful to many people who have provided helpful comments and stimulating conversations on various portions of the thesis. The list below is by no means exhaustive.

The chapter on voting behavior began while I was at the Santa Fe Institute Computational Economics Summer Workshop (a previous version appeared as Santa Fe Institute Working Paper #97-06-053). I would like to thank John Miller and Scott page for running this highly stimulating workshop and for making initial comments on the paper. Steve Ansolabehere and William Wheaton provided helpful comments and conversations on the chapter dealing with publicly provided goods.

The individual chapters also benefited from seminar and workshop participants at Amherst, Harvard, Haverford, MIT, Swarthmore, and the Federal Reserve Board of Governors.

The final chapter, coauthored with Jon Faust, is largely based on, and is an extension of, a previous joint paper (Faust and Irons (1999a)). The initial paper, which focused on monetary policy rather than the fiscal side, benefited from comments from Olivier Blanchard, Mike Gibson, Beth Ingram, Ed Leamer, Torsten Persson, Lars Svensson, and seminar participants at Duke, Indiana University, MIT, North Carolina State, and Northwestern/Chicago Fed.

I would also like to thank the National Science Foundation Graduate Research Fellowship
program, the Harvard/MIT Research Training Group in Positive Political Economy, and MIT for financial support. Ralph Bryant supported an interesting summer of research at the Brookings Institution.

Also deserving thanks are mentors and coauthors Neil Ericsson, Jon Faust, and Dale Henderson, who promoted my interest in graduate economics work and research.

I would finally like to thank my advisors Peter Diamond and Jim Snyder for providing feedback and guidance and for allowing me the freedom to wander down several dead-ends during my studies at MIT. Their patience is greatly appreciated.

I have been fortunate to have had a host of fine teachers both at MIT and at Swarthmore College. They collectively deserve any credit for any value that might come from this dissertation.
Chapter 2

Voting for Publicly Provided Goods: Local and Non-local Interactions

2.1 Abstract

In 1902, 58% of public expenditure was done at the local level, versus 8% at the state level and 34% at the national level. Since then, there has been a dramatic rise in the share of total government spending as a percentage of gross domestic product, as well as a shift away from expenditure at the local level. In 1998, the local share dropped to 29% while the state share has grown to 22% and the federal share has increased to 49%. While there is a relatively clear normative theory on the division of spending across governmental levels, positive political explanations are not as prevalent. A model of multi-level government provision of goods is developed to examine the role of politics and voter characteristics on spending outcomes. The amount of government provision is determined by majority rule, and the median voter is decisive at each government level. Individuals differ by income and/or by their share of the cost of the publicly provided good that they must bear. If individuals differ only by the share of the good’s cost and if the mean of the distribution of voters’ cost is greater than the median, a set of local communities characterized by homogeneous voters will have a lower level of local provision than a set of communities characterized by heterogeneous voters. This lower level of local provision is associated with a higher level of non-local provision. When individuals differ by income as well, the level of non-local provision is again higher in the case of homogeneous localities for at
least half of these localities, but the change in the total local provision will depend upon the
cost elasticity of public expenditures.

2.2 Introduction

In 1902, 58% of public expenditure was done at the local level, versus 8% at the state level
and 34% at the national level. Since then, there has been a dramatic rise in the share of
total government spending as a percentage of gross domestic product, as well as a shift away
from expenditure at the local level. In 1998, the local share dropped to 29%, while the state
share has grown to 22%, and the federal share has increased to 49%.\textsuperscript{1} Of central concern in
understanding these trends is the interaction between spending at one level of government and
spending at another. In addition, there are many goods and services which are provided at
multiple governmental levels.\textsuperscript{2}

This paper examines the role of majority rule voting in determining the outcome of spending
at the local and non-local levels.\textsuperscript{3} The model presented below specifies the preferred level of
provision by the individual members of the population and finds an equilibrium by simple
majority rule. Since all of the residents of a given political jurisdiction pay for the good, the
relative cost of the good that a voter must bear will influence their ideal level of provision. If
individuals differ by the share of the cost that they must pay—due, for example, to income
differences with progressive or proportional taxation—then the distribution of voters in the
district will be important for determining the equilibrium level of provision. This is especially
true since the specific cost share for an individual depends upon the other members of the
electorate.\textsuperscript{4}

Two extreme cases are examined. The first case examines a situation in which there are

\textsuperscript{1}Data from the U.S. Census Bureau.
\textsuperscript{2}For example, police protection is provided by in part through state and local law enforcement as well as the
FBI.
\textsuperscript{3}The theory presented below specifies a local and a non-local level for government expenditures. The U.S.
case, however, presents a more complex problem since there are at least three levels of government including:
local, state, and federal. The implications drawn from the model hinge on the substitutability of public good
provision at different levels. Given the pattern of spending in the U.S., the model is perhaps most relevant to
local and state spending. Evidence for provision at multiple levels is given in the next section.
\textsuperscript{4}For example, this is the case if a poor member of a rich community pays a smaller percentage of a new public
spending project than does a rich member of a poor community.
identical localities each composed of a heterogeneous group of voters. The second case considers a set of localities each containing a perfectly homogeneous group of voters. In each case the national distribution of voters will be the same. In each case equilibrium government provision is established and the characteristics of the equilibrium are investigated.

The main result of the paper, aside from establishing the existence of an equilibrium, is that when the distribution of voters nationally is skewed towards the upper end of the income distribution, the non-local level of provision is higher in the case where the communities consist of homogeneous voters. This is due to the fact that the median of the national electorate lives in a poorer locality relative to the case where each local community consists of a heterogeneous group of voters. The median voter thus wishes to provide more of the good at the non-local level.

Section 2.3 looks at the trends in government expenditure and briefly discusses the literature. Section 2.4 discusses a publicly provided goods model where provision can take place at either the local or non-local level. Section 2.5 examines the difference between a world with localities of homogenous voters and the heterogeneous voter case. Section 2.6 concludes.

2.3 Government expenditures, literature

Table 2.1 shows the expenditures for major categories for each level of government for 1962 and 1990. Growth at the federal level has been concentrated primarily in the area of Social Security and Medicare. The bulk of the state and local spending is in the areas of education and safety. Using data from Peterson (1995), in 1990 the federal government spent $286 billion on developmental functions and $561 billion on redistribution. The State governments spent $278 billion and $137 billion respectively, while local governments spent $312 billion and $51 billion. While there is some tendency for the federal government to provide redistribution

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5The period since 1900 has seen a dramatic shift in where people live. In particular, there has been a move toward suburban living and away from rural (primarily early 1900's) and urban (mid, and late 1900's) living. If a defining characteristic of suburbia is a greater degree of homogeneity when compared with urban areas, then the relocation, or sorting, of voters into suburban areas may be accompanied by a change in the demand for local provision of publicly provided goods and hence a change in the demand for non-local expenditure as well.  
6Table A.1 in the Appendix shows the expenditures by state and local governments in more detail.  
7There is also considerable variation in this split across states. Again, see Figure 2-1 in the appendix for the level of state and local spending for each state.
and local governments to provide developmental spending, the split is not complete—*for most categories there is significant spending at all levels.*

In addition, there is a wide variation across states in the state/local division of spending, see Figure 2-1.

### 2.3.1 Literature

Others have looked at the relationship between spending at various levels of government. Cremer and Palfrey (1999) (CP) model the implications of federal mandates to local governments. The assumption is made that a vote is taken to determine a federal mandate in the first round, then, given this minimum level of provision, the local government is free to "top-up" spending - i.e. provide more of the good. Each decision is determined by majority rule. They find that there are more voters that are made worse off by the federal mandate than those made better off.

In an application to the general theory of mandates, CP examines the case where a local public good is provided by both the local and the federal governments. CP assume perfect substitution between the provision at each level; and assume that the residents pay equal
Figure 2-1: Per-capita state and local spending by state, 1995.
amounts of the taxes and differ by the degree to which they enjoy the public good.\footnote{CP also extend the model to modify the efficiency of provision at each level and allow individuals to differ by how much utility they derive from provision at each governmental level.}

In contrast, the model presented below does not assume that the goods are perfect substitutes. In addition, the decision on how much of each good to provide is not determined sequentially. Finally, and importantly, the individuals are allowed to differ by the amount of the publicly provided good for which they must pay. Adding this heterogeneity increases the degree to which the distribution and composition of voters within and across localities effects the final public good outcome.

Also related to the current paper, the work by Epple, Zelenitz, and Visscher (1978) examines spending levels in a set of homogeneous communities and compares it with spending in a non-homogeneous community. This paper is similar in that it compares the decision made by the median voter in the homogeneous community with the decision made by voters in a non-homogeneous community. However, Epple, Zelenitz, and Visscher (1978) looks only at the local level of spending, while the current analysis examines the role of the non-local as well as local public good decisions.

Perhaps the most related line of work, in comparison with the specific model presented below, examines the role of private supplements to public spending (see Epple and Romano (1996b), Helsley and Strange (1998) and Epple and Romano (1996a); which build on Stiglitz (1974)). In the model presented below, the local government takes a role similar to that of private provision where there are homogeneous communities. The basic result from these papers is that if individuals can “top-up” public spending, then higher income voters may wish to “team-up” with lower income voters in trying to drive down public spending.

The following sections lay out the basic theoretical model for analyzing the provision of goods at two government levels.
2.4 The Basic Model: Cost of Provision

I assume that there is a single publicly-provided good that can be provided at the local and the non-local level; and a single private good. The voter maximizes utility which is given by

\[ U(c_i, g^L, g^N) = u(c_i) + f(g^L, g^N), \]  

subject to the budget constraint:

\[ y_i = c_i + \alpha_i^L g^L + \alpha_i^N g^N, \]  

where \( c_i \) is the level of consumption of the (numeraire) private good, \( g^L \) and \( g^N \) are the total amounts of provision by the local and the non-local governments, respectively. The parameters \( 0 < \alpha_i^L, \alpha_i^N < 1 \) are the costs that an individual voter \( i \) must pay for a unit of the public good at each governmental level. Note that the general specification of the public good component, \( f(g^L, g^N) \), allows the two governmentally provided goods to be imperfect substitutes.\(^9\)

In general, we would expect \( \alpha_i^N \neq \alpha_i^L \) since taxes are levied on different bases and on different populations at each governmental level. In addition it may be the case that \( \alpha_i^{N,L} \neq \alpha_j^{N,L} \) since the tax system is, in general, progressive; and because individual choices may impact their cost share. For example, if local taxes are based on property taxes, an individual who choses to live in a highly valued house would bear more of the cost of an increase in local expenditure.

Voters are assumed to have identical utility functions, and to differ only in their incomes and in the cost shares \( \alpha^L, \alpha^N \). The function \( u \) is assumed to be twice differentiable with \( u' > 0, u'' < 0 \). It is also assumed that \( f \) is twice differentiable with \( f_{11}', f_{11}'' > 0 \) and the second derivatives

\[ f_{12}', f_{21}', f_{11}'' f_{22}'' \leq 0. \]  

In other words, government provision at the two levels are assumed to be substitutes in the sense that an increase in provision at one level will decrease the marginal utility of the provision at the other level. Since the public and the private goods are separable in the utility function,

\(^9\)In general the goods could even be compliments; however, the investigation here assumes that the goods are substitutes, see below.
it is assumed that there is no effect on the marginal utility of private consumption by a change in public expenditures. This formulation also assumes that there are no economies of scale from the production of the public good.\(^{10}\)

The first order conditions for an interior optimum are given by

\[
\alpha_i^L u'(c_i^*) = \frac{\partial f(g_i^{L*}, g_i^{N*})}{\partial g^L}, \quad (2.4)
\]

\[
\alpha_i^N u'(c_i^*) = \frac{\partial f(g_i^{L*}, g_i^{N*})}{\partial g^N}, \quad (2.5)
\]

where a "*"\(^\text{\textsuperscript{n}}\) denotes the solution to the optimization problem.

The first set of lemmas will establish the properties of the individuals' solution to the optimization problem assuming a fixed income and a fixed spending amount at one level of government. We will derive how an individual's "ideal point" is related to the underlying cost parameters, and how spending at one level will alter the ideal level of spending at the other.

**Lemma 1** For an individual, \(i\), with a given amount of income, \(y_i\) and given government spending at the non-local level, \(g^N\), the local cost share \(\alpha_i^L\) and the desired amount of local expenditure \(g_i^{L*}\) are inversely related: \(\partial g_i^{L*}/\partial \alpha_i^L < 0\).

**Proof:** Suppose to the contrary that \(\partial g_i^{L*}/\partial \alpha_i^L \geq 0\). Setting \(c_i^* = y_i - \alpha_i^L g_i^{L*} - \alpha_i^N g^N\) from the budget constraint, the first order condition in 2.4 becomes

\[
\alpha_i^L u'(y_i - \alpha_i^L g_i^{L*} - \alpha_i^N g^N) = \frac{\partial f(g_i^{L*}, g_i^{N})}{\partial g^L},
\]

and differentiation with respect to \(\alpha_i^L\) gives

\[
u'(c_i^*) + \left[\alpha_i^L u''(y_i - \alpha_i^L g_i^{L*} - \alpha_i^N g^N) \right] \left[-\left(g_i^{L*} + \frac{\partial g_i^{L*}}{\partial \alpha_i^L}\right)\right] = \frac{\partial^2 f(g_i^{L*}, g_i^{N})}{\partial (g^L)^2} \left(\frac{\partial g_i^{L*}}{\partial \alpha_i^L}\right) \quad (2.6)
\]

\[
[+] + [-] = [-] [+], \quad [+, 0]
\]

\(^{10}\)In a more general formulation, the utility function could be specified as \(U = u(c_i) + f(\gamma^L g^L, \gamma^N g^N)\). The parameters, \(\gamma\), would represent the efficiency of production at the two levels of government or could be used to differentiate individuals by their preference for the public good. For example, higher levels of \(\gamma\) for the non-local level can represent gains from economies of scale in production. Alternatively, smaller levels of \(\gamma\) can represent slippage due to differing levels of competence or graft at the various levels of government. This would bring the model more in line with the Cremer and Faiik (1999) formulation.
(Brackets indicate the sign of each component.) The right hand side of 2.6 is non-positive given the assumption about the utility function above in (2.3) and the supposition. The left hand side is unambiguously positive given these same assumptions. The assumption that $\partial g_i^{N*}/\partial \alpha_i^L \geq 0$ must therefore be false.

Lemma 2 For an individual, $i$, with a given amount of income, $y_i$, and government spending at the local level, $g^L$, the non-local cost share $\alpha_i^N$ and the desired amount of non-local expenditure $g_i^{N*}$ are inversely related, $\partial g_i^{N*}/\partial \alpha_i^N < 0$.

As $g^N$ and $g^L$ are treated symmetrically, the proof is identical to the previous lemma starting with 2.5 and differentiating with respect to $\alpha_i^N$.

Lemma 3 For an individual, $i$, with a given amount of income, $y_i$, and holding the cost shares, $\alpha_i^N$ and $\alpha_i^L$, constant, the desired level of non-local spending $g_i^{N*}$ and the level of local spending $g^L$ are negatively related: $\partial g_i^{N*}/\partial g^L < 0$.

The proof is similar to the lemmas above as is the result of the assumption that the government expenditure at each level are substitutes. Suppose to the contrary that $\partial g_i^{N*}/\partial g^L \geq 0$.

Setting $c_i^t = y_i - \alpha_i^Lg^L - \alpha_i^Ng_i^{N*}$ from the budget constraint the first order condition in 2.5 becomes

$$\alpha_i^L u'(y_i - \alpha_i^Lg^L - \alpha_i^Ng_i^{N*}) = \frac{\partial f(g^L, g_i^{N*})}{\partial g^N},$$

and differentiation with respect to $g^L$ gives

$$[\alpha_i^L u''(y_i - \alpha_i^Lg^L - \alpha_i^Ng_i^{N*})] \left[-\left(\alpha_i^L + \alpha_i^N\frac{\partial g^{N*}}{\partial g^L}\right)\right] = \frac{\partial^2 f(g^L, g_i^{N*})}{\partial (g^L) \partial (g_i^{N*})} \left(\frac{\partial g_i^{N*}}{\partial g^L}\right). \tag{2.7}$$

(Comments indicate the sign of each component.) The right hand side of 2.6 is negative given the assumption about the utility function above in (2.3) and the supposition. The left hand side is unambiguously positive given these same assumptions. The assumption that $\partial g_i^{N*}/\partial \alpha_i^L \geq 0$ must therefore be false.

Lemma 4 For a given amount of income, $y_i$, the local cost share $\alpha_i^L$ and the desired amount of non-local expenditure $g_i^{N*}$ are positively related, $\partial g_i^{N*}/\partial \alpha_i^L > 0$. (In addition $\partial f_L^{N*}/\partial \alpha_i^N > 0$.)
Figure 2-2: Effect of a decrease in the cost share of local expenditure, $\alpha^L_i$.

This lemma is demonstrated graphically in figure 2-2 and is a direct consequence of the previous three lemmas. The graph shows the level of desired spending on local and non-local government as a function of spending at the other level. Lemma 3 shows the negative relation between the two and hence the shape as drawn. A higher lower share $\alpha^L_i$ will lead to a greater ideal level of local expenditure, $g^L_{L*}$ for any given level of non-local expenditure, $g^N_i$ (Lemma 1), thus shifting the $g^L_{L*}$ curve up. The result is a lower amount of non-local expenditure as suggested.

In this general form, it is difficult to get a sense of the spending levels preferred by the voter. Two examples illustrate the solution under alternative assumptions about the functional form of the voter’s utility.

**Example 1** Log utility.

Take $u(c_i) = \log c_i$ and $f(g^L_i, g^N_i) = \log g^L_i + \log g^N_i$. The first order conditions express the desired amount of the good at one governmental level given the amount of provision at the
other:

\[ g_{i}^{L*} = \frac{y_{i} - \alpha_{i}^{N} g_{i}^{N}}{2\alpha_{i}^{L}}, \text{ and} \]
\[ g_{i}^{N*} = \frac{y_{i} - \alpha_{i}^{L} g_{i}^{L}}{2\alpha_{i}^{N}}. \]  

(2.8)

Note the optimal amount of provision is decreasing in the amount of the good provided by the other governmental level. The full solution to the individual’s optimization problem is then

\[ g_{i}^{L*} = \frac{y_{i}}{3\alpha_{i}^{L}}, \text{ and} \]
\[ g_{i}^{N*} = \frac{y_{i}}{3\alpha_{i}^{N}}. \]  

(2.10)

These levels represent the ideal level of provision for the public good for each individual. Note that for each individual and for a given income \( y_{i} \), the ideal amount of provision at each governmental level is decreasing in the individual’s cost of provision, \( \alpha_{i}^{L} \) or \( \alpha_{i}^{N} \).

**Example 2** Cremer and Palfrey (1999), *extension*

Section 3 of CP sets \( u(c_{i}) = c_{i} \) and \( f(g_{i}^{L}, g_{i}^{N}) = h_{i}(g_{i}^{L} + \gamma^{N} g_{i}^{N}) \) with \( h_{i} \) as a standard utility function which can differ across individuals. The parameter \( \gamma^{N} \) represents the relative efficiency of production at the non-local level. Total utility is then

\[ U(y, g_{i}^{L}, g_{i}^{N}) = y - (\alpha_{i}^{L} g_{i}^{L} + \alpha_{i}^{N} g_{i}^{N}) + h_{i}(g_{i}^{L} + \gamma^{N} g_{i}^{N}). \]

CP initially set \( \alpha_{i}^{L} = \alpha_{i}^{N} = \gamma^{N} = 1 \). The optimum is this case is given by \( h'(G^{*}) = 1 \) with \( G^{*} = g^{L} + g^{N} \) and it does not matter if the good is provided locally or non-locally. CP also examine the case where \( \alpha_{i}^{N} = \alpha^{N} \leq 1 \forall i \) and \( \gamma^{N} \geq 1 \). In this case (where one of the of inequalities holds strictly) the non-local provision is more efficient, and hence each individual would like to have all the good provided non-locally.

**2.4.1 Cost of provision**

The previous section has taken the individual’s cost-share of provision (\( \alpha_{i}^{L} \) and \( \alpha_{i}^{N} \)) to be constant. This section develops the idea that this cost parameter will, in general, depend upon
the demographic makeup of the local and non-local community. To do this we introduce a voter’s “type” \((\beta_i)\) which indicates how much the individual will be required to pay for public goods relative to others. An individual with a high \(\beta\) will mean that individual will have a higher cost share than another individual with a lower \(\beta\) in the same community.

Consider a population set, \(N\), of individuals with identical utility functions. The population is partitioned into a set of local electorates, \(L = \{l_1, l_2, \ldots\}\) of equal size \(n = |N| / |L|\), where \(|N|\) is the size of the total population and \(|L|\) is the number of local communities.

As mentioned above, individuals differ by type, where an individual’s type is represented by a finite value \(\beta_i > 0\) representing the contribution to the expenditure on the public good that individual \(i\) must pay relative to others. Set the individual \(i\)'s share of the public good expense to be:

\[
\alpha_i^N = \frac{\beta_i}{\sum_{j \in N} \beta_j} \quad \text{and} \quad (2.12)
\]

\[
\alpha_i^l = \frac{\beta_i}{\sum_{j \in l} \beta_j} \quad (2.13)
\]

Again, a higher value of \(\beta_i\) means that individual \(i\) will have to finance a greater cost of the good than those with lower \(\beta\) in the same community. The “price” of the public good thus depends positively on the individual’s type and negatively on the average type in the relevant population.\(^1\) As described above, we would expect in general \(\alpha_i^N \neq \alpha_i^l\) since taxes are levied on different bases and on different populations at each governmental level. In addition, generally speaking, \(\beta_i \neq \beta_j\) since the tax system is progressive and because individual choices may impact their cost share. For example, if local taxes are based on property taxes, an individual who chooses to live in a highly valued house would bear more of the cost of an increase in local expenditure.

We might want to consider a special case, where the cost share will be a function of income, giving \(\beta_i = h(y_i)\) with \(h' > 0\). In this case, the cost share, \(\alpha_i\), for an individual \(i\) will be higher

\(^1\)Note that an individual’s type is the same at the local and the non-local levels. Since revenue is often raised in different ways by local and non-local communities, this assumption may not be appropriate. However, if the share paid for public goods is highly correlated across levels despite different revenue raising mechanisms, then this restriction should not be a problem. See Nechyba (1997) for reasons why local and non-local governments may wish to choose different tax bases.
for higher income individuals, and will be lower when the average income in the community is higher. This assumption complicates the analysis, since there will be an effect on government expenditures that arise with different incomes, and well as an indirect effect through the cost share parameter $\alpha$. Since the emphasis here is on the effects of alternative community structures, the exposition below will assume that $\beta$ does not depend upon income except where noted.

Assuming an interior maximum, the solution to the individuals maximization problem is again

\[
\alpha^L_i u'(c^*_i) = \frac{\beta_i}{\sum_{j \in L} \beta_j} u'(c^*_i) = \frac{\partial f(g^{L*}, g^{N*})}{\partial g^L},
\]

\[
\alpha^N_i u'(c^*_i) = \frac{\beta_i}{\sum_{j \in N} \beta_j} u'(c^*_i) = \frac{\partial f(g^{L*}, g^{N*})}{\partial g^N}.
\]

which defines the desired or the "ideal" amount of public expenditure, $g^L_{i*}$ and $g^N_{i*}$. These ideal amounts are an increasing function of the average level of $\beta$ in the community as shown in the lemmas of the previous section.

In the log case used above, if a voter were to move from a district with a low income "base"—a local community of low $\beta$ types—to a district with a higher income base, their ideal amount of public good provided at the local level will rise. Figure 2-2 again shows the effect of this rise in $\sum_{j \in L} \beta_j$ (and hence a reduction in $\alpha^L_i$). The lines represent the ideal amount of public provision at one level given the amount of provision at the other. When the voter's cost at the local level falls, the ideal quantity of local expenditure (given the level of non-local provision), rises as shown in the figure; thus resulting in a lower desired amount of non-local provision. The intuition is as follows: when a voter moves to a richer district, the individual's cost of local goods falls, and hence the quantity demanded of the local good rises.

The next section looks at the equilibrium that will arise if there is majority rule voting over government expenditures.

### 2.4.2 Voting equilibrium

The policy outcome is assumed to be determined by majority rule. A Nash multi-level majority rule equilibrium (MLMRE) is a policy outcome for which the local and non-local policy is determined by majority voting, and where voters take as given the policy outcome at the other
level. \(^{12}\) A MLMRE is a set of policy outcomes \(\{\tilde{g}^l\}\) and \(\tilde{g}^N\) such that

\[
\tilde{g}^N \succeq g^N \forall \forall g^N \in [0, \infty) \tag{2.16}
\]

\[
\tilde{g}^l \succeq g^l \forall g^l \in [0, \infty), \forall l \in L, \tag{2.17}
\]

where \(\succeq\) represents a weak preference by at least half of the population.

Note that by Lemmas 1 and 2 preferences are single peaked in the cost share \((\alpha_i^{N, L_i}'s)\) and hence in the distribution of \(\beta_i's. \(^{13}\)

Since the preferences in this case are single peaked in each public good, the policy outcome will be given by the preferences of the median voter

\[
\tilde{g}^N = \text{median}_{i \in N}(g_i^{N^*})
\]

\[
\tilde{g}^l = \text{median}_{i \in L}(g_i^{l^*})
\]

More specifically, since the amount of government provision at each level depends on the provision of government at the other level, the median voter multi-level majority rule equilibrium would be \(\{\tilde{g}^l\}\) and \(\tilde{g}^N\) such that

\[
\tilde{g}^N = \text{median}_{i \in N}(g_i^{N^*}|\{\tilde{g}^l\}) \tag{2.18}
\]

\[
\tilde{g}^l = \text{median}_{i \in L}(g_i^{l^*}|\tilde{g}^N) \forall l \in L. \tag{2.19}
\]

In general, this formulation of a MLMRE is too general to be very enlightening. The next section examines the characteristics of the equilibrium under two (extreme) assumptions about the demographics of the local communities.


\(^{13}\) The ideal amounts of expenditures are in fact monotonic in \(\alpha_i\) and hence single peaked. If \(\beta_i\) depends only on income, the distribution of ideal points will no longer necessarily be monotonic, but will still be single peaked.
2.5 Homogeneous and heterogeneous communities

Consider two extreme cases. In the first case (termed heterogeneous), we examine a population divided into a set of identical communities consisting of “perfectly” heterogeneous sub-populations. In this case we assume the \(|L|\) equal sized localities are microcosms of the whole, i.e., the distribution of \(\beta\) in the community is the same as the distribution of \(\beta\) for the entire population scaled by \(1/|L|\). Each community is thus of size \(n = |N|/|L|\). Note that this implies that \(\alpha_i^N = \alpha_i^L / |L|\).

The second case (termed homogeneous) assumes a population completely sorted into communities each of which contains identical voters with the same \(\beta\). In this case, the provision of the public good at the local level, which is equal to the median voter’s ideal amount, will also be the same as the ideal amount for each member of the community.\(^{14,15}\) Note that this implies that, for all individuals in the entire population, \(\alpha_i^L = 1/n\).

In both cases it is assumed that \(|N|\) is large relative to the number of localities and the number of types.\(^6\)

To better understand the equilibrium in each case, we will next examine the equilibrium when there is provision only at one level. Then the multi-level equilibrium will be examined. Also, we will assume initially that the individuals’ types do not depend on income; this restriction will be relaxed later.

Local provision only

If there is no non-local provision \((g^N = 0)\), then the expenditure on the local good will depend only upon the distribution of voters within localities.

First consider the case where the all communities are populated by heterogeneous voters. In this case all communities will provide the same level of the good, and that level will be set

\(^{14}\)This formulation ignores whether the configuration of voters across localities is stable. There may indeed be some incentive for, say, a low \(\beta\) voter to move to a locality with higher \(\beta\)’s. It is thus implicitly assumed that, e.g., zoning is available and perfectly used to segment the population by type and/or income.

\(^{15}\)A word on the terminology: the “heterogenous” case has identical local communities, but each community has a variety of voter types. The homogeneous case has a variety of communities, but each member of a local community is identical to the other members of that community.

\(^{16}\)In particular, we assume that \(N\) is large enough so that for all values of \(x\) the number of voters with \(\beta_i = x\) is equal to \(k/|L|\) where \(k\) is a (strictly) positive integer.
at the ideal level of the median voter. In the log-utility case of Example 1, this amount was given by:

\[ g^l = y/2\alpha_{\text{median}}^l \quad \forall l \in L. \]

Next consider the second case, where localities consist of homogeneous voters, and so \( \beta_i = \beta_j \quad \forall i, j \in l \), the cost of provision will be the same for every member of the community:

\[ \alpha_i^l = \frac{\beta_i}{\sum_{j \in l} \beta_j} = \frac{1}{n} = \alpha_{\text{mean}}^l \quad \forall l \in L. \]

Again, all communities will provide the same level of local provision. In the log-utility example, each community will have an amount of government expenditure of

\[ g^l = y/2\alpha_{\text{mean}}^l \quad \forall l \in L. \]

Note that in both cases, the level of local provision is the same across communities. Whether \( g^l \) will be higher in the homogeneous or heterogeneous case will depend upon the size of \( \alpha_{\text{median}}^l \) relative to \( \alpha_{\text{mean}}^l = 1/n \).

**Non-local provision only**

If there is no local provision (\( g^l = 0 \quad \forall l \in L \)), then the level of non-local government provision does not depend upon local demographics and is given simply by the median voter's ideal expenditure under both assumed distributions of voters. In the log-utility example from above, this will be \( g^N = y/2\alpha_{\text{median}}^N \).

**Combined local and non-local provision**

Given the assumptions about the shape of the utility function, preferences are single peaked along a single dimension (see Lemmas 1 and 2); and a single-level majority rule equilibrium exists at each government level independently, given any value of the provision at the other level. The multi-level majority rule equilibrium (MLMRE), however, is slightly more complicated since we need to look also at equilibrium across governmental levels.

Theorems 1 and 2 establish the existence of a MLMRE for each of the cases above.
Theorem 1 (Local communities with heterogeneous voters) If the median voter for each of the local heterogeneous communities is the same as the median for the whole population, then a MLMRE exists and the policy outcome is the preferred level of the median voter at each governmental level.

See Appendix A for proof.

The preferences for the voters are single peaked in both levels of government provision. Since the (same) median voter is pivotal at both the local and the non-local level (and since the median's preferences are the same across communities) the equilibrium will be that of the median, and the MLMRE is

\[
\hat{g}^N = \text{median}_{i \in N}(g_i^{N*}) \\
\hat{g}^l = \text{median}_{i \in L}(g_i^{l*}) \quad \forall l \in L.
\]

where \(g_i^{N*}\) and \(g_i^{l*}\) are the ideal levels for the voter with \(\alpha_i^N = \alpha_{\text{median}}^N(i \in N)\) and \(\alpha_i^l = \alpha_{\text{median}}^l(i \in L)\). Since all of the local communities have identical distribution of voters, \(\hat{g}^l\) will be the same for all local communities.

Note that the median is taken from the distribution of the ideal points for the expenditure and will not, in a more general model, be the ideal point of the median of the distribution of \(\beta\). In particular, if \(\beta\) (and hence \(\alpha\)) were to depend upon income levels then there is an income effect to be considered. Low income individuals have a low cost of provision, but a relatively higher level of marginal utility. High income individuals have low marginal utility, but higher costs of provision. The optimal level of provision thus may not be monotonic in income.

Theorem 2 (Local communities with homogeneous voters) If local communities consist of perfectly homogeneous groups of voters, then a MLMRE exists and the policy outcome is the preferred level of the median voter at each governmental level.

See Appendix A for proof.

To better describe the equilibrium, a comparison will be made between the locally homogeneous voter case and the locally heterogeneous voter case.
2.5.1 Symmetrical distribution

To further investigate the expenditure equilibrium, we initially consider the case where the cost of provision for an individual does not depend on income. This subsection and the next examine the equilibrium when we assume equal incomes and only allow heterogeneity in the cost parameter. This restriction allows stronger conclusions to be drawn about non-local expenditure. The following subsection then expands the model to allow for differences in income in addition to cost shares.

First we will investigate the case where the distribution of voters in the entire population is symmetrical – that is, the average $\beta$ is the same as the median $\beta$. We will also assume equal incomes across individuals.

Local spending results can be found by comparing the cost share in the two cases. As before, when communities consist of homogeneous voters,

$$\alpha_i^t = \frac{\beta^t}{\sum_{j \in L} \beta^t} = 1/n$$

for all localities and for all voters, including the median.

When communities consist of heterogeneous voters, the median voter will have a cost share of:

$$\text{median}(\alpha_i^t) = \frac{\text{median}(\beta^t)}{\sum_{j \in L} \beta^t} = \frac{1}{n} \cdot \frac{\text{median}(\beta^t)}{\text{mean}(\beta^t)}.$$  \hspace{1cm} (2.20)

If the distribution is symmetrical with $\text{median}(\beta_i) = \text{mean}(\beta_i)$, the decisive voter in all communities will have $\alpha_i^t = 1/n$ and hence there will be the same amount of expenditure on the local good in each case. In addition, since local spending is the same in the two cases, so too will non-local spending. In short, in all communities in both cases, the cost share for the decisive voter is the same leading to the same spending equilibrium in all localities.

Furthermore, consider local communities of homogeneous voters for which $\beta_i < \text{mean}(\beta_i)$. For these voters, the cost, $\alpha_i^t$, for the local good is greater than if they lived in a heterogeneous community. This implies that the ideal level of expenditure for these voters will be lower relative to the heterogeneous voter case for each amount of non-local provision (see Lemma 1). For local communities with homogeneous voters for which $\beta_i > \text{mean}(\beta_i)$, the reverse will be true. Note
that even though the ideal level of these voters will be different between the homogeneous and heterogeneous cases, the local spending outcome (as decided by the median voter) will not.

The next subsection examines the outcome when there is a non-symmetrical distribution.

2.5.2 Non-symmetrical distribution

Consider the case when the distribution of voters is not symmetrical and there is a split between the median and the mean level of $\beta_i$, and hence in the mean and median level of $\alpha_i^N$.

Assume that all individuals have the same level of income. As shown below, if we assume that $\text{mean}(\beta_i) > \text{median}(\beta_i)$, then the equilibrium with communities of homogeneous voters will have a lower level of local good provision than the equilibrium with heterogeneous voters. As the communities provide fewer goods at the local level, there will be a greater ideal level for the median voter at the non-local level. (This result may provide an explanation for the increase in centralization as seen in Section 2.3.)

**Lemma 5** Taking the level of non-local provision, $g^N$, constant, if people differ only in their type $\beta_i$ (i.e. have identical incomes and preferences) and if the distribution of the population as a whole is such that $\text{mean}(\beta_i) > \text{median}(\beta_i)$, then the level of local provision will be lower when localities consist of a homogeneous population relative to the case where the local population is heterogeneous.

Proof: Since $g^N$ is constant, we only need to focus on the local level of provision which is a function of $\beta_i$ for each individual. In the case where localities consist of heterogeneous voters, each locality has the same level of equilibrium local spending, $g^L = g(\text{median}(\alpha_i))$ where $g$ is the function describing how the level of local spending depending on the cost share and with $g' < 0$ (see equation 2.4, or 2.8.) When each locality consists of homogeneous voters, each voter’s $\beta$ is the same as other members of the locality, and hence the local cost share for each voter is the same ($\alpha_i^L = \frac{1}{n} = \text{mean}(\alpha_i)$, for all $i$) regardless of the locality in which they live.

In this case, the localities will have levels of local provision given by $g^L = g(\text{mean}(\alpha_i))$. Since $g' < 0$, and if the mean is greater than the median, then $g^L > g^L$ for all localities. □

To restate, the case with communities consisting of localities of homogeneous voters has a lower level of local spending holding $g^N$ constant. Note that this is true for all localities.
Theorem 3 If people differ only in their type $\beta_i$ (i.e. have identical incomes and preferences) and if the distribution of the population as a whole is such that $\text{mean}(\beta_i) > \text{median}(\beta_i)$, then the level of local provision will be lower, and the level of non-local provision will be higher, when localities consist of a homogeneous population relative to the case where the local population is consist of a heterogeneous population.

Proof: The MLMRE in the case with locally heterogeneous voters is again straightforward. The equilibrium is given by the median voter at both governmental levels.

$$\bar{g}^N = \text{median}_{i \in N}(g_i^{N*})$$

$$\bar{g}^l = \text{median}_{i \in l}(g_i^{l*}) \ \forall l \subset L.$$ 

From Lemma 5, for localities with homogeneous voters, we know that localities with homogeneous voters will provide fewer goods at the local level, $\bar{g}^L < \bar{g}^N$ taking the non-local provision to be $\bar{g}^N$.

This lower provision locally means a greater ideal level for non-local provision from all voters, including the non-local median (see Lemma 3 or equations 2.5, or 2.9) leading to higher equilibrium provision non-locally.

The results from the homogeneous voter and heterogeneous voter cases are a result of examining the cost share of the decisive voter and are summarized in Table 2.2, which shows the cost share of the decisive voter in each case.

To summarize the results of this section, when communities consist of homogeneous voters, we get a lower level of local provision and a higher level of non-local provision in equilibrium when compared to the case of communities with heterogeneous voters.
2.5.3 Income dependence

If we make the assumption that $\beta$ depends upon income in the following way, $\beta_i = \beta(y_i)$ with $\beta' > 0$, then there is another factor that must be considered to ultimately determine the absolute amount of government expenditure. High income communities (and thus communities with voters of high $\beta$), will—assuming that the public goods are normal—also have higher provision than the low income communities given the same cost share, $\alpha^l$. Thus, when $\beta$ depends upon income, there may be an unlikely coalition of high income voters who wish to have low non-local spending (since the price, $\alpha^l$, is high) and low income voters who also want low spending (since their marginal utility of income is high).\footnote{This intuition is very similar to the results of Epple and Romano (1996b) and Heasley and Strange (1998). In the first paper, government provision can be supplemented by private spending. The second paper looks at "private government" as a way to supplement the public provision.}

Note also that when $\beta$ did not depend on income, all local communities had the same equilibrium expenditure levels. In contrast, when income is allowed to vary, we will now see a distribution of expenditure outcomes in the homogeneous voter case. In the heterogeneous voter case, the level of local expenditure will still be the same across localities as before.

Lemma 6 If people differ only in their income level, $y_i$, and their type is dependent upon income with $\beta = h(y_i)$ with $h' > 0$; and taking the level of non-local provision, $\beta^N$, constant; if the distribution of the population is such that $\text{mean}(y_i) > \text{median}(y_i)$, then at least half of the communities will have a lower level of local provision when localities consist of homogeneous populations relative to the case where local populations are heterogeneous.

Proof: (Analogous to Lemma 5) Again, when localities have heterogeneous voters, the median voter determines the amount of provision, and this is the same for all localities. When the localities consist of homogeneous voters, the local amount of provision will depend upon the income of each locality. If a locality has a per person income less than the median, they will have a lower ideal level of the non-local good in the homogeneous voter case, since $\alpha^l_i$ is equal to $1/n$ (which is greater than $\frac{1}{n} \text{median}(\beta^l_i)$) for each member of the group, and because income is less than the median.

For all voters, the cost share will be higher in the homogeneous voter case ($\alpha^l_i = 1/n$) than the cost share for the median in the heterogeneous case ($\frac{1}{n} \text{median}(\beta^l_i)$). Thus, localities
<table>
<thead>
<tr>
<th>Cost Share</th>
<th>Homogenous</th>
<th>Heterogeneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrical</td>
<td>( \alpha'_l = 1/n \ \forall i, l )</td>
<td>( \text{median}(\alpha'_l) = \frac{1}{n} \text{median}(\beta'_l) = 1/n \ \forall l )</td>
</tr>
<tr>
<td>Non-symmetrical</td>
<td>( \alpha'_l = 1/n \ \forall i, l )</td>
<td>( \text{median}(\alpha'_l) = \frac{1}{n} \text{median}(\beta'_l) = 1/n \ \forall l )</td>
</tr>
</tbody>
</table>

Table 2.3: Summary of cost shares at the local level for the decisive voter.

<table>
<thead>
<tr>
<th>Spending Levels</th>
<th>Homogenous</th>
<th>Heterogeneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrical</td>
<td>( g'(y'_l</td>
<td>\alpha'_l = 1/n) \ \forall l )</td>
</tr>
<tr>
<td>Non-symmetrical</td>
<td>( g'(y'_l</td>
<td>\alpha'_l = 1/n) \ \forall l )</td>
</tr>
</tbody>
</table>

Table 2.4: Summary of the ideal level of local spending for the decisive voter.

with \( y'_l \leq \text{median}(y_i) < \text{mean}(y_i) \), local spending will be unambiguously lower than in the heterogeneous case since we have taken \( g^{t} \) to be a normal good. ■

However, for localities with \( \text{median}(y_i) < y'_l \), the voter’s income is greater than the median suggesting higher levels of spending locally than in the heterogeneous case. These two effects (income and cost) are opposite in sign, so the level of spending may be greater than or less than the equilibrium spending in the heterogeneous case.

Note that the community with the same equilibrium local expenditure in the homogeneous and heterogeneous case, (with income \( y^{same} \)), will be the one for which \( g'_h = g'(\text{median}(y_i) | \alpha'_l = \frac{1}{n} \text{median}(\beta'_l) = g'(y^{same} | \alpha'_l = 1/n) \). Note that if \( \text{median}(y_i) = \text{mean}(y_i) \), \( y^{same} = \text{median}(y_i) \).
So, exactly half of the localities with homogeneous voters will have an lower ideal level of spending than in the heterogeneous voter case. If \( \text{median}(y_i) < \text{mean}(y_i) \) then \( y^{same} \geq \text{median}(y_i) \).

Theorem 4 If people differ only in their income level, \( y_i \), and their type is dependent upon income with \( \beta = h(y_i) \) with \( h' > 0 \); and if the distribution of the population is such that \( \text{mean}(y_i) > \text{median}(y_i) \), then at least half of the communities will have a lower level of local provision when localities consist of homogeneous populations relative to the case where the local populations are heterogeneous.

The proof is identical to Theorem 3, using Lemma 6, except there are now some localities with higher levels of local provision in the homogeneous case than in the heterogeneous case. There are, however, at least as many communities with lower ideal levels as with higher levels. ■

These results are summarized in Tables 2.3 and 2.4, which shows the cost share of the decisive voter in each case, as well as the amount of local spending.
First consider the symmetrical distribution. In the homogeneous voter case, there will be a distribution of local expenditures. When compared to the heterogeneous case, half of the localities will have a greater amount of local spending, while the other half will have a lower level.

Next consider the non-symmetrical distribution. If $mean(y_i) > median(y_i)$, then we know that when compared to the heterogeneous case, at least half of the localities in the homogeneous case will have a lower amount of local spending, while fewer communities will have a higher level when compared to the heterogeneous case.

Figure 2-3 illustrates these results. The graph shows the homogenous and heterogeneous distributions of local spending outcomes (holding non-local spending fixed) for a symmetrical and a non-symmetrical distribution of voters (each with the same median). With the non-symmetrical distribution, there at least as many localities with a lower level of local spending in the homogeneous case as in the heterogeneous case.

The difference in the total amount of local provision across all localities across the two cases will depend upon the size of the greater amount of provision in the high income localities relative to the size of the lower amounts in the lower income communities. If the public good provision is very sensitive to the cost share, and the distribution is relatively symmetrical; then the total
level of spending locally may indeed be higher in the homogeneous voter case. However, in general, we cannot determine the relative levels of spending between the two cases.

To further illustrate, the results from Lemma 5 and Lemma 6 are shown in Figures 2-4 and 2-5. Comparing a set of communities with heterogeneous voters to a set of communities with homogeneous voters, the later has a lower desired level of local spending if $\beta_i$ is less than the mean. The local outcome is the ideal amount of the median voter in the heterogeneous case (for all the localities). The "homogeneous voters" line gives the local outcome in the homogeneous case.

### 2.6 Conclusion and Extensions

An obvious next step is to ask about the welfare consequences if communities consist of homogeneous voters versus heterogeneous voters, with the resulting difference in equilibrium policy as described above.\textsuperscript{19} In the context of the model presented here, a move to homogeneous com-

\textsuperscript{18}Note that $g^L|x|g^N$ need not be monotonic in $y$ in the case with heterogeneous voters. If the function $\beta(y)$ is sufficiently steep, then a higher income leads to a higher cost for the public good which may outweigh the income effect.

\textsuperscript{19}It could be argued that increasing suburbanization over the 20th century has led to an increase in the homogenization of local communities.
Figure 2-5: Desired level of local spending given a level of non-local spending as a function of $y$ in the two cases. Here the cost share is a function of income: $\alpha_i = \frac{h(y_i)}{\sum_{j} h(y_j)}$.

munities represents a gain in welfare for the groups that can reap the benefits of a higher tax base. Those with high cost shares are better off when they live in localities with homogeneous voters. However the reverse is true for those with lower cost shares.

While the model presented here appears initially to be in conflict with a Tiebout style model where voters are allowed to chose their locality, it is better viewed as a complement. In the textbook Tiebout model, voters move to find a locality which provides their preferred basket of local goods—preferences determine location. In equilibrium, people are able to achieve their ideal level of public expenditure at the local level and there little need to consider desires for a non-local good. The model presented here considers the case where there is some voter heterogeneity, and allows the voters to have ideal expenditure levels on publicly provided goods that depend upon the characteristics of the local population. It would thus appear that locality determines voter behavior. The two can be reconciled by noting that the underlying preferences of voters are constant in both models, and, in the model presented here, voters do care about where they live—it is the amount of the public good desired that changes with locality. Another difference between the two arise as a non-local government is combined with the potential for localities with non-homogeneous voters.
An important extension of the model would deal with the size and stability of the homogeneous communities. It was assumed that the size of communities was fixed and small enough to allow homogenization, as such, the factors affecting the efficient scale and governmental level of production were also not an explicit part of the model. There is also a clear incentive for low $\beta$ voters to move to high $\beta$ communities altering the size and composition of local communities. Describing the stability and the dynamics of the growth of homogeneous and heterogeneous communities when there is voting over subcultural goods would be another possible extension.\textsuperscript{20}

The model presented here also does not take into account the fact that property values may vary with the public good decision of the community, see e.g. Oates (1969). Extending the model to include property values and housing decisions might be a fruitful step to take. Finally, the median voter was assumed to drive the expenditure outcome at both levels. A model of pressure group influences along the lines of Dougan and Kenyon (1988) may provide additional insight.

2.6.1 Implications for voting

In the case of communities with heterogeneous voters, the non-median voters do not obtain their ideal amount of expenditure—the equilibrium expenditure level is not equal to their ideal points at both the local and the non-local level. In particular, if $\beta_i < \text{median}(\beta_i)$ the voter would prefer to have a higher level of spending at both the local and the non-local level. The opposite holds for $\beta'$s at the other end of the distribution.\textsuperscript{21}

In the case of communities with homogeneous voters, however, there may develop a split between the desire for the public good at the local and non-local levels. If there is substitutability between local and non-local goods, then communities with $\beta_i < \text{mean}(\beta_i)$ will have a lower ideal expenditure of local public goods, but have a higher ideal point for non-local goods than in the heterogeneous voter case. At the other side of the distribution, the reverse is true. In this case, and under certain assumptions about the role of political parties, there will be impli-

\textsuperscript{20}See Wheaton (1975) and Westhoff (1977) for analysis along this dimension. The relationship between the growth of suburbs and their center cities has been examined to a certain degree empirically, see Voith (1998). The discussion has also ignored the physical location and size of cities and suburbs, see Krugman (1995) and Gabaix (1998).

\textsuperscript{21}If $\beta$ depends on income, then the income effect must be considered also. Low income individuals have a high marginal utility of consumption, and so may want lower provision at both levels.
cations for voting patterns at the local and non-local level. Appendix C describes one possible test in more detail.

The political implications of the model are twofold. First, since homogenization implies that ideal levels for goods are decoupled across levels, it becomes difficult to interpret election results at one level as a shift in underlying preferences. Second, the decoupling effect may provide a partial explanation for what has been called "dealignment," the idea that people are more loosely affiliated with parties and less likely to vote based solely on party than in the past. If political parties impose the same platform at all levels of government, then we may continue to see an increase in split-ticket voting.
Chapter 3

Platform Setting with Endogenous Turnout

3.1 Abstract

In the framework of the median voter theorem, an ideologically driven candidate can fully alter policy when running against a vote-maximizing opponent. When turnout is allowed to depend on the relative positioning of the ideal points of the candidates relative to the voter, this result need not hold. This paper develops a model of turnout in which voters are assumed to abstain due to "indifference," lack of "identification" and "alienation." The politician faces a trade-off when moving her platform toward her opponent's: the total number of potential voters aligning themselves with the candidate increases, but the set of voters change. Depending upon the distribution of voters across the policy space, this may or may not lead to a net increase in the vote share. The main implications of this model are that the inclusion of platform dependent turnout (1) significantly alters the electoral landscape faced by the candidates, (2) causes the modal voter to have a significant impact on the policy outcome, (3) may lead to multiple platform equilibria, (4) lessens the effect of ideological candidates on platforms when running against a vote-maximizing opponent.
3.2 Introduction

Voter turnout is both endogenous and important. This paper considers plausible patterns of voter turnout – specified to depend upon the platforms of the candidates – to determine the implications for who wins an election and for the platform decisions of the candidates.

The model presented here modifies the standard model of voter turnout, where the utility of the voter depends only on the resultant policy, so that potential voters also receive “consumption value” from voting. The probability that a voter goes to the polls is smaller if the candidates’ policies are close together, referred to as “indifference,” or if the two policies are both far away from the voter’s ideal point, “alienation.” Also, the voter is more likely to turnout if the a candidate is close to the voter’s ideal point, “identification”. This type of voter behavior has important implications for who wins the election given candidate’s platforms and hence the platform choice of electoral candidates. Indifference, alienation, and identification are modelled individually as well as jointly.

The model is also used to investigate the degree to which ideological candidates can pull policy towards their ideal point, as well as to investigate the implications of endogenous voter turnout on the platform decisions of candidates. Using the spacial theory of elections originating with Downs (1957), and under the conditions of the median voter theorem with vote-maximizing candidates, the median voter sets the policy agenda. However, in the same setup, with one vote-maximizing candidate and a second ideologically driven candidate, the ideologically motivated challenger can completely determine the policy chosen by a vote-maximizing politician simply by running on (or near) her preferred platform. In part, this paper is about how, when voter turnout is endogenous to the system, this result need not hold.

The main findings of this paper are that the inclusion of endogenous turnout (1) significantly alters the electoral landscape faced by the candidates, (2) causes the modal voter to have a significant impact on the policy outcome, (3) may lead to multiple platform equilibria, (4) lessens the effect of ideological candidates on platforms when running against a vote-maximizing opponent, and (5) decreases the speed of platform convergence - the tendency each platforms to move toward the other - when there is incomplete information or any other inertial forces in
platform formation.\(^1\)

The median voter theorem has remained a standard result for use in empirical investigations of policy formation. The inclusion of the characteristics of the median voter in predicting policy outcome is thought either to rightfully capture the relevant determinant of policy (the sufficient statistic for the distribution of voters), or is at least thought to be a useful proxy for the effect of the preferences of the electorate on policy. This paper shows that an allowance for voter turnout lessens the theoretical importance of the median as the sole determining characteristic of policy, and, under certain conditions, implies that the modal voter plays an important role in the platform setting process.

The following section lays out a strategy for modelling voter turnout. A specific model of voter behavior that pays special attention to the turnout decision is presented in Section 3.4. A richer model is examined in Section 3.5, which looks at the implications for the model in one and two dimensions with both uniform and non-uniform voter distributions with comparisons between the full and endogenous turnout. Section 3.6 examines the implications for platform-setting when candidates do not have full information about the electoral landscape. Section 3.7 concludes.

### 3.3 Modelling strategy

The literature on voter turnout is extensive.\(^2\) Formal modelling of voter turnout in the rational choice tradition, where voters care only about electoral outcomes, has typically not been very successful in explaining many aspects of turnout behavior. Green and Shapiro (1994, chapter 4) summarizes and critiques much of the work in this area. The modelling strategy employed below involves a hybrid of rational choice modelling with a more behavioral approach to the description of the motivation of voters. I assume that the voters are "rational maximizing agents," but take a loose approach in the specification of the utility functions of the voters. In particular the forms of the functions are set to match hypothesized motivations for voting.

In the standard rational choice approach, the costs and benefits are weighed when deciding

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\(^1\)The "flattening" of the electoral landscape will have implications for models with adaptive parties along the line of Kollman, Miller, and Page (1992).

\(^2\)Aldrich (1993) provides a good survey.
to vote, with these depending only on the cost of voting and the enacted policy resulting from
the election outcome. See Aldrich (1993) or Riker and Ordeshook (1968) for an overview. In
the most simple of specifications with two candidates, a voter \(i\) goes to the polls if, and only if,
the expected value, \(V_i\), of voting outweighs the costs; or

\[
V_i(p_1, p_2, \text{vote}) > V_i(p_1, p_2, \text{abstain})
\]

\[
\pi^v [u_i (p_1)] + (1 - \pi^v) [u_i (p_2)] + B^v - C^v > \pi^n [u_i (p_1)] + (1 - \pi^n) [u_i (p_2)],
\]

(3.1)

where \(\pi\) is the probability of candidate 1 winning the election conditional on voting (\(v\)) or
abstention (\(n\)), and \(u_i(p)\) is the utility of the voter is policy \(p\) is adopted. Other benefits and
costs from voting, such as the benefit from participation in a democracy or the opportunity
cost of the time spent voting are represented by the fixed quantities \(B\) and \(C\), i.e. they do not
vary with the platforms of the candidates. Equation (3.1) simplifies to

\[
(\pi^v - \pi^n) [u_i (p_1) - u_i (p_2)] > C^v - B^v.
\]

(3.2)

One often noted problem with this specification is that the value of \((\pi^v - \pi^n)\) is extremely
close to zero in an election with a large number of voters—that is, an individual’s vote will most
likely have no effect on the outcome. The turnout decision thus boils down to an evaluation of
the costs and benefits associated only with the physical act of voting. The empirical implications
are thus not very interesting and in particular do not depend significantly, if \((\pi^v - \pi^n)\) is near
zero, on anything that directly relates to the platform choices of the candidates.³

This approach contains an explicit assumption about how the policy position affects
the utility of the voter—namely that the act of voting adds to the utility of the voter only to the
extent that it changes the probability that a candidate will win the election. The approach I
follow below is less restrictive in that I allow the costs and benefits of voting per se to depend
upon the policy alternatives in a more general manner. The more general specification is
presented in the next section.⁴

³Aldrich (1993) describes the act of voting as a “low-cost, low-benefit affair.” So, while the probability of
impacting the election is small in absolute magnitude, it may still be of sufficient relative size to be of interest.
⁴Unlike the model in Feddersen and Pesendorf (1996), the voters are assumed to possess full information
about the candidates. While Feddersen and Pesendorf (1996) provide a good explanation for abstention once a
3.4 Model Specification

This section introduces the basic model to be analyzed. Candidates are either vote maximizers or ideologues. Voters make their turnout decisions based upon the relative position of the candidates. The effects of “alienation” and “indifference” on turnout and platform setting are examined.

3.4.1 Candidates – ideologues and vote maximizers

The candidates are assumed to be one of two extreme types. The first type simply has a preference for office and maximizes her vote share. The second type, ideologues, care only about the final policy adopted and have no direct preference for being in office. A third, and more realistic, possibility is that the candidates have preferences for both the election outcome as well as the enacted policy. The core insights generated from the extreme cases should carry over to the mixed case, but the intermediate case will not be examined explicitly here. The sections below will investigate the behavior of candidates in elections with the various combinations of candidates.

3.4.2 Voters

The voters face a decision among voting for two candidates and abstention. The voter decides whether or not to go to the polls, and if she decides to go, she then votes for the candidate whose position is closest to her ideal point.

Specifically, the voter will go to the polls if the utility of voting for the preferred candidate is greater than the utility received from abstention. In contrast to the standard rational choice model in equation (3.2), the utility of the voter need not depend on only the resultant policy—voters also receive “consumption value” from voting.

At a very general level, the probability that a voter will turn out is a function of her own policy preferences as well as the platforms of the candidates. Assuming again a race with two

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voter is at the polls (and the cost of voting is zero), the model falls into the same trap as other standard decision theoretic models of turnout when explaining the motivation for going to the polls.

5Abstention and “protest votes” for third party candidates are assumed to fall into the same category.
candidates, the probability that an individual $i$ will vote is simply

$$prob_i(vote) = f'(p_1, p_2, p_i^*)$$

(3.3)

where $p_{1,2} \in \mathbb{R}^n$ are the vectors of policy positions of the two candidates and $p_i^*$ is the ideal preferred policy of individual $i$. Voters are assumed to have single peaked preferences.

Rewriting to stress the importance of the various components of the voter turnout decision, we get

$$prob_i(vote) = f($$

$$\max(||p_i^* - p_1||, ||p_i^* - p_2||),$$

(3.5)

$$\min(||p_i^* - p_1||, ||p_i^* - p_2||),$$

(3.6)

$$||p_i^* - p_1|| - ||p_i^* - p_2||)$$

(3.7)

where $||\cdot||$ represents the euclidean distance between the two policy positions.\(^6\)

This particular representation yields natural interpretation for each of the arguments. Term (3.5) is the “identification” effect: if $f'_1$ is negative, the closer the farthest candidate, the more likely it is that the individual will vote (e.g. the voter can identify with both candidate’s policy position, or the ”political process” more generally). Term (3.6) is the “alienation” effect: if $f'_2$ is negative, then the farther away the closest candidate is from the ideal point of the voter, the less likely they are to vote (e.g. the voter is alienated from the policies of both of the candidates). Term (3.7) is the “indifference” effect: if $f'_3$ is positive, then the closer the candidates are together, the less likely it is that the individual will vote (e.g. if the candidates have identical policy positions, a potential voter will be indifferent between the two and will not turn out).\(^7\)

Equation 3.4 can be further justified by first admitting to some of the failings of the positive choice model (see Green and Shapiro (1994, chapter 4)): and replacing the simple calculus of

\(^6\)This specification is equivalent to the general specification $prob_i(vote) = g(p_1, p_2, p_i^*)$ through a simple transformation of the arguments to $f$.

\(^7\)The previous literature defines indifference and alienation by using the utility of each policy $u_i(p_1)$ and $u_i(p_2)$ in (3.4) rather than the distance between the ideal point and policy. The two approaches are equivalent so long as we assume that utility is monotonically decreasing in $||p_i^* - p_2||$ - which is a standard assumption in the literature.
turnout as in 3.2 with the assumption that voters receive a consumption value from voting. This consumption value (say $B^w$ in 3.2) is then assumed to vary with policy as in (3.4).

3.4.3 Literature

The literature on voter turnout has modeled, in various ways, the effects on turnout of various electoral related factors. In general, the basic goal of these theories is to describe and/or predict how turnout might vary from election to election, and why it might vary with other parts of the model. In particular, the effect of the policy platforms of the candidates on turnout is examined.

Using the rational model of turnout as in (3.2) above, Ledyard (1984) allows the voter turnout decision to depend upon the expected probability of affecting the election outcome by including a non-zero cost of voting. Rather than taking the probability of impacting the election as fixed, he allows it to depend upon the level of turnout. A rational voter equilibrium can then be found that has the property that turnout will depend upon policy platforms.

An older strand of the literature models turnout, or political participation more generally, as directly depending upon candidates’ policy platforms rather than arising endogenously from the model. In particular, behavioral considerations, such as alienation and indifference, are hypothesized to be the primary motivating factors affecting the voter’s decision. These exogenously imposed behavioral characteristics can cause significant differences between the full-turnout models and the models where abstention is a factor. As such, the model presented here closely resembles some of this previous work. The focus in the previous work was on establishing the conditions for the existence of an equilibrium or a dominant policy position rather than investigating the range of possible multiple equilibria. The previous results are also largely limited to an examination of two, vote-maximizing candidates. In contrast, the presentation below also examines the outcomes if one candidate is ideologically driven. Finally, these previous papers largely do not examine in detail the impact of non-symmetric ideal point distributions. None examine the role of platform position “identification” in determining abstentions. This last factor is important in that it, along with alienation, may cause extremists

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9Identification suggests that the “extremists support” condition of McKelvey (1975) may not hold.
The following sub-sections make assumptions about plausible shape of the function $f$ and trace through implications for platform setting by the candidates. Section 3.4.4 examines the alienation effect and section 3.4.6 examines the indifference effect. Section 3.4.8 compares the current model to the full turnout case and discusses the nature of the resulting candidate equilibrium.

3.4.4 Alienation

Assume that $f_1^* = f_2^* = 0$, so that the effect of platform setting only matters through the effect on $\min(\|p_1 - p_1^*\|, \|p_2 - p_2^*\|)$. Assume further that $f_2^* < 0$. How will this affect the candidates' strategies?

Figure 3-1 shows the effect of Candidate 1 moving towards her opponent. The solid vertical line represents the midpoint of the two policy positions and hence the location of that voter who is just indifferent between the policies of the two candidates. The dotted lines represent the locations of those voters who are just indifferent between voting and abstention. While Candidate 1 gains votes from those located between the two candidates, she also moves her base of voters, a shift in $l_1$ and $u_1$, in the same direction.

For convenience, voters who prefer candidate 1 over candidate 2 are called candidate 1's

---

The implications for the identification and the alienation effect are similar, so I will focus only on the alienation and indifference effects.
base (i.e. \(\{\text{voters } i \mid \|p_1 - p_i^*\| < \|p_2 - p_i^*\|\}\)). As the candidate moves away from the preferred policy of a voter in her base, that voter will become less likely to vote. The candidate, when deciding on a change in policy platform toward the median, must then balance the possible loss of voter turnout in her base with an increase in that base (which comes from decreasing the base of her opponent).

Figure 3-2 shows the winner of the election as a function of the two policy positions under alternative assumptions about the distribution of voters' ideal points over the segment [0, 1]. The first panel shows the full turnout case (all distributions). The top right panel shows the winner when the distribution is uniform. The center box area is a region in which each candidate gets approximately 50% of the vote (share approaches 50% as \(n\) grows). The bottom left panel shows the outcome when the distribution is single peaked and symmetric, the winner is the same as in the full turnout case. The final panel shows the result when the distribution is single peaked and skewed so that the mode (= 0) < median (= 0.5).

**Example 3 Alienation, one-dimension, two vote maximizing candidates.**

To see why alienation matters in this model, consider the simple case with a one-dimensional policy space, two candidates who maximize votes, and full information about voter preferences. Assume that a continuum of voters' ideal points are distributed uniformly on [0, 1]. Consider again only the alienation effect:

\[
\text{prob}_j(\text{vote}) = f\left(\min\left(\|p_1 - p_i^*\|, \|p_2 - p_i^*\|\right)\right)
\]

(3.8)

with \(f' (0) = +\infty, f' < 0,\) and \(f'' < 0.\)

Take the case of two candidates with platforms \(p_1 < p_2.\) If everyone were to vote, candidate 1 would get \(\int_0^{\frac{1}{2} (p_1 + p_2)} dx = \frac{1}{2} (p_1 + p_2)\) votes and candidate 2 would get \(\int_{\frac{1}{2} (p_1 + p_2)}^{1} dx = 1 - \frac{1}{2} (p_1 + p_2)\) votes. The unique Nash equilibrium for vote maximizers is for the candidates to pick the median voter policy, \(p_1 = p_2 = 1/2.\)

Now assume that people decide whether or not to vote. The ratio of voters for candidate 1

\[11\text{Note that if only one candidate is an ideologue, she can obtain a policy arbitrarily close to her preferred point by setting her platform to her preferred point, } p^*.\] The vote-maximizing candidate would then pick a platform \(p^* \pm \epsilon,\) which would win the election.

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Figure 3-2: Alienation effect on who wins the election. Candidate 2 (vertical axis) wins in dark shaded area. Lightly shaded areas represent a tie. Clockwise from top left, Full turnout, uniform distribution of voters, single-peaked symmetrical distribution of voters, single peaked non-symmetrical distribution of voters (with mode at 0).
to candidate 2 is then
\[
\int_0^{1/2(p_1+p_2)} g (\|p_1 - p_i^*\|) \, dp_i^* \int_1^{1/2(p_1+p_2)} g (\|p_2 - p_i^*\|) \, dp_i^*.
\] (3.9)

When there are voters at the extremes \((p_i \in [0,p_1])\) and \((p_j \in [p_2,1])\) for whom the probability of voting is zero,\(^{12}\) the ratio in (3.9) is exactly 1 for all combinations of \(p_1\) and \(p_2\) implying each candidate gets half of the votes.\(^{13}\)

This implies that the candidates will receive equal vote shares regardless of their policy platforms—there are multiple Nash equilibria and no necessary draw to the median voter’s platform.\(^\blacksquare\)

This result also implies that an ideological candidate does not necessarily alter the platform of her competitor. This is to be contrasted with the full adjustment of the vote-maximizing candidate in the complete turnout case. The intuition for this result is simple: The vote maximizer must trade-off obtaining votes from her challenger and loosing the votes of the extremists to abstention. With full turnout the later effect is not present.

While this extreme result of multiple Nash equilibria is specific to this setup, in particular the assumption of a uniform distribution of voters, the simple example is meant to illustrate the importance of modelling turnout. In the more general case where the distribution of voters is not uniform, if the effect of alienation is strong, the candidate will have a strong incentive to find a high density of like minded voters and position herself near this peak. The pull of the median may not be very strong in comparison.

### 3.4.5 Identification

This section considers only the identification component of turnout \((f_2 = f_3 = 0)\), where the decision about whether to turnout depends only on \(\max (\|p_1 - p_i^*\|, \|p_2 - p_i^*\|)\). It is assumed that the voter is less likely to turnout if the candidates are both far away from the voter’s ideal point, \(f^1 < 0\).

Figure 3-3 shows the effect of Candidate 1 moving towards her opponent. While she gain votes from those voters located between the two candidates, she also expands the base of voters

\(^{12}\)This condition will always be satisfied in equilibrium when \(f(1/2) \leq 0\).

\(^{13}\)This can be seen by noting the symmetry in the range of the voters’ ideal points.
for her opponent by moving \( u_2 \) in the same direction. As above, the net effect will be zero in the uniform case\(^{14}\).

**Remark 1** A move from \( C1 \) to a point \( C1' \) closer to the opponent will (weakly) raise overall voter turnout.

Figure 3-4 shows the winner of the election as a function of the two policy positions under alternative assumptions about the distribution of voters' ideal points over the segment \([0, 1]\). The first panel shows the full turnout case (all distributions). The top right panel shows the winner when the distribution is uniform. The box areas in the second and fourth quadrant, where the candidates are at opposite ends of the extremes, are regions in which each candidate gets approximately 50% of the vote (share approaches 50% as \( n \) grows). The bottom left panel shows the outcome when the distribution is single peaked and symmetric, the winner is the same as in the full turnout case except for the regions where the candidates are at opposite ends of the extremes. The final panel shows the result when the distribution is single peaked and skewed so that the mode \((= 0) < \) median \((= 0.5)\).

### 3.4.6 Indifference

Assume that in equation (3.4) \( f'_1 = f'_2 = 0 \), so that the effect of platform setting only matters through the effect on the indifference term \( \|p'_1 - p_1\| - \|p'_2 - p_2\| \). Assume further that \( f'_2 > 0 \)

\(^{14}\)Again assuming there are abstentions at both ends of the spectrum.
Figure 3-4: Identification effect on who wins the election. Candidate 2 (vertical axis) wins in shaded area. Lightly shaded areas represent a tie. Clockwise from top left, Full turnout, uniform distribution of voters, single peaked symmetrical distribution of voters, single peaked non-symmetrical distribution of voters (with mode at 0).
Figure 3-5: Effect of moving C1 towards C2, indifference effect only.

- the greater the similarity of the two candidates platforms, the less likely it is that a voter will turnout.

In the previous section a movement of one candidate toward the other caused a decrease in the probability of voting for extremists, without effecting the turnout behavior of centrists. With indifference, there is a tendency for all voters to abstain when the candidates positions are close together. While a movement of, say, candidate 1’s platform towards her opponent increases the number of potential voters for candidate 1, the movement also decreases the number of voters across the spectrum. The distribution of voters over the policy landscape will determine whether or not the move will be beneficial.

Figure 3-5 shows the effect of indifference when Candidate 1 moves towards her opponent.

Figure 3-6 shows the winner of the election as a function of the two policy positions under alternative assumptions about the distribution of voters’ ideal points over the segment [0, 1]. The first panel shows the full turnout case (all distributions). The top right panel shows the winner when the distribution is uniform. The winner is the same as in the full turnout case except when the candidates are located very close to one another and turnout is driven to zero.\(^\text{15}\) The bottom left panel shows the outcome when the distribution is single peaked and symmetric. The final panel shows the result when the distribution is single peaked and skewed so that the mode (= 0) < median (= 0.5).

\(^{15}\)It is assumed that in this case each candidate always goes to the polls and votes for themselves. A zero turnout then gives a 50% vote share to each candidate.
Figure 3-6: Indifference effect on who wins the election. Candidate 2 (vertical axis) wins in shaded area. Lightly shaded areas represent a tie. Clockwise from top left, Full turnout, uniform distribution of voters, single peaked symmetrical distribution of voters, single peaked non-symmetrical distribution of voters (with mode at 0).
3.4.7 Comparison with Full Turnout

With the specification of voters in the previous section, an individual vote-maximizing candidate faces a trade-off and is illustrated in Figure 3-7. The top frame shows an initial position of two candidates (C1 and C2) over a single dimensional policy space. The solid vertical line represents the midpoint of the two policy positions and hence the location of that voter who is just indifferent between the policies of the two candidates. The dotted lines represent the locations of those voters who are just indifferent between voting and abstention.

As Candidate 1 moves her policy towards the second candidate, P1 to P1', the number of potential voters who prefer her platform increases (the solid line moves toward the second candidate); however, the number of voters who turnout changes as does the location of those that do turnout (some voters are less likely to vote, and the dashed lines shift as in the second panel of the figure). The distribution of voters over the policy space determines the net effect on the election result.
Who wins?

Using the above setup we can determine who wins in a given race. Define the candidates such that \( P_2 > P_1 \). Let \( h(x) \) be the probability distribution of voters over the policy space. Define \( u_{1,2} \) \( l_{1,2} \) to be upper and lower boundaries as shown in Figure 3-7 (where the probability of voting is zero).

**Theorem 5** Full Turnout

Set \( M \) to be the median of the distribution. When turnout is full, Candidate 1 wins the election if \( |p_1 - M| < |p_2 - M| \).

The vote share for C1 is

\[
\frac{\int_{-\infty}^{(p_1+p_2)/2} h(x)dx}{\int_{(p_1+p_2)/2}^{\infty} h(x)dx}. \tag{3.10}
\]

Since \( |p_1 - M| < |p_2 - M| \), \( M < (p_1 + p_2)/2 \) so the vote share in 3.10 becomes

\[
\frac{\int_{-\infty}^{M} h(x)dx + \int_{M}^{(p_1+p_2)/2} h(x)dx}{\int_{M}^{\infty} h(x)dx - \int_{(p_1+p_2)/2}^{\infty} h(x)dx} > 1.
\]

**Theorem 6** Uniform Distribution

If \( h \) is uniform on \([0, 1]\),

If potential voters at the extreme abstain, \( l_1 \geq 0 \) and \( u_2 \leq 1 \), each candidate will receive 50\% of the vote.

If the voters at the extreme do vote, in other words if \( l_1 < 0 \) or \( u_2 > 1 \), then the voter closest to the median (= 0.5) will win the election.

This result is a simple consequence of the symmetry imposed on the problem. Each candidate is described only by position, and the likelihood that a voter will turnout depends only upon the distance between the candidates' positions and the position of the voter's ideal point - absolute positions do not matter. As such, each candidates' voter base is equal to the other's: \((u_2 - l_2) = (u_1 - l_1)\). Since the uniform is uniform, the number of votes for each candidate is the same.■
Obviously, this is the case if $P_1 < P_2 < M$ or $M < P_1 < P_2$. By symmetry $u_1 - p_1 = p_2 - l_2$. If $P_1$ is closer to $M$ than is $P_2$ the $u_1$ is closer to $M$ than $l_2$, implying $M - u_1 < u_2 - M$ or $u_1 > 1 - l_2$.

**Theorem 7** Symmetric single peaked distribution

Set $M$ to be the median of the distribution, assume $h'(x) = 0$ if $x = M$, $h'(x) < 0$ if $x > M$, and $h'(x) > 0$ if $x < M$, and $h(M - x) = h(M + x)$. Candidate 1 wins the election if $|p_1 - M| < |p_2 - M|$.

The proof is straightforward if we first note that, by symmetry, the size of the base for each candidate is symmetrical when there are abstainers at each end of the spectrum (i.e. $u_2 - l_2 = u_1 - l_1$). A simple change in variables in the limits of integration in the expression for the excess number of votes for candidate 1

$$
\int_{l_1}^{u_1} h(x)dx - \int_{l_2}^{u_2} h(x)dx = \int_{l_2}^{u_2} h(x - (p_2 - p_1))dx - \int_{l_2}^{u_2} h(x)dx.
$$

will yield the result.

When there are not abstainers at the extremes, the candidate closer to the median has the larger base analogous to the previous theorem, and since the distribution is symmetrical, a larger number of votes.

If the distribution is single peaked but not symmetric, the above result need not hold. A candidate located farther from the median than his opponent may still win the election provided there is enough mass located in his voter base, $[l_1, u_1]$. In particular, if the candidate is located near the mode of the distribution, he may still win the election even though he is not closer to the median. See Example 4 below.

**3.4.8 Combination Equilibrium**

**Case 1: Running against one fixed candidate**

The comparison with the full turnout case (median voter result) is shown in Figure 3-8 which shows the vote share going to Candidate 2 when the distribution of ideal points is uniform and Candidate 1 is located at an arbitrary point (0.75) which is not the median.
When there is full turnout, a candidate running against an opponent who is not located at the median can win a majority of votes with any of a wide range of platforms. If she cares only about winning the election, then she will pick a point at $0.75 - \varepsilon$. If she cares about the resulting policy platform, she will choose a platform that comes as close as possible to her ideal point, $C^*$. If $C^* < \beta$ then she will choose $\beta + \varepsilon$ as her platform. If $C^* > 0.75$ then she will choose 0.75. In the intermediate case $\beta \leq C^* \leq 0.75$, she can fully achieve her policy goals by winning the election on her preferred platform by setting $C^* = C^*$.\(^{16}\)

When turnout is allowed to be endogenous as described above, the situation is very different. If Candidate 2 cares only about winning the election, Candidate 1 can do no better than a 50-50 chance of winning,\(^{17}\) and she can achieve this result for a wide range of platforms. If candidate 1 cares only about the resulting policy, then she will have a decision similar to the one in the preceding paragraph: if $C^* < \beta'$ then she will choose $\beta'$ and will win half the votes. If $C^* > \beta''$ then she will choose $\beta''$. Note that in this case, since $\beta'' > 0.75$ she will run on a platform that is more extreme than her opponent. This is in contrast to the full turnout case where 0.75 was the maximum chosen platform. In the case where $\beta' < C^* < \beta''$, she will run on $C^*$.\(^{18}\)

Case 2. Running against a vote maximizer, full turnout.

Case 1 showed how a vote maximizer will behave when confronted with a candidate at a fixed arbitrary point. As seen above, when there is full turnout, a vote maximizing candidate will pick a platform that is $\varepsilon$ away from her opponent in the direction of the median. As such, if two vote-maximizing candidates are running against each other, they will both locate at the median and receive 50% of the votes - this is the median voter result. If candidate 2 cares about policy alone, then she can achieve that policy exactly by choosing $C^* \pm \varepsilon$ and pulling her vote maximizing opponent to $C^*$.

\(^{16}\) If she chooses to maximize a weighted average of policy and vote share, then the policy will move closer to the opponent than in the discussion above.

\(^{17}\) The fact that the curve peaks at 50% is due to the assumption that the distribution is uniform. In general, if the distribution is unimodal, the peak vote share will be located between the mode and the median of the distribution of ideal points in the electorate.

\(^{18}\) Maximizing a weighted average of vote share and platform will yield platforms $\beta' \leq C^* \leq \beta''$, with $C^* = C^*$ for $\beta' \leq C^* \leq \beta''$. 

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Figure 3-8: Vote share for Candidate 1 against a candidate with platform $P_2 = 0.75$, as a function of $P_1$. 
Case 3. Running against a vote maximizer, endogenous turnout

As shown above, when turnout is allowed to be endogenous, a platform choice of one candidate will create be a wide range of platforms for which a vote maximizing opponent will be indifferent. The choice of platform then is more complex.

If we assume that there are two vote maximizers running, they will each be indifferent to a wide range of platforms since they can achieve at best half of the vote. The outcome platforms are thus indeterminate (within the range of policies that determine a 50% outcome) and need not be equal to the median.

If the candidate cares only about policy, the problem becomes more complex. By moving her platform away from the median and (say) towards 1, she (may) increase $\beta'$ and $\beta''$. She would like to position $\beta'$ and $\beta''$ to form a narrow interval around her ideal policy. There is no reason why the resulting positions need to be located either at the median, or at the ideal point of the policy-driven candidate.

Again, in each of these cases the multiple equilibria and indeterminacies arise from the assumption of the uniform distribution of voters. The following example assumes particular functional forms and specifies a single peaked non-symmetrical distribution of voters to investigate the outcome. The section following, in order to further examine the forces driving the location of platforms, generate electoral "landscapes"—vote share as a function of chosen platforms—given an electorate consisting of many voters. Examination of these landscapes will show where vote maximizing candidates will wish to locate — e.g. the minimum of their opponent’s maximum vote share. In general, the resulting equilibrium of a race between two vote-maximizing candidates will lead to platforms that are located between the mean and the median of the ideal point distribution.

**Example 4** Linear-step vote function, gamma distribution of voters.

---

\(^{19}\)See example 3 above.

\(^{20}\)To explicitly solve for the optimal position would involve specifying the decision rule of by which candidates choose between equally appealing platforms as well as the loss function of candidates' preferences over policy outcomes. The values of $\beta$ are determined by the specific shape of the voters' utility function and the distribution of voters. See example below.
Figure 3-9: Determinants of who turns out to vote.

Assume that the probability of voting is determined by

\[
prob(\text{vote}) = \begin{cases} 
1, & \text{if } g(\max(||p_1^* - p_1||, ||p_2^* - p_2||), \min(||p_1^* - p_1||, ||p_2^* - p_2||), ||p_1 - p_2||) > 0; \\
0, & \text{otherwise}, 
\end{cases}
\]

(3.12)

with \(g(x_1, x_2, x_3) = \gamma_0 - \gamma_1 x_1 - \gamma_2 x_2 + \gamma_3 x_3\), and the parameters \(\gamma_i \geq 0\).

Figures 3-10-3-12 show the vote share for each of the three distributions, uniform, single-peaked symmetrical, and single peaked asymmetrical.

The vote share for candidate 2 is \(v_2 = h(P_2|P_1)\). The optimal choice for candidate 1 is then

\[
P_1^* = \arg \min_{P_1} \{\max_{P_2} h(P_2|P_1)\}.
\]

The function \(h\) is given by

\[
h(P_2|P_1) = 1 - \frac{\Psi(u_1) - \Psi(I_1)}{[\Psi(u_1) - \Psi(I_1)] + [\Psi(u_2) - \Psi(I_2)]}
\]

where \(\Psi\) is the c.d.f. of the distribution of ideal points over \([0, 1]\) and \(u_1, u_2, I_1, I_2\) are upper and lower boundaries as shown in Figure 3-9 (where the probability of voting is zero), which depend upon the platform positions and the shape of the function \(g\).
Figure 3-10: Uniform distribution of voters. Level curves for the vote share for Candidate 1, lighter shades represent a victory for C1. (P1 is on the horizontal axis).

Figure 3-11: Symmetric, (normal) distribution of voters. Level curves for the vote share for Candidate 1, lighter shades represent a victory for C1. (P1 is on the horizontal axis).
Figure 3-12: Asymmetric distribution of voters, median of 0.5, mode of 0. Level curves for the vote share for Candidate 1, lighter shades represent a victory for C1. (P1 is on the horizontal axis).

With the specification in Equation 3.12, we can solve explicitly for \( u^{1,2} \) \( l^{1,2} \),

\[
\begin{align*}
l^1 &= \max \left[ 0, (\gamma_1 - \gamma_2)^{-1}(\gamma_1 P_2 - \gamma_2 P_1 - \gamma_3 (P_2 - P_1)) \right], \\
u^1 &= \min[MID, (\gamma_1 + \gamma_2)^{-1}(\gamma_1 P_2 + \gamma_2 P_1 - \gamma_3 (P_2 - P_1))], \\
l^2 &= \max[MID, (-\gamma_1 - \gamma_2)^{-1}(-\gamma_1 P_1 - \gamma_2 P_2 - \gamma_3 (P_2 - P_1))], \\
u^2 &= \min[1, (-\gamma_1 + \gamma_2)^{-1}(-\gamma_1 P_1 + \gamma_2 P_2 - \gamma_3 (P_2 - P_1))],
\end{align*}
\]

where \( MID \) is the halfway point between the two policy positions, \((P_2 + P_1)/2\), and it is assumed that \( P_2 \geq P_1 \).

Note that \( l^1 - u^1 = l^2 - u^2 \) so the optimal \( P_2(P_1) \) will be a \( P_2 \) that is located near the "bulk" of the distribution. The exact location will depend upon the shape of the distribution of ideal points over the policy range. Figure 3-13 shows the optimal platform choice for Candidate 2 as a function of the platform chosen by Candidate 1 when the distribution is gamma\(^{21}\).

\(^{21}\)The gamma distribution with parameters \( \alpha, \lambda \) is \( g(t) = \frac{\alpha^{\lambda}}{\Gamma(\lambda)} t^{\lambda-1} e^{-\alpha t} \). The distribution is normalized to integrate to 1 over the interval \([0, 1]\). If not otherwise specified \( \gamma = 10 \) and \( \alpha = 6 \), implying a median of 0.632.
Figure 3-13: Optimal choice of P2 given P1 (solid line) and distribution of ideal points (dashed line) with Median: 0.632, Mode: 0.555. Vote maximizing equilibrium is 0.577.

<table>
<thead>
<tr>
<th></th>
<th>$\alpha = 3$</th>
<th>$\alpha = 4$</th>
<th>$\alpha = 5$</th>
<th>$\alpha = 6$</th>
<th>$\alpha = 7$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>0.373</td>
<td>0.467</td>
<td>0.554</td>
<td>0.632</td>
<td>0.693</td>
</tr>
<tr>
<td>Mode</td>
<td>0.362</td>
<td>0.450</td>
<td>0.506</td>
<td>0.555</td>
<td>0.614</td>
</tr>
<tr>
<td>Equilibrium</td>
<td>0.372</td>
<td>0.452</td>
<td>0.491</td>
<td>0.577</td>
<td>0.677</td>
</tr>
</tbody>
</table>

Table 3.1: Equilibrium platform positions with two vote maximizing candidates, gamma distribution of ideal points. (Scale parameter=10 for all distributions.)

As the shape varies, so too does the equilibrium of the system with two vote maximizing candidates. Table 3.1 shows the equilibrium location for the two candidates for various shapes of the distribution along with the median and the mode of the distribution. ■

### 3.5 A Richer Model

To further investigate the implications of voter turnout for the position setting behavior of political candidates, I have built a slightly more general numerical model. The platform behavior discussed above - the inability of a policy driven candidate to fully determine policy - are demonstrated via numerical methods in Section 3.5.1. Section 3.5.2 relaxes the assumption that the distribution of voters is uniform. The model is slightly generalized in Section 3.5.3 to include a two-dimensional policy space, and non-uniform distributions are again examined in 3.5.4.

and a mode of 0.555.
In the extensions below, I will contrast the full turnout case with the case where voter turnout is explicitly taken into account. When turnout is dependent upon the platform decisions as in the above section, both the alienation and the indifference mechanisms are assumed to be a determinant of voter behavior.

The major results are as follows:

1. When voter turnout is taken into account the electoral "landscape" is much flatter about a region near the opponent's policy position. The flatter landscape means that ideological opponents would have a more difficult time pulling the electorally motivated candidate to her preferred policy position.

2. In general, the particular distribution of voters matters for determining the outcome—the median is no longer a sufficient statistic for the distribution.

3. When the distribution of voters is skewed such that the median is not the same as the modal voter, the policy equilibrium will be a point between the median and the mode.

4. A flatter electoral landscape slows the process of convergence of candidates' policies to one another.

3.5.1 One dimension

From the above example we know that a region exists in which both candidates can move without altering the election outcome. This is in contrast with the median voter result in which the median ideal point is the only equilibrium.

Figure 3-14 shows the median voter result. The vertical axis is the percentage of votes going to the first candidate, while the two horizontal axes represent the policy positions of the two candidates. The resulting surface is the "electoral landscape." From the figure we see that for any policy position candidate 2 takes, excepting the center, candidate 1 can always achieve more than half the votes. A vote-maximizing politician will minimize the maximum vote share achievable by her opponent, and so will adopt the median platform.

This figure also demonstrates that if candidate 2 is an ideologue, she will be able to pull a vote-maximizing candidate fully to her preferred point. The ridge along the diagonal demonstrates this result.

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Figure 3-14: Election results for platform positions with full turnout. The vertical axis shows the percentage of the vote won by Candidate 1 as a function of the policy platforms chosen by the two candidates (horizontal axes). Unless \( P2 = \text{median} = 0.5 \), Candidate 1 can win a majority of votes.
Figure 3-15: Election results for candidate platforms with endogenous turnout. The vertical axis shows the percentage of the vote won by Candidate 1 as a function of the policy platforms chosen by the two candidates (horizontal axes). There is now a range of policies, P2, for which candidate 1 cannot win a strict majority.

In contrast, Figure 3-15 shows the results when abstention is allowed in accordance with the model outlined in Section 3.4. Agents are assumed to be identical except in their ideal points. The probability of turnout is taken to be a function of the distances between the ideal point of the candidates and the ideal point of the voter as described above—a lower probability of voting results from the candidates being closer together or from both the candidates being farther from a voter’s ideal point.\(^{22}\)

Figure 3-15 shows a significant flat region about the center of the graph. This is the result of the trade-off between sacrificing extremist voters to abstention and winning centrist voters from the opposing candidate. Figure 3-16 shows this result for more clearly. For a given platform, a movement towards one’s opponent may lead to only modest gains in vote share. In this case, as in the simple example above, we find a range of policy positions for which the opponent’s vote share is at most 50 percent.

\(^{22}\)See appendix for exact specification of the functional form assumed.
Figure 3-16: Vote share for Candidate 1 when opponent is located at the median of 0.5.

Figure 3-17: Election turnout as a function of candidate platforms with endogenous turnout. (If $P1 = P2$ turnout is zero.)
Figure 3-17 shows the percentage turnout as a function of the candidates' platforms. Along the diagonal there is little or no turnout, while if the policies are located on the off diagonals, which represent a greater distance between the two candidates, turnout will be larger.

These results indicate an inability for an ideologue to fully and easily pull the opponent to her preferred platform. Only at extreme platforms are the vote maximizers drawn towards the opponents preferred point—it is only then that sacrificing voters to abstention becomes worthwhile. The following section examines the case of non-uniform distributions of voters.

3.5.2 Non-uniform distributions: 1 dimension

When the distribution is not uniform, there will be a tendency for the candidates to be pulled toward an area of greater voter density. This is shown in Figure 3-18, which shows the vote share for a candidate whose opponent's platform is located at the median of 0.75. The distribution in this case is skewed towards the upper end of the scale with the mode at 1. The median voter in this case is not decisive, since both candidates have an incentive to relocate away from the mean and toward the modal voter.\(^{23}\)

More complicated distributions will, of course, have different implications for the policy equilibrium. If the distribution is unimodal and the median is not equal to the mode, then the resulting equilibrium with two vote maximizing candidates will be a policy platform located between the median and modal voter.

3.5.3 Two Dimensions

Extending the model to more than one dimension is an important step since it is often the case that results derived in a one-dimensional setting do not carry over. This section again contrasts the full turnout model with the endogenous turnout model in the cases with a centrist opponent as well as a candidate located off the center.

Full turnout is shown in Figure 3-19. The horizontal axes mark the position of candidate 1's policy in two-dimensional space, and the vertical axis shows the vote share against a perfectly centrist opponent. As expected, the candidate cannot obtain greater than 50 percent of the vote, and can get 50 percent at only at the same position of the centrist. Figure 3-20 shows

\(^{23}\)In this case the equilibrium is located at 0.9.
Figure 3-18: Vote share for candidate 1 as a function of her platform against an opponent located at the median of 0.75, and with a skewed distribution with a mode of 1. The median voter platform can be defeated by choosing a platform closer to the mode.

how a vote-maximizing politician (candidate 1) will move to the policy position of a ideological candidate. The peak of the landscape is now centered over the ideologue’s (candidate 2’s) position. (The ideologue is at position 0.7, 0.7 on the policy grid.)

With endogenous voting, the story changes. Figure 3-21 shows the vote share going to the candidate when voting is endogenous. The figure shows a flat region near the center of the issue space. The region, as expected, forms a plateau at the 50 percent vote share mark. Figure 3-22 shows the percentage of the population that makes it to the polls for each of the possible platform choices. Note the prominent well in which there is little turnout. Also the turnout level peaks at moderate levels of turnout.

Similar plots are shown when candidate 2 is an ideologue. Figures 3-23 and 3-24 show the voting landscape for a candidate who takes an extreme position (again 0.7, 0.7).
Figure 3-19: Vote share for a candidate against a centrist opponent, located at \( \{0.5, 0.5\} \), with full turnout. Candidate 1 can at best receive 50% of the vote.

Figure 3-20: Vote share for a candidate against an extremist opponent, located at \( \{0.7, 0.7\} \), with full turnout. Candidate 1 can win the election by adopting a platform near the opponent and closer to the median.
Figure 3-21: Vote share for a candidate against a centrist opponent with endogenous turnout. Note the wide range of platforms which yield 50% of the vote.

Figure 3-22: Endogenous voter turnout for an election against a centrist opponent.
Figure 3-23: Vote share for a candidate against an extremist opponent, located at \( \{0.7, 0.7\} \), with endogenous turnout. Even if the other candidate is not at the median, the candidate cannot win more than 50% of the vote.

Figure 3-24: Endogenous turnout for an election against an extremist opponent.
3.5.4 Non-uniform distribution: 2 dimensions

As in the one-dimensional case, some of the results derived from the models hinge on the uniformity of the distribution of voters across the policy space. In particular the perfect flatness of the election results (which lead to multiple Nash equilibria) are due to the fact that movements across the policy space are accompanied by exactly offsetting abstention losses and vote gaining effects. Different distributions will lead to alternate equilibrium, but will still retain the flattening effect on the landscape. Figure 3-25 shows the landscape against an ideological candidate when the voters are distributed normally across the policy space. Note that the landscape is significantly flatter than would be the case with full turnout (figure 3-20).

While this flattening may not be important for perfectly informed candidates, it will be important for candidates who adapt slowly to their environment as in Kollman, Miller, and Page (1992). The following section examines the speed of convergence to equilibrium when the candidates only have local information on the popularity of alternate platforms.

Figure 3-26 and 3-27 show the vote share landscape and turnout when the distribution skewed towards the \(\{1,1\}\) point, and candidate 2 is located at the median. Again, as in the one dimensional case, the opposition candidate can receive a large share of the vote by moving away from the median and towards the modal voter.

3.6 Speed of Convergence

This section relaxes the typical assumption that candidates are able to move instantaneously to anywhere in the policy space and have complete information about the shape of the landscape. As Kollman, Miller, and Page (1992) note: “Once we relax the assumptions that parties have complete information and the ability to locate optimal platforms, we can model our parties in a variety of ways. There are many ways not to be perfectly rational.”

I will choose one such specification for the movement of policy positions. Obviously, others are possible and may lead to slightly different implications, but this setup should serve to illustrate the potential implications of variable voter turnout. The political candidates are assumed to poll the population repeatedly before the election and use the results to modify their policy. The candidates cannot, however, test all platform possibilities, and so test a grid
Figure 3-25: Vote share for a candidate against an extremist opponent with endogenous turnout and a normal distribution of votes across the policy space. Opponent is located at 0.7, 0.7. Candidate 1 can win by choosing a platform near 0.7, 0.7.

of points in the neighborhood of their current position. After the poll, the candidate moves to that policy which would have received the greatest vote share against the opponent’s current position. The polling is repeated until the candidate remains at (or near) the same policy position for a certain number of polls.

Two sets of results are presented. The first set is for an election between one candidate who is allowed to move about the policy space and a candidate at a fixed policy position (perhaps an ideologue or an incumbent). The second set is for an election between two movers. The initial candidate positions for those able to move across the space are generated at random.

Table 3.2 shows the simulation results. The time to convergence is greater in the partial turnout case, indicating a slower movement towards the competition’s ideal point. The figures for the distance from the opponent also indicate that the policies do not converge as completely as in the full turnout case.

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24 This strategy most closely corresponds to the random adaptive parties in Kollman, Miller, and Page (1992).
25 The averages are over 100 initial policy positions. The polls are conducted with 200 voters. The Gauss program used to generate the results is available upon request. In the one-mover case, the fixed candidate is located at (0.7, 0.7).
Figure 3-26: Vote share for a candidate against an opponent at the median with endogenous turnout and a skewed distribution of voters. Opponent is located at the median of \( \{0.75, 0.75\} \). With the skewed distribution, Candidate 1 maximizes vote share by moving away from the median and towards the mode \( \{1,1\} \).

Figure 3-27: Voter turnout in an election against an opponent at the median with endogenous turnout and a skewed distribution of voters. Opponent is located at the median of 0.75, 0.75.
Table 3.2: Simulation results.

<table>
<thead>
<tr>
<th>Turnout</th>
<th>Time to Conv.</th>
<th>Policy Dist.</th>
<th>Dist. to center</th>
<th>Dist. after 10 polls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full</td>
<td>Partial</td>
<td>Full</td>
<td>Partial</td>
</tr>
<tr>
<td>1 mover</td>
<td>Uniform</td>
<td>7.580</td>
<td>38.23</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>7.680</td>
<td>20.87</td>
<td>0.042</td>
</tr>
<tr>
<td>2 movers</td>
<td>Uniform</td>
<td>15.320</td>
<td>&gt;100</td>
<td>0.0196</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>27.640</td>
<td>&gt;100</td>
<td>0.0203</td>
</tr>
</tbody>
</table>

3.7 Extensions and Conclusions

The analysis in this paper has highlighted the importance of voter turnout in the platform setting behavior of candidates. Turnout is important because a candidate must balance the increase in vote share achieved by moving towards the opponent’s policy position with the loss of votes due to abstention. This effect may lead to multiple equilibria in some simple specifications and to a “flattening” of the vote share landscape in more general settings.

When turnout behavior is not considered, the candidates have a large incentive to move towards the platform of their opponent. When turnout behavior is taken into account, the effectiveness of such a move is greatly reduced or removed altogether. Thus, in the richer model of voter behavior, ideological candidates are much less able to determine platform outcomes than in models where full turnout is assumed. In the case where the voter distribution is skewed such that the median and the modal voter are not the same, the equilibrium policy platform is located in a position between the median and the mode.

The analysis and investigation has not taken into account heterogeneity in the voter parameters across the population. There may be important interactions between these characteristics which may play a role in candidate behavior. For example, if the extremists (extreme ideal points) are more likely to go to the polls ceterus paribus (due to a lower threshold value), then the candidates may be pulled further away from the center. In future work it would be useful to examine the implications of plausible relations between the heterogeneities.

Other possible extensions to the model include the role of polls and imperfect information in determining platform positions. Polls may give candidates information on the shape of the distribution of ideal points, but candidates need other information to predict turnout across
the political policy space. The latter piece of information is also needed to accurately predict the election results. The poll data (which typically poll likely voters, but may assume turnout among those polled does not depend upon the relative position of the candidates) will have landscapes that are too steep which may then cause “platform overshooting.”

Finally, I have not investigated the empirical implications of the model outlined above, but there may be interesting predictions about turnout, both over time and across segments of the population. The pure rational choice version of voter turnout yields very weak implications about how turnout varies over time or with the platform decision of the candidates. In addition to turnout, the model also suggests that the modal will play a role, along with the median voter, in determining policy outcomes. As such, empirical studies using the median voter as a predictor of policy may benefit from the addition of a measure of the mode of the voter distribution.
Chapter 4

Politics, Policy, and the Economy: A Puzzle

4.1 Abstract

The interaction of politics, policy, and the economy has long been a focus of research. Whether or not politics and the electoral cycle have significant influences on the private economy and how this influence is wielded is a central question in this interaction. This paper investigates a puzzle evident in much of the literature—the party of the president appears to be an important determinant of economic outcomes, but the channel of influence is unclear. The paper first provides evidence demonstrating the puzzle. A general framework for analyzing the influence of politics on an economic system is then developed. The framework is used to further examine the issue and to assess the importance of a fiscal policy channel. While the analysis shows a possible role for fiscal policy, and tax policy in particular, in an explanation of the channel of influence, the overall puzzle still remains.

4.2 Introduction

Election outcomes are seen by many to be largely determined by economic forces. Political strategists have long recognized this influence ("It’s the economy stupid"), and their academic counterparts in Political Science and Economics have echoed this belief with numerous studies
showing the effects of economic conditions on election outcomes\textsuperscript{1}. For this belief to be sustained on the part of voters it must be the case that the economy is, to some extent, under the control of the politician whose election is influenced by the economy. Theories pointing to the effect of elections and elected officials on the economy are numerous; however, the empirical evidence is mixed about the ability of elections and elected officials to influence the economy.\textsuperscript{2}

The evidence, broadly speaking, often supports the proposition that the economy is dependent upon the political process and the partisan component of election outcomes. However, evidence examining the role of politics on policy outcomes, and thus tracing the mechanism by which this power is channeled, is weaker. Hence, a puzzle emerges as to how the economy reacts to politics. Specifically the Presidential Party Instrument Puzzle (PPIP) states that while the outcome of elections seem to be sensitive to the economy, and the economy in turn responds to the state of the political environment, the instrument by which the president can and does significantly influences the economy seems to be a mystery.

This paper proposes to address this puzzle by looking at the (perhaps) most plausible tool of policy under control, albeit indirect control, of the president — namely fiscal policy. It will be very narrow in focus: the election in question will be presidential elections, and the components of spending will be very broad. The analysis will focus on the policy and economic outcome differences in the US between Republicans and Democrats in the post-WWII period.

The paper is organized as follows. The following section provides additional motivation and limits the scope of the paper. Section 4.4 gives some simple evidence illustrating the PPIP and highlights the role of politics in economic and policy outcomes. A general framework for the analysis of politics in a multivariate setting is then developed in section 4.5. This framework is then used in section 4.6 to further illustrate the PPIP in a multivariate setting and to examine the role of fiscal policy. Section 4.7 concludes.

\textsuperscript{1}For examples see Fair (1988), Haynes and Stone (1994), and Alesina, Londregan, and Rosenthal (1993).
4.3 Prior work, Limits of this study

The work linking election results to economic outcomes is typically univariate in that only one economic variable is examined at a time when assessing the importance of politics. The analysis also typically takes the political state (such as the party composition of congress, or the political affiliation of the president) as exogenous. Another related strand of work that relates politics to policy is multivariate in nature; especially when estimating monetary policy reaction functions.\textsuperscript{3} This stands in contrast with work relating policy instruments to the economy in which (sometimes extraordinary) efforts are taken to account for simultaneity. For example the struggle to find the effects of monetary policy take pains to address the determination of the central bank’s reaction function or make the correct identification assumptions to allow the effects of policy to be measured.\textsuperscript{4}

This work will be a step in the direction of bridging the gap between the political influence branch and the policy instrument literatures. Specifically, it is useful to operate within a framework that acknowledges the importance of simultaneity in the evolution of policy and the economy, as well as the influence of politics and elections. The rest of the section will delineate the scope of the paper.

4.3.1 Politics – Presidential elections

The political process is obviously much more complicated than the simple picture that will be painted here. Policy outcomes represent the outcomes of complex bargaining between the president and the congress. Implicit in the analysis is that the party of the president is a major determinant in the outcomes that emerge.

When we think of the main party in power, when it comes to thinking of fiscal policy outcomes, we typically think of the party of the president as being of relatively more importance than the party holding the majority in the house or the senate. For example the 1980’s were a period thought to be dominated by Reaganomics despite the democratic majority in both houses of congress over the same period. The president sets the tone and the terms of the


\textsuperscript{4}This is a large and growing literature. Example are Bernanke and Blinder (1992), and Christiano and Eichenbaum (1992).
debate on policy and has ultimately the final say on whether or not a certain policy is enacted, and usually gets the blame (or takes the credit) for economic outcomes. For these reasons when the party in power is examined as a possible influence on policy or the workings of the private economy the party of the president is most often the focus of attention.

In addition, empirical studies tend to support this view that the president plays the major role in economic policy. Typically, if an effect is found, the party of the president is a more significant influence on the economy than the composition of the congress. It should be noted that some studies do show that congressional influences do matter for policy outcomes. For example Kiewiet and McCubbins (1985) show allow appropriation decisions to depend upon the percentage of Democrats from northern states represented in the congress. These results, however, are typically overshadowed by the influences of the party in power of the presidency.

Another piece of evidence in support of this view comes from the literature examining the determinants of the outcomes of elections. The state of the economy seems to be an important determinant of the election performance of the presidential incumbent, but have only moderate or non-significant influences on congressional election outcomes, and especially so when coattail or mid-term "bounce" effects are taken into account. If voters use the state of the economy to judge the competency of the policymakers (as in, for example, Rogoff and Sibert (1988)) then the finding of no linkage from the economy to election results implies that voters do not think that the policymaker has significant control over the state of the economy.

4.3.2 Policy – Fiscal and monetary

Presidential influence of the economy has potentially several channels through which to work. These include regulatory burdens (including enforcement), tax levels and design, government spending in aggregate and in the allocation across areas (e.g. between defence and non-defence), program design (e.g. unemployment policies, welfare, heath care, Social Security), indirectly through monetary policy, etc.

The evidence provided below primarily sheds some light on the influence through fiscal policy. The monetary channel was extensively examined in previous work (see Faust and Irons (1999b)) and was found to play at best a minimal role in linking the election to the economy.

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The current paper is limited in its examination of broad components of fiscal policy. In particular we look at spending for defence and non-defence goods and services, entitlements (as measured by transfers), debt servicing, as well as aggregate tax receipts. If we assume that the government is working subject to some type of financial constraint (even if it is only a "soft" current year constraint) then these components cannot be examined in isolation and must be treated in a simultaneous equation framework.

The need to allow for interdependence is supported by prior evidence which shows that spending in a given category responds to the economic atmosphere as well as spending in other categories. The methodology taken from Faust and Irons (1999b) and presented in section 4.5 provides a general structural vector autoregression (VAR) methodology for examining the influence of politics on a system of simultaneous equations. The current paper estimates the effects of policy on the level of government spending at a disaggregated level without imposing any specific structure on the interaction of cross category spending.

Finally, the paper is entirely empirical. No mention is made of the motivations which lie behind the political parties different handling of government policy, nor of their (potentially) different goals, nor of the theoretical aspect of the interaction between government fiscal and monetary policy and the economy. Perhaps the empirical regularities may help to guide future theory. We next turn to some preliminary evidence on the "instrument puzzle" as well as on political influences on government spending.

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6See Kamlet and Mowery (1987) (KM) who find these cross effects but do not find a role for partisan effects. This paper is similar to KM in its subject matter — it investigates the determinants of spending in large components of federal outlays. KM however only investigates a reduced form model and does not allow for of dynamics in the evolution of either the spending variables nor the exogenous economic influences. Among other differences, the current study does not ignore the dynamic evolution of the variables in the estimation. Partisan control may take time to effect the economy and appropriations and the economy may take several quarters to exert its influence on policy outcomes. Further, the point of time within the administration may be of importance as in political and partisan business cycle theory. Another and more fundamental difference is the explicit allowance for the simultaneous determination of policy and the economy.

7Clearly these are topics which are of interest and are important, but beyond the scope this paper.
4.4 Preliminary evidence

4.4.1 Data

All data is quarterly from the Federal Reserve Board's US database and spans the time period 1948:1 to 1995:2. Appendix D gives greater detail. Of interest in this study are aggregate government spending on goods and services, which is split into defence and non-defence categories, net interest payments, transfer payments (as a proxy for entitlement spending), and net tax receipts. The economic variables of interest are GNP, M2, inflation (consumer price index), and short term interest rates (3 month T-bill). All variables except the interest rate are transformed by taking logarithms. The majority of the analysis also takes first differences of the data in light of most variables' apparent non-stationarity. Appendix E reports Augmented Dickey-Fuller tests for the variables. In short, all of the fiscal variables appear to be I(1) with the possible exception of defence spending, and thus the results will be reported for first differences. The results for the economic variables are more mixed with the CPI and M2 perhaps I(2), and GNP and interest rates I(1). For summary purposes and to maintain comparability with prior work we will treat GNP and M2 as differences and inflation and interest rates in levels.

Summary regressions for the series analogous to those presented in Alesina and Sachs (1988) and Alesina and Rosenthal (1995) can give a flavor of the importance of the political variables. In short we regress each of the variables on its own lags and political variables to assess the differences in means between the variables at different points in political terms and across parties. For example we consider the regression:

$$A(L)\Delta y_t = Dummies + \epsilon_t$$

(4.1)

with the *dummies* representing the political party of the president in power and the relative point in time in the election cycle. The next subsection provides evidence on the economic variables of interest and the final subsection provides evidence on the fiscal variables.
4.4.2 Evidence on the PP1P

Theories pointing to the role of elections and party affiliation in determining economic outcomes differ across two main dimensions. First, models of reelection motives such as the Nordhaus (1975) political business cycle highlight the dependence of the economy on the current time in the electoral cycle. Second, models of partisan differences such as Hibbs (1977) highlight the difference between parties in determining election outcomes. The two forces need not act independently as the model of partisan business cycles of Alesina (1987) emphasizes. In this case election uncertainty in which party will come to power plays a crucial role in driving the economy. Assuming Republicans have a greater distaste for inflation, an uncertain election which elects a Republican will induce a negative monetary shock to the economy which will affect output. This reaction will only be temporary under the assumption of rational expectations, and assumptions about the specific structure and timing of nominal contracts.

Given these two aspects of political theories, the summary evidence should be able to distinguish these different aspects of political influence. The particular dummies included in the summary regressions (4.1) thus contain dummies that take on a value of 1 for a given time period / party combination. For example a dummy may take on the value of 1 if a republican is in the presidency and it is the first half of the election cycle. Table 4.1 reports the p-values from regressions of this type and testing the restrictions that coefficients of the dummies be equal across parties (H_p), across time (H_t), and across both time and political party (H_0).

Two sets are presented, one for including quarter-party dummies and the second for half-term dummies.\(^8\)

The equation for GNP growth contains a significant difference between the political-timing variables. To illustrate this kind of evidence the regression for GNP growth is given by

\[
\Delta \ln(GNP)_t = \sum_{i=1}^{4} \alpha_i \Delta \ln(GNP)_{t-i} + 0.81 \times 10 + 2.71 r01 + 3.76 d10 + 2.90 d01 ,
\]

\(0.52\) \(0.57\) \(0.71\) \(0.78\)

---

\(^{8}\)Significant at the 1 percent level. \(^{8}\)Significant at the 5 percent level. \(^{8}\)Significant at the 1 percent level. Each regression contains four lags except the interest rate and inflation which contained twelve in the half term equations. H_p and H_t are \(\chi^2(2)\) and H_0 is \(\chi^2(3)\). The lag length was chosen to reduce residual auto-correlation and non-normality. Even so, the equations however do show signs of these problems, which is perhaps to be expected from a simple univariate approach.
Table 4.1: Hypothesis tests for univariate models: testing the restrictions that coefficients of the dummies be equal across parties (H_p), across time (H_t), and across both time and political party (H_b). **Significant at the 1 percent level. *Significant at the 5 percent level. +Significant at the 1 percent level. Each regression contains four lags except the interest rate and inflation which contained twelve in the half term equations. H_p and H_t are \chi^2(2) and H_b is \chi^2(3).

\begin{align*}
R^2 &= 0.511, \quad 1949(2) - 1995(2) \\
\end{align*}

with r10 taking the value of 1 in the first half of a republican term, and the other dummies similarly defined. The first half of the republican administration tends to drive the economy’s rate of growth below that in other political climates. Qualitatively similar results arise if the political state is broken down by quarters rather than half-terms.\(^9\) Similar evidence was taken as support for rational partisan theories, as the economy just after the election reacts to the election “shock”, while the economy remains the same under the two parties in the second half of the cycle.

Further informal evidence for this result is that 5 of 9 post War expansions (as marked by a NBER peaks) have ended in the first year of a republican administration, and 6 of 7 republican administrations included peaks, with 5 occurring in the first year.

These results are the essence of the PPIP. We find a reaction of the economy in terms of GNP growth to the political state; however, policy instruments show little reaction to the political state. Similar results can be found elsewhere in the literature.

There is some evidence in favor of a partisan difference in the interest rate series, H_p has a p-value of 0.0467 when only four lags are included. The equation also fails several diagnostic tests. In addition the direction of the effect does not support rational partisan theories as republicans have lower interest rates. However, noticing the poor performance of the economy under the first half of the republican term, this may represent a loosening of monetary policy in response to the economic downturn. These results and interpretations highlight the need to move beyond a simple univariate framework.
Table 4.2: Hypothesis tests for univariate models: testing the restrictions that coefficients of the
dummies be equal across parties (H_p), across time (H_t), and across both time and political party
(H_b). ** Significant at the 1 percent level. * Significant at the 5 percent level. † Significant at
the 10 percent level. Each variable contains four lags. H_p \chi^2(30) and H_t are \chi^2(16) and H_b is
\chi^2(31).

<table>
<thead>
<tr>
<th>Variable (Growth of)</th>
<th>H_t Half-Term</th>
<th>H_t Quarter</th>
<th>H_p Half-Term</th>
<th>H_p Quarter</th>
<th>H_b Half-Term</th>
<th>H_b Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non - Defence</td>
<td>0.2890</td>
<td>0.4288</td>
<td>0.2552</td>
<td>0.1788</td>
<td>0.4158</td>
<td>0.4737</td>
</tr>
<tr>
<td>Defence</td>
<td>0.1766</td>
<td>0.7914</td>
<td>0.0299*</td>
<td>0.4963</td>
<td>0.0549†</td>
<td>0.7277</td>
</tr>
<tr>
<td>Tax Receipts</td>
<td>0.1582</td>
<td>0.0043**</td>
<td>0.3436</td>
<td>0.0176*</td>
<td>0.2606</td>
<td>0.0017**</td>
</tr>
<tr>
<td>Transfers</td>
<td>0.5524</td>
<td>0.1676</td>
<td>0.1277</td>
<td>0.0135*</td>
<td>0.1968</td>
<td>0.1082</td>
</tr>
<tr>
<td>Net Interest</td>
<td>0.4735</td>
<td>0.0880†</td>
<td>0.0152*</td>
<td>0.0338*</td>
<td>0.0331*</td>
<td>0.0628†</td>
</tr>
</tbody>
</table>

4.4.3 Evidence on components of government spending

Table (4.2) reports similar results to those above for various major components of government
spending again with half term and quarterly political dummies.\textsuperscript{10,11} As indicated, there does
seem to be some evidence of political influence on these broad components of fiscal policy.
While non-defence spending shows no significant reaction to the political dummies, the other
four measures we can reject, in at least one specification, that the party coefficients are equal.
Taxes and interest payments show signs of dependence on the period in the election cycle in
the quarterly specification.

The results from this section are only suggestive, however. The political variables may
be proxying for other significant economic events that would not be captured in a univariate
framework. In general, simultaneity and omitted variable bias will cause simple univariate
modelling to be inadequate and may lead to invalid inference. The following section addresses
these issues in a generalized setting. The remainder of the paper uses this general framework
to assess the importance of the political environment on the variables examined above.

\textsuperscript{10,11} Significant at the 1 percent level. * Significant at the 5 percent level. † Significant at the 10 percent level.
Each variable contains four lags. H_p \chi^2(30) and H_t are \chi^2(16) and H_b is \chi^2(31).

\textsuperscript{11} The regression for transfer payments includes a dummy that takes on +1 during 1950(1) and -1 in 1950(2)
to account for a large upward movement in transfer payments in the first quarter of 1950.

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4.5 General treatment of election results

Examining the response of fiscal policy and the economy to a political outcome raises several unusual issues. First the party in power of the presidency can only take on two possible values, Republican or Democrat, and second this variable changes only every 16 periods, with the data frequency as quarterly in this study. Furthermore there is no reason to believe that appropriation decisions in one area are independent of spending in other areas – especially when concerns about the level of the deficit take on political importance. The mechanism used here to account for the later problem is an semi-structural VAR which is used in order to impose little structure on the dynamic reaction of government spending to the political outcome and to allow for the simultaneous determination of the variables of interest. Clearly it would be of interest to impose more structure on the problem, but, with the relative lack of theoretical motivation of the differences between parties and the structural mechanism by which macro policy outcomes are determined, a broader less restrictive framework is desirable.

The following sections lays out a general framework which explicitly deals with the above issues.

4.5.1 Deriving and Identifying the Standard VAR

Take one political variable \( z_t \) and an \((n \times 1)\) vector of macroeconomic and government variables \( X_t \) and posit that they are determined by

\[
\begin{bmatrix}
  z_t \\
  X_t \\
\end{bmatrix} = f(\tilde{z}_{t-1}, \tilde{X}_{t-1}, \epsilon_t^*),
\]

(4.2)

where \( \tilde{X}_t = (X'_t, X'_{t-1}, \ldots, X'_{t-p})' \), \( \tilde{z}_t \) is similarly defined, and \( \epsilon_t^* \) is a vector of exogenous shocks. While for any plausible political or macroeconomic model, \( f \) is nonlinear, we typically take a

\footnote{This section draws heavily on Section 2 of Faust and Irons (1999b).}
linear approximation to the model to give

\[
\begin{bmatrix}
  z_t \\
  X_t
\end{bmatrix}
= \alpha + B
\begin{bmatrix}
  \tilde{z}_t \\
  \tilde{X}_t
\end{bmatrix} + \epsilon_t.
\]

(4.3)

We attempt to choose the approximation and some transform of the variables so that \( \epsilon_t \) has constant mean and variance, and is serially uncorrelated. The adequacy of the linear approximation is testable, and while some evidence of non-linearities has been found in U.S. macroeconomic data, the evidence has not been strong enough to justify abandoning the linear framework. Equation (4.3) is a vector autoregression (VAR) and is often written,

\[
B(L)
\begin{bmatrix}
  z_t \\
  X_t
\end{bmatrix}
= \alpha + \epsilon_t
\]

where \( Lz_t = z_{t-1} \) and \( B(L) \) is a matrix polynomial in \( L \). While the nonlinear model is (generically) identified (see McMains (1992)), in linearizing we take on an identification problem arising from the fact that (4.3) is observationally equivalent to \( B_0B(L)X_t = \tilde{\alpha} + \tilde{\epsilon}_t \) where \( \tilde{\alpha} = B_0\alpha \) and \( \tilde{\epsilon}_t = B_0\epsilon_t \). Each \( B_0 \) gives a different identification of the system, and the response of the economy to, say, the first shock is different in each.

In this paper, we will only attempt to identify the effects on \( X_t \) of an exogenous shift in the \( z_t \) equation. In standard language, we are only identifying one shock. Our identification scheme in the richer context below has a direct analog that goes as follows. Suppose we assume that in each quarter, the value of the political variable \( z_t \) is determined before any other variable. This suggests a block recursive structure of the economy as in Sims (1980) in which \( X_t \) does not enter the \( z_t \) equation contemporaneously. Next we assume that \( \epsilon_{1t} \) is orthogonal to all the other \( \epsilon \)'s at all leads and lags. That is, we place \( z_t \) first in a block recursive ordering of the VAR and assume that \( \epsilon_{1t} \) is orthogonal to the remaining \( \epsilon_{jt} \) at \( t \).

We want to estimate the dynamic effects of one-period exogenous shifts in the \( z_t \) equation. The dynamic effects of such a change on the \( j^{th} \) \( X \) variable are summarized in an impulse
response function, which is the sequence of numbers,

\[ a_{j,t} = \kappa \partial X_{j,t+i} / \partial \epsilon_{1t} \quad i = 0, 1, \ldots \]  \tag{4.4}

where \( \kappa \) is an arbitrary scaling reflection the size of the presumed intervention on \( \epsilon \).\textsuperscript{13}

4.5.2 Adding presidential cycle variables—The augmented VAR

The only \( z_t \) variable we consider in this paper is the party in power. Suppose that \( z_t \) is 1 if a democrat is in the White House at \( t \) and zero otherwise. Several complications arise from the fact that \( z_t \) is discrete, taking on only the values \( \{0, 1\} \), and that \( z_t \) only changes every 16 periods in quarterly data. To deal with these problems, define \( q(t) \in \{0, \ldots, 15\} \) as the time \( t \) quarter of the presidential term, numbering from zero.

Assume that \( z_t \) evolves according to the following. For all \( t \), \( E_{t-1} z_t = z_t \). If \( q(t) \neq 0 \), \( z_t = z_{t-1} \), and if \( q(t) = 0 \),

\[ E_{t-2}[z_t|\tilde{X}_{t-2}, \tilde{z}_{t-2}] = \Phi(\tilde{X}_{t-2}, z_{t-2}). \]

Thus the party in power is picked every 16 quarters based on the economy two quarters earlier, and the outcome of the election is known one quarter before the president takes office. Further, the probability that a democrat will win, based on the macroeconomic and government variables and the current party in power, is \( \Phi(\tilde{X}_{t-2}, z_{t-2}) \). This would be exactly appropriate if the election were held October 1 and the president took power January 1. We will model as if this slightly modified timing were correct.

Now replace the standard VAR in (4.2) with the following description of the economy:

\textsuperscript{13}The \( a_{j,t} \) coefficients (up to a proportionality factor) are given by the coefficients of the \( (j,t) \)th element of \( A(L) = B(L)^{-1} \).
\[
z_t = \begin{cases} 
z_t & \text{if } q(t) \neq 0 \\
\Phi(\tilde{X}_{t-2}, z_{t-2}) + e_t & \text{otherwise}
\end{cases}
\]
(4.5)
\[
X_t = G(q(t), z_{t+1}, z_t, \tilde{X}_{t-1}, \nu_t^*)
\]

Consider the \(X_t\) representation. We allow the presidential party this quarter and next quarter to affect the economy and fiscal policy. Of course, both of these values are always known. Lags of \(z_t\) could be included without changing the analysis. Why is \(q(t)\) an argument of \(G\)? It will obviously be relevant under Nordhaus (1975) style theories, as well as under Alesina (1987) style rational partisan theories. The later effect arises since political uncertainty is not time homogeneous—the party in power two years from now is less certain at the end of the term than at the beginning. Macro and government variables will fail to be time homogeneous if political uncertainty has important effects on the economy and the policy determination process.

Of course, some form of time homogeneity must be imposed. Notice that \((z_{t+1}, z_t, q(t))\) form a triplet of discrete variables. It is natural to view this triplet as the state of the political environment at \(t\) and to assume that the economy is homogenous conditional on the political state. Call the set of the are 34 possible values of this state variable \(\Omega\).\(^{14}\) We can re-write the \(X\) equation as
\[
X_t = G_{s(t)}(\tilde{X}_{t-1}, \nu_t^*),
\]
where \(s(t) \in \Omega\) is the political state at \(t\). The evolution of the state variable is governed by (4.5). As before, we can linearize this equation to give the evolution of \(X_t\) in state \(s(t)\) as
\[
X_t = \alpha_{s(t)} + B_{s(t)} \tilde{X}_{t-1} + \nu_t.
\]
This expression says that the VAR representation for \(X_t\) has different \(\alpha\) and \(B\) coefficients.

\(^{14}\)For the first 15 quarters of the term \(z_t = z_{t+1}\) and can take on two values; in the final quarter, there are four possible values.
depending on the value of the political state. One can also write the full system as,

\[ X_t = \sum_{\omega \in \Omega} \alpha_{\omega} d_{\omega,t} + \sum_{\omega \in \Omega} B_{\omega} d_{\omega,t} X_{t-1} + \nu_t, \]  

(4.6)

where \( d_{\omega,t} = 1 \) if \( \omega = s(t) \in \Omega \) and \( d_{\omega,t} \) is zero otherwise. Thus, \( d_{\omega,t} \) is an indicator that is one if the state at \( t \) is \( \omega \) and zero otherwise. Equation (4.6) says that we simply need to take the standard macroeconomic VAR, (4.3), and interact the political state indicator variables with the intercept and with all the slope coefficients. Of course, while the values of these dummy variables are known at \( t-1 \) and, hence, predetermined at \( t \), they are not exogenous and cannot be treated as such.

It is clearly impossible to estimate the coefficients of (4.6) in the post-War macro and government data. The summation over \( \Omega \) involves 34 possible values of the state variable. Thus, the political model involves 34 times the (already large) number of coefficients in a standard macroeconomic VAR. We will follow a strategy outlined more fully below of allowing various of these coefficients to enter and testing whether we have an empirically adequate representation.

### 4.5.3 Identification in the augmented model

In order to test hypothesis relating to the interaction of politics, policy, and the economy, we must be able to form estimates which are free from simultaneity bias. We now have a model comprised of a nonlinear model for \( z_t \) (4.5), which determines the \( d_{m,t} \) variables, and (4.6), an augmented VAR. As in the discussion of the standard case above, we rely on a block recursive structure of \( z_t \) and \( X_t \) and an orthogonality assumption. Under the assumed timing of events and information in determining \( z_t \), the election outcome is treated as predetermined in the fourth quarter election year equations for \( X_t \).

We must also assume that is that \( e_t \) is uncorrelated with \( \nu_s \) for all \( s \). Economically, this amounts to the decision to attribute any macroeconomic outcomes that are correlated with the election surprise to the political variables. This assumption would be inappropriate, for
example, if variables other than \( \bar{X}_t \) that determine the outcome of the election at the end of period \( t \) also directly affect the economy. Suppose, for example, that news arrives in the third quarter before an election of the breakdown in peace talks in a war. The breakdown might, for example, alter the re-election prospects of the president and also directly affect the economy through its affects on military procurements. While it is easy to come up with examples like this, it is difficult to come up with such examples that systematically favor one party or the other, thus, inducing a spurious correlation between party and economy. By considering a large range of economic variables, and considering the sensitivity of the results to changes in the information set, we hope to minimize this risk.

These assumptions are sufficient to allow us to consistently estimate the augmented VAR for \( X_t \) while including \( z_t \) and \( z_{t+1} \) (through the \( d \) variables) in the equations.

4.5.4 What is an impulse response in the augmented VAR?

Now consider the impulse response of \( [z_t, X_t']' \) to an election shock. Because the \( z_t \) equation is nonlinear, several complications arise regarding what we mean by an impulse response function [see, e.g., Gallant, P.Rossi, and Tauchen (1993)]. Several of these are simplified by limiting ourselves to a 16 quarter impulse response, starting in the quarter of an election—there are no election shocks in other quarters. Note first, that after the election shock occurs, the process for \( z_t \) is constant for 16 quarters and is, hence, conditionally deterministic, relying on no unknown parameters for this period. Thus, the 16 quarter impulse response for \( z_t \) is trivial. As we shall see, because no variables feed back on the \( z_t \) equation for 16 quarters, we can also compute the 16 quarter impulse response of \( X_t \) to an election shock without estimating the non-linear \( z_t \) equation. There still remains a question as to the definition of an impulse response in this system.

What we report below for the impulse response of \( X_{t+1} \) to an election shock at time \( t \) is
the sequence of numbers,

\[
\alpha_{ji} = 0.10 \frac{\partial E_{t-1} X_{jt+i}}{\partial E_{t-1} z_{t+1}} \quad i = 0, 1, \ldots, 15. \tag{4.7}
\]

This is equivalent to the standard impulse response function in a standard VAR (up to a proportionality factor) for the case when \( z_t \) is ordered first in a recursive treatment of the VAR and the desired impulse response is for the first shock (see appendix E.1). Note that \( E_{t-1} z_{t+1} \) is the probability that a Democrat will be elected. Thus, while the standard impulse response gives the response of \( X_j \) to a one standard deviation change in \( \epsilon_t \), the modified impulse response gives the response of \( X_j \) to a change large enough to cause a 10 percentage point change in the probability that a democrat will take the White House at \( t+1 \). Under the assumed flow of information, the election outcome itself arrives at the end of period \( t-1 \) and can be thought of as the shock.\(^{15}\)

The method for calculating the impulse response function can be seen from the augmented VAR. The expected path of the economy at the end of \( t-1 \) can be written,

\[
E_{t-1} X_{jt+i} = E_{t-1}[X_{jt+i}|z_{t+1} = 1]E_{t-1}[z_{t+1}] + E_{t-1}[X_{jt+i}|z_{t+1} = 0](1 - E_{t-1}[z_{t+1}]).
\]

From this expression, it is clear that

\[
\frac{\partial E_{t-1} X_{jt+i}}{\partial E_{t-1} z_{t+1}} = E_{t-1}[X_{jt+i}|z_{t+1} = 1] - E_{t-1}[X_{jt+i}|z_{t+1} = 0], \tag{4.8}
\]

which is simply the difference in the expected path of the economy under the two parties. For \( i < 16 \), this expression can be evaluated simply from the augmented VAR and does not depend on \( \Phi \) or the \( z_t \) equation.

\(^{15}\)Much of the nonlinearity of the problem has disappeared in this formulation. It remains in the \( z_t \) equation, however. Thus, given the history up through \( t-1 \), only one of two possible shocks \( \epsilon_t \) can happen: \(-\Phi \) or \( 1 - \Phi \). In order to estimate the actual shocks that could have happened at \( t-1 \), we must estimate the \( z_t \) equation.
Expression (4.8) is easy to evaluate. The standard impulse response function can be calculated by a dynamic simulation of the response of the VAR variables to an impulse in some $\epsilon_{ut}$, and can be written as the difference in the path of the variables with $\epsilon_{ut} = 1$ and $\epsilon_{ut} = 0$ with all other shocks set to zero. Similarly, the impulse response to election shocks can be calculated as the difference in the dynamic simulation of the model under two possible values of the political state variable.

The following section uses this general framework to assess the impact of politics on the economic and fiscal variables.

4.6 Empirical Results

4.6.1 Further evidence on the PPIP

To demonstrate the PPIP in the system setting described above, Figure 4-1 gives the impulse response functions from the politically augmented system described in the section above. The standard VAR corresponding to the univariate evidence in favor of the PPIP as reported above consists of short term interest rates ($r_{3m}$), M2 ($m2$), consumer prices ($cpi$), and GNP ($y$), and was chosen to conform with other so-called RMPY VARs in the macroeconometric literature.\textsuperscript{16} Six lags were used in the VAR and intercept dummies for the quarter of the Republican administration and the year of the democratic administration were used to augment the standard VAR. This seemed to be the most reasonable specification given the large number of parameters in the model and the results from prior examination of the data as well as other empirical findings about the importance of political influences. The graph shows a response to a 10 percentage point shock to the chances of a Democrat winning the election as well as standard error bands calculated via the delta method (see Runkle (1987)).\textsuperscript{17} The results are reported in growth rates except for the short term interest rate.

\textsuperscript{16}R-M-P-Y: interest rates, money, prices, output.

\textsuperscript{17}There is still an open issue as to the calculation of confidence intervals for impulse responses. See for a discussion see Sims and Zha (1994).
Figure 4-1: Impulse responses in the four variable system to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR. RMPY.

The result shows the same pattern as the univariate results. The growth of the economy still responds to the election of the president even when controlling for other influences. In response to a 10 percentage point shock in the prospects of a Democrat being elected, there is an expected rise of over one half a percentage point in the rate of growth of output which dissipates over the course of the presidential term. The other variables show only a modest response responding as most 0.25 percentage points to the election shock. Here again is the puzzle, while there is some evidence of a shock to other factors the magnitudes indicate a much greater response of output versus the policy measure.

4.6.2 What constitutes evidence for a “solution” to the PPIP?

At this point it would be useful to explicitly state what we believe would be evidence for a “solution” to the PPIP. If we believe that the results cited above arose from the fact that important variables have been omitted from the system, then the inclusion of those omitted
variables should remove the response of GNP to the election shock. Another alternative would be a significant response to the election of some instrument which affects the economy. The chain of causality implicit in this analysis would be from the election to policy and then to the economy.

If, however, there are important expectational influences then this direction of causality would be confounded. Two examples giving opposite implications for the direction of the output shock will suffice to illustrate. First, suppose Democrats have a preference for higher spending. A shock to the probability that a democrat will get elected may then lead the economy to anticipate higher spending and thus "gear up" to accommodate the coming boom. The positive response would then be to output until the spending is put into place.

Second, suppose the economy reacts to the Democratic election shock by anticipating lower interest rates. This would be reflected in a negative shock to the economy as investment borrowing is delayed until the lower rates materialize. The negative response would then be initially on output then later through interest rates. In either of these cases there could still be a response of GNP to the shock, but there would also be a significant reaction of the policy instrument. The following sections investigate the possibility that fiscal policy variables may play the role of the omitted variable in the standard augmented VAR reported above.

4.6.3 Results from macroeconomic variables and aggregate government spending

One possible solution to the above puzzle is that the channel of political influence works through aggregate government spending and thus adding this variable to the standard VAR would pick up this effect. Figure 4-2 reports the results from the five variable augmented VAR. The same pattern emerges as above; and there does not appear to be a response of aggregate spending to the election shock.

As a alternative, we can replace the money supply series with government spending (say monetary policy is fully reflected in the interest rate so that M2 is redundant within the quarter).
4.6.4 Results from disaggregated components of fiscal policy

While it seems as though aggregate government spending does not respond to political influences, it may be the case that the influence of the party in power may work through the
Figure 4-3: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR. RMPY, -M, +G.

allocation of scarce tax dollars on various components of the budget. The reallocation may be the result of different preferences across parties due to, say, differing constituencies or responsiveness to political pressures (cf. Becker (1983) or Peltzman (1976)). It may also be the case that presidents seeking reelection may reallocate funds to more “visible” spending or to alter tax burden; and the predisposition to use these tools may differ across parties. In either case the resulting decisions may have important consequences for the economy.

To examine this issue we report a series of impulse response functions with different combinations of economic and fiscal variables. Figure 4-4 shows the impulse response in a system with only the five fiscal policy measures. As before, all results are reported in annualized growth rates.\(^\text{18}\) This system would be appropriate if fiscal policy did not depend upon the macroeconomy nor monetary policy.\(^\text{19}\)

\(^\text{18}\)Excepting the interest and inflation rates which is reported in levels when used.

\(^\text{19}\)In the present context this is inappropriate as interest payments surely depend upon interest rates and tax receipts will depend upon the state of the macroeconomy.
Figure 4-4: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal variables only. Variables are: Transfers, Defense spending, Non-defense spending, Taxes, Interest payments.
As the figure shows there does seem to be some reaction to politics. However, the responses show no clear pattern except for the tax revenue component. This obvious interpretation of this response should be cautioned as the rate of growth of the economy shows a similar pattern and is not included in this system.

There does appear to be an effect of an election surprise on tax revenue; however, this may be the result of excluding economic factors in the determination of the fiscal variables. In light of the evidence above the increase in tax revenue from a democratic shock may only reflect a growing economy rather than an increase in the tax rate.

To correct for this omission, Figure 4-5 reports impulse response functions for a system including all five fiscal measures well as output and interest rates. The magnitude of the output response to the election shock is approximately the same as compared to the response in the system with no fiscal policy variables; however, the standard error bands are much larger perhaps reflecting the loss of degrees of freedom in the system or the modified lag lengths.\textsuperscript{20} Note that the response in the tax revenue still remains when accounting for GNP.

To get a better handle on the influences of the election shock on the variables in more parsimonious systems Figures 4-6–4-10 report results from additional estimations. Figures 4-6–4-8 are four variable systems: each include GNP and prices, and break down fiscal policy according to, respectively, (i) Defence and non-defence spending, (ii) total spending\textsuperscript{21} and taxation, and (iii) transfers and taxes. Figures 4-9 and 4-10 include five variables and in addition to prices and GNP include (i) spending, transfers, and taxes; and (ii) total spending, interest rates, and taxes.

In summary, there is some indication that the tax revenue is responsive to the politics, as revenues increase with a shock in favor of a Democratic victory after an initial decrease. The magnitudes the response indicates that the rate of growth of tax revenue may fluctuate by up to 2% as a result of presidential politics. The responses of the other fiscal variables is of roughly

\textsuperscript{20}In this specification we are dealing with a large system and have over 50 regressors in each equation.
\textsuperscript{21}Total spending is defence plus non-defence.
Figure 4-5: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal and economic variables. Variables are: GNP, Interest rates, Transfers, Defense spending, Non-defense spending, Taxes, Interest payments.
Figure 4-6: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal and economic variables. Variables are: GNP, CPI, Defense spending, Non-defense spending.

Figure 4-7: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal and economic variables. Variables are: GNP, CPI, Total spending, Taxes.
Figure 4-8: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal and economic variables. Variables are: GNP, CPI, Transfers, Taxes.

Figure 4-9: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal and economic variables. Variables are: GNP, CPI, Total Spending, Transfers, Tax Revenue.
Figure 4-10: Impulse responses to a 10 percentage point shock in favor of the Democrat (±1 standard error) to the election equation calculated using the politically augmented VAR: fiscal and economic variables. Variables are: GNP, CPI, Total spending, Interest rates, Tax revenue.

the same magnitude but show no regular patterns across time or specifications. Furthermore, it appears that the impact of elections on the economy is not sensitive to the inclusion of various combinations of the fiscal variables.

4.6.5 Interpretation and caveats

As the preceding graphs make clear, the mechanism by which the party in power of the presidency influences the economy is still murky. There is some evidence that the patterns of spending and taxation are responsive to election outcomes, but these results seem to be sensitive to the information set, and no clear picture is produced with regards to the fiscal variables except perhaps the tax revenue variable. The output response to the election shock seems to remain intact when allowing for fiscal variables. The puzzle still remains.

A few caveats are in order. The empirical models analyzed are very simple in nature, and addition of other event specific information may have significant impacts on the interpretations
given above.\textsuperscript{22} Obvious candidates include indicators for oil shocks, armed conflicts or other measures of national security such as a soviet threat measure, the Bretton Woods period, and the 1980 credit controls. In addition there does not seem to be a consistent political impact on the fiscal variables across specifications with the possible exception of tax revenues. Next, the models tend to show signs of misspecifications in terms of residual autocorrelation and non-normality, possibly indicating some type of dynamic misspecification. Finally issues of integration and cointegration have not been adequately addressed.\textsuperscript{23}

Finally, the results here should not be interpreted as a final "model of the US economy" but rather as (i) an indication that politics are important when examining the macro economy, and (ii) an indication that more thought needs to be put into the channels of influence beyond broad fiscal measures. In particular, investigations on the influence of presidential politics on taxation may be fruitful.

4.7 Conclusion

We have provided evidence on what we see as a puzzle in the empirical macro- / political-economic field. Namely the Presidential Party Instrument Puzzle (PPIP) which states that while the outcome of elections seem to be sensitive to the economy, and the economy in turn responds to the state of the political environment, the instrument by which the president significantly influences the economy seems to be a mystery.

To assess the potency of one possible mechanism by which the president may be able to affect the economy we have examined the role of fiscal policy through taxes and government spending on defence and non-defence goods and services, transfer payments, and net interest

\textsuperscript{22}For example, in the univariate analysis above the inclusion of a dummy for the payment of Veterans Life insurance in 1950(1) had a significant impact on the results for net transfers.

\textsuperscript{23}A very brief investigation into the possible cointegrating properties of the variables of interest revealed a multitude of possible cointegrating relationships as would be expected when examining a large number of trending non-stationary macroeconomic data. This would be an interesting topic future for future research. The government's budget constraint represents a natural cointegrating relationship, and the adjustment of spending and taxation to deviations from this equilibrium (namely the deficit) as in Peterha (1994) would be an interesting issue to examine.
payments. While there does seem to be some impact of the party in power on these variables in a univariate setting, the evidence is weaker in a more general setting which allows for simultaneity in policy and economic outcomes.

While there is some very limited evidence that the political environment has an impact on fiscal variables, especially tax revenue, the PPIP is still alive and well—there does still seem to be an unexplained response of the growth of the economy to politics.
Appendix A

Proof of theorems 1 and 2

The proofs of the existence of the multiple-level majority rule equilibrium (MLMRE) follow from the single-peaked preferences induced by the shape of the utility function. Since there is more than a single level of government, the feedback between local and non-local provision must be examined.

Proof of Theorem 1 (communities with heterogeneous voters). This result follows from simply considering the median voter. In this case, local communities consist of heterogeneous voters as described in the text. Given the assumptions about the concavity of the sub-utility functions $u$ and $f$, the preferences for $g^L_i$ are single peaked for a given value of $g^N_i$ and thus we know the median voter in the local community decides the outcome. The same is true for the non-local level given the local outcome. Substituting the budget constraint, the utility of an individual, $i$, becomes

$$U(g^L, g^N) = u(y_i - a^L g^L - a^N g^N) + f(g^L, g^N),$$

and

$$\frac{\partial U(g^L, g^N)}{\partial g^L} = u'[-a^L - \alpha^N \frac{\partial g^N}{\partial g^L}] + f_1 + f_2 \frac{\partial g^N}{\partial g^L}.$$
The Nash assumption sets $\frac{\partial^N}{\partial y^L}$. Taking the second derivative yields

$$\frac{\partial^2 U(g^L, g^N)}{(\partial g^L)^2} = u''(-a^L)^2 + f'_{11}.$$ 

Given the assumptions about the shapes of the utility functions, this value is negative; thus, the voters' preferences are single peaked in the local provision. The same is true for the non-local level given local provision.

The two equilibrium values (local and non-local) are consistent with each other since the median at the local level is of the same type as the median at the non-local level by the assumption about the local and non-local voter distributions, namely, that the medians are equal across governmental levels. In addition, the median voter's ideal levels are the same across all localities, since we have assumed that the median $\beta$ is the same nationally as in each local community. The MLMRE exists and the outcome is equal to the median voter's optimum at the non-local level and in all localities. In other words, the equilibrium as defined by the ideal point of the voter with the median $\beta$ cannot be defeated by a majority vote either nationally or in any locality.

Proof of Theorem 2 (communities with homogeneous voters). In this case, local communities consist of homogeneous voters, so $\beta_i = \beta_j$ for all $i, j$ in a local community.

The local level equilibrium outcome, given the national level, is obvious since each locality consists of identical voters. The outcome locally can be described as the ideal level of the median voter (which is also the same as the ideal level of all voters in that community). Because of this homogeneity of voters at the local level, we only need to consider in detail the outcome at the non-local level.

Given the assumptions about the concavity of the sub-utility functions $u$ and $f$, the preferences for $g^N_i$ are single peaked a given value of $g^L$, so we will find that the median voter in the non-local community decides the outcome if $g^N_i$.

The cost share will be the same in all communities since $\alpha_i = \beta_i / \sum_{j \in I} \beta_j = 1/n$ for all
localities. The utility of a voter in some locality $l$ will be

$$
U(g^N) = u(y_i - 1/n g^l_N (g^N) - \alpha_i^N g^N)) + f(g^l_N (g^N); g^N)
$$

$$
U'(g^N) = u'[-1/n \frac{\partial g^l_N (g^N)}{\partial y^N} - \alpha_i^N] + f'_1 \frac{\partial g^l_N (g^N)}{\partial g^N} + f'_2
$$

(A.1)

which may be greater- or less-than zero. The second derivative yields

$$
U''(g^N) = u''[-1/n \frac{\partial g^l_N (g^N)}{\partial y^N} - \alpha_i^N]^2 + u'[-1/n \frac{\partial^2 g^l_N (g^N)}{(\partial y^N)^2}] +
$$

$$
+ f''_{11} \left[ \frac{\partial g^l_N (g^N)}{\partial y^N} \right]^2 + f''_{12} \frac{\partial g^l_N (g^N)}{\partial y^N} + f''_{11} \frac{\partial^2 g^l_N (g^N)}{(\partial y^N)^2} + f''_{21} \frac{\partial g^l_N (g^N)}{\partial y^N} + f''_{22}.
$$

Using the Nash assumption, $\frac{\partial g^l_N (g^N)}{\partial y^N}$, this yields

$$
U''(g^N) = u''[-\alpha_i^N]^2 + f''_{22}.
$$

which is negative given the assumptions about the shape of the utility curves. Preferences are thus single peaked in the non-local good.

So, given any set of local expenditures (including the local ideal point for any given $g^N$) there exists a majority rule equilibrium at the non-local level.

Furthermore, this amount is determined by the ideal point of the voter with the median $\beta$. Voters with $\beta_i < median(\beta)$ will have their non-local cost share $\alpha_i^N < median(\alpha^N)$ and thus will have an ideal level of non-local spending above that of the median (see Lemma 2). The reverse is true of $\beta_i > median(\beta)$. So the voter with the median $\beta$ will be decisive.
<table>
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<tr>
<th>Expenditure</th>
<th>State &amp; Local</th>
<th>State</th>
<th>Local Local Share</th>
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<td>Intergovernmental exp.</td>
<td>1,351,437,907</td>
<td>837,081,992</td>
<td>759,356,907</td>
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<td>Direct expenditure</td>
<td>1,347,763,004</td>
<td>596,325,152</td>
<td>751,437,852</td>
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<td>Direct general expenditure</td>
<td>1,146,188,343</td>
<td>492,525,280</td>
<td>653,663,093</td>
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<td>Capital outlay</td>
<td>132,403,627</td>
<td>55,594,891</td>
<td>76,808,736</td>
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<td>436,930,359</td>
<td>576,854,357</td>
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<td>101,509,904</td>
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<td>Capital outlay</td>
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<td>10,041,554</td>
<td>25,666,701</td>
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<td>Libraries</td>
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<td>3,932,011</td>
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<td>782,978</td>
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<td>Parking facilities</td>
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<td>-</td>
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<td>Sea and inland port fac.</td>
<td>2,309,348</td>
<td>603,537</td>
<td>1,705,811</td>
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<td>322,320</td>
<td>100,354</td>
<td>221,966</td>
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<td>Police protection</td>
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<td>5,734,937</td>
<td>35,319,595</td>
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<td>Fire protection</td>
<td>17,009,481</td>
<td>-</td>
<td>17,009,481</td>
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<tr>
<td>Correction</td>
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<td>24,091,069</td>
<td>11,765,786</td>
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<td>Protective inspection</td>
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<td>4,764,255</td>
<td>2,472,044</td>
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<td>Natural resources</td>
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<td>11,980,412</td>
<td>3,270,775</td>
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<td>Parks and recreation</td>
<td>17,888,496</td>
<td>2,964,508</td>
<td>14,923,988</td>
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<td>Housing and community dev.</td>
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<tr>
<td>Sewerage</td>
<td>23,583,401</td>
<td>1,462,387</td>
<td>22,121,014</td>
</tr>
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<td>Solid waste management</td>
<td>14,989,501</td>
<td>1,658,036</td>
<td>13,331,465</td>
</tr>
<tr>
<td>Financial administration</td>
<td>22,379,913</td>
<td>12,619,472</td>
<td>9,760,441</td>
</tr>
<tr>
<td>Judicial and legal</td>
<td>19,168,153</td>
<td>7,533,740</td>
<td>11,634,413</td>
</tr>
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<td>General public building</td>
<td>7,071,992</td>
<td>1,738,311</td>
<td>5,333,681</td>
</tr>
<tr>
<td>Other governmental admin.</td>
<td>11,397,896</td>
<td>2,889,110</td>
<td>8,508,786</td>
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<td>Interest on general debt</td>
<td>56,970,143</td>
<td>24,485,426</td>
<td>32,484,717</td>
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<td>Misc commercial activities</td>
<td>293,650</td>
<td>210,746</td>
<td>82,904</td>
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<td>Other and unallocable</td>
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<td>24,092,536</td>
<td>34,732,375</td>
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<td>Utility</td>
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<td>83,628,813</td>
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<td>Utility capital outlay</td>
<td>19,027,737</td>
<td>2,226,381</td>
<td>16,801,356</td>
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<td>Water supply</td>
<td>28,040,658</td>
<td>177,733</td>
<td>27,863,125</td>
</tr>
<tr>
<td>Electric power</td>
<td>34,021,256</td>
<td>2,589,489</td>
<td>31,431,767</td>
</tr>
<tr>
<td>Gas supply</td>
<td>3,433,922</td>
<td>4,419</td>
<td>3,429,503</td>
</tr>
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<td>Transit</td>
<td>25,718,742</td>
<td>4,814,324</td>
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<td>Liquor store expenditure</td>
<td>3,020,203</td>
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<td>497,784</td>
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<td>Insurance trust</td>
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<td>Unemployment compensation</td>
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<td>35,032,015</td>
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<td>Employee retirement</td>
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<td>47,060,989</td>
<td>14,367,181</td>
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<td>Workers' compensation</td>
<td>8,956,094</td>
<td>8,356,094</td>
<td>-</td>
</tr>
<tr>
<td>Other insurance trust</td>
<td>2,352,450</td>
<td>2,352,450</td>
<td>-</td>
</tr>
</tbody>
</table>

Table A.1: Local and State Expenditures.
Appendix B

The Basic Model II: Multiple public goods

The above model in Chapter 2 assumes that there is a single public good provided in order to focus on the effect of a change in the average income level within districts resulting from sorting. Further insight may come from considering the effect of introducing more than one public good. This appendix lays out a sketch of how this might be done.

Extending the model above to include 2 public goods, assume

\[
U(c, g^L_1, g^N_1, g^L_2, g^N_2) = u(y - \alpha_L^c(g^L_1 + g^L_2) - \alpha_N^c(g^N_1 + g^N_2)) \\
\quad + f_1(\gamma^L_1 g^L_1, \gamma^N_1 g^N_1) \\
\quad + f_2(\gamma^L_2 g^L_2, \gamma^N_2 g^N_2),
\]

(B.1)

The two public goods can be supplied at either the local or the non-local level. Voters derive utility from the consumption of the public goods and the private good. The same conditions are placed on the shape of the functions as above.\(^1\)

\(^1\)In general, with more than one good an MRE will not exist; however, the restrictions that the functional forms are the same and that individuals only differ by \(\alpha^N_L\) may guarantee a MLMRE.
This model can be simplified to focus on the effects of the multiple goods. Assume that the cost share is the same for each individual and hence \( a_i^{L,N} = a_i^{L,N} \forall i \). Further assume that there are two types of individuals. Consumers of type I prefer public good 1 to public good 2, so \( \gamma_{1I} > \gamma_{2I} \) for both the local and non-local goods. Consumer of type II prefer the public good 2, so \( \gamma_{2II} > \gamma_{1II} \) for both the local and non-local goods. Given the first order conditions, we know that the preferred level for type I set \( g_{1i}^* > g_{2i}^* \) at both the local and the non-local level.\(^2\)

**B.0.1 Homogeneous and heterogeneous communities**

In the heterogeneous community framework of section 2.5, the median voter again sets the policy at both levels of government. The total amount of government spending on the public goods will then depend upon which type of voter holds the majority. If there are more type I voters, then we will expect a greater level of spending on public good \( g1 \), and will end up at a point such as 1 in Figure B.1, which plots policy outcomes and voters’ ideal points. The amount funded by the local government will depend upon the values of \( \gamma_{1N,L} \) and \( \gamma_{2N,L} \) as well as the functional form chosen by the utility functions. The group in the minority in this case may have a higher ideal level of spending on the good \( g2 \).\(^3\) If this is the case, they will demand more of that good at both the local and the non-local level.

Now consider the outcome if the population sorts into perfectly homogeneous groups. In particular, consider the case where one set of localities will contain only type I voters and another set will contain type II voters. To generate intuition, take the level of spending on non-local goods as fixed. The community of type I voters, who were previously in the majority are happy with the same level of public good provision at the local level as they had in the heterogeneous case since they achieved their preferred outcome in both cases.

\(^2\)In addition to simplifying the problem, these assumptions guarantee a MLMRE in a rather trivial way by imposing only two types of consumers.

\(^3\)The restriction that is required for a higher demand of \( g2 \) is that the spending on \( g1 \) not be too high, in which case the marginal utility from the private consumption may be higher than that of the \( g2 \).
Figure B-1: Ideal points for total public good provision for voters of Type I and II.

The community of type II voters, however, were forced to consume too high a level of g1 and too low a level of g2 in the previous case. They therefore wish to alter their level of public good provision at the local level to compensate. Since they are now the majority of the voters at the local level they can in fact do so. Their prior demand for more g2 at the non-local level will thus be reduced. In summary, by providing for themselves at the local level, the ideal point for non-local government is lower relative to the heterogeneous case. The following example illustrates this point more completely.

B.0.2 Example: perfectly substitutable goods.

Consider the case of a restricted version of the model above with two types of voters. The goods provided at the two levels are perfect substitutes, and there is no intrinsic advantage of providing the good at the local or non-local level \( \frac{g_1}{\gamma_l} = \frac{g_2}{\gamma_N} \). The individual maximization becomes
\[ U(c_i, g_1^L, g_1^N, g_2^L, g_2^N) = u(y - \alpha^L(g_1^L + g_2^L) - \alpha^N(g_1^N + g_2^N)) \]
\[ + f_1(\gamma_1^L g_1^L + \gamma_1^N g_1^N) + f_2(\gamma_2^L g_2^L + \gamma_2^N g_2^N), \]

and the first order conditions reduce to

\[ \alpha^L u' = \gamma_1^L f_1' \] (B.3)
\[ \alpha^L u' = \gamma_2^L f_2' \] (B.4)
\[ \alpha^N u' = \gamma_1^N f_1' \] (B.5)
\[ \alpha^N u' = \gamma_2^N f_2' \] (B.6)

Given the restriction above two of the above are redundant and we can find the relation between 
\[ g_1 = g_1^L + g_2^L \] and \[ g_2 = g_1^N + g_2^N \] from

\[ \frac{\gamma_2^L}{\gamma_1^L} = \frac{f_1'}{f_2'} \] (B.7)

Equation B.7 says that a higher \( \gamma_2^L \) will imply that relatively more \( g_2 \) will be provided.
The split between local and non-local provision does not matter in this case — whatever level of public goods is provided at the non-local level can be “topped up” at the local level for the median voter.

In the heterogeneous community the minority type II voters are stuck with sub-optimal levels of provision of the goods. In particular, \( u' > f_1' \) at type 1 voters' optimum. If it is also the case that \( u' < f_2' \) then the “unhappy minority” will demand a level of \( g_2 \) that is higher than that currently being provided.\(^4\)

In the homogeneous community scenario, however, the minority of Type II voters can now

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\(^4\)Since they are the minority of voters, their demand will go unheard both at the local and the non-local levels, but they will still cast their votes for a candidate that offers more \( g_2 \). Note that they are indifferent to any level of \( g_1 < g_1^L \) since the level of \( g_1 \) will be topped up to this level by the local government anyway.
achieve their preferred level of provision at the local level. Whereas before they requested a higher level of \( g2 \) at the non-local level, they now do not care since they can provide for themselves.

The main result of this section is that, in this extreme case of perfect substitutability, any non-local provision such that \( g1 < g1^* \) and \( g2 < g2^* \) is unanimously approved by the voters.

This result can be seen in the context of Figure B-1 from above. Using a spacial model to represent the preferences, points I and II give the ideal points of each type of voter. Since local and non-local provision are equivalent, the provision of \( g1 \) and \( g2 \) can each be collapsed into a single dimension. Any non-local provision at a point in the box in the lower left region is unanimously approved by the voters in the homogeneous case. In the heterogeneous case, the voters in the minority, say type II, will strictly prefer higher amounts of provision of good 2 at the non-local level until the point at which \( g2^*_I = \arg\max_{g2} U(c, g1^*, g2) \) where \( g1^*_I \) is the optimal level of \( g1 \) chosen by the majority given \( g2^N \). Hence, the minority party will demand a higher level of non-local (and hence overall) government spending than would be the case in a homogeneous community.

Interestingly, if the figure is interpreted in a Downsian framework with the utility as quadratic in the distance from the ideal points, and if we restrict the policy options to lie along a ray from the origin, line \( O - B \), (or if this is perceived to be the case by voters) then minority of type II voters will prefer point B at the non-local level. If that preferred outcome is indeed achieved, type I voters will top-up locally to achieve point A. In this case, again, the minority party will demand an amount of non-local government spending greater than in the heterogeneous case.\(^5\)

\(^5\)In this case there is too much provision in the sense that there would be plenty of room for pareto improvements in the outcome if both groups could somehow agree to cut back on good provision.

Also, a word of caution: Note that the standard Downsian interpretation of the ideal points in the spacial model with a quadratic loss function is not consistent with the profit maximization framework. The indifference curves are not circles about the ideal points, but are instead ovals with their major axis stretching from above and to the left of the ideal point to below and to the right.
Appendix C

Evidence from NES

To the extent that the public good preferences are expressed in the political arena, we will expect partisan voting patterns to emerge or to shift in response to any demographic trends along the lines discussed in Chapter 2 above.

In particular, if the local / non-local interactions stressed here are important, we would expect to see a particular change in voting patterns of the following kind: if voters sort into homogeneous suburbs, their demand for public goods will change relative to the heterogeneous case.¹ An implication of the model below is that, for many voters, homogenization will cause changes in the ideal level for the public goods that are in opposite directions for the two government levels. If we assume that political parties enact similar policies across government levels we would expect to see a higher level of split-ticket voting, of a very specific kind, for people living in homogeneous communities. In particular, we might expect a decoupling of partisan preferences at the local and non-local levels. There is limited support from the National Election Survey (NES) that this may indeed be the case.

The growth of suburbs has been impressive. In 1968 approximately 35 percent of the

¹In the 1950s the trend towards urbanization and suburbanization began to become apparent. Some of the concern in that period was that the spacial growth of cities would result in a conversion of land from agricultural use to nonagricultural uses. Thus suburbanization was seen as a potential “threat to the future food supply of the Nation” [Bogue (1956)]. Today, the growth of suburban population is seen primarily to have important political and policy implications—threatening urban development more than rural development.
Figure C-1: Net migration to suburbs and net migration from central cities. Difference is due to rural and international flows.

population lived in suburbs—an increase from about 25 percent in 1950. That number has continued to grow; in 1996 over 50 percent of the population lived inside metropolitan areas, but outside the central city. In recent elections, for the first time, the majority of voters lived in suburban areas. If the suburban “explosion” was a important phenomenon in 1968, it is even more so today.

The mean rate of growth in the populations of suburbs has outpaced that of central cities by a wide margin. Figure C-1 shows the net inflows to suburbs over the past decade. These population shifts are not new: Table C.1 shows the mean rate of growth for suburbs and central cities in each decade since 1960. In 1990, 14 states had over 50% of their population in suburbs.

Politicians are, of course, wise to the population trend and have tailored much of their campaigning to appeal to the suburban voter. Conventional wisdom holds that suburban areas are more Republican than their urban counterparts. The article by Zikmund states confidently that “[e]veryone knows that before 1954 suburbs tended to vote heavily Republican.” That
<table>
<thead>
<tr>
<th>Suburbs</th>
<th>Central City</th>
<th>Metro Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Std. Dev</td>
<td>Mean</td>
</tr>
<tr>
<td>1960-1970</td>
<td>0.162 (0.211)</td>
<td>0.119 (0.220)</td>
</tr>
<tr>
<td>1970-1980</td>
<td>0.229 (0.186)</td>
<td>0.019 (0.155)</td>
</tr>
<tr>
<td>1980-1990</td>
<td>0.105 (0.141)</td>
<td>0.043 (0.132)</td>
</tr>
</tbody>
</table>

Table C.1: Population growth. Source: Voith (1998), Table 1. Constructed from the County and City Data Book, data tape and various years.

...stylized fact has survived to the current day when voters in suburban areas cast relatively more votes for Republican presidential candidates. In 1996, 47 percent of the two-party vote of suburban voters were cast for the Republican Bob Dole versus only 34 percent of urban voters. In all presidential elections between 1948 and 1996, 56 percent of the two-party vote has been for the Republican candidates, while in urban areas that number has been only 41 percent.

As the primarily Republican suburbs grow in population it is tempting to conclude that the political scales will be tipped in the favor of Republican candidates. Republican presidential victories in the 1980s and Republican congressional gains reflected by the current Republican majority in the Congress seem to bear this out. However, as votes are aggregated within states either directly or through multiple representatives, a simple shift of the population from urban areas to suburban areas should not affect the aggregate vote totals: if a shift in population is the only change, the urban areas should become proportionally more Democratic with no net effect.²

Any shift in partisan outcomes must therefore be due to a shift in partisan preferences for some part of the population. One possibility is that there has been an independent shift in preferences with only a coincidental relation to the growth in suburbanization. A second possibility follows the insight of Tiebout (1956). A shift in partisan preferences arising from a change in the public goods preferences of voters may cause more people to relocate to a preferred living area such as a suburb with the individual's optimal level of provision. That

²In general, there will be some effect on state vote totals of population shifts when the a city is located near a state border and it has suburbs in other states. There can also be some effects of population shifts if the movement alters the median in one district but not the other.
same shift in preferences may also cause a change in non-local voting patterns.

This paper has focused on a third possibility, that relocation to the suburbs may change the voter's demand for goods even though their underlying preferences remain unchanged. In this case, causality runs from location to preferences, rather than in the opposite direction as implied by the Tiebout model. More generally, the paper wishes to describe how we might expect political and policy outcomes at various governmental levels to evolve when there is a shift in the composition of local communities.

The relocation to the suburbs has several possible causes. A 1995 study by the Office of Technology Assessment [U.S. Congress (1995)] points to the decentralization of employment arising from lower land costs in suburbs, an increase in transportation infrastructure, and especially technological innovations that allow decentralization, including various advances in information technology. Also given as causes are an underlying preference for low-density residential arrangements, an "aversion of middle-class white households to ethnic and racial diversity," and a desire to avoid the problems typically associated with urban areas, such as high crime rates and decaying infrastructures. As population grows and technology improves, a natural expansion to outlying communities results. Whatever the causes, over the past decade, suburban areas have received a net inflow of 2.5 million residents per year at the expense of central cities (see Figure C-1).

While there are well articulated reasons for preferring spending at one level versus another (see Oates (1969)) less well understood is the positive political theory behind the spending outcomes. The recent theory on possible effects of multi-level government and suburbanization proceeds along two main dimensions. The first main dimension lies in the domain of theories of fiscal federalism. The focus is on the "functional" and "legislative" theories of multi-level federalism.

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3The last two possibilities are not mutually exclusive. A shift in preferences may lead to a relocation, which in turn further alters the voters' demand for goods.

4These theories in general assume that a federalism system exists: a broader issue is whether or not federalism is a stable form of governance, see Bednar, Eskridge, and Ferejohn (1997) which also provides a nice overview of the rational for federalism.
government. The functional theories of expenditure consider issues such as possible economies of scale in providing certain goods in order to determine the appropriate governmental level for provision. These factors must be balanced against possible diseconomies of scale, unresponsiveness of government to local preferences, and benefits from local area “experimentation.” For redistributive spending, the incentives leading to a “race to the bottom” lead to predictions that local communities cannot effectively redistribute.

The legislative theories of federalism focus on the role of the incentives facing policymakers and bureaucrats in determining policy outcomes. Of related interest is the role of elections and the manipulation of policy by politicians trying to maximize their re-election chances. While undoubtedly important in determining outcomes, these issues are beyond the scope of the current analysis, which determines policy by simple majority rule.

A second relevant strand of theory of interest focuses on Tiebout style sorting across localities. Suburbs may allow voters a wider choice of local governments, so a movement toward suburban living may reflect movement of people into local-communities that provide them with a preferred amount or mix of local government goods. The textbook Tiebout model, however, contains only one layer of government, and so must be modified to talk about the interaction between levels of government. One can plausibly choose local government, but the federal government is applicable to everyone.

The two strands of theories complement one another. If the each public good is provided at the efficient level of government as predicted by functional federalism theories, then the Tiebout model can focus exclusively on the basket of goods provided at the local level and can ignore any interactions between local and non-local provision. To the extent, however, that provision is done at multiple levels the Tiebout theory must examine the relation between the levels.

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5 The terms are taken from Peterson (1995).
6 For a recent example see Wheaton (1998).
8 See Nordhaus (1975), Rogoff and Sibert (1988).
9 An important question in the vein of the Tiebout models deals with the price of housing in Tiebout type models. The story is that localities with low tax rates for a given level of public services will draw more residents who will bid up the price of housing in that locality. (cf. Oates (1969)). The role of property taxes and housing values would be an interesting extension to the analysis above.
C.0.3 Model predictions

The model from section 2.4, which focuses on the individual differences in the cost of provision, suggest that homogenization may result in a rise in demand at the median for non-local good provision as well as a fall in demand for local provision for the majority of homogeneous districts versus the non-homogeneous case.

The model from section B, with two public goods, suggests that when demand can be satisfied at the local level, as is the case with homogeneous communities, there is a reduced demand for the public goods at the non-local level. In the case when the ratio of public good spending is restricted, the demand for both goods at the non-local level is higher for a the minority group in the case of heterogenous communities.

These observations suggest an empirical strategy of looking at observed policy outcomes either over time assuming an increase in the degree of homogeneity, or across regions that differ by the degree of homogeneity in the communities.\textsuperscript{10}

The analysis in previous sections, however, took underlying preferences for public goods as given and then looked at the effect of homogenization on demand for the goods. If these underlying preferences are either changing over time or vary across regions in a way that is correlated with community homogeneity, then relating policy outcomes to homogeneity will confound the effects of a preference shift with the effect of a shift towards homogeneity.

The approach taken here is to look at the implications of the model for the relation between local and non-local demand. In the model focusing on cost heterogeneity, one implication was that the process of homogenization will lead a majority of voters to demand more at the non-local level and less at the local level. In the model with two public goods, the prediction was that homogenization decreased the demand for the non-local goods for a group of voters while the demand at the local level increased. In both cases, this represents a decoupling across governmental levels of the demand for public goods.

\textsuperscript{10}There is a possible complication in that political districts are not fixed, but are rather subject to political gerrymandering. McDonald (1998) shows that dealignment gives politicians incentives to increase the political homogenification within districts.
If it is assumed that a shift in the underlying preferences for good provision is reflected by a shift in the same direction at both levels, then a finding of significant decoupling lends support to a homogenization effect which is in addition to any effects due to a shift in underlying preferences.

C.0.4 Evidence

The decoupling of demand may, under certain assumptions, have implications for partisan voting. If we assume that there is a correlation between the platforms of political candidates across governmental levels, and that these platforms represent, in part, policy positions on good provision, then we may interpret voting for a particular party as an expression of preferences for public goods.11 In this case we can interpret an increase in split ticket voting across levels of government as evidence of a decoupling of demand.

[fn. Parties could have platforms that are explicitly different at each level of government. As sorting becomes more prominent, we would expect smart parties to pick up on the divergence of preferences across levels and explicitly alter their platforms to match. There may be a trend in this direction—validating the theory in the previous sections, but making the empirical results harder to interpret.]

Further, if the homogenization effect is important, the decoupling effect should be correlated with some measure of local homogeneity. The assumption is made that suburban areas are more homogeneous than central cities, and hence an examination of split ticket voting across levels is examined using survey data on voter behavior.

The theory presented above specifies a local and a non-local level for government expenditures. The U.S., though, presents a problem since there are three levels of government, local, state and federal. The implications drawn from the model hinged on the substitutability of public good provision at different levels. From the type of spending typically done by each

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11 If parties play an important role providing information about platforms, then it seems reasonable to assume that voters will infer local candidates' policy positions, in part, by observing the platform of the national party.
level, the model is perhaps most relevant to local and state spending. The survey data on voting behavior, however, only asks about state and local voting jointly in a single question; hence, the national versus state and local split is the only available

The National Election Survey (NES) has recorded voting attitudes and behavior in elections years beginning in 1948. In addition to recording the demographic characteristics of the respondents, the survey also asks whether the voter lives in an urban, suburban, or rural area. Respondents were asked to name the party they chose in several races in the election. The question was asked for federal-level races for President, House Representative, and Senator. For the local level, a question was asked about how the respondent tended to vote at the state and local level.12

Tables C.2 and C.3 present the results from the NES. [redo as multinomial logit for each of the 4 outcomes] The dependent variable for Table C.2 is a binary variable that takes on the value of 1 if the respondent voted for a Republican at the national level and for a Democrat at the local level. Table C.3 is the reverse. If there is a decoupling of the voter preferences in homogeneous communities that is reflected in partisan voting, then we would expect that the indicator variable for suburban voters would come in significant in a regression predicting the vote variable.

The tables show some support that voters in suburban regions who vote democratic locally are more likely to vote republican nationally. Consistently across the three regressions the coefficient for the suburban dummy is statistically significantly greater than the urban dummy. This result would tend to support the multiple goods version of the model in Section B above.

The results for the voters who vote Republican locally are more mixed. There is some evidence for the decoupling in the Senate races for suburban voters, but overall there does not seem to be a consistent pattern.

12 The question asked was "How about the elections for other state and local offices, did you vote a straight ticket or did you vote for candidates from different parties. (IF STRAIGHT TICKET:) Which party? (IF SPLIT TICKET:) How did you split it?"

The question was asked in 1952, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 80, 82, 84

119
### Table C.2: Logit regressions. Dependent variable is 1 if local vote is Democrat and national vote is Republican. Results reported for national vote for Senate representative, House Representative, and President. Sample includes voters who cast a Democratic vote locally.

<table>
<thead>
<tr>
<th>National Vote: Republican, given Local Vote Democrat</th>
<th>Senate</th>
<th>House</th>
<th>President</th>
</tr>
</thead>
<tbody>
<tr>
<td>urban</td>
<td>0.092 (0.156)</td>
<td>0.060 (0.134)</td>
<td>-0.629 (0.126)</td>
</tr>
<tr>
<td>suburban</td>
<td>0.595 (0.141)</td>
<td>0.232 (0.125)</td>
<td>-0.170 (0.112)</td>
</tr>
<tr>
<td>sex</td>
<td>-0.275 (0.119)</td>
<td>0.049 (0.105)</td>
<td>-0.193 (0.096)</td>
</tr>
<tr>
<td>age</td>
<td>-0.007 (0.210)</td>
<td>-0.005 (0.036)</td>
<td>0.045 (0.032)</td>
</tr>
<tr>
<td>race</td>
<td>-0.371 (0.059)</td>
<td>-0.586 (0.202)</td>
<td>-1.195 (0.220)</td>
</tr>
<tr>
<td>edu</td>
<td>0.165 (0.061)</td>
<td>0.248 (0.0514)</td>
<td>0.219 (0.048)</td>
</tr>
<tr>
<td>income</td>
<td>0.012 (0.303)</td>
<td>0.095 (0.054)</td>
<td>0.030 (0.048)</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>3381</td>
<td>5092</td>
<td>3585</td>
</tr>
</tbody>
</table>

### Table C.3: Logit regressions. Dependent variable is 1 if local vote is Republican and national vote is Democrat. Results reported for national vote for Senate representative, House Representative, and President. Sample includes voters who cast a Republican vote locally.

<table>
<thead>
<tr>
<th>National Vote: Democrat, given Local Vote Republican</th>
<th>Senate</th>
<th>House</th>
<th>President</th>
</tr>
</thead>
<tbody>
<tr>
<td>urban</td>
<td>-0.080 (0.165)</td>
<td>0.011 (0.133)</td>
<td>0.421 (0.253)</td>
</tr>
<tr>
<td>suburban</td>
<td>0.171 (0.135)</td>
<td>-0.016 (0.113)</td>
<td>0.282 (0.231)</td>
</tr>
<tr>
<td>sex</td>
<td>-0.203 (0.118)</td>
<td>-0.082 (0.099)</td>
<td>0.452 (0.202)</td>
</tr>
<tr>
<td>age</td>
<td>-0.062 (0.039)</td>
<td>-0.047 (0.032)</td>
<td>-0.096 (0.063)</td>
</tr>
<tr>
<td>race</td>
<td>0.281 (0.628)</td>
<td>0.565 (0.426)</td>
<td>1.426 (0.465)</td>
</tr>
<tr>
<td>edu</td>
<td>0.107 (0.059)</td>
<td>0.163 (0.050)</td>
<td>0.159 (0.098)</td>
</tr>
<tr>
<td>income</td>
<td>0.055 (0.060)</td>
<td>-0.031 (0.050)</td>
<td>-0.011 (0.097)</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>2753</td>
<td>3971</td>
<td>3103</td>
</tr>
</tbody>
</table>
In summary, the NES data shows some mixed support for the decoupling effect. Among voters voting primarily or exclusively Democratic in local elections, the probability of voting Republican in national elections appears to be greater for people who report living in suburban areas. The results for people who voted Republican locally do not show the decoupling effect.
Appendix D

Data sources: VAR

All government spending and economic data is from the Federal Reserve Board’s US database. Data are reported in Billions of constant (1987) dollars, seasonally adjusted annual rates. Growth rates are expressed as percent changes at annual rates. The original sources for the government spending numbers are as follows:


- Government spending: Government consumption expenditures and gross investment, federal, annualized, U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, Table 1.1. Data used are prior to the 1995-6 revisions in order to maintain compatibility with the pre-1959 data.

- Government- Defence: Government consumption expenditures and gross investment, federal, Defence, annualized, U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, Table 1.1. Data used are prior to the 1995-6 revisions in order to maintain compatibility with the pre-1959 data.

Analysis, Survey of Current Business, Table 1.1. Data used are prior to the 1995-6 revisions in order to maintain compatibility with the pre-1959 data.


- M2: Federal Reserve Board of Governors, US Database.

- Inflation: Consumer Price Index, Federal Reserve Board, US Database

- Interest Rates: Three Month T-bill rate, Federal Reserve Board, US database
Appendix E

Aside: Incrementalism and non-stationarity

The notion of budgeting by small steps or by asking by government agencies for small increases over the prior year budget has come to be know as "incrementalism" in the political science literature. This idea comes from the more basic micro level theories of the budgetary process which stress the role of institutional norms over politics. An alternative which has been put forth is that politics plays a more important role in determining the level of funding, Lowery, Bookheimer, and Malachowski (1985).

While I have not seen a formalization of this concept, the essence of the debates comes down to a statistical view of the process driving allocations and budgetary requests. The incrementalism view is a hypothesis that the allocations are non-stationary and that budgets are not mean-reverting. The statistical properties for the series presented below for the fiscal variables might have some implications for this debate.

Table E.1 gives the results for augmented Dickey-Fuller tests for all the series used in Tables 4.1 and 4.2. The lag level was chosen by starting with 10 lags and eliminating insignificant lags one at a time until the last lag became significant at the 95% level. For variables in log-levels

\[ 1 \text{I should probably talk to someone who knows the theory better!} \]
Table E.1: Augmented Dickey-Fuller Tests

a constant and a trend were included, and for first differences a constant was included. The results were not sensitive to each of these strategies. Estimation dates were 1951(1) to 1995(2).

E.1 Impulse Responses

To see that the impulse response in (4.7) is the same as (4.4) up to a proportionality factor under the stated conditions, note that the response of the jth variable to the first shock in (4.4) can be written

\[ a_{j1} = k \frac{\partial E_{t-1} X_{j,t+1}}{\partial E_{t-1} \epsilon_{1t}}. \]

Suppose we alternatively considered the effect of a change in \( E_{t-1} z_t \), the first variable. In a general linear system, one would have to ask which exogenous variable (which \( \epsilon_t \)) changed to cause the change in expectation. In a recursive system, however, it must be that \( E_{t-1} \epsilon_{1t} \) changed and, in particular, we have \( \partial E_{t-1} \epsilon_{1t} / \partial E_{t-1} X_{1t} = \kappa^* \), for some \( \kappa^* \). Thus,

\[ \partial E_{t-1} X_{j,t+1} / \partial E_{t-1} z_t = (\kappa^* \kappa) a_{ji}. \]
Appendix F

Utility function and turnout

To conduct the computational experiments the function $f$ needs to be given an explicit functional form. The probability of turning out to vote is take to be the absolute difference in utility between the two potential outcomes in the election, where Figure F-1 shows the shape of the utility function.\(^1\) For platforms close to one another, the absolute difference will be low, and hence the probability of turning out will also be low. For platforms that are far from the voter’s ideal point, the absolute difference will also be low since the utility function is relatively flat for values far from the ideal point. This specification captures the roles of both alienation and identification.

Figure F-2 shows a schematic diagram of who votes in the model with a two-dimensional policy space. The shaded area represents the range of ideal points for which the decision is made to turnout to the polls. As the threshold level for turnout decreases, the “eyes” grow larger. As the candidates move towards each other the eyes decrease in size. It should be obvious from the diagram that when the distribution of ideal points is uniform and the eyes lie completely within the policy space, each candidate receives approximately half the vote.

\(^1\)In the two dimension examples, the difference was scaled by a constant to calibrate the voter turnout levels.
Figure F-1: Shape of the utility function. (Ignore axis labels).

Figure F-2: The shaded regions indicate the sets of ideal points of votes who turn up at the polls.
Bibliography


