

Four Essays on the Effects of Political Institutions

by

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B.A., Yale College (1986)

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ABSTRACT

1. Chapter 1, Campaign Spending and Election Outcomes

The conventional wisdom is that spending has important benefits for challengers, while incumbent spending does not have an important influence on election outcomes. This paper challenges conventional wisdom, finding that when the endogeneity of candidate spending levels is taken into account incumbent spending and challenger spending have statistically equivalent effects on the outcome of Senate elections. The major innovation of this study is the use of a new set of instrumental variables that permits consistent estimation of the effects of spending. This study employs variables which affect the ability of the candidate to raise campaign funds, such as the candidate's level of wealth. Re-estimation of the effect of spending on election outcomes reverses existing results. Previous research has found that the net effect of campaign spending in Senate elections raised the challenger's share of the vote by around 5 percentage points. This paper finds that at the average levels of candidate spending in Senate elections the incumbent's spending advantage results in more than a 5 percentage point increase in the incumbent's share of the vote. Simulations based upon these findings indicate that equalization of spending levels may significantly increase incumbent defeat rates, and that caps on candidate spending levels may significantly improve the chances of challengers.

2. Chapter 2, The Institutional Context of Legislators Career Decisions (jointly written with Professor Steve Ansolabehere)

This paper develops a formal model that ties career decisions of individual legislators to the organization of the legislature along majority and minority party lines. We predict the effects of on retirement rates of an increase in a party's share of the seats in the legislature, an increase in a party's popularity, and an increase in the incumbency advantage. Importantly, an increase in the incumbency advantage may have asymmetric effects on the majority and minority party; an increase in the incumbency advantage causes a decrease in retirements among the majority party but may cause an increase the minority party's retirement rate. Our empirical analysis of retirements from the U.S. House confirms that a higher incumbency advantage has led to increased minority retirements.

3. Chapter 3, Majoritarianism, Incumbency and the Composition of the Legislature

This essay analyzes how electoral factors, such as the incumbency advantage, interact with central features of legislative life, such as majoritarianism, to jointly determine the composition of the legislature. Theoretical analysis shows that, in the presence of an incumbency advantage, career decisions may lead to multiple steady state equilibrium legislatures. Interestingly, there may be an equilibrium legislature with a majority held by a political party that is less popular than the opposition.

4. Chapter 4, The Adoption of the Secret Ballot

This essay analyzes the adoption of the Secret Ballot in the United States. Conventional explanations focus on the critical role of reform groups who opposed the political corruption the open ballot permitted. Here it is argued that the secret ballot was adopted because it benefitted the powerful political parties. The secret ballot, by limiting the ability to verify how a voter cast his ballot, reduced the incentive for vote buying. The Secret Ballot allowed the political parties to escape from the increasingly costly vote purchasing competition which prevailed before the adoption of the Secret Ballot. To supplement the theoretical analysis, historical evidence is provided to account for the timing of the Ballot Reform.

Thesis Supervisor: Dr. James M Poterba

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Chapter One

Campaign Spending and Election Outcomes:

Re-estimating the Effects

In American Congressional elections incumbents routinely win re-election. A common explanation for this is the large campaign spending advantage enjoyed by incumbents. There is, however, surprisingly little evidence in the academic literature that incumbent campaign spending has any significant effect on the outcomes of Congressional elections. In fact, it is widely believed that challenger spending is very important, but incumbent spending has little or no effect on incumbent vote shares. In light of the effort incumbents undertake to raise funds these findings appear improbable. As a result the impact of money on election outcomes remains an important unresolved issue in the study of elections. It is still a matter of uncertainty and heated academic dispute despite the sustained attention the subject has received over a decade and a half of research.

Understanding what factors influence the outcomes of political contests has important implications. Politicians want to win elections, and so if money is important this will clearly influence their behavior. A high return to campaign spending will generate a great demand for campaign funds. If campaign finances are not an important factor for incumbent politicians, it is likely that concerns about the influence purchased by contributions from PACs and other "special interests" are exaggerated. Estimation of the effect of campaign spending on election outcomes is also necessary to understand the effects of different proposed reforms to the current system of campaign finance regulation. Since the significant reforms of the early 1970's, campaign finance has been an active area of policy debate. There is widespread popular discontent with current laws, and in recent opinion surveys nearly 50% of the public views "changing the campaign finance laws" as important or extremely important (Sorauf 1992). Evaluation of the effects

of reforms on political competition requires accurate measurement of the role of money in election outcomes.

A more precise understanding of the effects of spending may also help in understanding the political economy of campaign finance regulation. It would be important to know who benefits and who is harmed by the current system of regulation, and what this might tell us about how public policy is made more generally. Some attempts have been made to answer these questions, but without better ideas about the effects of campaign spending it is hard to see how the winners and losers in the current system are distinguished.¹ Finally, the bulk of the existing empirical literature on campaign finance has yielded a potentially anomalous finding that encourages additional investigation: incumbent campaign spending appears to have small returns when compared to challenger spending.

This paper estimates the effect of campaign spending on Senate election outcomes. Section 1 reviews the main existing findings regarding challenger and incumbent campaign expenditures. An important issue in estimating the effect of campaign spending on election outcomes is that campaign spending responds to expectations about the closeness of the election. Most existing empirical research ignores this. The few existing attempts to incorporate the endogeneity of candidate spending levels have not adequately addressed important issues. Section 2 develops a simple model of the determination of campaign spending. Section 3 presents a model of Senate election outcomes, and describes the instrumental variables used in estimation. This paper argues that contrary to a view often expressed (Jacobson 1985, 1990), valid instruments can be found to permit the identification of a Two Stage Least Squares (TSLS) model of the influence of campaign expenditures on election outcomes. The major innovation of this study is the use of a new set of instrumental variables that might permit consistent estimation of the effects of candidate spending. This study will emphasize variables which cause shifts in the

¹For some work on this question, and an example of the difficulties involved when spending effect estimates are questionable, see Bender (1988).

candidate cost of funds function, such as candidate wealth levels. If variables like candidate wealth levels do not have a direct effect on election outcomes, then they can be used to obtain consistent estimates of the effects of spending.

Section 4 reports estimation results. These results show that Ordinary Least Squares (OLS) and TSLS estimation of a standard model of Senate election outcomes produce very different results. OLS estimation of the Senate election model confirms the conventional view that incumbent spending has a lower marginal effect than challenger spending, while the TSLS estimation shows the marginal effects of spending by challenger and incumbent to be statistically equivalent. Section 5 examines the implications of the estimation results for different campaign finance reform proposals. Section 6 concludes.

Section 1: REVIEW OF THE LITERATURE

This Section reviews the existing findings regarding campaign spending and election outcomes. Section 1.1 reviews the empirical models which assume candidate spending levels are exogenous. The main finding of these studies is that incumbent spending has a much smaller marginal effect on vote totals than challenger spending. The result that incumbent spending appears to be less important than challenger spending has led to two main lines of analysis; attempts to explain this result, and attempts to re-estimate spending effects using techniques that account for the endogeneity of candidate spending levels. Sections 1.2 and 1.3 review these lines of analysis. Section 1.2 discusses the theoretical arguments regarding the importance of incumbent spending. The main conclusion to be drawn from Section 1.2 is that there are reasons for expecting incumbent spending to be less effective than challenger spending, but also reasons for expecting incumbent spending to be as or perhaps even more effective than challenger spending. Section 1.3 reviews studies which attempt to account for the endogeneity of candidate spending levels.

This paper analyzes the effects of campaign spending on Senate election

outcomes. Section 1.4 reviews recent work on the effect of campaign spending on Senate elections. Section 1.4 also discusses the characteristics that distinguish this paper's estimation strategy from the existing literature. The major innovation of this study is the use of a new set of instrumental variables to estimate the effect of campaign spending. This study focuses on variables, like candidate wealth levels, which may cause shifts in the candidate's cost of funds function. Readers who are familiar with the campaign finance literature may wish to skip ahead directly to Section 1.4.

Section 1.1 Models with Candidate Spending Levels Exogenous

Since the tabulation of congressional contribution and expenditure data, there have been numerous attempts to measure the effects of spending on election outcomes (among others see: Abramowitz, 1988; Caldeira and Patterson, 1982; Giertz and Sullivan, 1977; Glantz, Abramowitz, and Burkhart, 1976; Grier, 1989; Lott and Warner, 1974; Shepard, 1977; Silberman and Yokum, 1978; Thomas, 1989; Welch, 1974).² The canonical example of work in this literature regresses a measure of the vote on some function of the candidate's spending levels and other variables relevant to the election outcome. The basic differences between these studies were use of different functional forms for the function converting spending into votes (linear, quadratic and logarithmic functions were used), analysis of different types of campaigns (the U.S. House is most common), and whether or not incumbent spending effects and challenger spending effects are distinguished. Many of the earliest studies restricted the marginal effects of challenger spending and incumbent spending to be identical. When this assumption was relaxed, the central finding of this literature was uncovered. It was revealed that challenger spending had much greater marginal returns than incumbent spending; the effects

²See Jacobson (1985) for a review of this literature.

of incumbent spending were small and often not statistically significant (Glantz, Abramowitz, and Burkhart, 1976; Jacobson, 1978; Silberman and Yochum, 1978; Abramowitz, 1988). The result that challenger spending is important while incumbent spending is not has been verified consistently by OLS regressions. Jacobson summarizes the literature in 1985: "The idea that the challenger's spending level is what matters for election results is repeatedly supported. Indeed, it is supported by results from almost every set of elections where the question has been tested" (Jacobson 1985, p23).

The result that incumbent spending has little or no effect on incumbent's election chances, and in some studies actually appears to reduce the incumbent's expected vote, has led to two responses. First, there is an attempt to explain why these findings make sense. Second, there have been a few attempts to improve the empirical methodology to correct for possible endogeneity of campaign spending.

Section 1.2 Arguments For and Against the Finding that Incumbent Spending is Unimportant

The main explanation of why incumbent spending appears less effective than challenger spending is that attempts by both the challenger and the incumbent to influence the voters are subject to decreasing returns; since the incumbent begins with the built in advantages of staff, and free mailings, any spending by the incumbent is an addition to an already high level of campaign activity. Even before spending her first dollar, the incumbent is well known to the voters. Any additional communication by the incumbent will add relatively little to the voter's knowledge. Challengers, on the other hand, are generally unknown and so benefit greatly from campaign exposure (Jacobson 1978, 1990). Their spending will therefore have a large effect on the voters.

There are several reasons to be skeptical about this argument. There are a variety of reasons for believing that incumbent spending may be as important as challenger spending. First, there is evidence that voter don't know a lot about either

the challenger or the incumbent, and so incumbents may still benefit greatly from getting out their name and campaign message to the voters. Second, campaigning is not only about informing the voters about yourself, but also bringing to light information about your opponents. If the voter has little information about the challenger, this should provide an opportunity for both the challenger and the incumbent, not just the challenger. In addition, the campaign may raise new issues that the incumbent had not addressed in earlier communications.

There are other reasons for supposing that incumbent campaign spending is effective. Incumbents may have advantages in organization and expertise that make their expenditures more efficient and therefore more effective dollar for dollar than challenger's expenditures.³ If this is an important effect, the marginal effect of spending by the incumbent might actually be *greater* than the marginal effect of challenger spending. A final reason for skepticism about the finding that incumbent spending is unimportant is that the actual behavior of incumbents, who are political professionals, appears to contradict the premise that incumbent campaign spending has little effect.⁴ If incumbents are sensible, it may be hard to explain their substantial fundraising efforts.⁵

³ This point is emphasized by Erikson and Palfrey (1992).

⁴ It has been argued that politicians may be ignorant about the effects of their campaign spending. In order to explain why incumbents persist in raising and spending large sums, Welch argues that politicians may be unaware that the effects of spending are small, though political scientists understand this after analyzing a large sample of campaigns (Welch, 1981, p226). At best this might explain low spending in the 70s, since surely politicians could have learned the true spending effects from the years of research in this area, and reduced their spending in response. That the low estimates for incumbent spending leads to speculation that politicians might not know how to campaign seems independent justification for additional research in this area.

⁵ This common argument can be refuted if it is believed that the marginal cost of raising funds for the incumbent is very low, since then large amounts of money raised can be easily reconciled with low marginal benefits. Anecdotal evidence suggests otherwise: politicians find raising money tough and they hate it. Consider the view of Hubert Humphrey, who called raising funds "a disgusting, degrading, demeaning experience." (Jacobson 1978).

Overall, the arguments used to support the conventional finding that incumbent spending is less important than challenger spending are not decisive or without good counter arguments. There are arguments for why the incumbent's spending may be less effective than the challenger's, but there are also counter arguments which suggest that the incumbent's spending may be as, or even more effective than the challenger's spending.

Section 1.3 Models with Candidate Spending Levels Endogenous

There are a number of reasons to suspect that regressions which assume spending levels are exogenous yield biased coefficients. Some of the commonly cited reasons to expect that the levels of spending by the candidates are influenced by electoral conditions include: 1. As the probability of winning the election improves, it is easier for the candidate to raise money. 2. As elections become closer, individuals may be more likely to contribute to the candidates, in hopes of influencing the election outcome. 3. As the incumbent's election margin grows, the incumbent reduces fundraising activity. For these three reasons and others, if there are factors influencing the election outcome that are not captured in a single equation regression model, the effects of spending on election outcomes will be biased due to correlation between the spending levels and the regression error.⁶

The preponderance of the empirical literature on the effects of campaign spending ignores the issue of the endogeneity of spending levels. There have been several studies which attempt to correct for possible endogeneity biases. Attention has been focused on elections to the U.S. House. As part of his seminal work estimating the effects of campaign expenditures, Jacobson attempted to estimate a TSLS model of spending in House elections (Jacobson 1978). This study has been

⁶ Due to the variety of potential ways spending levels may be influenced by expectations regarding the election, it is not possible to predict the bias in OLS regression coefficients. A downward bias in the incumbent spending coefficients can easily follow if incumbents vary their fundraising intensity according to whether their re-election appears safe.

criticized on the grounds that the excluded variables, such as the challenger's political party, and the strength of the challenger's political party in the district, are obviously not excludable from a regression of candidate vote percent on spending levels. Jacobson has conceded that this is a problem (Jacobson, 1985, p32). Jacobson updates his 1978 work, using the same methodology, on data made available since the initial study (Jacobson 1985, p31-40).⁷

Welch (1981) attempts to estimate the effects of campaign spending in House elections using a TSLS approach. Welch estimates the effects on the Republican share of the two party vote of challenger spending, a measure of district party strength, and incumbency; incumbent spending is excluded from his model because it is assumed that incumbent spending does not affect the vote. This a priori exclusion is based on OLS regressions that indicate that incumbent spending is unrelated to vote totals (see Welch (1981), Appendix, table 4). Since Welch agrees that OLS is inappropriate, however, OLS yields biased regression coefficients and this conclusion based on the OLS estimates is unwarranted. Welch's study has several additional problems.⁸

The most recent attempt to estimate the effects of campaign spending using an instrumental variables approach is an important study of U.S. House elections by Green and Krasno (1988). Their study has caused the issue of incumbent spending effects to become a matter of heightened debate, as their results call into question

⁷The TSLS regressions performed in Jacobson (1985) drop incumbent spending from the equation relating challenger vote to candidate spending levels. This is justified by the low OLS coefficients on incumbent spending. Given that the hypothesis of TSLS is that OLS estimates are inconsistent, dropping incumbent spending from the regression is not correct.

⁸ The instruments selected for identification of the effects of spending also appear questionable. The empirical results presented in the study only cover a single year of elections, 1972, because the instruments appear to be uncorrelated with spending levels for other years (see Welch (1981), footnote 12). The instruments, median family income, median year schooling, and the district Gini coefficient, have been criticized as likely related to the Republican vote share and therefore invalid instruments (Jacobson, 1985, p38).

the conventional view that incumbent spending is less important than challenger spending. They find that, in contrast to the usual OLS findings that incumbent spending is insignificant, incumbent spending effects are statistically significant and roughly equal to challenger spending effects. This is a welcome result for those who suspect that incumbent spending is important, but several methodological questions have been raised regarding their study.⁹ Most important, because of a lack of instrumental variables, they assume that challenger spending is exogenous, and only incumbent spending is endogenous. If this assumption is false, this will result in inconsistent estimates of both challenger and incumbent spending effects.

Section 1.4 Campaign Spending and Senate Elections

This paper analyzes the effects of campaign spending in U.S. Senate elections. Existing studies of Senate elections rely on OLS regressions.¹⁰ Jacobson (1985) analyzes 6 years of Senate elections, presenting regression results separately for each year. Challenger spending has strong and statistically significant effects on candidate vote totals. He finds that the effects of incumbent spending for each of the election years 1972-1982 are positively related to the incumbent's vote totals, but the marginal effects of spending for the incumbent are unstable, close to zero for several years, never larger than the effects of challenger spending, and

⁹For a discussion of some potential problems with Green and Krasno, see Jacobson (1990) and Abramowitz (1991).

¹⁰There are two exceptions in the literature. Jacobson (1978) examines the 1974 Senate elections using the methodology discussed in Section 1.3. Stewart (1989) also estimates a model of Senate election outcomes. In this study, variables relating to the quality of the challenger, state ideological orientation, and special conditions regarding the incumbent such as scandal or poor health, are omitted from the election prediction model. He argues that it is necessary "as a practical matter" to "set certain direct effects equal to zero" (see Stewart, footnotes 5 and 12). The use of omitted variables like those listed above as instrumental variables is inappropriate as they have demonstrated explanatory value in the election prediction model and will therefore be correlated with the error in a regression explaining the Senate election outcome.

statistically significant for only 1 of the years studied.

Abramowitz (1988) estimates a model of Senate elections which includes many explanatory variables omitted from Jacobson's regressions and pools the results of 7 years of Senate elections. Like Jacobson, he finds that challenger spending has strong and statistically significant effects. He finds that incumbent spending is significant at the .05 level, and that the marginal effect of challenger spending is approximately three times that of incumbent spending. Abramowitz concludes that the net effect of campaign spending, using the challenger and incumbent spending means, was to increase challenger vote percentages by 5%, despite the fact that challengers were out spent by a wide margin.¹¹

This paper re-estimates the effect of campaign spending on Senate election outcomes. There are several ways it extends the current literature on campaign spending. First, it improves upon the best existing work on campaign spending effects by treating both challenger and incumbent spending as endogenous. Second, this study employs a new set of instrumental variables. Estimation will focus on variables, such as candidate wealth levels, that make raising campaign funds easier or harder for the candidate. These instrumental variables hopefully avoid some of the problems that called earlier work into question.¹² In addition, this study attempts to insure the accuracy of the regression results by performing formal statistical tests of the assumptions underlying the instrumental variables regressions, as well as undertaking several different regressions to establish the robustness of the paper's findings.

Section 2: MODEL OF CAMPAIGN SPENDING

¹¹For another OLS analysis of Senate elections, see Grier (1989). Grier uses a different functional form for spending effects than Abramowitz and Jacobson. Grier's findings are similar to those of Abramowitz. Grier concludes that the net effect of spending in Senate elections (1978-1984) was to increase challenger vote shares by around 3%.

¹²Section 1.3 discusses previous work which treats spending levels as endogenous.

The following simple model of campaign spending has two purposes: 1. to illustrate why spending levels should be viewed as endogenous, and 2. to motivate the use of variables that shift the candidates' cost of funds functions as instrumental variables. In this model each candidate determines the utility maximizing level of expenditure in a single period simultaneous move game. The equilibrium level of campaign spending is the Nash equilibrium of this game.¹³ Let the incumbent share of the two party vote be:

$$(1) \quad \text{Incumbent Vote} = \beta_1 \text{Spend}_c + \beta_2 \text{Spend}_i + \beta_3 Z + K + e - \text{Expected Vote}$$

where Incumbent Vote is the incumbent's vote share, Spend_c is the challenger spending level, Spend_i is the incumbent spending level, Z is a vector of political and/or economic variables known to influence the election outcome which are observable to the candidates and the outside analyst, K are similar variables observed by the candidates but not the outside analyst¹⁴, e is a random error term, and Expected Vote, which is abbreviated to "Vote" from now on, is the candidates' expectation about the incumbent candidate's vote total. Assuming that e is normally distributed, the probability that the incumbent wins is $P(\text{Spend}_c, \text{Spend}_i, Z, K) = \Phi((\text{Vote} - 50)/\sigma)$ where σ is the standard deviation of e. The incumbent sets spending levels to maximize the utility function:

¹³ Early applications of this equilibrium concept to campaign finance are Baron (1989) and Snyder (1989).

¹⁴ Examples of such factors include endorsements, candidate debate performances, candidate misstatements and other small controversies, and candidate specific characteristics which are not included in the analyst's model of the election outcome.

$$(2) \quad U_i - V_i P(\text{Vote}(\text{Spend}_c, \text{Spend}_i, Z, K)) - C_i(\text{Spend}_i, Z_i, X_i)$$

where V_i is the value of office, C_i is a cost of funds function capturing the effort costs associated with raising money for the campaign, Z_i is a subset of the variables Z which directly influence both fundraising costs and the election outcome¹⁵, and X_i are variables thought to influence fundraising alone. As will be shown below, candidate spending levels will adjust to changes in the expected vote totals due to the effect of changing vote totals on the marginal benefits of campaign spending.¹⁶ For simplicity, the model ignores the other stories about how campaign spending may be influenced by changes in the likely election outcome. Since the structural equations for candidate spending levels will not be estimated, but will merely be used to provide instruments for estimation of the relationship between spending and votes, the estimation of the Senate election outcome model is unaffected by this simplification.

In order to illustrate the endogeneity of spending levels and the general estimation strategy most clearly, several assumptions are made. First, the probability of incumbent election victory is approximated by a second order Taylor series expansion: $P(\text{Vote}) = \gamma_1 + \gamma_2 * \text{Vote} + \gamma_3 * (\text{Vote})^2$. Since the incumbent wins most races, the Taylor series is taken around $\text{Vote} > 50$, which implies that γ_2 is greater than zero, and γ_3 is less than zero. The cost functions for the incumbent is assumed

¹⁵ For an example of such a factor, consider the case of a challenger who is a state Governor. Being a former Governor may win votes through 2 channels; the challenger's political experience may make him an attractive candidate to the voters, and the candidate's experience raising money, as well as the celebrity associated with powerful politicians may lead to easier fundraising.

¹⁶ Under the assumption of normally distributed errors, high margins of victory for the incumbent will be associated with low marginal benefits to spending. That incumbent candidates spend less when victory is assured appears to be an important effect. Incumbent spending and incumbent share of the vote are negatively correlated, and incumbents who received less than 65% of the vote spent on average 1/3 more than those who received more than 65% of the vote.

to be quadratic¹⁷:

$$(3) \quad C_i - \alpha_1 \frac{(Spend_i - \alpha_2 Z_i - \alpha_3 X_i)^2}{2}$$

It is assumed that α_1 , α_2 , and α_3 are positive.

The incumbent maximizes utility given the spending level of the challenger. Substituting the expressions for probability of victory and cost of funds into the incumbent's utility function yields:

$$(4) \quad U_i - V_i[\gamma_1 + \gamma_2 \text{Vote}(Spend_c^*, Spend_i) + \gamma_3 (\text{Vote}(Spend_c^*, Spend_i))^2] - C_i(Spen$$

where $Spend_c^*$ is the equilibrium level of challenger spending.

The incumbent sets the marginal benefit of spending equal to the marginal cost:

$$(5) \quad V_i(\gamma_2 \beta_2 + 2\gamma_3 \beta_2 \text{Vote}) - \alpha_1 (Spend_i - \alpha_2 Z_i - \alpha_3 X_i)$$

This results in the structural equation for incumbent spending:

$$(6) \quad Spend_i - a_1 + a_2 \text{Vote} + a_3 Z_i + a_4 X_i$$

where $a_1 = (V_i \gamma_2 \beta_2) / \alpha_1$, $a_2 = 2\beta_2 \gamma_3 / \alpha_1$, $a_3 = \alpha_2$, and $a_4 = \alpha_3$. A similar condition can be derived for the equilibrium level of challenger spending.

Equations 1 and 6 can be used to illustrate the source of the endogeneity problem in traditional models of election outcomes, as well as suggest a possible source of instrumental variables for estimation of a TSLS model. When equations like (1) are estimated, there are factors such as K which are not observed by the data analyst, and therefore are absorbed into the regression error. The model traditionally estimated empirically is $\text{Incumbent Vote} = B_1 \text{Spend}_c + B_2 \text{Spend}_i +$

¹⁷ In a recent mimeo, Erikson and Palfrey (1992) have used a related functional form in analyzing campaign spending levels.

$B_3Z + E$, where $E=K+e$. From equation 6 it is clear that, since $Spend_i$ is a function of $Vote$, which is in turn a function of K , $Spend_i$ will be correlated with the regression error. Equation 6 suggests a source of instrumental variables for use in estimation of equation 6; if there exist variables like X_i which shift the candidate's cost of funds but do not enter directly into the equation determining the candidate's vote share, these variables can be used to obtain consistent estimates of the effects of spending on the election outcome.

The specific functional form assumptions for the cost of funds function combined with the use of a second order approximation for the probability of incumbent victory lead to spending levels that are linear in the incumbent's expected vote total. This is of course a very special case. If the cost of funds function is not quadratic, or if, for example, it is a function of the incumbent's probability of victory, the reduced form relationship between spending and the exogenous variables Z in equation 1 will be non-linear. Due to these non-linearities, both linear and nonlinear functions of the predetermined variables can be used as instruments (Kelijian, 1971). The estimation approach used in Section 4 will be nonlinear two stage least squares (Bowden and Turkington (1984), Hausman (1983)).

Section 3: DATA AND METHODS

This section is divided into 2 subsections. Section 3.1 discusses the instrumental variables which will be used to estimate a model of Senate election outcomes. Section 3.2 describes the model of Senate election outcomes that will be estimated, and describes the data used in the estimation.

Section 3.1 Instrumental Variables used for Estimation of Spending Effects

Before discussing the instrumental variables used in the estimation of spending effects on election outcomes, it is useful to understand the general pattern of campaign contributions to Senate candidates. Table 1 shows contributions to Senate campaigns in 1986 by source of funds. This general pattern over the years studied in the sample is similar, with a small increase in the relative share of incumbent contributions coming from political action committees over the period covered by this study.¹⁸ The basic outline of campaign contributions is that individual contributions are by far the largest source of funds to the campaigns, followed by, in distant second place, Political Action Committees.

Three types of instrumental variables were selected to estimate the model. The rationale behind the instrument selection was to find variables likely to affect campaign spending without directly affecting the election itself. A first instrumental variable was based on a measure of challenger wealth. Wealthier challengers should be able to spend more money on their Senate races. This variable was generated by reading through the descriptions of the upcoming Senate races contained each election year in the Congressional Quarterly election preview issue. Challengers

¹⁸For additional discussion of the sources of campaign contributions, see Jacobson (1985), Snyder (1989, 1990) and Sorauf (1988, 1992).

were categorized as not affluent, affluent, or rich based upon the description.¹⁹ Overall, challenger contributions to their own campaigns constitute about 8% of total challenger spending.²⁰ This spending appears to be concentrated in subset of races, and the classification by the CQ description isolates a large portion of challenger self financing.²¹ Overall spending by candidates, broken down by classification as not affluent, affluent, and rich are shown in Table 2. Table 2 reveals that, as might be expected, rich candidates out spent poor candidates. The mean level of real campaign spending per voter in 1974 dollars for an affluent or rich challenger candidate was around 60% greater than the mean level of spending for not rich candidates.²²

¹⁹First, the challenger wealth variable was coded 0, 1, or 2. The challenger wealth variable was set equal to 0 if the Congressional Quarterly election preview listed the challenger's profession or former profession as, for example, public sector jobs, teacher, military, or lawyer. Challenger wealth was set to 1 if the description indicated the challenger was or had been a real estate developer, an independent businessman or president of a business, or a banker or important sounding executive. Challenger wealth was set at 2 if the description specifically mentioned the challenger was wealthy, "independently wealthy", a millionaire, or an "heir". To generate the variables used in estimation, the challenger wealth variable was separated into 2 different variables, with the first variable ("affluent challenger" equal to 1 if challenger wealth was equal to 1 or 2, and the second variable ("rich challenger") equal to 1 if challenger wealth was equal to 2.

²⁰See Table 1, Jacobson (1985). Also see Sorauf (1992), page 88.

²¹To see how well the CQ descriptions picked up which candidates were contributing to their own campaigns, the contribution information in the FEC final report for 1984 and 1986 were analyzed. For all 66 Senate races over the period 1984-6 total unpaid loans and contributions to Senate races, including open seats but excluding Sen. Rockefeller's campaign, was \$8.4 million. Spending by the 10 candidates CQ description indicated to be affluent or rich was \$2.8 million. This implies that the 7.5% of the candidates described as rich or affluent made 33% of all candidate self contributions.

²² In the estimation Section 4 reports the instrumental variable indicating if the challenger was affluent was divided by the state voting age population, since the implications for campaign spending of being affluent in a small state will be very different than those of being affluent in New York or California. The instrumental variable based upon whether the challenger was rich was not adjusted for population, since a rich challenger might be

A second instrumental variable was based on the state population. State voting age population was used as an instrument for several reasons. The basic idea behind the use of population is that, if Senators are able to raise some fixed sum that is independent of the population of their state, Senators from small states will have the ability to raise large sums in per capita terms, while those from large population states will have more difficulty raising the same per capita sum. The next two paragraphs discuss reasons to expect that per capita contributions from both individuals and PACs vary inversely with state size. Empirical evidence does show that campaign spending per capita is lower in high population states.

First, Senators raise much of their individual contributions from out of state sources. There is no systematic accounting of the geographic origins of campaign money, but there is some evidence of its importance. The Washington Post found that in 1984 Senate elections, 16% of all individual contributors of more than \$200 were from out-of-state (Sorauf (1992), p47). Sorauf describes how Senators exploit this source of campaign funds: "Unlike most House incumbents, they (Senators) can and do raise large sums from individuals in other states. They offer much greater eminence than do House members, and some even cultivate the well-tailored, photogenic manner of celebrities. Their campaigns are the classic locus of the well-brokered reception in which the Senator flies in for cocktails, smiles, handshakes, a few words, and a covey of \$1000 checks..."(Sorauf (1992) p90). If a Senator's appearance fee is not a function of the population of the Senator's home state, the per capita funds raised by a Senator will vary inversely with state population.

In addition to out of state individual contributions, the level of contributions from "investor PACs", those classified by the FEC as trade, membership, and health organizations, corporations, labor unions, and cooperatives, appear

better able to adjust spending levels as state population increases. Dividing this variable by population as well has no significant effect on the regression results reported later in this paper.

unrelated to the population size of the Senator's state (see Snyder, 1989). This can be explained by the observation that the amount of favors a Senator is able to deliver to an interest group is a function of the Senator's single vote. An implication of this is that in per capita terms, a Senator from a state with a small population has much more to sell than a Senator from a populous state.²³

A third set of instrumental variables was based on lagged spending by Senate incumbents and challengers. The lagged spending levels employed were those generated by the *previous* Senate election in the state. Due to the staggered nature of Senate elections this previous election does not involve the same incumbent Senator who is running for re-election in the current year.²⁴ This means that the variable is not subject to the criticism that specific candidate attributes are correlated with both the regression error and past fundraising levels, since for the case of Senate elections, this measure of incumbent fundraising does not use the fundraising of the same candidates who seek election in the current period. These lagged spending variables should be correlated with the included spending variables for the current election, since candidates from the same states may face similar fundraising environments.

Section 3.2 Discussion of Data and Election Outcome Model

Data were collected for all Senate elections occurring in the years 1974 through 1986. After eliminating open seats, and elections for which there were missing variables (the measure of ideological distance of the incumbent from the ideological outlook of the state, and partisan makeup of the state's electorate was

²³A final reason for spending to vary inversely with state population is that the legal limits on contributions are fixed sums, which do not vary with state population levels.

²⁴This variable is not the variable used by Green and Krasno (1988), which relies upon a candidate's own lagged spending.

not available for Alaska or Hawaii) there remained 166 elections.²⁵ The model estimated had the basic form:

$$\text{Incumbent Vote \%} = a + \beta_1 \log(\text{Spend}_c) + \beta_2 \log(\text{Spend}_i) + \beta_3 Z + E$$

where Spend_c is challenger spending, Spend_i is incumbent spending, Z is a vector of variables capturing political conditions, economic conditions, and other factors thought to be important to the Senate election outcome, β_3 is a vector of coefficients, and E is an error term.

In all regressions the left-hand side variable is incumbent percentage of two party vote. In addition to candidate spending levels, a number of additional variables were included on the right-hand side. These were selected to measure the effects of challenger quality, and partisan, ideological, and economic conditions on the challenger's percentage of the vote. This model format is familiar in the literature which attempts to determine the effects of spending on election outcomes. The remainder of this Section discusses these variables.

Variables included to capture the influence of economic conditions on the election outcome were state unemployment levels in the election year, and state unemployment levels in the election year interacted with a dummy variable which equalled 1 when the challenger was not from the same party as the President. It was expected that bad local economic conditions would help all challengers, and it would help them more if they were not from the President's party.

Variables measuring the quality of the candidates challenging the incumbent

²⁵ While the analysis of contested elections is standard in the literature, it is possible that the decision of the incumbent to seek re-election will be endogenous, resulting in biased estimates. This may be a small problem. The overwhelming majority of open seats are due not to primary losses by weak incumbents, but due to retirements. (Westlye (1991) tabulates incumbent primary defeats and finds that from 1968-1984 incumbents lost only 7 out of 241 tries.) Common explanations for endogenous retirements, such as the desire of politicians to avoid the harm to future political ambitions from becoming "damaged goods", do not apply to an office like the Senate, which is at the top of the political career ladder.

were included. Challenger quality was measured by differences in the level of challenger political experience.²⁶ The challenger quality variable was based on the information about challengers reported in the Congressional Quarterly election preview issue. Challengers were divided into 5 groups, according to whether they had been 1. a state Governor, 2. a U.S. Representative, 3. a state level elected official such as the state Attorney General, or mayor from an important city such as Pittsburgh or Indianapolis, 4. a less important elected official such as a member of the city council, or a member of the state legislature, or 5. held no previous political office.²⁷

Several variables relating to state political conditions and the characteristics of the incumbent Senators were taken from Abramowitz's earlier study of Senate election. The variables designed to measure partisan and ideological orientation were originally based upon Wright, Erikson, and McIver (1985), who compiled data on partisan and ideological orientation by state from CBS News-New York Times surveys conducted between 1974 and 1982. The difference in the percentage of Democrats and the percentage of Republicans in a state as measured by the survey responses was used to account for different levels of strength of the challenger's political party across states. A measure of the ideological distance between the voting record of the incumbent and the ideological leanings of the state represented is included in the model. This variable, which is calculated according to a formula based on voting record ratings by the Americans for Democratic

²⁶Use of political experience as a proxy for challenger quality is a common practice in the literature on Congressional elections. See, for example, Jacobson and Kernell (1981), Bianco (1984), and Born (1986).

²⁷It is possible that the challenger quality variable is endogenous, if the challenger's decision to run responds to electoral weakness of the incumbent. While this may be a problem, there are several reasons why it is likely to be a minor one. First, candidates enter well in advance of the election, and therefore entry can not respond to factors in the error that develop nearer the election. Second, as Squire (1991) has argued, Senate seats are very scarce and therefore it is difficult to time your run, since there will likely be only a few opportunities to run, and many potential challengers.

Action (ADA), the Americans for Constitutional Action (ACA), and state ideological rankings based upon the survey data, is detailed in Abramowitz (1988).

One-zero variables were used to account for special conditions which effected the Senate race.²⁸ Several types of special conditions were isolated. A "scandal" occurred if there were allegations of illegal activity by the incumbent. Examples of scandal include Senator Jepson, who was a member in a "health spa" used for prostitution, and Senator Brooke who lied about his financial worth in divorce proceedings and may have been involved in medicaid fraud. A "controversy" occurred when there was an incident that raised questions about the honesty, judgement or competence of the incumbent. Examples of controversy include Senator Hartke's excessive foreign travel, and Senator Andrews controversial medical malpractice suit. A "health" problem occurred when the incumbent's ability to function in office appeared in question. Examples of this were Senators Goldwater, Dominick, and Magnuson, who all had difficulty walking.

Several challengers were distinguished as "celebrities" if they were well known for some reason other than politics.²⁹ These challengers were the astronauts Schmitt and Lousma, U.N. Representative Moynihan, Vietnam POW Thorsness, and S.I. Hayakawa, a university President made famous by a confrontation with student demonstrators.

One-Zero variables were included for each party for each year in order to assess the influence of partisan tides and swings in feeling toward or away from incumbents.

The log of candidate spending levels, measured in real 1974 dollars per voter,

²⁸For a complete listing of the classification of scandal, health, and controversy, see Abramowitz (1988).

²⁹Westlye (1991) isolates a set of candidates for this distinction. Abramowitz also distinguishes a similar set of candidates.

were included in the challenger vote percentage model.³⁰ This functional form was selected since it is a simple function with the desirable features that candidate spending should have positive returns at all observed levels, and exhibit decreasing returns as the most critical tasks are attended to with the first expenditures.³¹ Table 3 contains summary statistics for the variables used in the estimation.

Section 4: ESTIMATION RESULTS

This Section reports the results of estimation of the Senate election model. Section 4.1 examines the results of OLS regression. Section 4.2 examines the results of instrumental variable estimation. Section 4.2 is divided into two subsections. Section 4.2a presents the main instrumental variables regression results. Section 4.2b presents the results of some procedures designed to test the robustness of the regression results reported in Section 4.2a.

Section 4.1 Ordinary Least Squares Estimation Results

Table 4 reports the results from OLS estimation of the Senate election model. For the first 3 columns there are 174 observations. Regressions estimating the full model (column 4) have 166 observations, since 8 observations are dropped when the variable for partisan division of the state and ideological distance of the incumbent from the state ideology are included. In Table 4 the right-hand side

³⁰This treatment follows Jacobson (1985) and Grier (1989) who use spending per voter in their analysis of Senate elections. Abramowitz (1988) assumes that there are economies of scale and adjusts the denominator of the spending variable.

³¹Several other functional forms were analyzed as well. The major finding of the estimation, that TSLS equalizes the marginal spending effects of incumbent and challenger spending, and that the marginal spending effects for both challenger and incumbent spending increase substantially over the OLS coefficients when re-estimated by TSLS held for all functional forms tested.

spending variables are in the form natural $\log((\text{real spending per voter})+.01)$. The constant .01 was added to real spending per voter before taking the logarithm due to the fact that for very low spending levels the log transformation sends the value of the right-hand side variables to negative infinity.³²

The OLS regression results show challenger spending having roughly twice the marginal effect of incumbent spending. To get some perspective on the coefficient magnitudes in Table 4 recall from Table 3 that the mean value of incumbent real spending per voter in 1974 dollars was 52 cents, and the mean value of real spending per voter for the challenger was 30 cents. To see the effects of spending on vote total, consider the effect of increasing each candidate's spending by \$300,000 in a state with a voting age population of 3 million.

Using the mean spending figures by each candidate as a base, the coefficient estimates on spending in Table 4 imply a 10 cent per voter increase in spending generates an increase in the challenger's share of the vote of 1.0%, and a similar increase in spending would raise the incumbent's vote by .35%. Using the mean values of incumbent spending and challenger spending, the total effect of spending on the vote was calculated. The total effect of incumbent spending was to increase the incumbent's share of the vote by 8.04%, while the total effect of challenger spending was to decrease the incumbent's vote by 12.32%. While the incumbent out spent the challenger nearly 2 to 1, the higher marginal returns to challenger spending result in a net effect of campaign spending reducing the incumbent's share of the vote by 4.28%.

A formal test of the hypothesis that the coefficient on spending for challenger spending and incumbent spending are of equal magnitude equal was performed for the regressions reported in Table 4. For the results reported in columns 3 and 4 the hypothesis that the spending effects were equal was rejected at the .01 level.

³²The addition of \$5000 to spending levels in House elections by Green and Krasno is of very similar magnitude to an addition of \$10,000 per million voters in a Senate election. Qualitatively similar results were obtained by all constants tested for the Instrumental Variable estimation reported in Table 5.

The regressions yield the result that incumbent spending has a smaller marginal effect than challenger spending, but the marginal effect of incumbent spending is the intuitively expected direction and statistically significant. These results are close to those found in Abramowitz (1988), but different from those reported by Jacobson (1985) who finds incumbent spending statistically insignificant.³³

A preliminary conclusion to be drawn here is that for Senate elections the extreme form of the incumbency spending problem, where incumbent spending has no effect, does not exist. Incumbent spending helps, but is less effective than challenger spending. If the arguments regarding the endogeneity of spending made earlier are correct, however, OLS does not provide consistent estimates of the model. In order to get accurate measures of the impact of spending on the candidate's vote percentage, the estimation should account for the endogeneity of the spending variables.

Section 4.2 Instrumental Variable Estimation Results

Section 4.2a Re-estimating the Senate Election Model Using Instrumental Variables

Table 5 reports the results of instrumental variables estimation. The instruments used in the estimation were the challenger wealth variables and voting age population.³⁴ Table 6 reports the results of reduced form estimation of the

³³ Replicating Jacobson's regressions revealed that the main reason for the difference between the OLS results obtained in Table 4 and those found by Jacobson is Jacobson's treatment of very low spending races. Jacobson regressed the incumbent vote percentage on incumbent spending, challenger spending, and a dummy variable indicating whether the challenger was a Democrat. Jacobson adds only \$1.00 to the raw spending totals, and then takes the log of spending, leading to very large negative values for spending levels near zero. This results in a poorer fitting model. In order to fit the extreme values generated for the spending variables, the coefficients on the spending variables are relatively small.

³⁴ The estimates presented in Table 5 include several squared terms and interaction terms as instrumental variables. Use of only linear terms does not effect the coefficient results, but does raise the standard errors a little. Using only linear terms in the instrument

candidate spending levels.³⁵

The basic result of re-estimation using instrumental variables is an increase in the campaign spending coefficients for both challenger spending and incumbent spending, and an especially large increase in the effects of incumbent spending. Focusing on column 4, Table 5 shows that the marginal effect of incumbent and challenger spending are roughly equal, in contrast to the OLS results which showed incumbent marginal spending effects to be around half that of challenger spending. A formal test that the spending coefficients were equal was performed, and the hypothesis that the coefficients were equal could not be rejected.³⁶ One possible objection to the regression results reported in Table 5 is that the instruments might not actually be exogenous.³⁷ In order to test the assumption of exogeneity of the

matrix results in estimates of incumbent spending effects of 7.24 (2.52) and challenger spending effects of -6.27 (2.24). Under the assumption that the instruments are valid, both Instrumental variables estimates are consistent.

³⁵ The reduced form regressions shown in Table 6 include only the linear terms for the exogenous variables. Similar results were obtained when interaction and squared terms are included.

³⁶ In addition, a formal test of endogeneity of spending levels was performed using a regression based version of the Hausman-Wu specification test. The fitted values from a regression of incumbent spending and challenger spending on the instruments were included along with incumbent spending and challenger spending in an OLS regression of the incumbent vote share model. Under the null hypothesis that incumbent spending and challenger spending are exogenous, the coefficients on the fitted variables should be zero. The F test of the exclusion restriction is distributed $F(2,136)$ under the null hypothesis that spending levels are exogenous, and the test statistic of 5.45 rejects the null at the .01 level.

³⁷ A wealthy candidate may be attractive to voters if the candidate's wealth reduces the chances of corruption, or may be unattractive to the voters if it makes him "out of touch" with the concerns of the average Joe, or if wealth inspires resentment. The overall importance of these effects is hopefully small, and the net direction is unclear. It should be noted that among the large body of empirical work on Senate elections, it does not appear candidate wealth has ever been included as an explanatory variable. Some objections may also be raised regarding the use of population as an instrument, especially if there are scale economies that are not accounted for in the model linking campaign spending to election results. It is not clear that there are important scale economies to spending, and the evidence that is sometimes taken to indicate the existence of such economies, that spending

instruments, a test of the overidentifying restrictions was performed.³⁸ The hypothesis that the instruments were exogenous could not be rejected at the .10 level.³⁹

Briefly examining the reduced form regressions presented in Table 6, the challenger wealth variables and the voting age population variable had the expected signs, and the instrumental variables for affluent challenger and population were statistically significant. One interesting finding of the reduced form regression was the large effect of challenger political experience on challenger spending levels. Political trouble for the incumbent due to scandals, controversies, or health problems was also associated with high levels of challenger spending.

The regression results in Table 5 show the important finding that incumbent spending and challenger spending have the same marginal effects. To see the implications of these findings, the effects of a 10 cent per voter increase in spending, and the total effects of candidate spending are reconsidered using the new regression coefficients. Again using 52 cents per voter as the base for the incumbent and 30 cents per voter as the base for the challenger, the results in Table 5, column 4 are used to calculate the effects of an increase in spending. Increasing challenger spending by 10 cents per voter leads to a 1.80% decrease in the incumbent's vote percentage, while a 10 cent increase in incumbent spending increases the incumbent's vote percentage by 1.21%. The results in Table 5 reverse the conclusions about spending that were based on the OLS regressions. The total effects of spending now favor the incumbent. The total effect of spending by the

is lower in larger states, may be sensibly explained by variation in the supply of funds available to Senate candidates, as discussed in Section 2.

³⁸For a discussion of this test, see Hausman (1983) p433.

³⁹The test was performed using the challenger wealth variables, voting age population, and interaction and squared terms of exogenous variables used in estimation. The test statistic under the null hypothesis of exogenous instruments is distributed chi-square with 6 degrees of freedom. The value of the test statistic was 3.91, which is well below the .10 level of 10.64.

challenger lowers the incumbent vote percentage by 22.29%, while incumbent spending raises incumbent vote percent by 27.78%. The net effect of spending by the incumbent is to increase incumbent vote percent by 5.49%, which contrasts sharply with the conclusions generated by OLS that the net effect of spending favors the challenger by 4.28%. Table 7 summarizes the comparison of results obtained using the OLS and the TOLS coefficients.

The effects of the other variables in the model on the incumbent's vote share are briefly examined. Attention will focus on column 4 of Table 5. First, all the variables relating to the characteristics of the incumbent and the challenger have the expected signs. A challenger with political experience does better than a challenger with no political experience, with statistically significant results for U.S. Representatives, state level elected officials, and important local officials. The relatively low effect associated with challengers who are Governors can be attributed to imprecise estimation due to the small numbers of such cases in the sample. A regression estimating the effect of the size of the state on the benefits from being a U.S. Rep was also performed. The effect of interacting the number of state Congressional districts with the one-zero variable indicating the challenger was a U.S. Rep were statistically insignificant, though the point estimate indicated that a representative from a state with 25 Congressional districts was expected to do .54% worse than a Representative from a state with only 5 districts. The effects of special political conditions surrounding the incumbent all had the expected signs, as did the effect of celebrity challengers.

The effect of the economic variables, unemployment and unemployment interacted with whether the incumbent's party holds the Presidency, were not statistically significant. Since year and party one-zero variables were included, the economic variables basically captured state deviations from national means. Swings in national economic conditions were captured by the dummy variables. For example, the high unemployment rate during the 1982 election is associated with a point estimate for 1982 Democratic challengers that indicates it was as good a year for Democratic challengers as 1974, the year of the post-Watergate Democratic

Congressional landslide. For the Republicans, in 1982 a Republican challenger started about 9% behind a similar Republican challenger 2 years earlier.

The one-zero party and year variables can be used to assess partisan swings as well as swings toward or away from incumbents. In contrast to 1982, which is characterized by a large swing to the Democrats, 1978 and 1984 show only small differences between the parties. From the coefficient estimates, 1984 was a better year for incumbents than 1978. The pattern of coefficients generally follows the mid term effect. 1978 was a better year for Republicans than Democrats, 1982 was a much better year for Democrats than Republicans, and 1986 was a good year for Democrats as well.

Section 4.2b Examining the Robustness of the Instrumental Variable Estimation Results

In order to test the robustness of the results in Table 5, several additional procedures were performed. The spending variables used in the regressions reported in Table 5 were based upon spending per voter. It is possible that campaign spending exhibits some economies of scale. Dividing spending by population might deflate spending levels too much if there are important fixed costs of campaigning that are independent of population size. If there are important such economies of scale, they would likely be of greatest importance in the very large states. To test the significance of this the model was re-estimated excluding the 25 observations from the largest states (those with voting age populations of 7,000,000 or more). The results of re-estimating the Senate election model were that the spending coefficients in the subsample of smaller states were lower than for the full sample, but the hypothesis that they were identical to the full sample coefficients could not be rejected at the .10 level.

The model of column 4 Table 5 was re-estimated using lagged spending levels described in the discussion of instrumental variables in Section 3. In this estimation, lagged spending levels, the challenger wealth variables, and voting age population were used as instrumental variables. The results of this estimation were similar to

the results reported in Table 5; the spending coefficients were larger than the OLS coefficients, and the incumbent spending and challenger spending coefficients were of approximately equal magnitude. The smaller sample size for which lagged spending is available, however, leads to less precise estimates of the effects of spending. For the subsample for which the lagged spending variables were available, both OLS and TSLS spending effect estimates were lower than those from the full sample.⁴⁰

As a further test of the robustness of the results, an additional instrumental variables estimation was undertaken. There exists theoretical and empirical support for the proposition that as elections become closer the level of contributions by individual contributors, as well as the level of contributions by ideological political action committees, increases. One explanation for this is that if contributors make contributions with an eye to affecting the election outcome, as the election becomes closer the likelihood that the contribution has an influence increases.⁴¹

Instrumental variables based upon the closeness of the vote were generated using the exogenous variables thought likely to affect the incumbent's share of the vote in the election prediction model (partisan composition of the state, ideological distance of incumbent from the electorate, specific characteristics of the incumbent and the challenger, etc.) These variables were used to generate a conditional expectation of the incumbent's share of the vote, which was then transformed into a measure of closeness of the election by calculating the distance between the expected vote and 50%. In addition to the absolute value of the distance between the expected incumbent vote and 50%, that quantity squared was also included as

⁴⁰For the subsample of 105 observations available for using lagged spending levels, the coefficient estimates on the spending variables were smaller than those for the entire sample. The Instrumental variables estimate of incumbent spending (standard errors in parenthesis) was 5.30 (3.03). The OLS estimate of the effect of incumbent spending for the sample was 1.19 (.97). For challenger spending, the estimate of the effect of spending was -5.06 (2.45). The OLS estimate of the coefficient on challenger spending was -2.96 (.74).

⁴¹ For additional details, see Snyder (1989).

an instrumental variable.

Table 8 reports the results of estimation using instrumental variables based upon the closeness of the election. There are several findings. First, the results from column 2 show that adding the measures of closeness of the election to the basic instrumental variables estimation regression reported in Table 5 does not change the results. Both candidate spending variables were easily significant. A formal test of the hypothesis that the effects were of equal size was performed and revealed that the hypothesis that the coefficients were equal could not be rejected at the .10 level.⁴² Second, examining column 3 reveals that, despite the high standard errors indicating that closeness fits spending relatively loosely, the coefficients generated from the regressions are in line with the main results of this paper; the effects of both incumbent and challenger spending are higher than those estimated by standard OLS regressions, and the effects of incumbent spending and challenger spending are indistinguishable. Testing the null hypothesis that the incumbent spending effects are 0 versus the one directional alternative that they are greater than 0, reveals that incumbent spending is significant at the .10 level. The hypothesis that the sum of the candidate spending effects equals zero could not be rejected. Note that the results Table 8 column 3 report employ a different set of instruments than that used to generate Table 5, but produce quite similar coefficient estimates of candidate spending effects.

⁴² A Wald test was performed. The test statistic is distributed chi-squared with 1 degree of freedom under the null hypothesis that the sum of the spending coefficients equals 0. The value of the test statistic was .73, which is well short of the .25 significance level of 1.32.

Section 5: EVALUATING CAMPAIGN FINANCE REFORMS

This section explores some of the implications of the Table 5 regression results. The TSLS estimation results suggest that spending by incumbents has a much greater effect on election outcomes than previously thought. In order to see the implications of the regression results more clearly, this Section examines the effects of changing the level of campaign spending for the races in the sample. In extrapolating these findings to Senate elections in general, an implicit assumption is that the sample of conditions faced in the 166 elections are not unusual. This section examines several different types of changes in spending, corresponding to some of the policy options that are commonly considered.⁴³ Specifically, we consider the effects on election outcomes of equalizing spending, providing some public funds to the candidates without capping spending, and imposing spending caps.

In the 166 elections in the sample, the model reported in Table 5, column 4 correctly predicted the outcome of 140 elections for a success rate of a little over 84%. The model predicted 10 challenger victories that did not occur, and predicted 16 incumbent victories incorrectly. The model predicted 35 incumbents were likely to lose, 21% of the sample. As an initial attempt to see the effects on election outcomes of differences in candidate spending levels, spending levels of challengers and incumbent spending levels were equalized at 40 cents per voter, and the predicted incumbent share of the two party vote was recalculated for each observation. While few incumbent defeats are predicted by the model when the actual candidate spending levels are used, equalizing spending changes the situation

⁴³ In this section, the effect of changing candidate funding levels on the probability of challenger victory is examined. In addition to the issue of electoral competitiveness considered here, there are clearly other important issues in campaign finance regulation. For instance, limiting incumbent spending may increase competitiveness of elections, while reducing the ability of the incumbent to communicate useful information to the voters. How best to make these types of tradeoffs is unclear.

substantially. The number of predicted incumbent defeats rises from 35 to 53, an 18 seat increase over the original predictions. The number of incumbents expected to receive less than half the vote rises from 21% to 32%.

It should be noted that this finding, like all calculations of this sort in the existing literature on campaign finance and all the predictions that follow in Section 5, are just partial equilibrium results. Incumbents, challengers, and contributors will react to a change in spending regime. The results do however suggest the importance of the spending advantage enjoyed by the incumbents. Since the effects of adjustments by both candidates and contributors to a new spending regime are unclear, it is hard to say a priori whether the final outcome of equalization of campaign spending would be fewer, or even greater numbers of incumbent defeats than that indicated by partial equilibrium calculation. The important effects of incumbent spending advantages shown in the calculations above suggests that any explanation for the current high rates of incumbent re-election should examine influence of incumbent campaign spending.

Examining which party would be most affected by the equalization of expenditures reveals an interesting pattern. When measured by the number of incumbents whose expected vote totals drop below 50%, more Republican incumbents than Democratic incumbents are harmed by spending equalization. Of the net change of 18 races where the incumbent is now expected to lose, equalization of expenditures leads to a net of 14 additional races where Republican incumbents are predicted to lose. With incumbent and challenger spending set equal, the percentage of Republicans likely to lose increases from 27% to 45%, and the percentage of Democrats likely to lose increases from 16% to 20%.

This asymmetry is due to the tendency of Republican incumbents to out spend their Democratic counterparts. For the sample period Republican incumbents spent on average 63 cents per voter, while Democratic incumbents spent 43 cents per voter. Republican and Democratic challengers spent similar amounts with Democratic challengers spending 32 cents per voter, and Republican challengers spending 28 cents per voter. While this will not be pursued further in this paper, it

would appear that Senate Republican incumbents have the most to lose from equalization of spending levels.⁴⁴

The remainder of this section examines the effects of altering spending levels on election outcomes in a slightly different framework. The rest of Section 5 calculates the effects of changing spending levels using the predicted vote and the confidence intervals for each of the sample's observations. The actual vote for an incumbent in a race with the characteristics of a given observation is a random variable, with a mean value equal to the predicted incumbent vote, and a variance determined by the standard formula for prediction error. Using this information for each observation, the characteristics of each observation are altered according to the type of change in spending levels being examined. Analysis will focus on the average predicted number of incumbent defeats for given changes in candidate spending levels. The analysis considers the effects on electoral competition of 4 different types of campaign finance regulations: 1. Public financing with spending limits, 2. Grants to both challenger and incumbent, 3. Grants to the challenger only, and 4. Spending Caps for both candidates.

5a. Equalization of Spending Levels

An alternative way to see the implications of the regression results is to focus on how the expected number of incumbent defeats changes as the level of spending

⁴⁴ Additional analysis is necessary to form reliable judgements about the partisan impact of spending limits. A much better understanding of the source of the differences in spending levels across parties seen in the sample of elections studied here would be needed. High levels of spending by Republican incumbents may be due to rich supporters, who will presumably be present for many years, or due to a particularly difficult re-election year, or some other cause. The simple conclusion that Republicans will always spend more than Democrats because Republicans have more money is not supported by all the evidence on Congressional campaign spending. For example, in open seat Senate elections between 1978 and 1986, the Democrats spent 10% more than the Republicans, while the pattern over that period for House elections shows a slight Republican spending advantage, though much smaller than that enjoyed by Senate Republican incumbents over their Democratic counterparts. For more details, see Sorauf (1988).

by the candidates changes. The confidence intervals implied by the coefficient estimates are used to calculate the expected number of incumbent defeats when spending levels are equalized. Recall the mean incumbent vote percentage was 58.3%. Based on the standard errors of the predictions, it was calculated that the average probability of victory for an incumbent in the sample was .755, which correctly predicts the 125 incumbent victories in the sample. When both the incumbent and the challenger spending levels are fixed at 40 cents per voter, the predicted mean incumbent vote percentage falls to 52.9%. This results in the mean probability of incumbent victory falling to .63, which implies an expectation of 104 incumbent victories.

5b. Provision of Some Public Funds to Both Candidates

This Section considers the effects of giving each candidate a fixed sum. Giving each candidate 25 cents per voter changed the mean expected vote for the incumbent from 58.3% to 55.3%. Increasing each candidates spending levels by 25 cents per voter resulted in the probability of an incumbent victory falling from 75.5% to 71.4%, for an increase of 7 in the number of incumbent defeats. If the amount of public funding was set at 50 cents per voter, the probability of incumbent victory would fall to 69.7%. The number of additional challenger victories generated by the public financing would be 10. Given the large amount of public funding implied by a 50 cent per voter grant for both candidates (around 560 million 1974 dollars to cover the 166 races in the sample), this seems like a small change in the competitiveness of elections. The reason for the small change in the number of incumbent defeats is that despite decreasing returns to scale, the fact that incumbent spending is highly effective means that the benefits to incumbents from the public financing are substantial enough to offset most of the gain to challengers.

5c. Provision of Public Funds to Challengers Only

This section examines the effects of giving grants only to the challenger. Relatively small grants to the challenger can increase the probability of challenger victories substantially. A 10 cent per voter grant leads to a reduction in the mean incumbents' share of the vote to 53.78%, and a reduction in the incumbents re-election rate to .649. This amounts to an increase of 17 seats in the expected number of incumbent defeats. Larger grants have smaller effects on the mean incumbents' vote share due to decreasing returns to spending, but continue to have large effects on the probability of incumbent victory. Grants of 15 cents lead to an incumbent re-election rate of .606, while grants of 20 cents to each challenger lead to incumbent reelection rates of .567. In contrast to the case of funding both the challenger and the incumbent, funding the challenger only results in large increases in electoral competitiveness at a relatively low cost. Note that, if incumbent spending was assumed to be ineffective, case b. and case c. would be equivalent. In light of the findings of Section 4, this would be very misleading.

5d. Imposition of Spending Caps

It is commonly observed by opponents of spending limitation that they are "incumbent protection" policies. This argument follows from the belief that challenger spending is effective, while incumbent spending is not. Any attempts to reduce spending levels which end up decreasing the spending of challengers will therefore aid the incumbent, even if the spending limits force greater reductions for incumbents than challengers. According to this conventional view, spending limits "can only work to the detriment of the challengers."⁴⁵

The results in Section 4 question the findings upon which this belief is based. This section analyzes a variety of different spending caps. Given that the marginal

⁴⁵Quote of Jacobson, reported in Sorauf, page 210

effects of spending by incumbents and challengers is estimated to be very similar, and that incumbents spend substantially more than challengers, the result that spending caps harm incumbent re-election chances follows easily. Setting spending caps at low levels, such as 20 cents per voter, results in a decrease in the average incumbents' share of the vote to 55.91% and a drop in incumbent re-election rates to .688. Limiting expenditures to 50 cents per candidate leads to a smaller benefit for challenger; the incumbents' share of the vote falls less than 1%, from 58.28 to 57.49, while the re-election rate falls to .733. The small effect from spending limits of 50 cents stems from the relatively few candidates who spend over 50 cents (only 16% of challengers, and 34% of incumbents), and the effects of decreasing returns to spending. Table 9 summarizes the results of Sections 5a through 5d.

Section 6: CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

In his recent article on Senate elections appearing in the *American Political Science Review*, after finding that the coefficients on challenger spending were much larger than those on incumbent spending Abramowitz concluded that "the most important conclusion about the effects of campaign spending remains secure: challenger spending has a much stronger influence on the outcomes of Senate elections than incumbent spending."⁴⁶

The main result of this paper is that the conventional view that incumbent spending is not an important factor in election outcomes does not hold up when the standard OLS regressions are re-estimated using an instrumental variables approach. In fact, after taking the endogeneity of spending into account, the marginal effects of incumbent spending and challenger spending are statistically equivalent. This result appears very robust to changes in the set of instruments used to estimate the spending effects. The assumptions underlying the TSLS estimation hold up very well; standard statistical tests confirmed the endogeneity of candidate

⁴⁶ See Abramowitz (1988).

spending levels and the exogeneity of the instruments.

The finding that incumbent spending is effective in winning elections has important implications for the understanding of American politics. One direct implication of the finding that incumbent and challenger spending are both important factors in elections outcomes and that they both have roughly the same effect, is that campaign finance, and specifically the level of incumbent spending, is a potentially critical factor in the competitiveness of Congressional elections. While the ratio of mean incumbent to mean challenger spending has not changed much in contested Senate elections over the last decade, House challengers in 1990 faced a much larger spending disadvantage than a decade earlier. The ratio of mean spending by incumbents to mean spending by challengers has increased from 1.7:1 in 1980 to 3.7:1 in 1990. This increase in the funding advantage of House incumbents has accompanied a significant decline in the rate of turnover among House members; the percentage of House members returning after an election averaged 90% from 1984-1990, up from only 82% in the years 1974-1980.⁴⁷ It is of course possible that results about the effects of spending in Senate elections may not hold exactly when applied to elections to the U.S. House. This paper's results do suggest, however, that if the role of incumbent spending in winning elections is neglected, an important potential explanation of this trend will be overlooked.

The finding that incumbent spending effects are important also requires a reconsideration of the effects of campaign finance reform proposals on the competitiveness of elections. Due to the OLS findings indicating the relative unimportance of incumbent spending, analysis of campaign finance reform measures generally focuses on the effects of the proposed reform on challenger spending levels, and neglects the effects on incumbent expenditures. For example, spending limits that apply to both challengers and incumbents are seen as severely biased in

⁴⁷ The periods of comparison have been chosen to omit redistricting years. The decline in turnover was due to a combination of lower defeat rates for those who choose to run for re-election, and a decline in the number of members of the House choosing to leave the House. See Sorauf (1992), pg 62.

favor of the incumbents. As Jacobson argues, "Campaign spending does have an important effect on who wins (congressional elections) and it is the amount spent by challengers (and other disadvantaged candidates) that actually makes the difference. Spending limits, if they have any effect at all on competition, can only work to the detriment of the challenger."⁴⁸ Simulation of some different policy alternatives shows that, when the new estimates of the spending effects of incumbents are taken into account, the policy conclusions generated by the traditional view of campaign spending need to be revised. The results of Section 5, for example, show that capping expenditures benefits challengers. Also, under the traditional view regarding challenger and incumbent expenditures, giving money to both the challenger and the incumbent would have similar effects on election outcomes as a policy that gives money to the challengers only. The results of these 2 policies are dramatically different when the new estimates of the effects of incumbent spending are used to evaluate these policies.

There remain a number of very important issues regarding campaign spending that this paper does not address which would be useful topics for additional research. First, the mechanism by which campaign spending influences vote totals is summarized by a reduced form relationship. This is useful first approximation of a complicated process, but additional work that attempts to isolate cases where spending might have greater or lesser effect on election outcomes may lead to important insights into the role of money in elections.⁴⁹ One natural empirical direction would be to study variations in resource allocation by candidates, which

⁴⁸ Jacobson (1980), pg 186.

⁴⁹ Exactly how campaign spending leads to more votes is an ongoing research question. Some existing theoretical work emphasizes the role of campaign spending conveying information about the policy positions of the candidate and the opposition when voters are risk averse. Others have included campaign expenditures in the voter's utility function directly. See Hinich and Munger (1989) for a discussion of this literature. Alternative models could presumably emphasize credibility of communications and signalling considerations, and also the component of spending that does not involve communication with the voters.

would permit analysis of when different kinds of spending were most effective.⁵⁰ In addition to allowing examination of how spending patterns change in response to different election conditions, understanding expenditure patterns would allow candidate spending to be broken down more precisely into spending that is directed toward winning the election, and spending that is aimed at other goals, such as personal consumption by the candidate.

This paper estimates one equation of a several equation system. An additional area for research is to extend current work to examine each of the sources of funds to the candidates. The goal of such analysis would be constructing and estimating a full system model linking contributors' and candidates' decisions. This would allow much better understanding of the effects of campaign finance policy reforms. This would also be a natural framework for evaluating how difference across the parties, and between challengers and incumbents determines the effects of various reform proposals.

⁵⁰ Relatively little is known about how money is spent. This is due at least in part to difficulties in interpreting candidate expenditure reports, which allow substantial discretion in how expenditures are categorized. (Personal Communication with Bob Biersack, statistician at the Federal Election Commission).

Table 1					
Receipts for Major Party General Election Candidates by Source, 1986					
	Individuals	PACs	Candidates	Parties	Total in Millions
Incumbents	71.3%	27.6%	.5%	.5%	90.3
Challengers	70.2%	20.4%	8.8%	.6%	54.0

The percentages exclude receipts from other sources. Other sources accounted for about 8% of general election candidate receipts. By far the most important of these other sources is interest earned on invested cash.

Source: Federal Election Commission, Reports on Final Activity, Table A, reported in Sorauf(1992).

Table 2			
Challenger Spending by Challenger Wealth Level			
Challenger Wealth	Observations	Mean Spending per voter (1974\$)	Standard deviation
0	143	.275	.418
1	23	.444	.380
2	11	.446	.378

Table 3		
Sample Statistics		
Variable	Mean	Standard Deviation
Incumbent Share of Two Party Vote	58.28	9.56
Incumbent Spending per Voter, 1974\$.52	.57
Challenger Spending per Voter, 1974\$.30	.42
Incumbent Party Partisanship	2.17	15.30
Ideological Distance	26.30	14.01
Unemployment Rate	7.07	2.18
Unemployment Rate Interacted with Governing Party	3.49	4.05
Vote Age Pop (thousands)	3375	3549
Number of observations where the Variable=1		
Challenger Wealth, Affluent	23	
Challenger Wealth, Rich	11	
Governor	9	
U.S. Rep	36	
Important State or Local Official	22	
Minor Public Official	38	
Scandal	5	
Controversy	14	
Health Problem	3	
Celebrity Challenger	5	
Note: The number of Observations is 166		

Table 4

OLS Regressions of the effects of Campaign Spending				
Independent variable	Dependent Variable for all Specifications is Incumbent Share of Two Party Vote			
Constant	49.84 (.93)	44.44 (1.84)	51.57 (2.17)	53.67 (2.21)
Log Incumbent Spending	3.71 (.87)	3.31 (.83)	2.77 (.75)	2.02 (.76)
Log Challenger Spending	-6.58 (.54)	-6.09 (.56)	-4.78 (.50)	-3.58 (.51)
Dem Chal 1976	-----	.36 (2.80)	1.55 (2.95)	-.38 (2.49)
Dem Chal 1978	-----	2.60 (2.64)	.42 (2.97)	4.35 (2.73)
Dem Chal 1980	-----	8.21 (3.27)	4.80 (3.78)	8.31 (3.44)
Dem Chal 1982	-----	4.79 (2.26)	4.57 (2.07)	1.34 (2.06)
Dem Chal 1984	-----	9.72 (2.45)	10.39 (1.93)	9.27 (1.76)
Dem Chal 1986	-----	3.02 (2.06)	3.30 (1.86)	3.00 (1.63)
Rep Chal 1974	-----	7.75 (1.88)	5.15 (2.89)	6.00 (2.65)
Rep Chal 1976	-----	6.71 (2.73)	4.08 (3.92)	5.72 (3.72)
Rep Chal 1978	-----	3.80 (3.14)	3.22 (2.54)	-.37 (2.52)
Rep Chal 1980	-----	3.01 (2.15)	3.31 (1.90)	-1.50 (1.99)
Rep Chal 1982	-----	11.16 (2.09)	6.72 (3.81)	8.20 (3.94)
Rep Chal 1984	-----	8.52 (2.34)	5.32 (3.82)	5.31 (3.66)
Rep Chal 1986	-----	10.00 (2.36)	5.90 (3.65)	6.87 (3.82)

Governor	----	----	-4.39 (2.12)	-4.66 (2.02)
U.S. Rep	----	----	-6.53 (1.05)	-5.76 (1.05)
State level or important local	----	----	-6.89 (1.28)	-6.23 (1.21)
minor public official	----	----	-2.87 (1.16)	-1.79 (1.13)
state unempl	----	----	-.16 (.30)	.15 (.29)
state unempl*governingsp arty	----	----	.41 (.45)	-.34 (.44)
Scandal	----	----	-8.89 (1.63)	-10.73 (2.17)
Controversy	----	----	-1.45 (1.59)	-2.79 (1.53)
Health	----	----	-7.97 (2.30)	-8.07 (2.04)
Celebrity Chal	----	----	-10.93 (2.04)	-9.04 (2.41)
Ideological Distance	----	----	----	-.03 (.03)
Partisan Composition	----	----	----	.17 (.03)
R-Squared	.49	.61	.73	.75
N	174	174	174	166

Note: Standard errors in parenthesis.

Table 5

TOLS Regressions of the effects of Campaign Spending				
Independent variable	Dependent Variable for all Specifications is Incumbent Share of Two Party Vote			
Constant	55.76 (2.92)	49.58 (3.14)	52.26 (3.72)	54.46 (4.08)
Log Incumbent Spending	5.11 (2.59)	7.51 (2.47)	7.45 (2.24)	6.98 (2.25)
Log Challenger Spending	-4.24 (2.59)	-6.54 (2.46)	-7.28 (2.03)	-6.58 (2.04)
Dem Chal 1976	-----	.07 (3.70)	2.57 (3.73)	.96 (3.79)
Dem Chal 1978	-----	.14 (3.60)	-2.28 (4.35)	1.71 (4.44)
Dem Chal 1980	-----	5.48 (4.07)	1.18 (4.84)	4.57 (4.89)
Dem Chal 1982	-----	1.04 (3.36)	2.83 (3.62)	-.08 (4.01)
Dem Chal 1984	-----	5.46 (4.04)	5.70 (3.43)	4.76 (3.23)
Dem Chal 1986	-----	-1.16 (3.52)	-.56 (3.16)	-.81 (3.06)
Rep Chal 1974	-----	7.54 (3.30)	4.04 (4.07)	5.70 (4.07)
Rep Chal 1976	-----	7.87 (3.01)	4.80 (4.35)	6.77 (4.38)
Rep Chal 1978	-----	2.72 (3.29)	3.12 (2.98)	.06 (3.30)
Rep Chal 1980	-----	1.76 (2.92)	2.56 (2.79)	-1.16 (3.30)
Rep Chal 1982	-----	10.62 (2.89)	5.73 (4.81)	7.87 (5.01)
Rep Chal 1984	-----	6.22 (3.57)	2.51 (4.58)	2.74 (4.63)
Rep Chal 1986	-----	8.46 (3.75)	3.55 (4.50)	5.31 (4.52)

Governor	----	----	-3.08 (3.40)	-3.54 (3.12)
U.S. Rep	----	----	-4.78 (2.38)	-4.45 (1.98)
State level or important local	----	----	-6.73 (1.83)	-6.40 (1.72)
minor public official	----	----	1.43 (1.53)	-1.09 (1.47)
state unempl	----	----	-.17 (.45)	.12 (.50)
state unempl * governing pty	----	----	.47 (.56)	-.22 (.61)
Scandal	----	----	-7.82 (3.20)	-9.34 (3.24)
Controversy	----	----	-1.68 (1.98)	-2.93 (2.04)
Health	----	----	-4.80 (4.57)	-4.68 (4.31)
Celebrity Chal	----	----	-10.27 (3.25)	-9.22 (3.23)
Ideological Distance	----	----	----	-.05 (.04)
Partisan Composition	----	----	----	.13 (.06)
F Statistic	F(2,171)= 2.13	F(15,158)= 5.36	F(25,148)= 9.71	F(27,138)= 10.26
N	174	174	174	166

Note: Standard Errors in parenthesis.

Table 6, Reduced Form Regressions, Linear Instruments		
Independent Variable	Dependent Variable	
	Log incumbent spending	Log challenger spending
Challenger Wealth, affluent	164.67 (136.55)	605.41 (181.58)
Challenger wealth, rich	.26 (.25)	.47 (.33)
Voting Age Population	-.00011 (.00002)	-.000080 (.000022)
Scandal	.039 (.34)	.76 (.45)
Controversy	.34 (.22)	.66 (.29)
Health	-.33 (.22)	.61 (.59)
Ideological Distance	.012 (.005)	.015 (.0063)
Partisan Composition	-.007 (.005)	-.025 (.0066)
Unemployment	-.07 (.05)	-.17 (.07)
Unemployment x Governing Party	.024 (.067)	.11 (.09)
Governor	.71 (.27)	1.73 (.36)
U.S. Rep	.47 (.17)	1.20 (.22)
State level or important local	.39 (.19)	.70 (.26)
minor public official	-.07 (.05)	.053 (.22)
Celebrity Chal	1.00 (.37)	1.21 (.49)
R squared	.56	.58

Note: Standard errors are in parenthesis. Year and party one-zero variables were included in the regressions.

Table 7				
Summary of the comparison of OLS and TSLS spending effects on Incumbent Percentage of the Two party Vote				
	OLS		TSLS	
	Incumbent	Challenger	Incumbent	Challenger
10 cents more spending per voter	.35%	-1.00%	1.21%	-1.80%
Total effects of Spending	8.04%	-12.32%	27.78%	-22.29%
Net effect of spending	-4.28%		5.49%	

Table 8			
TOLS Regressions of the effects of Campaign Spending, using new instruments			
Independent variable	Dependent Variable for all Specifications is incumbent Share of is Incumbent Share of Two Party Vote		
	closeness, closeness squared	closeness, closeness squared, challenger wealth variables, population	closeness, closeness squared, lagged incumbent spending, lagged challenger spending
Constant	61.44 (20.67)	55.52 (4.11)	56.53 (7.74)
Log Incumbent Spending	13.67 (21.36)	7.33 (2.37)	6.37 (5.42)
Log Challenger Spending	-7.89 (6.81)	-6.29 (1.90)	-5.79 (3.78)
Governor	-6.16 (8.49)	-4.15 (3.04)	-2.39 (5.49)
U.S. Rep	-5.01 (3.58)	-4.74 (1.91)	-3.88 (3.63)
State level of important local	-7.77 (4.66)	-6.60 (1.74)	-8.20 (2.49)
minor public official	.51 (5.23)	-.93 (1.51)	.50 (2.18)
Scandal	-9.58 (5.17)	-9.60 (3.24)	-9.93 (4.42)
Controversy	-4.90 (6.32)	-3.24 (2.07)	-4.51 (3.66)
Health	-1.42 (12.78)	-4.66 (4.35)	-3.25 (7.35)
Celebrity challenger	-10.87 (6.72)	-9.47 (3.28)	-13.36 (5.08)
F(27, 138)	4.50	9.92	7.54

Note: Standard errors in parenthesis. Year and party one-zero variables, economic variables, and political variables were included in the regression, but are not shown here. The results for these variables were similar to those reported in Table 5.

Table 9	
Simulated effects on election outcomes of changes in candidate spending levels	
Policy change	Percent of races the incumbent is expected to win, number of incumbent victories in 166 election sample
no change (results for the sample, based upon regression predicted values)	75.5%, 125
spending for both challenger and incumbent fixed at 40 cents per voter	63.0%, 104
each candidate given 25 cents per voter	71.4%, 118
each candidate given 50 cents per voter	69.7%, 115
challenger only given 10 cents per voter	64.9%, 108
challenger only given 15 cents per voter	60.6%, 101
challenger only given 20 cents per voter	56.7%, 94
spending by both candidates capped at 20 cents	68.8%, 114
spending by both candidates capped at 50 cents	73.3%, 122

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Chapter Two

The Institutional Context of Legislators' Career Decisions

One of the most striking features of contemporary American politics is the persistence of the Democratic majority in the U. S. House. A plausible explanation for the permanent Democratic majority is the electoral advantage of incumbency. Some time in the late 1950's and early 1960's incumbents began to win reelection by ever wider margins at the polls. As the incumbency advantage grew U. S. House elections became less responsive to national tides and the party that held a minority of seats faced an apparently insurmountable electoral handicap.

Gary Jacobson (1990) has rightly pointed out that incumbency alone cannot explain the Democrats' fortunes. He notes that turnover can come one of two ways: beating incumbents and winning open seats. The incumbency advantage makes it nearly impossible for the Republicans to gain ground in races where incumbents run for reelection. Republicans and Democrats, however, win nearly equal numbers of open seats, and almost every seat has been open since 1974. By this logic, one would also expect that the Republicans should be gaining seats in the U. S. House. The GOP, however, has actually lost a net of 30 seats over the last decade.

The Republicans' problems come from retirements. Republicans retire early and often. Since 1974, on average 10.2 percent of Republican incumbents have retired each year compared to just 6.9 percent of Democratic incumbents. As a result, Democrats do not lose as many seats through retirements as one would expect and they may actually be gaining seats. This paper examines why that is so.

We argue that the incumbency advantage combined with the fact the GOP is the minority inside the legislature contributes to the higher Republican retirement rate. Our starting point is the observation that for individual politicians being in the majority is decidedly more rewarding than being in the minority. As minority leader Robert Michel (R-III) recently commented, "how is it possible to be effective in the minority?" His frustration is shared by members of his party who do not "expect to see Republicans in the majority in [their] lifetimes let alone during [their] tenures in office."¹ In the end, many secure but disheartened members of the minority party simply leave the House. Republican House member Rod Chandler of Washington state's 8th district put the matter baldly:

"I'm part of the problem. I'm moving on. It reflects a lack of confidence on my part that we'll be a majority party in the House any time soon."²

To better appreciate the political implications of career decisions such as Representative Chandler's we develop a formal model that ties the decision to run for reelection or retire to the value that individual members of Congress place in being in the minority versus being in the majority. From this model we are able to derive several testable implications that allow us to compare electoral systems and examine the dynamics of retirements within an electoral system. The model is tested using data from the U.S. House and the British House of Commons. In the end, we are able to gauge the effects of the incumbency advantage on retirements.

The theory goes as follows. We assume that members of the minority party find their tenure less rewarding than members of the majority party. Members of the majority, for example, get committee and subcommittee chairs and other perks.

¹ Quoted in Janet Hook, "New Milieu for Republicans Doesn't Bring More Power," Congressional Quarterly Weekly Report March 3, 1990, p.64

² Quoted in Jackie Calmes, "In an about face Gingrich becomes an apostle of grass roots politics, averting clashes in the GOP," Wall Street Journal, March 27, 1991, p. A16.

When election time comes each individual legislator decides whether to run for reelection, but in the presence of an incumbency advantage their decisions are interdependent. If a legislator decides to retire, her decision generates a positive externality for the opposing party since it increases (however slightly) the chances that they win a majority and a negative externality for her own party since it decreases the chances that they will win a majority. What is more, simply because the minority party holds fewer seats it will be less likely to win a majority when there is an incumbency advantage. As a result, members of the minority party will tend to retire at a faster rate than members of the majority party, and the majority party will remain in power for long stints despite changes in public sentiment.

In section 2, we review existing formal and empirical work on career decisions. In section 3 we extend Gordon Black's model of career decisions to incorporate majoritarianism within the institution. In section 4 we characterize the equilibrium. In sections 5 and 6 we develop the political implications of this model and test it using data from the U.S. and Britain. The non-technical reader may wish to skip sections 3 and 4, and proceed directly to sections 5 and 6. These sections contain the main analytical results along with some empirical evidence regarding the paper's main claims.

2. A Simple Model of Career Decisions

Following Joseph Schlesinger's (1966) seminal study of the career paths of politicians, Gordon Black (1972) formalized the career decisions of politicians in terms of expected utilities. Our work builds on Black's framework.

There are four components to legislators' career decisions. Let P be the probability that a House member wins reelection if she chooses to run for reelection. Let V be the value of the holding a legislative seat. Let c be the cost of running for a seat, and, finally, suppose that any member that leaves office

receives “retirement wage” r . Politicians are essentially taking a gamble each time they run. If an incumbent makes a bid for reelection she could win the seat, which is worth V , or she might lose and move on to some other career, the personal value of which would be r . The chances of winning are P , and the chances of losing $1-P$.

To run for a seat a politician would have to invest c in the election campaign. Alternatively, the legislator could forego the risky proposition and retire, which would bring her r . An incumbent runs for reelection if and only if the expected value of running exceeds the retirement wage. In mathematical terms,

$$P V + (1 - P) r - c \geq r.$$

She retires from politics if and only if

$$P V + (1 - P) r - c < r.$$

At first glance these inequalities do not seem to be very meaningful: the election probabilities of legislators, P , are observed, but V , c , and r are not. Rewriting the inequalities in terms of P shows the empirical usefulness of thinking about this problem formally. A legislator runs for reelection if and only if

$$P \geq c/(V-r).$$

And the fraction of legislators that run is the fraction that have reelection probability P higher than the ratio, $c/(V-r)$.

It is quite easy to speculate about reforms in this simple model. Legislation that increases the retirement wage or the cost of running for office or that decreases the value of office will increase retirements. Pay raises, for example, will decrease retirements. Anything that increases legislators’ chances of reelection, like pork-

barrel politics or franking privileges, will decrease retirements.

Empirical work on career decisions of U.S. House members has tried to determine how much weight politicians give to each of these factors.

Several studies emphasize the personal value that legislators ascribe to their office, the personal costs of running for office, and the value of retirement. Stephen Franzitch (1978)

interviewed retiring members of Congress to ascertain what factors led them to resign. The majority of politicians in his survey listed very personal reasons for retiring, such as family, health, and age. Two important studies have examined that value that politicians place on being in office. John Hibbing (1982) looked at the effects of pay raises, pension increases, and seniority on retirement rates. He found that pay increases decrease retirements, pension increases raise the retirement rate, and members in position of power tend to retire later in their careers than backbenchers. David Cannon (1990) examined the subjective value that politicians place on being in office. He distinguished three sorts of politicians: professionals, ideologues, and amateurs. The first two are likely to have lengthy political careers, while the third group tend to have shorter careers and are less involved in the internal politics of the legislature.

Other studies emphasize electoral rather than personal concerns. In their book *Strategy and Choice in Congressional Elections*, Gary Jacobson and Sam Kernell find fear of defeat to be the most important reason behind legislators' decisions to voluntarily leave the House. Specifically, politicians face two layers of electoral uncertainty: their chances of winning and shocks that may occur between the time they make an electoral decision and the general election. First, House members recognize that they benefit from a strong incumbency advantage but they may also be turned out of office by bad economic times or an extremely unpopular president. Second, while the outcomes of elections make incumbents appear relatively safe,

politicians act on fears that are well out of proportion to the actual electoral threat.(See also Rohde (1979)) Incumbents must make electoral decisions a year or more in advance of the general election and it is hard to anticipate the mood of the country a year hence.

Despite considerable empirical research on legislative careers the difference between Republican and Democratic retirements remains a puzzle. The discrepancy could be due to party labels themselves. Something about being Democrat makes them less likely to retire. For example, Democrats may have less lucrative professions to retire to, or the Republican's laissez faire ideology would make government service less valuable than private sector employment. Alternatively, it could be, as Jacobson (1990) posits, that Republicans are less electorally secure than Democrats.

We explore a third consideration: the internal organization of the legislature makes holding office much less valuable for members of the minority party. Parties structure legislative life. They provide positions of power---like committee chairs and party leadership roles---and they can produce coordination of legislators decisions so that legislation may be passed. Members of the minority party enjoy much less of the spoils. If minority is unlikely to win a majority of seats in the future, many of that party's members will prefer retirement to a long career as the loyal opposition.

Other studies have detected differences in retirement rates along minority and majority lines (See Jacobson and Kernell, 1981, pages 50--51 and *fn 4.*, Gilmour and Rothstein, n.d.) To date no one has spelled out the causes and political implications of this discrepancy.

3. A Model of Legislative Majorities and Career Decisions

A formal model helps clarify the connection between the organization of the legislature and the career of the individual. We consider a large legislature with two parties, such as the U. S. House. There are N seats, N_D of which are currently held by Democrats and $N_R = N - N_D$ of which are currently held by Republicans. It will be assumed that both parties are always represented in the legislature ($N > N_D > 0$). As in Black's model of retirement, there are four components in each individual's decision: the retirement wage, r , the cost of running for office, c_D and c_R , the value of office V , and the probability of winning election P .

We extend the simple model of career decisions four ways. First, the value of office depends on being in the majority. Rather than all legislators' valuing their tenure equally, we assume that the value of being in the majority is greater than the value of being in the minority. Mathematically, we denote the value of being in the majority as V_1 and the value of being in the minority be V_0 , and $V_1 > V_0$. It will also be assumed that V_0 is also greater than r , since if it was not then minority legislators would prefer retirement to serving in the minority. No legislator knows for certain whether his party will be in the majority, so in making career decisions legislators must also consider their chances of being in the majority. We define q to be the probability that the Democrats win a majority of seats in the legislature. The functional form of this probability is derived in the appendix.

Second, the cost of running for office varies across legislators. Specifically, a Democrat's cost of running for reelection is represented by the variable c_D . The distribution of costs across Democratic incumbents is $F(c_D)$. Similarly, a Republican's cost of running for reelection is the variable c_R , which has distribution $F(c_R)$. One interpretation of this notion is that the cost of running for reelection depends on a number of factors that we can measure imperfectly, such as the state of an individual's health. It is assumed that the probability density functions f_D and f_R are continuous and strictly positive over their supports. The supports of f_D and f_R

will range from a low of $c_{d,\min}$ to a high of $c_{d,\max}$ and a low of $c_{r,\min}$ to a high of $c_{r,\max}$ for the Democrats and the Republicans respectively. We will also assume that Democrats and Republicans have the same distribution functions (i.e. $F_D(X)=F_R(X)$ for all X). Finally, we assume that the distribution of C 's across legislators is known to all members of the House.

Third, electoral probabilities vary across parties and types of races. There are four types of races: incumbent Democrats run for reelection, incumbent Republicans run for reelection, Open Democratic seats, and Open Republican seats. How many seats there are in each category depends on what career decisions legislators choose to make. The extensive literature on the incumbency advantage suggests a straightforward way of formalizing these considerations. (King and Gelman, 1990) Let P_{ID} be the probability that a Democratic incumbent wins reelection, P_{IR} be the probability that a Republican incumbent wins reelection, P_{OD} be the probability that the Democrats win an open seat previously held by the Democrats, and P_{OR} be the probability that the Republicans win an open seat previously held by the Republicans.

The *incumbency advantage* is defined as the expected (or average) difference in the election probabilities between incumbent-contested and open seats in the election probability, controlling for party. In our notation,

$$I = P_{IR} - P_{OR} = P_{ID} - P_{OD}$$

The *partisan advantage* is expected difference in the election probabilities between the Democratic held seats and the Republican held seats. That is

$$S = P_{ID} - P_{IR} = P_{OD} - P_{OR}$$

If S is positive the partisan advantage benefits the Democrats, and if it is negative the Republicans. Later on we will derive the effects of incumbency and partisan advantages on retirement rates, and it will be convenient to write the reelection probabilities in terms of these factors. We assume that when $I=0$ and $S=0$ each party has the same chance of victory, which implies all values of P will equal $.5$. Using this we can express P_{ID} , P_{IR} , P_{OD} , and P_{OR} as $P_{ID} = .5 + I + .5S$, $P_{IR} = .5 + I - .5S$, $P_{OD} = .5 + .5S$, and $P_{OR} = .5 - .5S$.

Finally, when deciding on whether to run or retire, there are factors which will affect the election results which will be revealed as the election nears, but which are unknown at the time the legislator must make the decision to run or not. Jacobson and Kernell point out that politicians must make career decisions early in an election cycle in order to qualify for the primary ballot and to develop a good campaign. Over the nine months to a year before an election much can happen to a party's fortunes. We formalize these forces as a random variable ϵ , which has distribution function F_ϵ which is assumed symmetric around 0. It is assumed that the density of ϵ is continuous and strictly positive over its support. A positive value of ϵ represents a short-term force that benefits the Democrats and a negative value benefits Republicans. Thus, at the time a politician makes career decisions she faces the following electoral probabilities: $P_{ID} + \epsilon$, $P_{OD} + \epsilon$, $P_{IR} - \epsilon$, and $P_{OR} - \epsilon$.

Using these notions we can formulate a model of retirement that incorporates features of life inside the legislature. The basic framework is that an individual runs for reelection if the expected utility of running exceeds the utility of retiring.

The utility of not running is just r .

To derive the expected utility of running for reelection we consider legislator's utility under three possible outcomes. First, the legislator may lose the election. If this happens she receives the retirement wage r . The probability that a Democrat who runs for reelection loses is $1 - (P_{ID} + \epsilon)$, and the probability that a Republican who runs for reelection loses is $1 - (P_{IR} - \epsilon)$. Second, the legislator may win the election but end up in the minority. If the legislator ends up in the

minority she receives V_0 . Third, the legislator may win and be in the majority. In this case the legislator receives V_1 . The second and third outcomes depend on the probability of winning and on the probability of being in the majority. The probability that a Democrat wins reelection is $P_{ID} + \epsilon$ and the probability that a Republican wins reelection is $P_{IR} - \epsilon$. The probability of being in the majority is $q = \text{Prob}(\epsilon \leq z)$, where z is defined as a number such that values of ϵ below this level spell a Democratic majority and values of ϵ greater than z produce Republican majorities.

The expected utility of running for reelection is a weighted average of the utilities received in each of these outcomes, where the weights are the probabilities of winning or losing office and of being in the majority or minority. For Democrats this calculation is

$$EU_D(\text{Run}) = P_{ID}[qV_1 + (1-q)V_0] + (1-P_{ID})r - c_D.$$

For the Republicans, the expected utility of running equals

$$EU_R(\text{Run}) = P_{IR}[(1-q)V_1 + qV_0] + (1-P_{IR})r - c_R.^3$$

The key difference between the model presented in section 2 and the decisions represented by equations (3--1) and (3--2) is the asymmetry in the value of office. Even if incumbent Democrats and Republicans had identical costs of running for office and reelection probabilities, their retirement decisions would differ because they would have different chances of being in the majority party.

³ The expected utilities are actually approximations. A technical wrinkle arises calculating the expected utilities. The chances of winning reelection and the probability of being in the majority depend on the same random variable ϵ . This generates some additional terms in the expected utility calculation that can be shown, under assumptions about the variance of ϵ to be very small.

The effects of specific factors---namely, the size of the majority, the incumbency advantage and the partisan advantage---on retirements are spelled out in sections 5 and 6. First, we establish the conditions under which our model generates predictions about legislators' retirements.

4. Equilibrium

The retirement rate predicted by our model is simply the fraction of legislators who have costs high enough so that the expected utility of running for office is less than the expected utility of retiring.

A specific formula for the retirement rate can be derived by considering the legislator whose cost of running for reelection is such that she is indifferent between running and retiring. For Democratic legislators that cutoff is defined by

$$P_{ID}[qV_1 + (1-q)V_0] + (1-P_{ID})r - c_D^* = r.$$

For Republican legislators the cutoff is defined by

$$P_{IR}[(1-q)V_1 + qV_0] + (1-P_{IR})r - c_R^* = r.$$

Solving for c_D^* and c_R^* gives the costs that separate those legislators who run for reelection and those who do not:

$$(4-1) \quad c_D^* = P_{ID}[qV_1 + (1-q)V_0 - r]$$

$$(4-2) \quad c_R^* = P_{IR}[(1-q)V_1 + qV_0 - r]$$

Hence, the fraction of Democrats that run for reelection is $F_D(c_D^*)$ and the

fraction of Republicans that run for reelection is $F_R(c_R^*)$.

This is not a complete solution to our problem. The cutoffs, c_D^* and c_R^* , depend on probability of a Democratic majority which in turn depends on the fraction of legislators who decide to retire. To make a career decision, then, each legislator must anticipate the career decisions of all other legislators. In doing so, each member forms an expectation about q , the chances that the Democratic party will be in the majority.

How are expectations about q formed? Some assumption about this is necessary to predict retirement rates. One possibility is that q is calculated by looking at recent patterns of legislative composition. We assume that legislators have rational expectations about the equilibrium probability of q , denoted q^* . The rational expectations assumption means that legislators in our model know the distribution of costs across legislators, they correctly anticipate the levels of retirement from each party, $F_D(c_D^*)$ and $F_R(c_R^*)$, and they form statistical expectations expectation for all other random factors in the model. The equilibrium probability that the Democrats win a majority of seats, then, can be expressed as the probability that the Democrats win a majority of seats given that $c_D = c_D^*$ and $c_R = c_R^*$. In appendix A we give a full derivation of this probability. The result is

$$(4-3) \quad q^* = F_c(.5S + I \left[\frac{N_D}{N} F_D(c^*_d) - \left(1 - \frac{N_D}{N}\right) F_R(c^*_r) \right])$$

The expression for q^* relates retirement decisions of the candidates to the probability that the Democrats will be the majority party next period. Notice that when there is no incumbency advantage ($I=0$), the relative retirement rates of the parties does not affect the probability the Democrats will be the majority party next period. When there is an incumbency advantage, which party holds the majority depends upon each party's retirement rate ($F(c^*_d)$ and $F(c^*_r)$) and the current

composition of the legislature (N_d/N). Sections 5 and 6 are devoted to examining the details of these relationships.

Equations (4-1) to (4-3) define an equilibrium to the model of legislative majorities and career decisions. We will be examining the comparative statics properties of an "interior" equilibrium, which is defined as an equilibrium where some members of both parties retire and some members of both parties run. Under fairly general conditions this equilibrium exists and is unique. Appendix A contains a detailed statement of the required conditions. For the results which comprise the remainder of the paper, the conditions that insure a unique interior equilibrium will be assumed to hold.

The basic requirement for the existence of an interior equilibrium is that the distribution of cost of running for the candidates is sufficiently wide that someone runs even when she is sure to be in the majority, and someone retires even when she is sure to be in the minority. There are additional requirements for a unique equilibrium.⁴ The appendix examines these conditions. As a final note, the conditions for uniqueness play a limited role in much of the analysis. They play no role in the first 2 results of Section 5. While they are sufficient for the remaining result in Section 5 and the results in Section 6, they are not necessary.⁵ Further

⁴ A sufficient condition to prevent multiple equilibria is that the probability that a party is in the majority next term not respond too dramatically to a change in the cutoff costs c_d^* and c_r^* . To understand why this might matter, consider the following. Suppose that c_r^* is fixed. When c_d^* is high, then many Democrats run for re-election, and q , is high as well. The high value of q encourages a large number of Democrats to seek re-election. Assume that the pair (c_r^*, c_d^*) satisfy the equilibrium condition 4-1. Now consider a cutoff value $c_d^{**} < c_d^*$. Is it possible that this second value, c_d^{**} , also satisfies 4-1? It is possible, but only if the fall in q in response to the increase in Democratic retirements is large enough. The exact condition is examined in the Appendix. Conditions that are sufficient to insure that the fall in q is too small to permit multiple equilibria include that the distribution of costs of running are dispersed enough, or the distribution of ϵ is dispersed enough.

⁵To be precise, the "uniqueness conditions" contained in the appendix are sufficient for a unique equilibrium, not necessary for a unique equilibrium. Secondly, even if there are multiple equilibria, the comparative static results can still be valid for variation around some of the equilibria.

examination of the possibility of multiple equilibria is left for future research.

5. Comparing Electoral Systems

In this section we show how the presence of either a partisan advantage or an incumbency advantage in an electoral system affects the retirement rates of the parties. An important asymmetry arises here: incumbency not party produces an advantage for the majority party through retirements. After deriving the theoretical implications of the model in Propositions 1, 2, and 3, we test the model by comparing retirement rates in the U.S. House and the British parliament.

5.1 Theoretical Results

We begin by establishing a result that serves as a baseline for comparisons. In highly competitive electoral systems---where there is neither a partisan nor an incumbency advantage---retirement rates should be equal across parties.

Proposition 1 If there is no incumbency advantage and no partisan advantage (ie., $I=0$ and $S=0$) then the retirement rate of the current majority⁶ and current minority parties will be the same.

Proof. When $I=0$ and $S=0$, $q=F_e(0)=1/2$. Hence, $c^*_D=c^*_R=.5[.5(V_1-V_0)-r]$. Since $F_D(X) = F_R(X)$ for all X , $c^*_D=c^*_R$ implies the retirement rates are the same.

What happens when there is a partisan advantage or bias to the elections but no incumbency advantage?

⁶The current majority is the party with a majority of the seats in the legislature before the election; current minority is defined similarly. When there is no possibility for confusion, "current" is sometimes left implicit.

Proposition 2 *If there is no incumbency advantage (ie, $I=0$) but one party enjoys a partisan advantage (ie., $S \neq 0$), then the retirement rate will be smallest for the party with the partisan advantage.*

Proof. Assume that $I=0$ and, for sake of presentation, $S > 0$. Thus, $q^* = F_c(S) > 1/2$, and $c_{D^*} = (.5+.5S)[q^* V_1 + (1-q^*)V_0 - r] > (.5+.5S)[(1-q^*) V_1 + q^* V_0 - r] > (.5-.5S)[(1-q^*) V_1 + q^* V_0 - r] = c_{R^*}$. Hence, the Democratic retirement rate is greater than the Republican retirement rate.

Proposition 2 corresponds to a setting like the British House of Commons. It is generally thought that there is no or little incumbency advantage in the British parliament, but that there are strong partisan tides. Our theory reveals that a partisan advantage in the vote translates directly into an edge in retirements for the party that benefits from that tide. In years that favor Conservative candidates, for example, there will be fewer Conservative retirements.

Neither case presented in Propositions 1 and 2 produces asymmetries in q^* that would benefit either the current majority or minority parties. Asymmetries between the majority and minority parties arise, however, when there is an incumbency advantage.

Proposition 3 *If there is no partisan (ie., $S=0$) advantage but there is an incumbency advantage (ie., $I > 0$), then the current majority party will have a lower retirement rate than the minority party.*

Proof. Suppose $N_D = .5N$. Then $S=0$, $I > 0$, and $N_D = .5N$ implies that $q = F_c(.5I[F_D(c_{D^*}) - F_R(c_{R^*})])$. Since $F_D(X) = F_R(X)$ for all X , it is clear that the unique equilibrium values of c_D and c_R must be equal and $c_D = P_{ID} [.5(V_1 + V_0) - r] = c_R$. Now increase N_D . It will be shown in the proof of Proposition 4 that c_{D^*} always increases in N_D , and c_{R^*} always decreases in N_D . This implies that, for

$N_D > .5N, c_D^* > c_R^*$, which implies lower retirement rates among the Democrats whenever $N_D > .5N$.

5.2 Empirical Comparison of Britain and the U.S

Propositions 1, 2, and 3 provide useful results for comparing different electoral systems. In highly competitive electoral systems, we expect there to be no differences in retirement rates. In systems where there are partisan biases but no incumbency advantage we expect there to be partisan differences in retirement rates. But in such cases there should be no asymmetry in retirements between the current majority and minority parties. Finally, in systems with an electoral bias toward incumbents, such as the U. S. House and many American state legislatures, we expect retirement rates of the current minority party to be higher than the retirement rates of the current majority party.

The contrast between the British House of Commons and the U.S. House of Representatives corroborates the implications of Propositions 1--3. The small or non-existent incumbency advantage in Britain leads us to expect little difference between the retirement rates of the majority and minority parties. In any given year, however, there are strong partisan tides. The implication from Proposition 2 is that there will be differences in the retirement rates in any given year and that the winning party (the one with the partisan advantage in that year) will have the lower retirement rate.

Retirements from the British House of Commons from 1945 to 1979 fit this pattern well.⁷ The average retirement rate of the current majority party from the

⁷We stop our data analysis in 1979 because there is some dispute over whether there was an incumbency advantage in Britain in the 1980's. For details, see Cain, Ferejohn, and

British House of Commons has been 9.7 percent, while the average retirement rate for the current minority party has been 9.8 percent. The difference between these is statistically insignificant.⁸ Nor is there a difference between the average retirements of the two parties over the post war period. Labour's average retirement rate was 9.6 percent while the Tories' average retirement rate was 9.9 percent. There is, however, a striking difference between retirement rates of the party that benefits from an electoral tide and the one that doesn't. In the absence of an incumbency advantage, the party that wins an election is the one that has a partisan advantage. Looking at the retirement rates of the parties that won elections and the rates of those that lost, we find that the average difference in retirement rates between losers and winners was 1.34 percent. This estimate has a standard error of .41 percent. So the t--statistic for the difference of means is 3.03, indicating a significant difference in retirements between winning and losing parties.

Post-war elections in the U. S. House of Representatives provide a sharp contrast with British career patterns. House elections from 1945 to 1990 have been characterized as suffering from creeping incumbency.⁹ At the beginning of this period office holders had an incumbency advantage of 3 percentage points in the vote which grew to nearly 12 percent in the mid-1980s. (King and Gelman, 1990) Propositions 3 implies that we should find a big difference between the retirement rates of current majority and current minority party members in the U.S. We do.

Fiorina (1988).

⁸We calculated the retirement rates from F.W.S.Craig's British Parliamentary Elections, 1945 to 1979. Eleven elections were included in our analysis. The standard deviation for the majority party was .0409 and for the minority party .0293. The t-statistic for the difference in means was .314. Alternatively, we could have treated each year as a pair of observed retirement rates. The average difference in the retirement rates of the minority and majority parties was .12 percentage points with a standard deviation of .0198. The t--statistic was .01916.

⁹The 1992 election had many highly uncharacteristic features and special circumstances. These are described and analyzed in Groseclose and Krehbiel (n.d.) .

From 1946 to 1990, an average of only 6.1 percent of the majority party's members retired while 9.25 percent of the minority members retired. This difference is statistically significant at the .01 level.¹⁰

One criticism of our comparison of the majority and minority retirements in the U. S. House is that for most of the period the Democrats were the majority and Republicans the minority. The differences, then, may be due to party labels themselves. Members of the Republican party, for example, may retire more frequently because they have better political opportunities in the private sector due to their party's close ties to business. Alternatively, the Republican ideology is hostile to government, so Republican legislators may become frustrated more quickly. Both of these arguments suggest that there should be a systematic difference between the Labour and Conservative party retirements over the post-war period. There isn't. Any difference in British retirements appears to be due to electoral advantages enjoyed by a party in a given election. Differences in the U. S. follow majority--minority lines. An additional test of our model is to examine how well majority status and incumbency explain fluctuations in retirement over time within a country.

6. Explaining Fluctuations in Retirements Within a System: The U.S. House from 1946-1990

Propositions 1--3 point to crude differences between electoral systems. Our simple comparison of the national legislatures in Britain and the United States confirms

¹⁰The standard deviations are .0255 around the majority party's retirement rate and .0228 around the minority party's retirement rate. The difference in the means had a t-statistic of 4.333. Another way to slice these data is to treat each election as a pair. The average difference in the pairs over the 23 elections was .0316 with a standard deviation of .024. The t-statistic for the difference in pairs was 5.49.

these predictions. Within countries, there are important variations in retirements that need to be explained. Most importantly, we have treated the U.S. as a strictly incumbency-oriented system, but there are strong partisan advantages in the U. S. House that typically benefit the Democratic party. In this section we examine how career decisions are affected by *changes* in the size of the majority, the incumbency advantage, and the partisan advantage?

6.1 Theoretical Results

In Section 6 we examine how career decisions are affected by changes in the size of the majority, the incumbency advantage, and the partisan advantage. These results are organized in Propositions 4, 5, and 6. In this Section we will assume that the incumbency advantage, I , is strictly positive. Some of the intuitions behind the results will be presented in the main body of the text. A detailed derivation of the results, which is mainly a standard "comparative statics" exercise, will be presented in the Appendix. First, we consider the effect that an increase a party's share of the seats will have on that party's retirement rates.

Proposition 4 Increasing party's share of the seats increases (decreases) the retirement rate of its members decreases (increases).

Proof. See appendix B.

This is true regardless of which party is in the majority or benefits from an electoral advantage.

To see the intuition behind this result, suppose that, holding the pattern of retirements c_D^* , and c_R^* constant, N_D increases. Increasing N_D makes q , the probability the Democrats are in the majority next term, larger, since there will now be fewer Republican incumbents seeking re-election, and more Democratic

incumbents seeking re-election. This makes running for office more attractive to Democrats, since now the chances they will be in the majority are greater. Conversely, Republicans are less likely to be in the majority, and so the value of running for re-election will fall for Republican legislators. The marginal legislator are no longer indifferent between running and retiring. The value of running for office for the marginal Democratic legislator, the legislator with the cost of running c_D^* , is now strictly positive since q has increased. Conversely, the value of running for the marginal Republican is now strictly negative. Retirement decisions must be adjusted to restore the equilibrium. The new equilibrium is found when enough new Democrats decide to run rather than retire, and enough Republicans decide to retire rather than run.

Second, electoral tides that benefit a party will be reflected in retirement rates. As a party's electoral fortunes rise, the retirement rate of members of that party's congressional delegation will fall.

Proposition 5 Increasing a party's electoral advantage (S) increases (decreases) the retirement rate of its members decreases (increases).

Proof. See appendix B.

The intuition behind this result is similar to the intuition behind Proposition 4. As S increases there are two effects. The value of running for office for Democratic legislators changes in two ways. First, the probability of winning given that the Democratic legislator runs increases. Second, the value of winning office for a Democratic legislator is larger when S increases. This is because q , the probability the Democrats are in the majority next term, increases in S . As S increases, the probability a Democrat wins election is larger, and therefore the probability that the Democrats win a majority of the seats next term increases. Both of these effects work in favor of the Democratic legislator and against the Republican legislator.

This leads more Democrats to seek re-election, and more Republicans to retire.

Our final result establishes the effect of the incumbency advantage on retirement rates. Proposition 6 shows that a rise in the incumbency advantage decreases a party's retirement rate for the majority party, while an increase in the incumbency advantage may actually increase retirement among the minority party. The proposition is stated for the Democrats.

Proposition 6

Assume the Democrats hold a majority of the seats. Assume that the partisan advantage for the Democrats, S , is not too negative. Then:

- 1. An increase in the incumbency advantage will always decrease the retirement rate of the current majority party.*
- 2. An increase in the incumbency advantage may decrease or increase the retirement rate of the current minority party.*

Proof: See appendix B.

The equivalent result will hold for the Republicans. The basic intuition behind Proposition 6 is that an increase in the incumbency advantage has two types of effects. First, increasing the incumbency advantage makes running for office more attractive to both the majority and the minority party legislators by increasing the chances that they will defeat their challengers. (This is the "direct effect".)

Second, an increase in the incumbency advantage changes the value of office for legislators. (This is the "indirect effect".) An increase in the incumbency advantage increases the probability that the majority party will remain the majority party next period. This increases the value of running for re-election for members of the majority party, and decreases the value of running for members of the minority party.

To see this suppose the Democrats hold a majority of the seats. Assume for simplicity that Democrats and Republicans initially retire at the same rate F . (In

fact, Proposition 4 implies that when $S=0$, if the Democrats are in the majority they will retire less often than the Republicans). Since there are more Democrats running for re-election than Republicans, increasing the incumbency advantage will help more Democrats than Republicans. To see this notice how increasing the incumbency advantage affects the expected number of Republican seats.

Assuming that Republicans have an equal chance at winning the open seats, if there were no incumbency advantage the expected number of Republican seats next term would be $.5N$. What happens when there is an incumbency advantage? For all the seats where an incumbent Republican runs for re-election, the expected number of Republican seats increases by I , for a total increase in expected number of Republican seats of $+I * F * (N - N_D)$ (i.e. the incumbency "bonus" times the fraction of the party's legislative delegation seeking re-election times the size of the delegation). The incumbency advantage benefits Democratic incumbents as well; the total increase in the expected number of Republican seats of an increase in the incumbency advantage in the Democratic seats is $-I * F * (N_D)$. Since the Democrats are the majority, the total effect on the number of Republican seats next term of increasing the incumbency advantage, $I * F * (N - 2N_D)$, is negative and decreasing in I . Increasing the incumbency advantage lead to a higher expected number of Democratic seats. The indirect effect of increasing the incumbency advantage is to help the majority party retain its majority next term.

Finally, notice that for members of the majority party the direct effect and the indirect effect both encourage more legislators to seek re-election. For the minority party the direct effect and the indirect effect work in opposite directions: the direct effect makes running for office more attractive, but the indirect effect makes the prize associated with winning office less attractive. This accounts for the contrast between part a and part b of Proposition 6. As might be guessed, it can be shown that, when the legislature is evenly divided, and the "indirect effect" is zero, the retirement rates of both parties decrease as the incumbency advantage increases.

6.2 Explaining Fluctuations in Retirements from the U.S. House, 1946-1990

The predictions of our model of retirements imply a definite pattern of retirement rates in the U. S. House of Representatives. Proposition 4 predicts that an increase in a party's share of the seats will decrease that party's retirement rate. Proposition 5 suggests that a rise in a party's electoral advantage will decrease its retirement rate. And Proposition 6 predicts that the incumbency advantage may affect the party's differently. A rising incumbency advantage may drive the majority party's retirement rate down, while pushing the minority party's retirement rate up.

To test Propositions 4--6 we estimated a multiple regression of retirement rates on each party's share of the seats, the partisan advantage, the incumbency advantage, and the fraction of a party's House members over 65 years old. Our dependent variable is the fraction of a party's House delegation that voluntarily retires as reported in Mann and Ornstein's (1991). The partisan and incumbency advantages were calculated using techniques described in King and Gelman (1990).¹¹ In addition, we included a variable for age (ie., fraction of a party's members over 65 years old).¹² Age is often found to be an excellent predictor of retirement.¹³

¹¹In each year, the percent vote received by the candidate of the incumbent party was regressed on an indicator for incumbent, an indicator for party and past vote. There is a problem of discontinuities in the data at redistricting. For those years we took the linear interpolation of the preceding and succeeding elections. Results of these regressions are available upon request. Ideally, we would like to make the incumbency advantage an endogenous function of the retirement patterns. It should be noted that, according to results reported by Gelman-King, the Gelman-King measure of the incumbency advantage is not sensitive to fluctuations in retirement rates.

¹²We tried average age and fraction over 75 as well, but over 65 worked best.

¹³We restrict our attention to the post war period for several reasons. Data on age is readily available only since 1946. In addition, data on retirement are less reliable before this period.

The results of that regression are presented in Table 1. The first column is the estimated coefficients, the second contains the standard errors, and the third the t-statistics for the hypothesis that the coefficient equals zero. The regression was estimated using generalized least squares to correct for both autocorrelation and heteroskedasticity.¹⁴

These regression results are encouraging. First, consider the hypothesis implied by Proposition 4: a rise in the fraction of seats held by a party will decrease that party's retirement rate. The estimated effect of the fraction of seats on the retirement rate is $-.107$ with a standard error of $.065$. The effect has the correct sign, and is significantly less than zero at the $.05$ level of significance.

Second, Proposition 5 predicts that the coefficient on the partisan advantage should be negative. As a party's electoral fortunes rise, members of that party will increasingly choose to retire. The estimated coefficient is $-.021$ with a standard error of $.020$. The coefficient has the expected sign, but is not statistically significant.

Third, Proposition 6 predicts that an increase in the incumbency advantage will decrease the retirement rate of the majority party but may increase the retirement rate of the minority party. In other words, the coefficients on the incumbency advantage should be negative for the majority party and may be positive for the minority party. We estimate the effect of incumbency on the majority party's retirement rate to be $-.122$ with a standard error of $.155$. The estimated effect of incumbency on the minority party's retirement rate is $.394$ with a standard error of $.125$. The coefficient for the majority party is not significant (perhaps because the

¹⁴Specifically, we used the Prais-Winsten transformation to correct for autocorrelation and, after that adjustment was made, we corrected for additional heteroskedasticity using White's adjustment.

majority retirement is about as low as one can go), while the coefficient for the minority party is quite strong. Our interpretation of the effect of incumbency on retirement is that for every 1 percentage point increase in the incumbency advantage, the minority party's retirement rate increases 4 tenths of a percent.

Our estimates indicate that in contemporary House elections the incumbency advantage produces a steady hemorrhaging in the minority party. Consider the current state of affairs: the majority party holds approximately 265 seats; there is a .1 incumbency advantage, 0 partisan advantage, and one in twenty members of each party are over 65. This constellation of forces implies that then 3.5 percent of the majority party will retire and 11.5 percent of the minority party will retire. In other words, only 10 majority party seats will be open under these circumstances compared with 19 minority party seats. A further calculation reveals how the incumbency advantage protects the Democratic majority in the U.S. House. If the each of the parties wins half of the 9 additional open seats created by the incumbency advantage then the majority party should increase its majority by 4 and a half seats.

This result clarifies our initial puzzle. Even though almost all House seats have been open at least once since 1974, the Democrats have strengthened their hold on the U.S. House. As the incumbency advantage has grown the value of the congressional career for Republicans has dropped relative to the value for Democrats, causing Republican seats to be open more frequently than Democratic seats.

7. Conclusions

The wisdom about legislative elections emphasizes incumbents' single-minded concern with reelection. (See especially, Mayhew, 1971; Erikson, 1970; Mann, 1978; Brady, 1988) By most accounts turnover in and, ultimately, control of Congress

depends on electoral forces, such as the incumbency advantage and partisan tides produced by economic forces, realignments, and scandals. These forces are extremely important for understanding electoral competition, but what goes on in an election is only part of the story. Politicians also care deeply about the quality of their political lives once in office, and the legislative life of an individual depends greatly on his party's ability to gain and distribute power among its members.

To that end, this paper has presented a formal model that ties one aspect of the internal organization of the legislature to the career choices made by individual politicians. Our empirical investigation of retirements from the British House of Commons and the U. S. House lend a great deal of credence to our model. In Britain, a strong party system, differences in retirement rates follow partisan tides. In the U.S., a system with strong incumbency advantages, the majority party has a much lower retirement rate. Also, our regression estimates for post-war U. S. elections confirm the comparative statics generated by the model for the U. S. House.

The implication of our analysis for the U. S. House is that the incumbency advantage contributes to the permanency of the Democratic majority on two fronts. The direct effect of incumbency advantage comes in seats where members of Congress run for reelection. Incumbents rarely lose reelection making it very hard for the minority party to gain ground in these races even in very favorable years, such as 1980. The indirect effect of incumbency comes in open seats. The incumbency advantage produces a higher retirement rate for the minority party because members of the minority value their office less and have a small chance of gaining majority status. This indirect effect is almost never discussed in the literature on legislative elections, and in the U. S. House we find that the incumbency advantage is sufficiently large so that the minority party actually loses seats through retirements.

The applications of the theory developed in this paper go well beyond the confines of U. S. House elections. Politicians in any majority rule system look at the same set of considerations as face U. S. House members. The predictions of our model are quite important for comparing different electoral systems, such as Britain and the United States. They also allow us to think carefully about how political changes in an electoral system may affect party competition. If Britain, for example, is developing an incumbency advantage, as Cain, Ferejohn, and Fiorina (1988) have argued, then a permanent majority party may evolve in the House of Commons as it has in the U. S. In the British case, we would guess that the Conservative party would become the permanent majority, since, like the Democrats of the early 1960s, they happened to be in power when the incumbency advantage began to take hold.

Appendix A.

Construction of q. Let X be the fraction of seats won by the Democrats. $q = \text{Prob}(X > .5)$. X may be decomposed into the fraction of Democratic held seats that stay Democratic (denoted X_d) and the fraction of Republican held seats that switch to the Democrats (denoted X_r). Since the legislature is "large" we will assume that, conditional on ϵ , the democratic share of the legislature is deterministic. The fraction of seats won by the Democrats is a random variable due to the randomness of ϵ .

$$X_d = \frac{N_d}{N} [F_D(c^*)P_{ID} + (1 - F_D(c^*))P_{OD}] + \frac{N_d}{N} \epsilon$$

and

$$X_r = (1 - \frac{N_d}{N}) [F_R(c^*) (1 - P_{IR}) + (1 - F_R(c^*)) (1 - P_{OR})] + (1 - \frac{N_d}{N}) \epsilon$$

Substituting in the definitions of P_{ID} , P_{OD} , P_{IR} , and P_{OR} yields

$$X = .5(1 + S) + I \left[\frac{N_D}{N} F_D(c^*) - (1 - \frac{N_D}{N}) F_R(c^*) \right] + \epsilon$$

Hence,

$$q = \text{Prob}(\epsilon > [(-.5S) + I \left[\frac{N_D}{N} F_D(c^*) - (1 - \frac{N_D}{N}) F_R(c^*) \right]])$$

$$q = 1 - \text{Prob}(\epsilon < -z)$$

$$q - 1 - F_c(-(.5S + I [\frac{N_D}{N} F_D(c^*_D) - (1 - \frac{N_D}{N}) F_R(c^*_R)]))$$

If F_c is symmetric around 0, then

$$q - F_c(.5S + I [\frac{N_D}{N} F_D(c^*_D) - (1 - \frac{N_D}{N}) F_R(c^*_R)])$$

Theorem 1: Conditions for the existence and uniqueness of interior equilibrium.

Suppose the values of the re-election probabilities, the incumbency advantage, the partisan advantage, and the composition of the legislature are: $P_{ID}, P_{IR}, P_{OD}, P_{OR}, S, I, N_D/N$.

There exists a unique interior equilibrium to the career model if:

- a. $F_D(P_{ID}(V_0 - r)) > 0$ and $F_D(P_{ID}(V_1 - r)) < 1$; $F_R(P_{IR}(V_0 - r)) > 0$ and $F_R(P_{IR}(V_1 - r)) < 1$.
- b. $(\text{MAX}[q_D, -q_R])[V_1 - V_0][P_{ID} + P_{IR}] < 1$,
where $q_D = \partial q / \partial c_D$, $q_R = \partial q / \partial c_R$ and $\text{MAX}[q_D, -q_R]$ is the largest value of q_D or $-q_R$ for any pair of cutoff values c_D , and c_R .

The part a. conditions state that the costs to some Democrat of running for election are smaller than $P_{ID}[V_0 - r]$, and the costs of running to some Democrats is larger than $P_{ID}[V_1 - r]$. Since this represents the lowest and highest possible expected value of running for re-election, the condition insures that there will always be some Democrats retiring and some Democrats running for re-election. The conditions for the Republicans have the same interpretation. Together they insure an interior equilibrium.

The part b. conditions play a role similar to that of technical assumptions such as concavity of objective functions in other contexts. The assumptions of part b. insure the uniqueness of the equilibrium. Note that condition b. implies:
 $[P_{ID}[V_1 - V_0]q_D < 1$ and $P_{IR}[V_1 - V_0](-q_R) < 1$, where $q_R = \partial q / \partial c_R$.

a. Existence of an equilibrium

Brouwer's Fixed Point Theorem states that a continuous function from a non-empty, compact, convex set into itself has a fixed point. Let C be the set of all possible combinations of c_D and c_R . The assumptions in Section 3 clearly lead to C

being non-empty, compact, and convex. Define $\alpha: C \rightarrow C$, where $\alpha = (P_{ID}[qV_1 + (1-q)V_0 - r], P_{IR}[(1-q)V_1 + qV_0 - r])$. The function α is continuous if q is continuous, and q is continuous if the distributions of c_d , c_r , and ϵ are continuous, which is assumed. Since q , the probability the Democrats are a majority next term, is an element of $(0,1)$, α is bounded. The first element of α must be between $P_{ID}(V_1 - r)$ and $P_{ID}(V_0 - r)$; the second element of α must be between $P_{IR}(V_1 - r)$ and $P_{IR}(V_0 - r)$. This implies that if the supports of c_d and c_r are wide enough, then α will map C into C . QED.

b. Uniqueness of the equilibrium

To show that the assumptions of part b provide sufficient conditions for uniqueness, we proceed in two steps. First we construct conditions under which, given the retirement rate of the opposition, there is a unique solution for each party's retirement rate. Then we establish conditions under which there is only one pair of values which satisfy the equilibrium conditions.

1. The assumptions stated in part b. of Theorem 1 insure that equation 4-1 defines there a single valued implicit function $c_D(c_R)$, and equation 4-2 defines a single valued implicit function $c_R(c_D)$. To see this, consider equation 4-1 rewritten as:

$$c_D - P_{ID}[(V_1 - V_0)q + (V_0 - R)] = 0$$

The left hand side is monotonically increasing in c_D as long as $1 - P_{ID}(V_1 - V_0)q_d > 0$, where q_d is the partial derivative of q with respect to c_D . Theorem 1 part a, which requires that the support of c_d be wide enough, implies that there is an interior solution to 4-1. Therefore there must be a unique value of c_D which solves equation 4-1 for each value of c_R . Similar arguments establish the parallel result for $c_r(c_d)$.

2. The assumptions stated in part b of Theorem 1 also insure that there is only one point at which the function $c_D^*(c_R)$, the function defining the solution of equation 4-1 as a function of c_R , crosses the function $c_R^*(c_D)$, the function defining the solution of equation 4-2 as a function of c_D .

From 4-1 it can be shown that

and from 4-2 it can be shown that

$$\partial c_D^* / \partial c_R = \frac{P_{ID}(V_1 - V_0)q_R}{1 - P_{ID}(V_1 - V_0)(q_D)}$$

$$\partial c_R^* / \partial c_D = \frac{-P_{IR}(V_1 - V_0)q_D}{1 - P_{IR}(V_1 - V_0)(-q_R)}$$

By the assumptions in part b, both denominators are positive. Both numerators are negative if q_D and $-q_R$ are positive. It will be assumed here that q_D and $-q_R$ are positive. It is easily shown in appendix B that q_D and $-q_R$ are positive if $I > 0$. This means that both functions $c_D^*(c_R)$ and $c_R^*(c_D)$ have strictly negative slopes in a graph where the support of c_D is the x axis and the support of c_R is the y axis.

The functions must cross at least once and in particular the corner conditions in part a. imply that $c_D^*(c_R)$ crosses $c_R^*(c_D)$ from above. This is seen by the fact that when c_D equals $c_{D,\min}$, by the conditions in part a. c_R^* must be less than $c_{R,\max}$. But from part a. $c_D^*(c_{R,\max})$ must be greater than $c_{D,\min}$. Since c_D^* increases as c_R decreases, this implies that $c_D^*(c_{R,\max}) > c_{D,\min}$. By similar reasoning it can be shown that $c_D^*(c_{R,\min}) < c_{D,\max}$.

To insure that c_D^* crosses c_R^* only once it is sufficient that the absolute value of the slope of c_D^* > absolute value of the slope of c_R^* for all values of c_D and c_R . This is true if

$$\frac{1 - P_{ID}(V_1 - V_0)(q_D)}{P_{ID}(V_1 - V_0)(-q_R)} > \frac{P_{IR}(V_1 - V_0)q_D}{1 - P_{IR}(V_1 - V_0)(-q_R)}$$

Which can be simplified to the condition $1 > [V_1 - V_0][q_D P_{ID} - q_R P_{IR}]$, or condition b.

Appendix B.

Overview of the Comparative Statics:

Before proving propositions 4-6, it is useful to show some results that will be used repeatedly.

Two equations determine the equilibrium values of c_r^* and c_d^* , These are the "cut off value" conditions. These are conditions 4-1 and 4-2 in the text:

$$(4-1) F(c_D^*, c_R^*) = c_d^* - P_{ID}[(V_1 - V_0)q^* + V_0 - r] = 0$$

$$(4-2) G(c_D^*, c_R^*) = c_r^* - P_{IR}[(V_0 - V_1)q^* + V_1 - r] = 0,$$

where starred quantities represent equilibrium values of c , and q evaluated at the equilibrium values of c .

The change in the equilibrium values of c_D and c_R that is caused by a change in the exogenous variables N_D , S and I can be expressed as:

$$(1) \quad \frac{\partial c_d^*}{\partial z} = \frac{-[G_r^* F_z - F_r^* G_z]}{F_d^* G_r - F_r^* G_d}$$

and

$$(2) \quad \frac{\partial c_r^*}{\partial z} = \frac{-[F_d^* G_z - F_z^* G_d]}{F_d^* G_r - F_r^* G_d}$$

where Z represents the particular exogenous variables being examined, F_d , F_r , and F_z are the partial derivatives of F with respect to c_D , c_R , and z .

Lemma 1: Assume condition a and b of Theorem 1. The sign of dc_d^*/dz = the sign of $[F_r G_z - G_r F_z]$, and the sign of dc_r^*/dz = the sign of $[G_d F_z - F_d G_z]$.

Proof: The lemma follows if $F_d G_r - F_r G_d > 0$. These partial derivatives are:

$$F_d = 1 - P_{ID}[(V_1 - V_0)q_d]$$

$$F_r = P_{ID}[(V_1 - V_0)(-q_r)]$$

$$G_d = P_{IR}(V_1 - V_0)q_d$$

$$G_r = 1 - P_{IR}(V_1 - V_0)(-q_r),$$

where q_d , and q_r are the partial derivative of q with respect to c_D , and c_R respectively.

The condition $F_d G_r - F_r G_d > 0$ is equivalent to $1 - [(V_1 - V_0)(q_d P_{ID} - q_r P_{IR})] > 0$, which is

true under condition b of Theorem 1.

The paper makes several assumptions about the initial values of the parameters P_{ID} , P_{IR} , P_{OD} , P_{OR} , I , N_D , S , V_1 , V_0 , and R . The paper also makes assumptions about the distribution of ϵ . The relevant assumptions are collected for convenience in A1:

- A1. 1. All values of $P_{ID}, P_{IR}, P_{OD}, P_{OR}$ satisfy $1 > P > 0$.
 2. $N > N_d > 0$.
 3. $1 > q > 0$ and $f_\epsilon > 0$ in equilibrium.
 4. $V_0 > R, V_1 \geq V_0$.

A1 assumes that all the probabilities are strictly between 1 and 0, that the legislature always has at least some members of both parties. A1.iii states that the density of ϵ must be positive at the equilibrium values of c_d and c_r and that the probability that a party is in the majority next period is never equal to 1. This insures that it is possible for changes in retirement rates to influence the probability a party is in the majority. A1.4 says that given they have won the election, minority party members would rather serve than retire and that it is at least as good to serve in the majority party as in the minority party.

The signs of some partial derivatives will be used in the proofs. For convenience, they are collected in Lemma 2.

Lemma 2: Assume $I > 0$ and conditions a. and b. of Theorem 1. Then $F_d > 0, F_r > 0, G_d > 0, G_r > 0, G_r > F_r$, and $F_d > G_d$.

Proof: $F_d > 0$ and $G_r > 0$ by Theorem 1, b. $F_r > 0$ if $(-q_r) > 0$. $-q_r = I(1 - N_d/N)(f_\epsilon)(f_r) > 0$ by $I > 0$ and A1. $G_d > 0$ if $q_d > 0$, which is true by reasoning similar to $-q_r > 0$. $G_r > F_r$ and $F_d > G_d$ by Theorem 1, condition b.

Proposition 4:

Assume $I > 0$ and Conditions a and b of Theorem 1. Increasing (decreasing) a party's share of seats increases (decreases) the retirement rate of its members.

Proof:

By lemma 1, $dc_d^*/dN_d > 0$ if $[F_r G_{Nd} - G_r F_{Nd}] > 0$. $F_{Nd} = -P_{ID}(V_1 - V_0)q_{Nd}$ and $G_{Nd} = P_{IR}(V_1 - V_0)q_{Nd}$, where q_{Nd} is the partial derivative of q with respect to N_D . Using this, $[F_r G_{Nd} - G_r F_{Nd}] = P_{ID}(V_1 - V_0)q_{Nd}$. This is positive if $q_{Nd} > 0$. The partial derivative $q_{Nd} = I[f_\epsilon(1/N)(F(c_d^*) + F(c_r^*))] > 0$, since the equilibrium values of c_d and c_r are always in the interior of their support, $I > 0$, and $f_\epsilon > 0$.

The analysis of dc_r^*/dN_d is similar.

Proposition 5:

Assume $I > 0$ and Conditions a and b of Theorem 1. As a party's electoral advantage (S) increases (decreases) the retirement rate of its members decreases (increases).

Proof:

By lemma 1, $dc_d^*/dS > 0$ if $[F_r G_s - G_r F_s] > 0$. This can be shown in two steps, i. $F_r G_s > 0$, and ii. $0 > F_s G_r$. i. $F_r > 0$ by lemma 2. $G_s = .5[q(V_0 - V_1) + V_1 - r] + P_{IR}[q_s(V_1 - V_0)]$, where q_s is the partial derivative of q with respect to S . $q_s = .5f_\epsilon$, which is greater than zero by since f_ϵ is greater than zero. $G_s > 0$ since $1 > q > 0$ and $V_0 > R$ ii. $G_r > 0$ by lemma 2. $F_s = -.5[q(V_1 - V_0) + V_0 - r] - P_{ID}[(V_1 - V_0)q_s]$. $F_s < 0$, since both terms in F_s are negative by parallel arguments to those establishing the sign of G_s .

The analysis showing the result $\partial c_r / \partial S < 0$ is similar.

Proposition 6

The proposition is stated for the Democrats.

Assume $I > 0$, and Thm 1 conditions a. and b. Assume that $S > S^*$, where S^* is a negative number. Then:

1. An increase in the incumbency advantage will always decrease the retirement rate of the current majority party.
2. an increase in the incumbency advantage may decrease or increase the retirement rate of the current minority party.

Proof:

First we show the following Lemma.

Lemma 3. Assume that conditions a. and b. in Thm 1 hold. Assume $(N_D/N) > .5$, $I > 0$, and $S > S' < 0$ then $[(N_D/N)F(c_D^*) - ((1 - (N_D/N))F(c_R^*))] > 0$.

Proof:

Proposition 3 shows that, when $I > 0$ and $S = 0$, $N_D/N > .5$ implies that $c_d^* > c_r^*$. Therefore $S = 0$ implies $[(N_D/N)F(c_D^*) - ((1 - (N_D/N))F(c_R^*))] > 0$. Proposition 5 implies that, if the inequality is satisfied at S , it will be satisfied when $S > S^*$. (Proposition 5 shows that, under the assumptions in lemma 3, increasing S increases c_d^* and decreases c_r^*). Since c_d^* and c_r^* are continuous functions of S , S can be lowered some amount below $S = 0$, and the inequality will still be satisfied. Let S' be the value with the characteristic that after $S = S'$, lowering S further will reverse the inequality.

Part 1. By lemma 1, $dc_d^*/dI > 0$ if $[F_r G_I - G_r F_I] > 0$. By lemma 2, $G_r = X + F_r$, $X > 0$. this implies that $[F_r G_I - G_r F_I] > 0$ can be rewritten $F_r [G_I - F_I] > X F_I$. This is true if two conditions hold: 1. $G_I - F_I \geq 0$ and 2. $F_I < 0$.

Condition 1: $F_r > 0$ by lemma 2. The partial derivative $F_I = -[(V_1 - V_0)q + V_0 - r] - P_{ID}(V_1 - V_0)q_I = -ED - P_{ID}(V_1 - V_0)q_I$, and $G_I = -[(V_0 - V_1)q + V_1 - r] + P_{IR}(V_1 - V_0)q_I = -ER + P_{IR}(V_1 - V_0)q_I$, where q_I is the partial derivative of q with respect to I . $G_I - F_I = [(2q - 1)(V_1 - V_0)] + [(P_{ID} + P_{IR})(V_1 - V_0)q_I]$. $G_I - F_I \geq 0$ if $q \geq .5$ and $q_I \geq 0$. Using lemma 3 and the continuity of q it can be shown that $q \geq .5$ if $S > S''$, where $S'' < 0$. The partial derivative $q_I = f_\epsilon [(N_D/N)F_D(c_D) - (1 - N_D/N)F_R(c_R)]$. By lemma 3, $q_I > 0$ if $S > S'$, where $S' < 0$. Therefore $G_I - F_I \geq 0$, if $S > S^* = \max\{S', S''\}$.

Condition 2: $F_I < 0$ if $q_I > 0$. By lemma 3, $q_I > 0$ if $S > S^* \geq S'$.

Part 2. It is easy to show that an increase in the incumbency advantage may decrease the retirement rate of the minority party. To prove that an increase in the incumbency advantage may increase minority party retirements, a simple example is provided. Let $S = 0$, $F(c_D) = F(c_R)$ be uniform over $[0, Z]$, $Z > [V_1 - R]$. Let the distribution of ϵ be uniform $[-a/2, a/2]$. If $P_{ID} = P_{IR} = .75$, $I = .25$, $N_D/N = .35$, $V_1 = 1$, $V_0 = .5$, $R = 0$, $Z = 1$, and $a = .2$, then increasing the incumbency advantage will decrease the minority party retirement rate. The result of this example is not knife edge, and will still hold for some variation of all the parameters.

**Table 1. Regression Estimates of U.S. House Retirements,
1946-90**

Variable	Coefficient Estimate	t-statistic
Intercept	.107	2.21
Incumbency Advantage	-.122	-.79
Incumbency Advantage X minority	.517	2.67
Partisan Advantage	-.021	-1.09
Share of Seats	-.107	-1.66
Percent over 65	.201	1.55
R squared	.31	
Note: There are 46 observations.		

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Chapter Three
Majoritarianism, Incumbency and the
Composition of the Legislature

The 1992 Congressional elections marked the 4th decade of Democratic majority in the U.S. House of Representatives. Though the fortunes of the Democratic party wax and wane, the persistent Democratic majority in the House appears a fixed feature in contemporary American political life. This paper explores a possible explanation for continued Democratic success in the House in particular, by examining the factors influencing the composition of the legislature more generally.

It has been suggested that the incumbency advantage is responsible for the persistence of the Democratic majority in the House.¹ The intuition behind this is that high incumbent re-election rates limit the amount of change any single election can bring to the House. Since the Democrats start with a big lead in seats, they will also hold the majority in the subsequent period.

This argument, however, fails to explain the *long term* success of a legislative party. It has been correctly observed that incumbency alone can not explain the Democrats' success. The incumbency advantage can explain why Republican challengers fail to defeat Democratic incumbents. It can not explain persistent Democrat majorities, however, since nearly every seat in the House has been open

¹ The possibility that the incumbency advantage is responsible for the Democratic majority in the House is analyzed by Jacobson (1990). His book reviews and critiques the most prominent explanations for the Democratic party's continuing majority in the House. See also Orenstein (1990). For a discussion of the causes of the incumbent's advantage, see Cain, Ferejohn, and Fiorina (1988).

at some time in the past 2 decades.² In elections for these seats, incumbency advantages play no role. Accordingly, it appears incumbency must be absolved of blame and/or denied credit for the continuing Democratic dominance of the House.

The conclusion that the incumbency advantage has nothing to do with persistent Democratic success in the House is premature. While incumbency alone can not explain how one party stays in power over time, this paper argues that the incumbent's advantage plays a necessary role. To understand this role, we must consider the career decisions of individual legislators. It is widely believed that service in the legislature is more rewarding to members of the majority party than to members in the minority. This will be assumed throughout the paper. This feature of legislative life will be referred to as "majoritarianism".

If service in the majority is more rewarding than service in the minority, it might be expected that legislators who believe they will be in the minority party next period would be more likely to retire than members of the legislature who expect to be in the majority party. When there is an incumbency advantage, the legislature next period will look much like the legislature this period. This implies that the current majority party will have lower retirement rates than the current minority party. In fact, this is true in the U.S. House, where the Republican retirement rate over the last 4 decades is nearly 50% higher than the Democratic retirement rate.³

A high minority party retirement rate will make it very difficult for the minority party to gain ground in the legislature. To see this, suppose that only open seats can switch parties and that both parties have an *equal* chance of victory in an open seat

²A seat is "open" when neither the Democratic nor Republican candidate is the incumbent.

³For elaboration of the role of majoritarianism in the career decisions of House members and empirical evidence see Ansolabehere and Gerber (1992).

election. Assume the majority party holds 60% of the seats in the legislature. If both party's legislators retired at the same rate, eventually the legislature would be equally divided between the parties. In contrast, if the minority party legislators retired at a rate 50% higher than the majority party, the legislature would remain divided 60% to 40% forever.

The example illustrates how the combined effect of the incumbency advantage and majoritarianism may allow the current majority party to persist in the legislature, despite enjoying no advantage when it does not run an incumbent candidate. This example raises an interesting possibility; retirement patterns may lead to a legislature whose composition does not reflect the partisan preferences of the voters.

The analysis in this paper has been motivated by the history of the Democrats in the post-War House. While the case of the U.S. Federal legislature is of considerable interest in its own right, it is a "special case". The model in this paper develops a more general set of insights about legislatures, which are independent of the details of American national politics. The arguments will apply generally to two party political systems with majoritarian legislatures, such as England and most of the U.S. state legislatures.

There is, of course, already a vast body of theoretic research on political competition. Most work has focused on position taking by candidates seeking election once. Among the many variations considered are: variations in candidate objective function (do politicians desire winning office per se or are they policy motivated; do they wish to only win election or do they maximize votes), the degree and type of uncertainty facing candidates, and the behavior of the voters (are they sincere or do they vote strategically).⁴ The issue of what are a reasonable set of assumptions for analysis of political competition, especially with respect to voter

⁴For a detailed introduction to this literature, see Shepsle (1990).

behavior, remains controversial.⁵

The analysis in this paper suppresses many of the concerns in this well developed literature. Platform competition between the political parties and between the candidates, and assumptions regarding voter behavior are all summarized parametrically by probabilities of victory for different types of candidates. Candidates face probabilities of re-election which will depend upon their political party and whether or not they are challengers or incumbents. This is a "reduced form" for some more complicated process. As always, this is a compromise. The formal literature closest to the model developed here, and which also shares the reduced form features, is the work on political career decisions (for example, Black, Rohde, and Banks and Kiewiet). As in the earlier models, to focus on career decisions of individual legislators, the only strategic decisions considered are candidate career decision. The policy positions of the parties, for instance, are assumed to be fixed.

There are several distinctive features of the current model. First, the model focuses on the dynamics of candidate career decisions. The individual legislator decides to run for re-election or retire by weighing the lifetime expected utility from each choice every period. Expectations about the future are fully rational, and there is no arbitrary "final date". Second, the career decision of the individual legislator is linked to the composition of the legislature as a whole, in two separate ways. First, the career decisions of the individual legislators influences how the legislature is divided between the political parties. Second, how legislator's expect the legislature to be divided between the two parties influences the career decision of the individual legislators. The model isolates equilibria where the career decisions

⁵ Consider the situation of the voter deciding which candidate for Congress to vote for. For a fully rational voter, the problem of casting a ballot entails having a theory of how the composition of the legislature determines policy, knowledge of the theories held by the other voters, and enough information about voter preferences across the population to place her own vote in this context. However, if the voter is fully rational, it is almost certain she would not have shown up to vote in the first place. For some of the latest in modelling controversies, see Simon (1993).

of the individual legislator are fully forward looking and consistent with the composition of the legislature as a whole. This allows consideration of the main substantive issue this paper: in equilibrium, how do "electoral factors", such as incumbency advantages, interact with central features of legislative life, such as majoritarianism, to jointly determine the partisan composition of the legislature?

This paper explores the consequences for the composition of the legislature of the incumbency advantage and majoritarianism. Section 1 presents a model of the individual legislator's career decision. Section 2 links the career decision of the individual legislator to the composition of the legislature. Section 3 introduces majoritarianism into the legislator's career calculus. Section 4 examines the equilibrium steady state composition of the legislature. Section 5 concludes with a discussion of some implications and avenues for future research.

Section 1. The incumbent's decision to run or retire

The standard formal treatment of the politician's career decision is to assume the politician acts to maximize expected utility (Black 1972, Rohde 1979). Suppose the Congressman (MC) has two choices, retire from office or run for re-election.⁶ The MC compares the expected value of running for office, $PV + (1-P)R - C$, with the value of retiring, R , where V is the value of winning the election, P is the probability of victory, R is the value of retirement, and C is the utility cost of running for office. The MC decides to run iff:

⁶For analysis of congressional retirement decisions see Hibbing (1982), Cannon (1990), and Franzitch (1978). The findings of these studies are briefly reviewed in Ansolabehere and Gerber (1992)

$$P(V-R) \geq C.$$

Assume the cost C varies across members of Congress according to the distribution F . The probability that an MC runs is the probability that $P(V-R) \geq C$, or $F(P(V-R))$ ⁷. The effect on retirement of changing P , V , or R can then be calculated easily by examining the partial derivatives of $F(P(V-R))$.

This standard decision framework isolates important factors in the retirement decision. One shortcoming, however, is the ambiguity of " V ", the value of office. The value of winning election can be divided into two different components. The value of winning election contains two types of benefits, the "flow" benefits and the "option value" of winning. To see this, assume that once you retire you leave public office permanently. The "flow" benefits are associated with serving in office this period. The "option value" benefits come from having the opportunity to run for re-election next period, if the situation is favorable. Since the value of this option will depend on the level of the variables P and R , analysis based on the standard expected utility formula is strictly valid only when V is limited to the "flow" benefits and the MC does not care about what happens after next period. To analyze the

⁷The assumption that the cost of running c is random and p , the probability of victory is fixed is a helpful simplification. Under some plausible assumptions about incumbent behavior, the case where only C is random approximates the more general case where both p and c are random. To see this, suppose that costly effort (E) by the incumbent can be turned into votes, with severe decreasing returns around some high level, with the probability of victory associated with that level of votes equal to P^* . Political conditions for the incumbent in the district (" X "), combined with effort yield the observed P according to the simple relationship $X+E=P$, if $P \leq P^*$ and P^* if $P > P^*$. Assuming that given the incumbent runs, the optimal degree of effort is the corner solution $E=P^*-X$, where X is random. This implies random costs $C(E)$ will be equivalent to the case of randomly varying incumbent popularity X .

MC career decision over time, the expected utility calculation must be extended to take the effect of current decisions on future options into account explicitly.

Several simplifying assumptions are made regarding the incumbent's dynamic career decision. First, it is assumed that each period the incumbent receives an independent draw from F , the distribution of the cost of seeking office. Second, once the incumbent retires, the incumbent can no longer run for election in the future. (Retirement is an "absorbing" state.) These assumptions imply that for the incumbent, the decision to seek re-election in any period will be a function only of the current period's cost of running for re-election. Past values of c can be ignored. It can be shown that the optimal decision rule for the incumbent takes the form of a cutoff rule, with the incumbent seeking re-election to office if $c \leq c^*$, where c^* is some constant.

To find the expression for c^* , first we calculate the expected utility for an arbitrary cutoff rule, and then we use this expression to find the optimal cutoff rule.

Given the cutoff level c^* is used in the candidate career decision, the expected utility of the incumbent equals:

$$(1) U_t = F(c^*)[U_1] + (1-F(c^*))[U_2],$$

where U_1 is the expected utility for the incumbent from following the cutoff rule given the initial value of c is less than c^* , and U_2 is the expected utility for the incumbent from following the cutoff rule given the initial value of c is greater than c^* . The expected utility U_2 can be rewritten as:

$$(2) U_2 = R/(1-\delta),$$

where δ is the discount rate, assumed to be less than 1.

U_1 can be rewritten as:

$$(3) U_1 = K^* + \delta [p U_t + (1-p) R/1-\delta],$$

where $K^* = pV + (1-p)R - E(c|c < c^*)$ is the expected utility flow in the current period from following the rule of running given that $c < c^*$, and $E(c|c < c^*)$ is the expected cost of running, given the cost of running c is less than c^* .

Substituting (2) and (3) into (1) and solving for U_t yields:

$$(4) U_t = [1/1-\delta pF(c^*)](F(c^*)(K^*-R)) + R/1-\delta.$$

The first term represents the improvement the strategy c^* makes over the strategy of always retiring, which would yield $R/1-\delta$. Notice that if the discount factor equals 0, the expected utility reduces the one period problem that has been analyzed previously. Assume the utility function is continuously differentiable. Maximizing (4) with respect to c^* and simplifying yields the necessary condition for an interior maximum:

$$(5) z - c^* + \delta pF(c^*)[c^* - E(c|c < c^*)] = R,$$

where $z = pV + (1-p)R$.⁸

This can be compared to the one period cutoff value of c^* when the multi-period decision rule is expressed as the rule run for re-election if:

$$(6) p(V-R) + \delta pF(c^*)[c^* - E(c|c < c^*)] = c^*.$$

Since the second term on the left hand side is always weakly positive, the incumbent now runs at times when there is an expected utility loss in the current period. This loss is offset by expected future gains, which will be a function of factors such as the probability there will be a political future (p), and the value of the future (δ) versus the present.

This relationship can be seen clearly when (6) is expressed as the condition that:

$$(6') \delta pF(c^*) / (1-\delta pF(c^*)) [p(V-R) - E(c|c < c^*)] + p(V-R) - c^* = 0.$$

When the cutoff value is c^* , the incumbent is indifferent between running and retiring. The benefit of retiring is $c^* - p(V-R)$, while the benefit of running is equal to the geometric sum of the per period additional expected benefit from running

⁸The details of the differentiation are in the Appendix.

rather than retiring this period. Note that, given you decide you run this period, the probability you run again next period is pF , where p is the probability you win this period times the F , the probability your costs are low enough to justify running next period. The probability you will run two periods from now is equal to the probability you run next period times pF , or $(pF)^2$. The expected utility "flow benefit" associated with running in any period is $G=[p(V-R)-E(c|c < c^*)]$. Since future benefits are discounted by d , the expected gain from running rather than retiring this period is equal to the sum $\delta(pF)(G)+[\delta(pF)]^2(G)+\dots$, or $\delta pF/(1-\delta pF)[p(V-R)-E(c|c < c^*)]$. It will be assumed that the solution to the first order conditions yield a cutoff value c^* which is in the interior of the distribution of costs F . These conditions will be referred to as A1:

Assume that $V > R$, and $p > 0$.⁹ Suppose the distribution of candidate costs, F , has a support of $[C_{\min}, C_{\max}]$. Sufficient conditions insuring an interior solution are:

$C_{\min} = 0$ and the unconditional expected value of $C > p(V-R)$. The cutoff value must be $> C_{\min}$. At $c^*=0=C_{\min}$ there is a current period loss when $p(V-R) > 0$ and since $F(0)=0$, the sum of future period gains is zero. The cutoff value of $c < C_{\max}$. At $c^*=C_{\max}$ there is a current period loss (since $c_{\max} > p(V-R)$) and an expected loss from running in the future ("G" in the discussion of equation 6' is negative).

Finally, the solution to the first order conditions is the unique maximum. This is implied by the fact that whenever the first order conditions are satisfied, the utility function is concave in c^* . The calculations showing this are in the Appendix.

As the values of the parameters vary across parties, then the cutoff values, and consequently the retirement rates will vary across parties as well. This paper will study 2 party legislatures. For convenience, the parties will be referred to as Democrats and Republicans. For the Democrats, let the cutoff value of c^* be the

⁹ The assumption $V > R$ is equivalent to the assumption a politician would rather win than lose an election, given the politician has chosen to run.

value which satisfies:

$$(7) P_{id}(V_d - R) + \delta P_{id}F(c^*)[c^* - E(c|c < c^*)] = c^* ,$$

where P_{id} is the probability that an incumbent Democrat wins re-election, V_d is the value of serving one period in office to the incumbent Democrat, and R is the per period retirement wage.

Using the result that incumbents run iff $c \leq c^*$, the probability that an incumbent democrat runs is:

$$F_d = F(c_d^*),$$

where c_d^* is the value of c^* that solves (7) .

For the Republicans, the cutoff value c_r^* is the value of c^* which satisfies:

$$(8) P_{ir}(V_r - R) + \delta P_{ir}F(c^*)[c^* - E(c|c < c^*)] = c^* ,$$

where P_{ir} is the probability that an incumbent Democrat wins re-election, V_r is the value of serving one period in office to the incumbent Democrat, and R is the per period retirement wage. The probability that an incumbent Republican retires is:

$$F_r = F(c_r^*),$$

where c_r^* is the value of c^* that solves (8).

Section 2. The steady state composition of the legislature

In this Section, we calculate the steady state composition of the legislature for given retirement behavior by the parties. To calculate the expected number of Democratic seats next period, first the expected number of seats retained by the Democrats is calculated and then the expected number of seats gained from the Republicans is calculated. The probability that a seat currently held by a Democrat will remain Democratic is:

$$(9) P_d = F_d P_{id} + (1 - F_d) P_{od} ,$$

where P_{od} is the probability that an open seat that was formerly held by a Democrat stays Democratic next term.

The probability that a seat currently held by a Republican will become Democratic is:

$$(10) p_r = F_r(1 - P_{ir}) + (1 - F_r)(1 - P_{or}),$$

where P_{or} is the probability that an open seat formerly held by a Republican is Republican next term.

For the calculations in this paper the following notation will be useful. The 4 variables of the form P_{ab} , which represents the probability that given an election is incumbent contested or open ($a=i$ or o), the seat will be retained by the party that currently holds it (the current party is d or r) have already been introduced. Let $P_{id}-P_{od}=P_{ir}-P_{or}=I$, where I is called the incumbency advantage. Let $P_{id}-P_{ir}=P_{od}-P_{or}=S$, where S is called the partisan advantage. Assume when $S=0$, and $I=0$ all types of races have $P=.5$. We can then express the values of P as: $P_{id}=.5+I+.5S$, $P_{od}=.5+.5S$, $P_{ir}=.5+I-.5S$, and $P_{or}=.5-.5S$.

The values of the variables P_{ab} and I are restricted by assumption. It will be assumed that all values of P are strictly positive but less than 1. Note that this implies that $1 > p_d > 0$, and $1 > p_r > 0$. For any seat there is a chance it will change party next term. It will also be assumed that I is greater than or equal to zero. These assumptions are called A2.

Using the definition of p_d and p_r the *expected number* of Democratic seats next period is expressed as:

$$(11) \quad N_d(t+1) = N_d(t)p_d + (N-N_d(t))p_r,$$

where $N_d(t)$ is the number of Democratic seats at time t , and N is the total number of seats in the legislature.

A simplification is made. $N_d(t+1)$ is the *expected number* of seats at $t+1$, while the number of Democratic seats at $t+1$ is a random variable. The random variable "number of Democratic seats next period" is based upon the 2 binomial random variables determining the number of Democratic seats generated from currently Democratic seats, and the number of Democratic seats generated from currently Republican seats. In what follows, the fact that the number of seats next period is a random variable will be ignored: it will be assumed that this random variable equals its expectation. As will be seen later, this assumption allows considerable simplification of the problem. In what follows it is the share of seats held by each party that is important. For large legislatures the law of large numbers insures that

whenever the Democrats are expected to get more than half the seats in the legislature, they are effectively certain to be the majority next session.¹⁰

The equation describing number of Democratic seats next period can be rewritten as:

$$(12) \quad N_d(t+1) = N_d(t)(p_d - p_r) + Np_r,$$

which is a difference equation.

The solution to this difference equation is:

$$(13) \quad N_d(t) = [N_d(0) - N(p_r / (1 - (p_d - p_r)))] (p_d - p_r)^t + N(p_r / (1 - (p_d - p_r))).$$

An important feature of this equation should be observed. Note that $1 > p_d - p_r \geq 0$. That $1 > p_d - p_r$ is implied by assumption A2. That $p_d \geq p_r$ is implied by A1 and A2. To see this, recall the definitions, $p_d = F_d P_{id} + (1 - F_d) P_{od}$, and $p_r = F_r (1 - P_{ir}) + (1 - F_r) (1 - P_{or})$. Rewriting the values of "P" in terms of I and S, $1 - P_{or} = P_{od} = .5 + .5S$. Also, $1 - P_{ir} = .5 + .5S - I = P_{id} - 2I$. Substituting and simplifying, this implies that $p_d - p_r = I(F_d + F_r)$. Since A1 insures $F_d + F_r > 0$, and A2 requires $I \geq 0$, $p_d \geq p_r$.

The condition that $1 > p_d - p_r \geq 0$ has two implications; the steady state composition of the legislature N_d satisfies $N > N_d > 0$, and is stable to small perturbations.

The condition $1 > (p_d - p_r)$ implies that the steady state $N(p_r / (1 - (p_d - p_r))) > 0$. The steady state level of N_d is strictly less than N since $1 - p_d > 0$ by assumption A2. The condition that $1 > p_d - p_r \geq 0$ implies $|p_d - p_r| < 1$; this property implies the steady state is stable to small perturbations. Since $|p_d - p_r| < 1$, the distance between the steady state level of N_d , denoted N_d^* , and the initial level $N_d(0)$ is gradually shrinks to zero as t increases.¹¹

¹⁰ For cases where the expectation is a nearly equal division of the legislature, the assumption underestimates the minorities chances of becoming the majority party and so the difference in party retirement rates will be overestimated.

¹¹ The condition $p_d - p_r \geq 0$, also implies that if $N_d(0)$ is less (more) than the steady state, $N_d(t)$ will always be less (more) than the steady state.

Section 3. Equilibrium with Majoritarianism

Equation (13) defines the steady state composition of the legislature for given values of p_d and p_r . The values of p_d and p_r , however, are more properly viewed as endogenous; they are functions of the party retirement behavior, which is in turn a function of the composition of the legislature.

Treating p_d and p_r as fixed would be innocuous if V_d and V_r , the valuation of one term in office for Democratic and Republican incumbents respectively, are independent of the composition of the legislature. There is, however, reason to believe that serving in the majority party is more valuable to a legislator than serving in the minority. In the U.S. House, for example, members of the majority receive powerful committee and subcommittee chairmanships. Minority party legislators often voice frustration with their status in the legislature. As Republican House member Rod Chandler of Washington state's 8th district explained his decision to leave the House:

"I'm part of the problem. I'm moving on. It reflects a lack of confidence on my part that we'll be a majority party in the House any time soon."

The condition of a minority party legislator is captured by this description of the prospect facing Senator Bob Dole in 1986, if the Republicans lost control of the Senate: "Bob Dole had known powerlessness. He knew what it was to live in the minority, to scrape along in the opposition, scrambling to get into the papers, struggling to make a difference, on the edge of fights...knew it too well: he spent a political lifetime in that sour, still pond."¹² Less colorful, but more systematic evidence supporting the importance of majority party status in retirement patterns from the U.S. House has been reported elsewhere (Ansolabehere and Gerber 1992).

¹²The quotation is from the point of view of Dole, as presented by Cramer (1992), page 50.

Taking into account the view that service in the majority is more desirable than service in the minority, V_d can be written as:

$$(14) \quad V_d = V_1(q) + V_0(1-q),$$

where V_1 is the value of serving in the majority party, V_0 is the value of serving in the minority party, and q is the probability that the Democrats will be in the majority next term. It is assumed that $V_1 \geq V_0 > R$. The expected value of office to next terms Republicans can be written as:

$$(15) \quad V_r = V_0 q + V_1 (1-q).$$

Equations (14) and (15) link retirement rates and consequently p_r and p_d to q , the probability the Democrats are in the majority. The variable q is linked to the steady state composition of the legislature N_d in a simple way. Recall earlier that the random variable $N_d(t+1)$ is approximated by its expected value. An implication of this is that, for a given steady state number of Democrats in the legislature, q is approximated by a step function:

$$q=0 \text{ if } N_d < .5N$$

$$q=.5 \text{ if } N_d = .5N$$

$$q=1 \text{ if } N_d > .5N,$$

where N_d is the steady state number of Democrats in the legislature.

We are now ready to define the "equilibrium steady state". An "equilibrium steady state" is defined as a steady state composition of the legislature N_d that is consistent with the retirement decisions that support it. Formally, there is an equilibrium steady state N_d^* with a Democratic majority iff:

$$a. \quad N_d^* = N(p_r / (1 - (p_d - p_r))) > .5N$$

$$b. \quad p_r = F_r(1 - P_{ir}) + (1 - F_r)(1 - P_{or}),$$

where $F_r = F(c_r^*)$, and c_r^* satisfies:

$$P_{ir}(V_0 - R) + \delta P_{ir} F(c_r^* - E(c | c < c_r^*)) = c_r^*$$

$$c. \quad p_d = F_d P_{id} + (1 - F_d) P_{od},$$

where $F_d = F(c_d^*)$, and c_d^* satisfies:

$$P_{id}(V_1 - R) + \delta P_{id} F(c_d^* - E(c | c < c_d^*)) = c_d^* .$$

Parallel conditions define an equilibrium steady state with a Republican majority ($N_d^* < .5N$). It is important to notice that the equations for p_r and p_d are functions of N_d^* ; since $N_d^* > .5$, $q(N_d^*)=1$, and $V_d(N_d^*)=V_1$, while $V_r(N_d^*)=V_0$. The conditions b. and c. are the retirement patterns generated by the steady state Democratic majority (that is when $q=1$); condition a. requires that these retirement rates are consistent with a Democratic steady state majority.

Section 4. Examining equilibrium steady states

For any given values of the parameters (I, S, V_1, V_0) there will be two potential equilibrium steady states, an equilibrium with $q=1$ and an equilibrium with $q=0$. Depending on whether $q=1$ or $q=0$ in equilibrium, the values of p_d and p_r (p_d and p_r are the probability that a seat currently held by the Democrats stays Democratic after the election, and the probability a currently Republican seat turns Democratic respectively) can take on different values. Some notation is developed to aid exposition of results. When the Democrats are the majority in steady state ($N_d > .5N$), $q=1$ and $V_d=V_1$, and $V_r=V_0$. Let the values of p_d and p_r associated with this equilibrium be p_d^1 and p_r^1 respectively. When the steady state equilibrium has $N_d < .5N$, $q=0$ and $V_d=V_0$ and $V_r=V_1$. Let the values of p_d and p_r associated with this equilibrium be p_d^0 and p_r^0 respectively. The steady state value of N_d generated using p_d^1 and p_r^1 will be denoted N_d^{1*} , while that associated with p_d^0 and p_r^0 will be denoted N_d^{0*} .

In this section we examine the relationship between the parameters I, S, V_1 , and V_0 and the steady state composition of the legislature. The analysis will focus on the conditions under which parties hold a majority in the legislature.

Figure 1 shows the 4 general cases which are analyzed. Within each of the 4 cases, there are three subcases, $S > 0, S = 0, S < 0$. In Part 1 will analyze cases A, B, and C. Part 2 will analyze Case D. The objective of the analysis is to determine how the parameters effect the relationship between S , the parameter representing "partisan advantage", and the composition of the legislature. Special emphasis will be given to cases where the partisan advantage favors one party, while the other

party holds a majority of the legislature in steady state.

Part 1. Cases where there is always a unique equilibrium steady state

Proposition 1 states results for Cases A, B, and C.

Proposition 1:

If either $V_1 = V_0$ or $I = 0$ then

a. There is a unique equilibrium steady state composition of the legislature. ($N_d^{1*} = N_d^{0*}$).

b. Whenever $S > 0$ ($S < 0$), in the equilibrium steady state the Democrats (Republicans) are the majority in the legislature.

Proof:

Part a of Proposition 1:

$N_d^{1*} = N_d^{0*}$ if either $V_1 = V_0$ or $I = 0$.

Recall $N_d^* = N(p_r / (1 - (p_d - p_r)))$.

There are two cases to consider:

a. $V_1 = V_0$

If $V_1 = V_0$, then F_d , the proportion of Democrats seeking re-election, is the same for $q = 1$ and $q = 0$. F_r is also the same for $q = 1$ and $q = 0$. This implies that $p_d^{1*} = p_d^{0*}$, and $p_r^{1*} = p_r^{0*}$.

b. $I = 0$. This implies that $P_{id} = P_{od}$. Similarly, it implies $P_{ir} = P_{or}$. This implies that $p_d^{1*} = p_d^{0*}$, and $p_r^{1*} = p_r^{0*}$.

The intuition behind this result is straight forward. In case a., when V_1 and V_0 are the same, whether or not you are in the majority or not does not effect the value of office to you. This means that q does not effect your retirement decision. In particular, the equilibrium retirement rates, $1 - F_d$ and $1 - F_r$, will be the same when $q = 0$ and when $q = 1$. Since the values of the parameters S and I are the same in both steady states, the differences in retirement rates are the only potential source of difference between the two steady states. This implies that the steady state level of N_d must be the same at both steady states.

In case b., since $I=0$, the expected number of Democrats next period is independent of the retirement decisions of this period's incumbents. The probability that the Democrats win a seat is a function only of I and S , which are constant across the steady states. This means that there can be no difference between N_d^{1*} and N_d^{0*} .

Part b of proposition 1:

There are 3 cases to consider: Cases A, B and C.

a. Case A ($I=0$ and $V_1=V_0$).

Let $p=p_r/(1-(p_d-p_r))$, the steady state proportion of Democrats in the legislature.

This can be written:

$p=[A-F_r I]/[1-(F_d+F_r)I]$, where $A=(1-P_{or})$. Substituting $P_{or}=.5-.5S$, yields:

$$p=[.5+.5S-F_r I]/[1-(F_d+F_r)I].$$

Since $I=0$, $p=[.5+.5S]$. If $S>0$ (<0) implies that the steady state will have a Democratic (Republican) majority.

b. Case B ($I=0$ and $V_1>V_0$).

Since $I=0$, $p=[.5+.5S]$. This is the same as in a.

c. Case C ($I>0$ and $V_1=V_0$).

From a., the steady state proportion of Democrats can be written as

$p=[.5+.5S-F_r I]/[1-(F_d+F_r)I]$. In contrast to a., and b., since $I>0$, the retirement rates do not disappear from this expression. A few steps of algebra reveals that $p > (=) .5$ iff:

$$S > (=) (F_r-F_d)I.$$

In Case C it is assumed that $V_1=V_0$. This implies that the decision to seek re-election is independent of q (the probability the Democrats are in the majority next term). It can be shown that F_r-F_d strictly decreases in S .¹³ This is not surprising, as partisan shifts toward the Democrat (increases in S) raise the Democrats

¹³See appendix 2.

probability of victory and lower the Republicans probability of victory. Since at $S = 0$, $F_d = F_r$ it must be that $S > 0$ implies $F_d > F_r$. For $I > 0$, this implies $p > .5$. Analysis of the case for $S < 0$ is similar; $S < 0$ implies that $p < .5$.

Proposition 1 shows that, when there is no incumbency advantage, or the legislature is not majoritarian, partisan preferences are faithfully represented by the majority composition of the legislature. In case C, where there is no majoritarianism, but there is an incumbency advantage, an incumbency advantage does not allow a party out of favor with the voters to remain in power indefinitely. This confirms the intuition of those who argue that incumbency can not explain the Democrat's "permanent lock" on the U.S. House. An incumbency advantage alone is clearly not a sufficient condition for a party with a partisan disadvantage to stay in the majority. Proposition 1 implies that $I > 0$ and $V_1 > V_0$ are both necessary conditions for there to be equilibria where the partisan advantage favors one party, but the other party has a steady state majority (i.e. $S > (<) 0$ and $P < (>) .5$). Part 2 examines the conditions under which $I > 0$, and $V_1 > V_0$ are sufficient to generate this event.

Part 2. Cases where there may be multiple equilibria

Proposition 2 states results for Case D.

Proposition 2:

If both $V_1 > V_0$ and $I > 0$ then

- a. There may be multiple equilibrium steady state compositions of the legislature.
- b. When $S = 0$, there will always be two equilibria. Whenever $S > 0$, there will an equilibrium steady state with the Democrats in the majority in the legislature. If $S > 0$, and S is "small", there will also be an equilibrium steady state with the Republicans in the majority in the legislature.¹⁴

¹⁴Parallel conditions hold when $S < 0$.

Part a of proposition 2:

A necessary condition for multiple equilibria is that $N_d^{1*} > N_r^{0*}$. This condition is satisfied for Case D ($V_1 > V_0$ and $I > 0$).

If both $I > 0$ and $V_1 > V_0$, then $N_d^{1*} > N_d^{0*}$.

Proof:

Let $p^1 = p_r^1 / [1 - p_d^1 + p_r^1]$, and let $p^0 = p_r^0 / [1 - p_d^0 + p_r^0]$.

$N_d^{1*} > N_d^{0*}$ is equivalent to $p^1 > p^0$. Since the denominators of p^1 and p^0 are positive, this is equivalent to the condition:

$$p_r^1(1 - p_d^0) > p_r^0(1 - p_d^1).$$

Since each of the terms is strictly positive (assumptions A1 and A2 assure this), the inequality is true if $p_d^1 > p_d^0$ and $p_r^1 \geq p_r^0$. Recall that p_d can be written as $p_d = P_{od} + F((V_d - R)P_{id})I$. For the steady state where $p_d = p_d^1$, $V_d = V_1$. For the steady state where $p_d = p_d^0$, $V_d = V_0$. Assume that $F(c_d^*)$ strictly increases in V_d .¹⁵ Then $p_d^1 > p_d^0$ if $I > 0$ and $V_1 > V_0$. The probability p_r can be written $p_r = P_{od} - F((V_r - R)P_{ir})I$. For the case p_r^1 , $V_r = V_0$. For the case p_r^0 , $V_r = V_1$. By a similar argument as above, $p_r^1 \geq p_r^0$, with strict inequality if $I > 0$ and $V_1 > V_0$.

Part b of proposition 2:

In understanding the conditions under which different possibilities occur, the key equation is:

$$p > (=) .5 \text{ iff } S > (=) (F_r - F_d)I. \text{ }^{16}$$

First, consider the case when $S=0$. Since p takes on distinct values depending upon whether $q=1$ or $q=0$, both these possibilities are examined to see if the steady state p associated with is an equilibrium.

When $q=1$, if $S=0$ (which implies $P_{id} = P_{ir}$), it is easy to see $V_1 > V_0$ implies $F_d > F_r$. Since $I > 0$, this implies $S > (F_r - F_d)I$ and therefore $p > .5$. There is an

¹⁵This is shown in Appendix 2.

¹⁶See proof of Prop 1, part b for the derivation of this condition.

equilibrium with $q=1$ for $S=0$, when $I > 0$ and $V_1 > V_0$.

When $q=0$, if $S=0$, $F_d < F_r$. Following similar logic as above, this implies that there also exists an equilibrium with $q=0$ for $S=0$. Therefore when $S=0$ there are two equilibria; one with a Democratic majority, and one with a Republican majority.

This illustrates an interesting feature of legislatures with majoritarianism ($V_1 > V_0$) and an incumbency advantage ($I > 0$). It may be the case that while the public is indifferent between the Democrats and Republicans ($S=0$), one party may enjoy persistent majority status in the legislature. In fact, even when the public prefers the Democrats, there may be a persistent Republican majority. To see this, we next explore the composition of the legislature when $S > 0$.

Consider the case where $S > 0$. Again, there are two possible equilibria; $q=1$ and $q=0$. Suppose $q=1$. Given $S > 0$, this implies that $F_d > F_r$. This implies that $p > .5$, so there is a steady state equilibrium with $q=1$. Is there an equilibrium with $q=0$? Consider again the case where $S=0$. From analysis of the case where $S=0$, we know that when $S=0$, $q=0$ implies $F_r > F_d$. Therefore when $S=0$, $(F_r - F_d)I = W(S) > 0$. Recall $W(S)$ is strictly decreasing in S . The continuity of $W(S)$ insures that there exists a neighborhood of values of S , $S > 0$ around $S=0$ for which $(F_r - F_d)I = W(S) > S > 0$. This implies that there will always exist an equilibrium steady state with $q=0$ for some $S > 0$, for S sufficiently close to 0.

Proposition 2 shows that an incumbency advantage, combined with majoritarianism, is sufficient to generate cases where the party with the partisan advantage is permanently in the minority. The intuition about the role of incumbency in the perpetuation of the majority party is now refined; incumbency is necessary, but not sufficient. It must be combined with institutional features of the legislature. More generally, Proposition 2 shows that it is possible that the relationship between the voter's partisan preferences, as expressed by S , and election outcomes, as expressed by p , may be distorted by the career decisions of the legislators.

3. Equilibria where the partisan favorite is the minority party

Proposition 2 shows that it is possible that $S > 0$ while $p < .5$. Under what conditions is this likely to occur? This subsection addresses this question.

A final set of results concerns the conditions under which $S > 0$, but the Republicans are the majority party in steady state. These results are stated in Proposition 3.

Proposition 3:

a. If $V_1 > V_0$ and $I > 0$ there exists a unique value of S, S^* , such that for all $S < S^*$ there is an equilibrium steady state composition of the legislature with a Republican majority. Additionally, $S_* > 0$.

b. $dS^*/d(V_1 - V_0) > 0$

c. $dS^*/dI > 0$ if $f(c_r^*)$ is not too much smaller than $f(c_d^*)$

Proof:

Part a.

Part a. states that there is a unique "cutoff" value S^* . For there to be an equilibrium steady state with $q=0$ (a republican steady state majority), it must be the case that: $(F_r - F_d)I = W(S) > S$.

The right-hand side increases as S increases. The left-hand side strictly decreases in S . This is because F_r strictly decreases in S , and F_d strictly increases in S . This implies that $W(S) = S$ at most only once. To show that they are equal for some S , it is sufficient to show that $W(S) > S$ for some S , and $W(S) < S$ for some S .¹⁷

Since $q=0$, (and $V_1 > V_0$) $W(S) > S$ at $S=0$. This follows from the fact that the proportion of the majority party running for re-election F_r will exceed F_d , the proportion of the minority party running for re-election. There exists a value of S

¹⁷ $W(S)$ is continuous.

for which $S > W(S)$ since $W(S)=(F_r-F_d)I$ is bounded.¹⁸

Part b and c describe how the critical value S^* varies with the parameters V_1 , V_0 , and I .

Part b and c.

To examine how S^* varies with I and V_1-V_0 (the strength of majoritarianism in the legislature), the implicit function theorem is applied to the equation:

$(F_r-F_d)I-S=0$. The details are contained in Appendix 2.

The result that as the importance of majoritarianism increases, the cutoff S^* increases follows from the affect of majoritarianism on retirement decisions. Holding S constant, stronger majoritarianism causes more Republicans to run, and fewer Democrat to run. This raises the Republican share of the legislature. S^* adjusts to keep the Republican share of the legislature constant after the increase in (V_1-V_0) . Increasing S reduces the Republican's share of the legislature; a higher value of S decreases the Republican victory rate in all elections, raises the number of Democrats running for re-election, and lowers the number of Republicans seeking reelections.

Subject to the conditions of the distribution of candidate costs, increasing I will increase S as well. Holding S constant, increasing I has two effects:

Effect 1. Holding the retirement rates constant, since there are more Republican incumbents than Democratic incumbents running for re-election, increasing I will increase the Republican's share of the legislature.

Effect 2. In addition, raising I will change the retirement rates of the parties. Raising I increases the proportion of incumbent's seeking re-election from both

¹⁸There is a technical qualification to this. Since assumption A2 also places bounds on S , it is possible that when S reaches its maximum, $W(S) > S$. This case is of little practical significance; it represents a "corner" situation where there is an equilibrium with a Republican majority despite partisanship favoring the Democrats to the maximum degree possible. In the comparative statics, it is assumed that S^* is interior (i.e. is less than the maximum value allowed by A2).

parties.¹⁹ It can be shown that the "cutoff value" for the Republican's increases more than the "cutoff value" for the Democrat's. While this is true regardless of the value of δ , the explanation of why the Republican increase is larger is easily seen when δ is low. When δ is small, raising the probability of victory for the incumbent raises the expected value of running by $(V-R)$; this is a larger increase for the Republican's since they are the majority party.²⁰

The effect of increasing c_r and c_d on the retirement rates depends upon the density of F at the equilibrium cost levels. The increase in c_r in response to an increase in I is always larger than the increase in c_d , but the decrease in the Democratic retirement rate may be larger if $f(c_d)$ is sufficiently larger than $f(c_r)$. If F were uniform, the second effect would re-enforce the first effect, and increasing I would raise the Republican share of legislature when S is held constant. To sum up, increasing I will raise the Republican share of the legislature unless $f(c_d)$ is sufficiently larger than $f(c_r)$ to make Effect 2 negative, and a large enough negative value to outweigh Effect 1.

S^* adjusts to keep the Republican share of the legislature constant after the increase in I . Subject to conditions on f , a higher value of I raises the Republican share of the legislature. Increasing S reduces the Republican's share of the legislature and so the response to higher levels of I will be an increase in S^* .

Finally, preliminary analysis of the effects of raising both V_1 and V_0 by the same amount was performed. It can be shown that, if $f(c_r)$ and $f(c_d)$ are similar in size,

¹⁹Earlier work considered an additional effect of raising I . By increasing the probability that the current majority party remains in the majority after the next election, an increase in I may have an asymmetric effect on party retirements: it may encourage majority party candidates to run for re-election, while discouraging minority party candidates. In the current paper, this effect is not present, since it is assumed that the probability that the majority party stays in the majority is not effected by increasing I . For details about the potential asymmetric effect of increasing the incumbency advantage, see Ansolabahere and Gerber (1992).

²⁰The expected value of running when $\delta=0$ is $pV+(1-p)R$, where p is the probability of incumbent victory, V is the value of office, and R is the value of retirement.

and δ is small, then raising V_1 and V_0 together will lower S^* . This follows from the fact that, under the conditions stated, equal increases in the value of office cause a larger decrease in retirement among the minority party than among the majority party.²¹

Proposition 3 examines when the composition of the legislature is likely to deviate from the partisan preferences of the voters. As long as there is some degree of majoritarianism, and some incumbency advantage, it is possible that the majority in the legislature will be held by the less favored political party. If the voters have only weak partisan preferences, then there will always be an equilibrium where the legislative majority is held by the less favored party. As the legislature becomes more majoritarian, stronger voter preferences may be associated with a majority that is less favored. Similarly, as the incumbency advantage increases, stronger levels of voter preference may co-exist with a majority held by the less popular party.

Section 5. Conclusions

The analysis in this paper has a number of significant implications.

First, the institutional arrangements which result in incumbency advantages and majoritarianism have an important effect on the way in which partisan preferences are translated into the composition of the legislature. While many papers have been written trying to gauge the magnitude of the incumbency advantage, there has been less formal analysis of its consequences. This paper isolates an important new consequence of incumbency advantages; incumbency can lead to a steady state legislature with a majority of the seats held by a party that the voters do not prefer. It should be emphasized that this is not a "temporary effect" due to the fact that an incumbency advantage helps even the incumbent of an unpopular party to win re-election. It is a steady state effect that works through the differential retirement rates for majority and minority parties.

²¹The conditions on f and δ are sufficient for the result, not necessary.

In particular, this paper sheds light on role of incumbency in the "Democratic lock" on the U.S. House. It challenges the opinion that incumbency can not be responsible for the persistence of the Democratic majority in the House. Those who dismiss the role of the incumbency advantage in explaining the persistent Democratic majorities are only partially correct. As the results show incumbency alone could not explain sustained Democratic majorities, but incumbency together with majoritarianism can lead to persistent legislative majority even if the partisan preferences of the voters do not favor the legislative majority party.

The analysis presented here has isolated an overlooked channel through which the incumbency advantage works. An incumbency advantage plays two roles: it makes retirement decisions matter for the composition of the legislature, and it makes the legislature tomorrow look like the legislature today. If the value of serving in the minority is less than the value of serving in the majority, then retirements will be higher in the party that expects to be in the minority. If your party is in the majority today, assuming the retirement rate in your party is not greater than minority party retirements, you will be in the majority tomorrow. Assuming that no other factor are at play, this assures that retirements in your party will actually be at a lower rate than those from the minority party.

Retirement patterns matter when there is an incumbency advantage, since when a member of your party retires your party forgoes the incumbency advantage in that election. This implies that the higher rate of minority party retirement can prevent the minority party from gaining ground, even if the two parties are win equal numbers of open seat election. As shown in Propositions 2 and 3, the incumbency advantage, when combined with majoritarianism, can result in steady state legislative majorities from one party, when voters the other party.

Second, the analysis provides a new perspective on the causes of divided government. There is a detailed literature on the causes of divided government in the United States. One important line of argument posits that voters split their ballots in order to balance a legislature controlled by one party with a President of

the opposing party.²² In the analysis here divided government may occur as a by product of the partisan preferences of voters, the political advantages of incumbency, and the career decisions of legislators.

In this paper, voters have partisan preferences, and preferences for incumbent representatives, which may be assumed to apply equally to both the legislature and the executive. Divided government can emerge as a consequence of the equilibrium steady state in which the public prefers one party, but the other party holds a majority in the legislature.

For example, in the case where $S < 0$ (voters favors the Republicans), there may be a Democratic Congress, but voters selecting between 2 non-incumbents for President will tend to elect a Republican. This explanation of divided government has some satisfying features. It places minimal demands on the voters; they just vote for the candidate they prefer in each election, without a need to know any other features of the political landscape. Also, this theory has is that it predicts that extended periods of divided government will coincide with a high incumbency advantage. This roughly coincides with the facts regarding the recent experience with divided government and the incumbency advantage in the United States.

Third, the model provides an important role for history. When there is an incumbency advantage and majoritarianism, there will be a range of values of voter preferences (S) that generate multiple equilibria. If S is in this range, which equilibria prevails is a matter of historical accident. In order to appreciate the full implications of this point, additional analysis of the dynamics of the legislatures composition out of steady state would need to be performed. Intuitively, the existence of multiple steady states implies that, when a party suffers a "temporary setback" in the legislature due to scandal (Watergate, for example), this may have more permanent effects. The loss of seats may cause a switch to a new legislative

²² See Fiorina 19XX. For another model in which voters engage in moderating behavior see Alesina and Rosenthal 19XX.

equilibrium even without any change in the long run values of S , I , and V .

Finally, the model suggest a role for parties. In the model, the decision to seek re-election or retire is made by each legislator independently. Since the value of office is a function of the composition of the legislature, there are important externalities to the decision of the individual MC. There may be a role for the political party to transfer resources to MC's who might otherwise retire, to encourage them to stay in the legislature, since this will yield benefits to all members of the MC's party. This type of activity will be subject to the familiar difficulties associated with collective action. A second role for the party may be present in the cases where there are multiple equilibria. The political party might try to co-ordinate the behavior of party members to achieve the more favorable steady state outcome.

There are a number of additional topics and possible extensions of the model. One of the most active areas of legislative reform involve efforts to limit the terms of politicians. It would be interesting to know what the model could add to our understanding of the effects of term limitations. It is possible that term limitations may have more subtle effects than those usually considered. The most evident effect of term limits would be some equalization of retirement rates, as the term limits are more likely to hit members of the party with the lower voluntary retirement rate. This is the "first round" effect. The model here suggests a "second round" effect may be important. In the multiple equilibria case, reducing the retirement differential between the parties may eliminate one of the equilibria altogether. Recall that the key condition for maintaining an equilibrium with the majority party in the legislature different from the party with the partisan advantage: the differential in retirement rates times the incumbency advantage must be larger than the out-of-power party's partisan advantage. Therefore reducing the differential in retirement rates could generate a major swing in the composition of the legislature, even if the number of legislators effected by the "first round" effect is small. This second round effect has been overlooked by analysts of the effects of term limitations, who have

generally ignored the issue of endogenous retirement decisions.

Before concluding, it should be recognized that like all simple models of complex things, much is left out and many things that are included have been drastically simplified. Some important features of the model are simply assumed and not derived from more primitive assumptions about voter preferences and candidate objectives. The model has focused on the narrower question of how rational politicians make their career decisions, and how the externalities associated with these decisions affect the way partisan preferences of the electorate are translated into the composition of the legislature. As noted in the introduction, political competition is treated in reduced form fashion. The incumbency advantage and the partisan advantage are assumed to be fixed and exogenous. Extending the model to explicitly incorporate voter behavior, and to include strategic platform decisions by political parties is left for future work. Given the different perspectives on modelling voter and party behavior, especially, voter behavior, careful consideration of the implications of different approaches for the conclusions outlined in this paper is important and requires substantial additional attention.

The career decision of the legislator is simplified as well. The legislator decides to run for re-election or retire. The possibility of retiring to run for higher office is not considered, though this would effect the results only if these opportunities differed systematically across the parties. The value of office is assumed to be a function of whether you are in the majority or minority. While there is widespread belief that this is so, there has been no attempt to "endogenize" this feature of legislative life. It is hoped that the important substantive implications generated by this analysis, which is based upon this assumption, will lead to more detailed consideration of the assumption, and its shortcomings.²³

Finally, the analysis here has focused on understanding steady states. More detailed consideration of the dynamics of adjustment may lead to additional insights

²³In addition, some important features of the legislative career, such as seniority, are ignored

regarding the role of incumbency advantages. The size of the incumbency advantage, for example, will have an effect on the speed with which the composition of the legislature converges to steady state.

APPENDIX

The first and second order conditions.

The utility function is:

$$U_t = [1/1-\delta pF(c^*)](F(c^*)[p(V-R)-E(c|c < c^*)]) + R/1-\delta.$$

$$dU/dc^* = [1/1-\delta pF(c^*)]^2 [-\delta pf(c^*)][(F(c^*)[p(V-R)-E(c|c < c^*)]) + [1/1-\delta pF(c^*)][f(c^*)][p(V-R)-c^*]] = 0$$

Multiply the left hand side by $[1-\delta pF(c^*)]^2$ and simplify for the solution to the first order conditions.

To see that whenever the first order conditions are satisfied the objective function is concave, write the first order conditions as:

$$[f/[1-\delta pF]^2] [p(V-R)-c + \delta pF[c^*-E(c|c < c^*)], \text{ where } f=f(c^*) \text{ and } F=F(c^*).$$

Since the second term equals zero by the first order condition, the sign of U'' is the sign of

$$[f/[1-\delta pF]^2] [-1 + \delta pF], \text{ which is less than } 0 \text{ if } 1-\delta pF > 0, \text{ which is true.}$$

Appendix 1

Some of the algebraic simplifications.

$$\begin{aligned} p_r &= F_r(1-P_{ir}) + (1-F_r)(1-P_{or}) \\ &= F_r(1-P_{or}-I) + (1-F_r)(1-P_{or}) \\ &= -F_r I + (1-P_{or}) \\ &= -F_r I + .5 + .5S \end{aligned}$$

$$\begin{aligned} p_d &= F_d(P_{id}) + (1-F_d)(P_{od}) \\ &= F_d(P_{od} + I) + (1-F_d)(P_{od}) \\ &= P_{od} + F_d I \\ &= F_d I + .5 + .5S \end{aligned}$$

$$p = p_r / (1-p_d + p_r)$$

$$p = (.5 + .5S - F_r I) / (1 - I(F_d + F_r))$$

$$p > .5$$

$$.5 + .5S - F_r I > .5 - .5I(F_d + F_r)$$

$$.5S + .5IF_d + .5IF_r > F_r I$$

$$.5S + .5IF_d - .5IF_r > 0$$

$$S + I(F_d - F_r) > 0$$

$$S > (F_r - F_d)I$$

Appendix 2

Comparative Statics

A1 and A2 are assumed.

(A1 and A2 require that $V_0 > R$, $1 > F(c^*) > 0$, $I \geq 0$, and all values of $1 > P_{ab} > 0$.)

Preliminaries to Proposition 3

The comparative statics will require the calculation of how changes in the exogenous variables effect the retirement rates of the parties. The retirement rates for the parties, F_d and F_r are determined by the cutoff values c_d and c_r respectively.

Equation (7) defines the cutoff for Democratic Incumbent's:

$$P_{id}(V_d - R) + \delta P_{id}F(c^*)[c^* - E(c|c < c^*)] = c^*,$$

$$\text{where } E(\cdot) = [1/F(c^*)] \int_{c_{\min}}^{c^*} x f(x) dx.$$

This can be rewritten as:

$$G(c^*, S, V, I) = P_{id}(V_d - R) - c^*(1 - \delta P_{id}F(c^*)) - \delta P_{id} \int_{c_{\min}}^{c^*} x f(x) dx = 0$$

To determine the effect of changing $S, I,$ and V_d on the Democrats cutoff value, the implicit function theorem is applied to this equation. The calculations organized as 1-4 below are the partial derivatives of $G(\cdot)$.

$$\begin{aligned} 1. \partial G / \partial c^* &= -(1 - \delta P_{id}F(c^*)) - c^*(-\delta P_{id}f(c^*)) - \delta P_{id}c^* f(c^*) \\ &= -[1 - \delta P_{id}F(c^*)] . \end{aligned}$$

Therefore $\partial G / \partial c^* < 0$ since P_{id} , and $F(\cdot)$ are all < 1 by assumptions A1 and A2, and $\delta < 1$.

This implies that the direction of the "comparative static" for the variables $I, S,$ and V will be the sign of the partial derivative of G with respect to $I, S,$ or V .

$$2. \partial G / \partial S = .5[(V_d - R) + \delta F(c^*)(c^* - E(c^*|c < c^*))].$$

The derivative $\partial G / \partial S > 0$ since $(V_d - R) > 0$ and $(c^* - E(c^*|c < c^*)) > 0$ for any c^*

in the interior of the support of F.

$$3. \partial G / \partial I = [(V_d - R) + \delta F(c^*)(c^* - E(c^* | c < c^*))].$$

The derivative $\partial G / \partial I > 0$ since $(V_d - R) > 0$ and $(c^* - E(c^* | c < c^*)) > 0$ for any c^* in the interior of the support of F.

$$4. \partial G / \partial V_d = P_{id} > 0.$$

The results are similar for the Republican cut off value. It can be shown that c_r^* :

1. Decreases in S
2. Increases in I
3. Increases in V_r

Proposition 3

$$c. \partial S^* / \partial I > 0$$

$$\text{Recall } H(S^*, I, Z) = S^* - (F(c_r) - F(c_d))I = 0.$$

$$\partial H / \partial S = 1 - I[f(c_r)(\partial c_r / \partial S) - f(c_d)(\partial c_d / \partial S)]. \text{ From the comparative statics } (\partial c_r / \partial S) < 0 \text{ and}$$

$$(\partial c_d / \partial S) > 0. \text{ This implies that } \partial H / \partial S > 0.$$

$$\partial H / \partial I = (F_d - F_r) - I[f(c_r)(\partial c_r / \partial I) - f(c_d)(\partial c_d / \partial I)].$$

Since $\partial H / \partial S > 0$, $\partial S^* / \partial I > 0$ if $\partial H / \partial I < 0$. Assume $f = \text{constant}$. Then $\partial H / \partial I < 0$ if $\partial c_r / \partial I > \partial c_d / \partial I$. From earlier calculations,

$$\partial c_d / \partial I = [(V_0 - R) + \delta F(c_d)(c_d - E(c_d))] / [1 - \delta P_{id} F(c_d)] = [c_d / P_{id}] / [1 - \delta P_{id} F(c_d)].$$

$$\partial c_r / \partial I = [(V_1 - R) + \delta F(c_r)(c_r - E(c_r))] / [1 - \delta P_{ir} F(c_r)] = [c_r / P_{ir}] / [1 - \delta P_{ir} F(c_r)].$$

Since $S = (F_r - F_d)I$ and $S > 0$, then it follows that $c_r > c_d$ and $P_{id} > P_{ir}$. This implies that

$\partial c_r / \partial I > \partial c_d / \partial I$ if $P_{ir} F_r \geq P_{id} F_d$. Substituting in the definitions of P_{ir} , and P_{id} , this condition can be written as:

$$F_r [.5 - .5S + I] > F_d [.5 + .5S + I]$$

$$[F_r - F_d] [.5 + I] > [F_r + F_d] [.5S].$$

Using the equilibrium condition,

$$[F_r - F_d] [.5 + I] > (F_r - F_d)I = S \geq [F_r + F_d] [.5S].$$

Since it is always true that $\partial c_r / \partial I > \partial c_d / \partial I$, a constant f is a sufficient condition

for the result. What is necessary is that f_d not be too much greater than f_r .

b. Let $V_1 = V + \alpha/2$, and $V_0 = V - \alpha/2$. Then $V_1 - V_0 = \alpha$.

$\partial H / \partial \alpha = -.5I[f(c_d)[\partial c_d^* / \partial V_0] + f(c_r)[\partial c_r^* / \partial V_1]] < 0$, by the results of the results contained in the "preliminaries to proposition 3".

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	$I = 0$	$I > 0$
$V_1 = V_0$	CASE A	CASE C
$V_1 > V_0$	CASE B	CASE D

Figure 1

Chapter Four

The Adoption of the Secret Ballot

As the Nation emerged from the dislocations of the Civil War, the political system was changing as well. Within a decade and a half, vigorous two party competition prevailed throughout much of the country. The money flowing to political parties from levies on the salaries of patronage appointments, and percentages from government contracts and franchise awards, fueled the increasingly expensive politics of the 1880's. By the 1880's politics throughout most of the country was dominated by the two political parties, organized and financed to an unprecedented degree. The basic rules covering political competition, however, originated in a very different political era. Specifically, the rules of voting that were in use before the ballot reforms of the late 1880's and early 1890's dated back to the ante bellum period.

Section 1 Introduction

This paper will examine the origin of the ballot reforms which occurred in most states between 1888 and 1891. The reforms, called the adoption of the "Australian ballot" after the country whose voting rules served as a model, enacted the secret ballot throughout most of the country.¹ An analysis of the ballot reform will

¹This paper will focus on the fact that the Australian ballot was a secret ballot, and contrast this with the public voting that prevailed before its adoption. For a discussion of

attempt to answer the question: What caused the secret ballot movement to succeed?

Traditional accounts of the enactment of the secret ballot appear somewhat paradoxical. Conventional explanations focus on the agitation of reform groups, "all standing outside the normal two-party system...".² This account stands in sharp contrast with one of the main themes of the political history of the late 19th century, the concentration of political power in party organizations and "political machines". Given the power of the parties, how did these outside interests prevail?

This paper will argue in favor of a revisionist hypothesis that the political reforms were not the product of reformist agitation; the secret ballot was adopted because it was favored by the powerful political parties of the day, the very parties who were engaged in the "abuses" that the secret ballot prevented. The political "machines" may actually have benefitted from the sharp reduction in vote buying that followed the adoption of the secret ballot.

How did this work? The secret ballot eliminates the ability of a vote buyer to verify how the voter actually casts his ballot, and therefore the incentive to bribe the voter will disappear. While this would harm a political party if the other party could continue to bribe effectively, when both parties must act under the new regime simultaneously, they may both be better off when the ability to bribe is limited. This explanation of the adoption of the electoral reform runs counter to the standard account of the adoption of the ballot reforms, which gives centrality to the actions of political reformers, and neglects the interests of the political parties.

another aspect of the Australian ballot reform, that it initiated the official ballot listing the candidates of all recognized political parties, see Rusk. Rusk argues that the Australian ballot increased split ticket voting.

²The quotation is from Argersinger (1992), page 53. Argersinger cites the influence of several different reform groups, while Fredman (1968) emphasizes the activity of the "mugwumps". For a more detailed account of the proponents of the secret ballot, see Fredman (1968) and Argersinger (1992), especially Chapter 2 and pages 52-57. For the motivations of the reformers, see Fredman, Argersinger and also Kousser (1974), especially pages 52-53.

A second puzzling feature regarding the adoption of the secret ballot is its timing. Historical developments leading up to the adoption of the secret ballot made the votes purchased by political organizations especially valuable; after the Civil War government spending and regulation of economic activity was high and increasing, and elections were closely fought. Suppose that within a jurisdiction one of the two parties had the more efficient campaign organization and was therefore able to turn bribes into votes at lower cost. Intuition might suggest that as votes become more valuable the efficient campaign organization will be less likely to support shifting to the secret ballot; when winning over voters is more important any source of advantage would be more important as well.

It will be shown that this intuition, while appearing plausible, is in fact misleading. The strategic responses of the parties may actually lead to the opposite result; as the value of additional votes increases the more efficient party actually switches from preferring the "open ballot" to preferring the secret ballot.³

This paper constructs and analyzes a model of political competition, comparing the utility of the political parties under the electoral regime before and after the adoption of the Secret ballot. Section 2 provides historical background. This section describes the important changes in the political environment and details the voting procedures in effect before and after the adoption of the Australian ballot. The goal of Section 2 is to motivate the model presented in Section 3. Section 3 constructs a simple model of political competition. Section 4 characterizes the equilibrium behavior of the parties. Section 5 calculates the equilibrium utility level of the parties under the open ballot regime. Sections 6 and 7 compare the equilibrium outcome for the parties under different ballot regimes, and examines how the relative desirability of the open ballot regime changes as the value of office

³The electoral regime before the adoption of the secret ballot will be referred to as the "open ballot". Section 2 provides details of voting rules before and after the Australian ballot reform.

changes and as elections become more competitive. Section 8 reviews the paper's main findings and discusses some of the implications of the results as well as topics for future investigation.

Section 2 Historical Background

A. The changing political environment

This paper emphasizes two important changes which occurred during the period preceding Ballot reform: 1. the major expansion of the public sector, and 2. the increase in the competitiveness of elections.

1. The size of the public sector

The level of government spending was much greater after the Civil War than before it, and continued to grow in the decades following the War.

The federal government grew quickly during the decades after the Civil War. The federal bureaucracy consisted of 26,000 employees in 1850; by 1871 it had doubled to 51,000, and doubled again to 100,000 in 1881. In 1891 the total reached 157,000.⁴ The nominal expenditure level by the Federal government increased by eight times between 1850 and 1890, while the price level increased by only 10%.⁵

Growth in the number of public offices took place at the state and local level as well. Keller reports that by the 1870's Pennsylvania county officials included "inspectors of flour, lumber, domestic spirits, sole and harness leather, banks, petroleum, illuminating gas, pickled fish; auctioneers, slaters of weights, measures railroad policemen, county marshalls, quarantine masters; and a multitude of other place holders."⁶ In addition to patronage positions in government, large

⁴The totals are for Paid Civilian Employment of the Federal Government, Series Y 308-317, Historical Statistics of the United States (1975), page 1103.

⁵Federal Budget Expenditures (in thousands) were 1850:39,543; 1870:309,654; 1890:318,041. The Consumer Price Index for these years was 1850:25; 1870:38; 1890:27. The source of these statistics is Historical Statistics of the United States, Series E 135-166 and Series Y 335-338.

⁶The case of New York city provided an example of the level of Government activity. In New York City it was estimated that one in twelve household heads had a public position.

government contracts and valuable municipal franchises were awarded. Ornate public buildings were constructed at corruption inflated costs. Notorious among these was the New York Court House, the construction of which cost four times as much as Britain's Houses of Parliament. (Keller,240)

2. The competitiveness of elections

The political situation in the 1880's was characterized by balanced competition between the Democrats and Republicans throughout most states and at the national level.

The Presidential elections of 1880, 1884 and 1888 were among the closest in U.S. history. The difference in the popular vote for the major party candidates in these elections was less than 40,000 votes in 1880 and 1884, and under 100,000 votes in 1888.⁷

In addition to national balance, intense two party competition prevailed at the state level as well. As Keller describes the political environment during the period in which ballot reform was adopted; "The close national balance between the major parties during the 1880's made it necessary to bring out the votes of the largest number of potential supporters...This was especially (important) where party balance was very close. Indiana, New York, Connecticut, and New Jersey were the most evenly divided states of the period. But interparty competition was keen in New Hampshire, Pennsylvania, Maryland, North Carolina, Ohio, Illinois, Michigan, Wisconsin, Minnesota, Wyoming, Montana, Oregon, and California as well."(Keller, p533) In the state with the largest number of electoral votes, New York, the average difference between the winner's percentage of the vote and the loser's

One "opponent of efforts to prohibit civil servants from participating in politics pointed out that there were more than 140,000 federal, state, and local officeholders in New York--about one in eight voters." (Keller, 239)

⁷The electoral vote margins were also quite narrow. The electoral vote total for the 1880, 1884 and 1888 elections were 214 to 155, 219 to 182 and 233 to 168 respectively.

percentage of the vote in the 3 Presidential elections of the 1880's was 1%, or a little over 10,000 votes. In the next two largest states, Ohio and Pennsylvania, elections were very close as well.⁸

B. The ballot reform

This section describes the electoral institutions before and after the introduction of the Australian ballot.

1. Voting before the adoption of the Australian ballot

In the era preceding the Australian Ballot reform, states did not provide an official ballot to the voter. Instead, the voter would come to the voting place with a ballot that had been prepared beforehand, listing candidates the voter wished to vote for. The voter would then place the ballot in a ballot box. Theoretically, the voter could prepare this ballot himself; in practice the voter received a ballot, or "ticket", printed in advance by his preferred political party, which a party representative would hand out to voters at the polling place. The party tickets were prepared in a manner designed to make it easy to see which party the voter voted for. Often parties used tickets with different colors or patterns. The following situation was typical: "In a municipal election in Massachusetts the Republicans used a red ticket and the opposition a blacken; in the same state in 1878 the Republican ticket had a flaming pink border which threw out branches toward the center of the back, and had a Republican endorsement in letters half an inch high."(Evans,7) Some regulation of the coloration of party tickets was attempted in a few states, but the efforts appear to have been half-hearted and failed to make the tickets indistinguishable (Evans, 8 and 10-11). In addition to the easily distinguishable party ballots, a party official could have uninterrupted view of the voter from the time he received the party's ticket until the time he deposited it into

⁸For the three Presidential elections in the 1880's the average percentage of the two party vote recieved by the winning party in Ohio was 52%, and in Pennsylvania was 54%. The average victory margin in Ohio was 30,000 votes, and the average victory margin in Pennsylvania was 65,000.

the ballot box (Evans,11).

The effect of these election practices was that the ballot was not secret. Though accounts of bribery are by their nature anecdotal, there is substantial reportage of widespread bribery in the pre-reform period. Votes were not cheap, and vote buying was prevalent in both cities and rural areas. Votes appear to have been worth several dollars each.⁹

The institutional regime in effect before the adoption of the Australian ballot will be referred to as the "open" ballot.

2. Voting after the Australian ballot reforms

The ballot reforms adopted in 35 states between 1888-1891 had two basic characteristics. While there was some variation across states in the exact form of the new ballot, and there was also variation in the enforcement of the new laws' provisions, new voting practices did follow a basic pattern. First, the old method of the voter bringing his prepared ballot to the polls was replaced by a standard state prepared official ballot. When the voter came to the polls, he received this official (unmarked) ballot. Second, the voter was now required to mark the ballot in a secret voting booth, fold the ballot to conceal its face, then drop it in a ballot box. By concealing the voter from outside observation, the ability of parties to monitor

⁹ In San Francisco in the 1880s, a local political boss would hand out \$2.50 gold pieces to those who voted his way. (Keller, 523) Evans reports that by one contemporary account "for securing (the votes of) the more disreputable elements-the "floaters," as they are termed-new two dollar bills have been scattered abroad with a prodigality that would seem incredible but for the magnitude of the object to be obtained." (Evans, 11) Enormous sums of money were spent to win elections in the 1880's. In New York City, one estimate of the cost of a typical election was \$700,000. During extraordinary elections, Republicans in New York paid as high as \$25 for a vote, "the usual price being from \$2.00 to \$5.00 dollars." (Milholland, 94) An estimate of total campaign spending by two candidates in one New York congressional race in the mid 1880's was nearly a quarter of a million dollars. An average congressional district of this time period contained about 30,000 voters. In the 1888 election, the two major parties reportedly spent \$250,000 in Connecticut. Connecticut contained less than 2% of the electorate. (Keller, 542). Henry George, in an article attacking the role of money in elections remarks that "...Mr. Arthur went downtown to gather in an hour the last \$500,000 needed to carry Indiana..." Indiana contained around 3% of the electorate at the time. (George, 204)

vote purchase agreements was eliminated. Contemporary observers pronounced the law a success, and noted that the practice of bribery at the polls was greatly reduced. Harris comments on the improved environment at the polls, and attributes this in part to "the Australian ballot, which has practically put a stop to bribery..." (Harris, p20, see also Milholland, 95). The institutional regime in effect after the adoption of the Australian ballot will be referred to as the "secret" ballot.

The next several sections develop a model to analyze the utility of the parties under the open ballot (the regime before the Australian ballot) and under the secret ballot. The purpose of this model is to understand how the important political changes which preceded electoral reform (those described in Section 2) might have altered the behavior of the political parties, and how these changes in behavior may have altered the parties preferences for open versus secret ballot.

Section 3 constructs a simple model of political competition. First, the voter's decision will be described. Next, the objective of the parties' is described. Section 4 will characterize the equilibrium behavior of the parties. Section 5 will calculate the equilibrium utility level of the parties under the open ballot regime. Sections 6 and 7 will compare the equilibrium outcome for the parties under different ballot regimes, and examine how the relative desirability of the open ballot regime changes as the value of office changes and as elections become more competitive.

SECTION 3 Model

A. The voter's decision

Assume that there are two parties, Democrats and Republicans. The electorate is divided into three groups: Democratic partisans, Republican partisans, and Marginal voters. Within each group, the preferences of the individual voter vary; the parties, however, only observe the voter's group. Before the adoption of the secret ballot, bribes could be made contingent on voting behavior, after the adoption of the secret ballot, bribes can be made contingent on turnout. To simplify the analysis, it is assumed that the bribe necessary to win over voters who are

partisan to the opposition is prohibitively high. Additionally, bribes to your own partisan voter's to encourage turnout are not optimal for either party; it is assumed that a high enough portion of your own voters show up without being bribed to make paying a bribe to all your voters who turnout a losing proposition. Finally, it is assumed that there is a sufficient level of uncertainty about which voters will turnout among the opposition to make paying a bribe to opposition voters who do not turnout too expensive as well. Political competition focuses on bribing the "Marginal voter" group.¹⁰

The two parties compete for the votes of the "marginal" portion of the electorate. A voter acts to maximize the utility associated with voting. The marginal portion of the electorate has unobserved partisan preferences, with each voter indexed by their position on a line. All marginal voters appear identical to the parties; the parties do not know the individual voter's preference. When the bribes offered by both parties equal 0, a voter votes for the Democrat if $\epsilon > 0$, where ϵ is an index of partisan preference for the Democrats. The partisan preferences of these voters are approximated by a continuous distribution, the uniform over the interval $[-T, T]$. Normalizing the total number of voters to 1, this implies that, were no bribes to be offered, each party receives .5 votes. In general, parties will offer bribes for casting a ballot for them. The voter casts his ballot according to the rule:

Vote Democratic if $\epsilon + B_d > B_r$,

where B_d is the bribe offered by the Democrats and B_r is the bribe offered by the

¹⁰The assumption that the only form of political competition is buying the votes of the marginal voters is motivated by a desire to simplify the analysis. Under some, but not all conditions, this is restrictive. Results will compare the party utilities under the open and secret ballot. The elimination of the open ballot eliminates the strategy of bribing the marginal voters, since the bribe will not win any votes. Other aspects of political competition, such as efforts aimed at effecting turnout levels of voters whose partisan allegiances are known, would be equally effective both before and after the Australian ballot. If the elimination of the open ballot does not change the closeness of the election (but just eliminates bribery of the marginal voters), the parties' behavior in these other areas of political competition is completely separable from whether or not the marginal voters can be bribed.

Republicans. Using the fact that partisan preference are distributed $U[-T, T]$, this implies that the vote total for party V_d can be expressed as:

$$V_d = 0, \text{ if } B_r \geq B_d + T$$

$$V_d = .5 + (B_d - B_r) / 2T, \text{ if } |B_d - B_r| < T$$

$$V_d = 1, \text{ if } B_d \geq B_r + T .$$

B. The party's objective

Each party decides on the bribe to offer voters in exchange for their ballot. Parties seek to win office while minimizing the amount of money spent in bribes. The expected benefit to the Democrat from the election is:

$$G^*P_d,$$

where G^* is the value of winning the election, and P_d is the probability of a Democratic victory.

The cost of the campaign is:

$$(1 + C_d)B_dV_d,$$

where B_dV_d is the amount of money distributed in bribes, and C_d is the additional organizational cost associated with the distribution of bribes. C_d is indented to capture the level of organizational efficiency and the level of electoral experience that a party has accumulated. C_d could also be loosely interpreted as representing the level of intimidation the voter feels; if a party is very intimidating, to generate the amount of votes associated with a given level of B_d will be relatively less expensive than if the party is not intimidating.¹¹

Assume the objective function of the Democratic candidate is

$$(1) \quad U_d = G^*P_d - \alpha_d[B_dV_d],$$

where α_d is substituted for $(1 + C_d)$. The equivalent expression for the Republican candidate is:

¹¹The interpretation is "loose" since a more natural way to incorporate this effect is through a constant term added or subtracted from the party bribe level, not a multiplicative interaction term.

$$(2) \quad U_r = G^*P_r - \alpha_r[B_rV_r],$$

where $\alpha_r = 1 + C_r$.

The probability that the Democrats win is a function of the number of votes the Democrats receive from committed partisan voters, as well as the number of votes the Democrats win through bribery. The Democratic vote margin among the partisan voters is $M1_d = Z_d - Z_r = Z$, where Z_d is the number of committed Democratic partisans who vote, and Z_r is the number of committed Republican partisans who vote. It is assumed that $M1_d$ is a random variable, $M1_d = Z + e$, with e distributed F_e . It will be assumed that F_e is a normal distribution, with mean 0.¹² The Democratic vote advantage among the bribable votes is $M2_d = V_d - V_r = 2V_d - 1$. The probability that the Democrat wins is therefore:

$$P_d = \text{Proba}[M1_d + M2_d > 0] = F[Z + 2V_d - 1].^{13}$$

To simplify the candidate objective functions, this will be approximated by the linearization:

$$P_d = \text{approx } F(Z) + f(Z)[2V_d - 1] = X1 + X2V_d,$$

where $X1 = F(Z) - f(Z)$, and $X2 = 2f(Z)$.

Substituting into the candidate objective functions:

$$(1) \quad U_d = G_d^* + G^*[X2V_d] - \alpha_d[B_dV_d]$$

$$(2) \quad U_r = G_r^* + G^*[X2V_r] - \alpha_r[B_rV_r],$$

where $G_d^* = X1G^*$ and $G_r^* = [1 - X1 - X2]G^*$.

Let $\alpha_r = \theta\alpha_d$. Without loss of generality, it will be assumed that $\theta \geq 1$. Using this the objective functions can be rewritten as:

$$(1)' \quad U_d = [G - B_d]V_d + G_d,$$

$$(2)' \quad U_r = [G - \theta B_r]V_r + G_r,$$

¹²The only property of the distribution of e that will be used is that its density has a local maximum at 0.

¹³For those paying careful attention to the units, rescaling the variables Z and G^* to reflect the fact that V_d has been scaled to range from 0 to 1 would not have any influence on the results.

where $G = X2G^*/\alpha_d$, $G_d = G_d^*/\alpha_d$, and $G_r = G_r^*/\alpha_d$, and the objective functions have been rescaled by dividing by α_d . G is the marginal benefit of increasing the Democratic share of the bribable vote, B_d and θB_r are the marginal costs of winning bribable votes. Notice that the assumptions on V_d and P_d insure that the candidate objective functions are concave in their bribe level.

Later in the paper, the utility under the secret ballot will be compared with elections in which bribery is feasible (the "open ballot" regime). Using the notation developed here, the difference between party utility under the two regimes can be stated concisely. Since under the secret ballot regime there will be no bribes, the utility under the secret ballot regime, denoted U_i^s , will equal:

$$U_d^s = F(Z)G^*/\alpha_d$$

$$U_r^s = (1-F(Z))G^*/\alpha_r.$$

The Democratic utility under a regime where bribery is feasible (the "open" ballot regime) is:

$$(3) \quad U_d^0 = [G^*/\alpha_d][F(Z) + f(Z)[2V_d - 1]] - B_d V_d = U_d^s + [G^*/\alpha_d][f(Z)[2V_d - 1]] - B_d V_d.$$

The utility under the "open ballot" regime is equal to the utility under the secret ballot plus the change in utility from the ability to bribe. The additional utility from bribery is equal to the increase in utility from raising the probability of victory above $F(Z)$ by winning a share of the bribable vote (V_d) greater than .5, minus the cost of bribing the bribable voters who cast Democratic ballots. Rewriting (3) using the definition of G yields:

$$(3)' \quad U_d^0 = U_d^s + [G - 1/2]V_d - B_d V_d.$$

SECTION 4 Equilibrium Bribe Levels

The two parties are assumed to simultaneously select bribe levels. Analysis will isolate pure strategy Nash equilibria. Equilibrium levels of candidate bribes will be denoted by B_d^* and B_r^* for the Democrat and Republican respectively.

This Section derives the conditions which characterize Nash Equilibrium levels of candidate bribes. Part a. considers necessary and sufficient conditions for "corner equilibria"; corner equilibria are defined as cases where $V_d^* = 1$ or 0, where V_d^* is

the equilibrium level of V_d . There are two possible cases; Case A. $B_d^* = B_r^* + T$ or Case B. $B_r^* = B_d^* + T$.¹⁴ Part b. examines the other possible equilibria, in which $0 < V_d^* < 1$. These will be called "interior equilibria". Note that the condition $0 < V_d^* < 1$ is equivalent to restricting the difference of the equilibrium bribe levels to $|B_d^* - B_r^*| < T$.

a. Corner equilibria

Result 1:

There will be a Nash equilibria with $B_d^* = B_r^* + T$ iff $G \geq 3T$ and $\theta \geq G/[G-3T]$.

There will never be a Nash equilibrium with $B_r^* = B_d^* + T$.

Proof: See appendix

The equilibrium conditions for Case A. follow from two other conditions: $B_r^* \geq G/\theta$ and $B_d^* - G + 2T \leq 0$. (The conditions stated in Result 1 follow from these two conditions after substituting the equilibrium relationship for Case A, $B_d^* = B_r^* + T$.) The condition that $B_r^* \geq G/\theta$ insures that B_r^* is high enough that R does not want to buy any votes in equilibrium, since votes are too expensive. Equation (2)' shows that for the Republicans the change in utility from getting another vote is $G - \theta B_r^*$; when $B_r^* = G/\theta$, the change in utility from receiving an additional vote is exactly zero. For higher values of B_r^* the value of an additional vote is negative.

The condition that $G - 3T \geq B_r^*$ insures that B_r^* is not too high. If B_r^* is high, then $B_d^* = B_r^* + T$ will be high as well, and the Democrat may prefer to win fewer voters by offering a bribe less than $B_r^* + T$. Combining the conditions ($B_r^* \geq G/\theta$ and $G - 3T \geq B_r^*$) reveals that the existence of a Case A equilibrium depends upon θ (the Republicans relative campaigning cost disadvantage) being large enough. If θ is too small then $B_r^* = G/\theta$ will be large, and the bribe the Democrat is required to pay

¹⁴There will never be a Nash equilibrium in which one party pays a bribe which exceeds the opponents offer by more than T , since in this case the party paying the higher bribe is strictly better off lowering his bribe offer.

in equilibrium, $B_r^* + T$, will be so large the Democrat prefer to set a lower bribe level.

Result 1 shows that there will never be an equilibrium where the Republicans win all the bribable votes, while under certain conditions there will be equilibria where the Democrats win all the bribable votes. The asymmetry between the Democrats and Republicans is a consequence of the relative efficiency of campaigning by the parties.

To see this, suppose there is an equilibrium of the Case B type, where the Democrat receives none of the bribable vote (i.e. $V_d^* = 0$). The Case B equilibrium must satisfy conditions which parallel those necessary for a Case A equilibrium. In a Case B equilibrium, it can be shown that for the Democrat to be content not to increase his bribe, it must be that $B_d^* \geq G$.¹⁵ Since in equilibrium $B_r^* = B_d^* + T$, this implies that $B_r^* = B_d^* + T \geq G + T$. From (2)', the utility to the Republican of offering the bribe $B_d^* + T$ is $[G - \theta B_r^*] - G_r$, which is at most $[G - \theta(G + T)] - G_r$ (The Republican share of the vote in equilibrium is $V_r^* = 1$).

Given that $\theta \geq 1$, the Republican bribe level is clearly too high; the Republicans lose utility for each vote they receive. Since the Republicans can strictly improve their situation by lowering their bribe level, there can not be a Case B equilibrium. The "problem" with the Case B equilibrium is that, in order for the Democrat to not want to increase his bribe, the Democratic bribe level (B_d^*) must be high, and therefore the equilibrium level of the Republican bribe ($B_d^* + T$) must be higher still. But any equilibrium level of B_d sufficiently high to discourage the Democrats from wanting to increase their bribe will make the Republicans, who are never more efficient campaigners (i.e. $\theta \geq 1$), strictly better off lowering their bribe. In

¹⁵ This follows from (1)', which shows that, holding B_r fixed, $dU_d/dB_d = [G - B_d](dV_d/dB_d) - V_d$. The marginal utility of increasing B_d is the change in V_d (the Democratic share of the bribable vote) multiplied by the value of a vote, minus the cost of paying a higher bribe to those bribable voters already voting for the Democrat. Since $V_d^* = 0$, and $dV_d/dB_d > 0$, unless $B_d^* \geq G$, the Democrat could offer a bribe between B_d^* and G , raise V_d from 0 to something greater than 0, and thereby raise the Democratic utility level.

contrast, if θ is high enough, the Case A equilibrium Republican bribe level can be held down. If Democrat's marginal benefit of bribery is high enough, the Democrat will be willing to offer $B_r^* + T$.¹⁶

b. interior equilibria

This subsection establishes the conditions for interior Nash equilibria. The "interior equilibria" are pairs of bribes (B_d^*, B_r^*) that satisfy the condition that B_d^* is optimal given B_r^* , B_r^* is optimal given B_d^* , and $|B_d^* - B_r^*| < T$.

Solutions in which both parties offer strictly positive bribes will be analyzed first.

RESULT 2:

There exists an interior equilibrium with $B_d^* > 0$ and $B_r^* > 0$ iff $T < G < 3T$ and $\theta < 2G/[3T - G]$ or $G \geq 3T$ and $\theta < G/[G - 3T]$. The values of (B_d^*, B_r^*) are given by $B_d^* = G(2\theta + 1)/3\theta - T$, $B_r^* = G(2 + \theta)/3\theta - T$.

Proof. See Appendix.

Figure 1 illustrates the reaction functions and the equilibrium pair of bribes. The reaction functions are upward sloping for both parties. To see why this is, consider the optimal reaction of the Democrats to a given Republican bribe. (The arguments are similar for the Republican reaction function). The effect of increasing B_r is to shift the Democrat's marginal cost curve, which is increasing in B_d , downward, while not affecting the Democrat's marginal benefit curve, which is constant in B_d .

The Democrat's marginal benefit of increasing B_d is $G/2T$, which is the change

¹⁶ To see the details of how θ can affect the existence of a Case A equilibrium, consider the following examples. First, suppose θ is extremely high. This implies that, to discourage the Republican's from increasing their bribe it is necessary that $B_r^* \geq x$, where x approximately 0. (The extremely high θ means that campaigning by the Republicans is so inefficient that bribery wins few votes.) This implies that in equilibrium $B_d^* = B_r^* + T \geq x + T \approx T$. The Democrats will be willing to offer this bribe, if the marginal benefit from winning bribable votes, G , is large enough. On the other hand, if $\theta = 1$, then the situation facing the parties is symmetric. In equilibrium it must be that $B_r^* \geq G$. This implies that $B_d^* = B_r^* + T \geq G + T$. The utility of the Democrat in equilibrium is given by (1)'; $U_d = [G - (G + T)]V_d - G_d$, and now the Democrats lose money on each vote. This implies that, when θ is too low there will never be a Case A equilibrium.

in V_d associated with an increase in B_d times G . G is the marginal benefit associated with an increase in V_d . The marginal benefit of increasing B_d is independent of B_r .¹⁷ The marginal cost of increasing B_d is not independent of B_r . When the Republicans increase their bribe, the Democratic share of the bribable vote falls; this lowers the Democrat's marginal cost of bribery. This can be seen by examining the 2 components of the marginal cost. Holding B_r fixed, the cost of the campaign to the Democrats is $V_d B_d$, and $\partial(V_d B_d) / \partial B_d = (\partial V_d / \partial B_d) B_d + V_d$. The two terms in the marginal cost are 1. the product of the quantity of newly won voters and the bribe level (i.e. how much each newly won voter costs) plus 2. the cost of paying a higher bribe to those already voting Democratic. Since $(\partial V_d / \partial B_d) = 1/2T$ is independent of B_r , it follows that the marginal cost of increasing B_d will fall as B_r rises, since an increase in B_r results in a decrease in V_d .

The slope of the Democratic reaction function is less than 1, and the slope of the Republican reaction function is greater than 1. To see the intuition behind why the slope of the Democratic reaction curve is less than 1, suppose that the slope equalled 1 (i.e. the increase in the optimal Democratic bribe was equal to the increase in the Republican bribe).¹⁸ If this were true V_d would not change along the Democratic reaction function. From the previous paragraph, for a given value of V_d , the marginal cost of bribery increases in B_d , since the cost of winning over new voters is equal to the number of new voters won multiplied by the bribe level. This implies that, given V_d is fixed, if the Democrats increase their bribe as the Republican bribe increases, the Democrats equilibrium marginal cost will be higher

¹⁷ This special feature follows from two assumptions: 1. candidate shares of the bribable vote are linearly related to candidate bribe levels and 2. the probability of victory in the election is linearly related to the candidate's share of the bribable vote. Together, these assumptions generate a linear relationship between the candidate's bribe level and the probability of victory, and therefore a constant marginal benefit curve.

¹⁸ The argument for why the slope of the Republican reaction function is steeper than 1 is similar.

whenever the Republican bribe level is higher.

However, from the discussion of the upward slope of the reaction function, the Democrat's marginal benefit of bribing is constant as the Republican bribe level increases. Assume the Democrat's bribe at the lower level of the Republican bribe was optimal (the marginal benefit of bribery equals the marginal cost). If the Democratic bribe rises one for one with the Republican bribe, at the higher Republican bribe level, the Democrat's marginal cost is higher than before; at the new Democratic bribe level the marginal cost exceeds the marginal benefit of bribing. A one for one increase in the Democratic bribe level can never be optimal. The Democrat's optimal response to an increase in the Republican bribe level must be less than a one for one increase.¹⁹

Finally, observe how the value of θ determines the position of the Republican reaction function: as θ increases, the reaction curve shifts upward. This follows from the effect of increasing θ on the Republican marginal cost curve. The marginal cost of increasing B_r , given B_d , is $\partial(V_r B_r) / \partial B_r = \theta[(\partial V_r / \partial B_r) B_r + V_r]$. The marginal cost of bribery increases in B_r . An increase in θ shifts the marginal cost upward. Since the marginal benefit curve is independent of B_d , the best response to a given B_d will be lower when θ is high.

Turning to the specific conditions stated in Result 2, when $G < 3T$, the condition $2G/[3T-G] > \theta$ insures that the curve $B_d(B_r^*)$ intersects the y axis below the point where $B_d^*(B_r)$ does. When $G \geq 3T$, $B_d(B_r^*)$ always intersects the y axis below the point where $B_d^*(B_r)$ does. However, when $G \geq 3T$, if θ is too high the intersection between the reaction curves occurs at a point where the difference between bribe levels is greater than T . To see this, suppose θ is very large. This implies that the Republican reaction curve will not move when G is increased. Increasing G shifts the Democratic reaction curve upward, and the equilibrium moves up the

¹⁹ The Democrat's marginal cost at the higher Republican bribe level is set equal to marginal benefit when B_d increases, but V_d falls; this implies that the Democratic bribe must rise less than the Republican bribe.

Republican reaction curve. Since the slope of the Republican reaction curve is greater than 1, $B_d^* - B_r^*$ is increasing as G increases. If G increases sufficiently, the difference will exceed T .

Next, Results 3 and 4 establish conditions for Nash equilibria in which one party offers a positive bribe and the other party does not.

RESULT 3

There never exists an interior equilibrium with $B_d^* = 0$ and $B_r^* > 0$.

Proof: See Appendix.

RESULT 4

There exists an interior equilibrium with $B_d^* > 0$ and $B_r^* = 0$ iff $3T > G > T$ and $\theta \geq 2G/[3T - G]$. $B_d^* = [G - T]/2$.

Proof: See Appendix.

Result 3 follows from the fact that, whenever the Republicans prefer a positive bribe the Democrats would always rather bribe than not. The definition of Nash equilibrium can establish this. From the definition of Nash Equilibrium and (2'), the Republican's equilibrium utility when the Republicans bribe and the Democrats do not is $U_r^* = [G - \theta B_r^*][.5 + B_r^*/2T] + G_r$. Since B_r^* is the Republican bribe in equilibrium, it must be that $G_r + [G - \theta B_r^*][1/2 + B_r^*/2T] \geq G_r + G/2$; the Republicans must be at least as well off offering $B_r^* > 0$ as offering 0. Similarly, for the Democrats it must be that the equilibrium utility $U_d^* = G[1/2 - B_r^*/2T] + G_d \geq [G - B_r^*]/2 + G_d$; the Democrats must be at least as well off offering 0 as offering B_r^* . Simple calculations show that these 2 inequalities can not both hold.²⁰

Result 4 shows that there may be equilibria where $B_d > 0$ and $B_r = 0$. The result states that in order for there to be an equilibrium of where $B_d^* > 0$ and $B_r^* = 0$, G must be relatively small, and θ must be "large enough", where "large enough" is increasing in G . To understand this, notice that in the equilibrium described in Result 4, as G increases $B_d^* = [G - T]/2$ rises. This implies that V_r^* falls in G . As V_r^*

²⁰The condition on Republican utility is 1. $[G - \theta B_r^*][1/2 + B_r^*/2T] \geq G/2$. The condition on Democratic utility can be written as 2. $G/2 \geq [GB_r^*/2T] + [G - B_r^*]/2$.

falls, the marginal cost of bribery for the Republicans falls, since there are fewer voters already voting Republican.²¹ Since the Republican's marginal benefit to bribery is also increasing in G , the Republican's marginal utility of bribery rises as G rises.

The Republican's marginal utility of bribery rises continuously as G increases. In order to keep the Republican's willing to set $B_r=0$, the cost of bribery (θ) must increase. The condition that $\theta \geq 2G/[3T-G]$ insures that θ is high enough that Republican marginal utility of bribery is not positive at $B_r=0$. There is never an equilibrium with $B_r=0$ when $G \geq 3T$. The condition $3T > G$ prevents V_r^* from reaching 0. As G approaches $3T$, V_r^* approaches 0, and the value of θ necessary to keep the Republican marginal utility at 0 approaches ∞ .²²

Finally, Result 5 establishes conditions for a Nash equilibrium in which neither party offers a bribe.

RESULT 5

There exists an interior equilibrium with $B_d^*=0$ and $B_r^*=0$ iff $G \leq T$.

Proof: See Appendix.

Result 5 follows from the fact that, since G is low, the marginal benefit of bribing is small. Consider the marginal utility from increasing B_d for the Democrats, given $B_d^*=B_r^*=0$:
 $\partial U_d^* / \partial B_d = -V_d^* + [G-B_d^*]/2T = -(1/2) + (G/2T)$. When $G \leq T$, the marginal utility of increasing B_d is less than or equal to 0. Since marginal utility is falling in B_d (as B_d increases V_d rises, and the utility gain from each vote, $G-B_d$, falls), when $G \leq T$

²¹If this is not clear, the details of this argument are elaborated in the discussion of Result 2 in this Section.

²² For the Republicans, the change in utility from increasing their bribe, holding B_d constant, can be divided into 2 components; $dU_r/dB_r = -\theta V_r + [G-\theta B_r]/2T$. The first term is the additional cost from paying more to those voters already voting Republican, and the second term is the value of an additional voter, $G-\theta B_r$, times the number of new voters won over by the bribe increase, $1/2T$. If $V_r^*=0$ then the Republican marginal utility of bribery is: $[G-\theta B_r]/2T$. When $B_r=0$, then marginal utility equals $G/2T$, which is positive; this implies that $B_r=0$ can not be the equilibrium Republican bribe.

the optimal $B_d=0$. Similar arguments show that when $G \leq T$ the Republicans prefer to set $B_r=0$ as well.

Proposition 1 summarizes the necessary and sufficient conditions for the corner and interior equilibria.

Proposition 1. Characterization of the Nash Equilibria.

$(B_d^*=0, B_r^*=0)$ iff $T \geq G$.

$(B_d^*=[G-T]/2, B_r^*=0)$ iff $3T > G > T$ and $\theta \geq 2G/[3T-G]$

$(B_d^*=G(2\theta+1)/3\theta - T, B_r^*=G(2+\theta)/3\theta - T)$ iff $3T > G > T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$

$(B_d^*=B_r^*+T, G-3T \geq B_r^* \geq G/\theta)$ iff $G \geq 3T$ and $\theta \geq G/[G-3T]$.

Figure 2 illustrates Proposition 1. For the remainder of the paper, the different equilibrium bribe configurations will be referred to by type: Type 1 has $B_d=B_r=0$, Type 2 has $B_d=[G-T]/2$, $B_r=0$, Type 3 has $B_d=G(2\theta+1)/3\theta - T > 0$, $B_r=G(2+\theta)/3\theta - T > 0$, but $B_d-B_r < T$, and Type 4 has $B_d=B_r+T$.

Section 5 Equilibrium Utility Levels

Given any values of the parameters G, T , and θ , Proposition 1 provides a corresponding equilibrium level of bribes by each party. The equilibrium utility levels can be calculated for the political parties for any values of the parameter by using these equilibrium bribe levels. Proposition 2 summarizes the equilibrium utility levels for the Democrats and Republicans for all open ballot equilibria.

Proposition 2. Equilibrium Utility Levels

(Type 1) If $T \geq G$ then $U_d^*=F(Z)G^*/\alpha_d$ and $U_r^*=[1-F(Z)]G^*/\alpha_d$,

(Type 2) If $3T > G > T$ and $\theta \geq 2G/[3T-G]$ then $U_d^*=(G+T)/2 + G_d$ and $U_r^*=G[3T-G]/4T + G_r$.

(Type 3) If $3T > G > T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$ then $U_d^*=[1/2T][G(\theta-1)/3\theta + T]^2 + G_d$ and $U_r^*=[1/2T\theta][G(1-\theta)/3 + T\theta]^2 + G_r$.

(Type 4) If $G \geq 3T$ and $\theta \geq G/[G-3T]$ then $U_d^*=G[\theta-1]/\theta - T + G_d$ and $U_r^*=G_r$.

Proof: See Appendix.

The "proof" of the proposition, provided in the appendix, is almost entirely algebra. To calculate the utility levels for type 4 equilibrium an equilibrium refinement was necessary; the details are in the appendix.

Section 6 and Section 7 take two different approaches to analyzing the parties' utility under the open and secret ballot. The analysis in Section 6 and Section 7 correspond to different hypotheses about when a public policy change might occur.

Section 6 analyzes the conditions under which both parties individually prefer the open ballot, and shows how the relative desirability of the open ballot changes as the political environment changes. Section 6 derives the conditions under which Both parties individually prefer the open ballot or the secret ballot. It will never be the case that both parties prefer the open ballot; the implicit theory of policy change is that the shift to the secret ballot expected to occur when the party which prefers the open ballot changes preference in response to historical conditions.

Section 7 analyzes how the total amount spent by both parties in bribes changes as the political environment changes. Section 7 details the effects of changing political conditions on the sum total of the bribery costs. In Section 7, the implicit theory of policy change is that the shift toward the secret ballot became increasingly likely as the total cost to the two parties under the open ballot system became increasingly burdensome.

SECTION 6. Comparing Utility Levels Under Open and Secret Ballot

This Section compares the utility levels for the parties under the open ballot and secret ballot. It is divided into 2 parts. Part A compares the profit levels under the different electoral regimes for all possible values of the parameters θ , G , and T . Part B discusses the relationship between the historical developments of the late 19th century and the "comparative statics" from Part A; Part B links the results from Part A to the effects of increasing the value of office (G^*) and increasing the competitiveness of elections (decreasing Z). In addition, Part B provides

explanations for the results stated in Part A.

Part A. Utility levels under open and secret ballot

A main hypothesis of the paper is that as the political environment changed, the relative advantages of the open ballot versus the secret ballot changed as well, stimulating the parties to institute the ballot system which leads to higher expected utility. Part A isolates the conditions under which BOTH parties prefer to change from open ballot to secret ballot. Because the contest for office is a zero sum game, unless both parties pay out no bribes it is impossible that both parties are better off under open ballot than under secret ballot. It can be shown that the difference in Democratic utility under the open ballot and secret ballot is always at least as high the difference in Republican utility under the open ballot and the secret ballot. The means that finding the conditions under which the Democratic party prefers the secret ballot imply that under those same conditions both the Democrats and the Republicans prefer the secret ballot.

To see the details of this, recall from equation (3)' that the utility of the open ballot regime for the Democrats can be written:

$$(3)' \quad U_d^0 = U_d^s + [G - B_d]V_d - G/2.$$

From (3)' it follows that the Democrats prefer the open ballot iff $[G - B_d]V_d > G/2$. Similar calculations for the Republicans reveal that Republicans prefer the open ballot iff $[G - \theta B_r][1 - V_d] > G/2$. Since $B_d \geq 0$, for the Democrats to prefer the open ballot it is necessary that $V_d > .5$. (Intuitively, this follows from the fact that the Democrats can get $V_d = .5$ without any bribery under secret ballot.) For the Republicans to prefer the open ballot it must be that $V_d < .5$ under open ballot. This is intuitive since under the secret ballot the Republicans do not pay any bribes and $V_d = .5$, which is clearly at least as good for the Republicans as an open ballot equilibrium where $V_d \geq .5$ and where the Republicans possibly pay a bribe as well.

From Section 5, it can be seen that, the Democratic bribe is always at least as

large as the Republican bribe, so $V_d \geq .5$.²³ This implies that the Democrats may prefer the open ballot to the secret ballot, but the Republicans will never prefer the open ballot to the secret ballot.

The remainder of Part A isolates the specific conditions under which the Democrats prefer the secret ballot. Simple algebra suffices to establish when Democratic utility will be higher under open ballot than under secret ballot. Proposition 3 summarizes these findings.

Proposition 3. Comparing Utility under Open and Secret Ballot

(Type 1) If $T \geq G$ then profits are the same under open ballot and secret ballot.

(Type 2) If $3T > G > T$ and $\theta \geq 2G/[3T-G]$ then Democratic profits are greater under open ballot than secret ballot.

(Type 3) If $3T > G > T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$ then open ballot may or may not be preferred to secret ballot. The Democrats will prefer the open ballot iff $\theta > \theta^*$, where $\theta^* = G/[G-3Z]$, $Z = (TG)^{.5} - T$.

(Type 4) If $G \geq 3T$ and $\theta \geq G/[G-3T]$ then open ballot may or may not be preferred to secret ballot. The Democrats will prefer the open ballot iff $\theta > 2G/(G-2T)$.

Proof: see Appendix.

The proof of the proposition, provided in the appendix, uses the results stated in Proposition 2 to find when the Democrat's utility is higher under open ballot. Figure 3 illustrates the Proposition 3. The shaded regions represent the areas of the graph where the utility of the open ballot exceeds the utility of the secret ballot for the Democrats. The findings in Figure 3 can be organized by dividing the Figure into three regions: $\theta \leq 2$, $2 < \theta < 4$, and $\theta \geq 4$. When $\theta \leq 2$, increasing G eventually leads the Democrats to prefer the secret ballot, and further increases in G do not reverse this preference. When $2 < \theta < 4$, increasing G leads the Democrats to prefer the secret ballot, but further increases in G reverse this preference. If $\theta \geq 4$, the

²³In the type 1 equilibrium, neither party bribes and so $V_d = .5$ and both parties are indifferent between the open and secret ballot. In all other equilibria, $V_d > .5$.

Democrats will never prefer the secret ballot. Part B clarifies and explains these results.

Part B. The Effect of Changing the Value of Office and Electoral Competitiveness

This subsection explores the results from Part A. Changes in G can be related directly to changes in the value of office (G^*) and the competitiveness of elections (Z). Changes in these variables have interpretations related to political developments in the late 19th century which were discussed earlier in the paper.²⁴ The increase in the competitiveness of elections is captured by a reduction in partisan advantage (decreasing Z). A decrease in Z increases the marginal benefit of an additional vote. The increase in the size of the public sector is captured by increases in G^* . It is assumed that as the size of government increases, the value of governmental power, and therefore the value of office G^* , increases as well.

Using the definition of G , changes in G^* and Z can be related to changes in G . Recall that $G = 2f(Z)G^*/\alpha_d$; G is the marginal benefit of winning a vote. G increases in G^* . G increases as Z falls toward 0, since the distribution F is assumed to be distributed normally with mean zero, and therefore $f(x)$ increases as x moves toward zero.

The "comparative statics", the effect of changing G or θ on whether or not the Democrats prefer the open or secret ballot, can be read off Figure 3. The aim of the discussion below is to explain the findings of Part A. Figure 3 shows the effects of changing the parameters for all possible values of the parameters; detailed discussion will be provided for the special case $\theta \leq 2$.²⁵

²⁴See Section 2, Part A for the historical background.

²⁵ The explanation of the case where $\theta \leq 2$ provides a detailed description of how the relative utility of the open ballot versus the secret ballot changes as G changes for all 4 types of equilibria. Additional explanation of the remaining cases, $2 < \theta < 4$ and $\theta \geq 4$, would be mostly repetition.

1. The effect of increasing G

The effect of increasing G on the relative value of the open versus the secret ballot depends upon the parameter values. When there is a secret ballot, the marginal benefit of increasing G is constant.²⁶ When there is an open ballot, the effect of increasing G depends upon the equilibrium level of V_d , and how the parties' equilibrium bribe levels change as G increases.

For more graceful exposition, results will be stated in terms of the ratio G/T . It will be assumed that $\theta \leq 2$.

Figure 3 illustrates the effect of increasing G/T . Fix θ at some value, $\theta \leq 2$. As G/T increases, the type of equilibrium will change.²⁷ When $G/T \leq 1$, the equilibrium will be of type 1 in which neither party will offer bribes. As G/T increases from 1, the equilibrium will become a type 2 equilibrium, as the marginal value of additional votes rises sufficiently to induce the Democrat to begin offering a positive bribe. As G/T increases further, the Republican will begin to offer a bribe as well. The increase in G/T raises the marginal value of a vote. In addition, since the Democrats are winning many bribable voters, the marginal cost of bribery for the Republicans has been falling.²⁸ As G/T increases further, the equilibrium becomes a type 4 equilibrium. The Democrat offers a bribe sufficient to win all the bribable votes.

Figure 3 shows when the open ballot yields the Democrats greater utility level than the secret ballot. This section explains how the relative utility of the open and secret ballot changes as G/T increases and the equilibrium moves through each of the different types of equilibria.

In the type 1 equilibrium, neither party offers a bribe. The utility under open

²⁶ The marginal increase in the secret ballot utility from a change in G is equal to $F(Z)/\alpha_d$; $F(Z)/\alpha_d$ is the probability that the Democrats win when bribes by both parties equal zero divided by a scaling factor for cost of bribes.

²⁷ Equilibria are classified by type. See Figure 2 and Proposition 1 for details.

²⁸ If the reason for this is not clear, the details are provided in Section 4.

ballot will be the same as the secret ballot utility level for all values of G/T .

In the type 2 equilibrium, the Democrat offers a bribe, while the Republican offers no bribe. In the region where type 2 equilibria prevail, increasing G/T raises the Democrat's utility under open ballot faster than it raises the Democrat's utility under secret ballot. The intuition for this can be seen by revealed preference.

To maximize utility, when G increases the Democrats will want to adjust the bribe level to the optimal level given the new value of G . Suppose that instead the Democrats were to keep their bribe at the old level, which was optimal before G increased. This will be called "NA" for no adjustment, and compared to "A", which will represent optimal adjustment.

From equation (3)' the "utility difference" between Democratic utility under open and secret ballot equals: $G[V_d-1/2]-B_dV_d$. Suppose that G increases to G' . The utility difference at G' is $G'[V_d'-1/2]-B_d'V_d'$, where V_d' and B_d' are the new equilibrium levels of V_d and B_d after G has increased to G' . If the Democrats used NA instead, the utility difference at G' would be $G'[V_d-1/2]-B_dV_d$. V_d remains unchanged as G increases; $B_r=0$ at both G and G' since the equilibrium is type 2, and B_d at G' equals B_d at G under "NA".

Subtraction reveals that the utility difference will be larger under G' and NA than under G if $[V_d-1/2] > 0$. This is true since in type 2 equilibria $B_d > 0$, and $B_r=0$, which implies $V_d > 1/2$. Intuitively, as long as the cost per vote does not increase, the relative advantage of the open ballot will increase in G since the Democrats receive the larger share of the bribable vote. By revealed preference, the Democrats can always get at least as high a utility level at G' and NA as they can when G increases to G' and they adjust optimally. And since, when the Democrats adjust optimally, the utility difference must be at least as high as when they do not, the advantages of the open ballot must be increasing in G when the equilibrium is type 2.

Figure 3 illustrates an implication of this finding; when G/T increases sufficiently to cause the equilibrium to shift from a type 1 to a type 2 equilibrium, the Democratic utility level under open ballot will exceed the Democratic utility level

under secret ballot. At the border between type 1 and type 2 equilibrium, neither party offers a bribe and so the Democratic utility level under the secret ballot and the open ballot are equal. Once G/T increases, and the equilibrium moves into type 2, Democratic utility increases faster under open ballot than under secret ballot, and therefore the Democratic utility level under open ballot is higher than under secret ballot. Since Democratic utility increases faster under the open ballot throughout the region where the type 2 equilibrium prevails, the Democratic utility level under open ballot must continue to exceed the utility level under secret ballot throughout the region where type 2 equilibrium prevails.

In the type 3 equilibrium, both parties offer bribes. Given θ , as G/T further increases the equilibrium eventually moves from a type 2 equilibrium into the region of type 3 equilibria. In contrast to the type 2 equilibrium, when θ is low, the relative value of the secret ballot increases as G/T increases.

Figure 3 shows that the level of θ is critical in determining the effect of increasing G/T on the relative utility of the open and secret ballot.

Figure 4a illustrates the Type 3 equilibrium when $\theta=1$. When G increases, the Republican reaction function shifts out, and the Democratic reaction function shifts up. If θ is equal to 1, the problem is symmetric and both reaction functions shift the same amount. The new equilibrium lies on the $V_d=1/2$ line, and both parties are paying higher bribes. From the expression for $U_d^0-U_d^s$ it is clear that when $\theta=1$ increasing G lowers the relative utility of the open ballot. At higher levels of G both parties pay out more in bribes and neither party enjoys an advantage among the bribable voters.

While the mathematical details are given below, Figure 4b provides an intuitive explanation for how the equilibrium utility levels change when θ is low but greater than 1. When G increases, the Republican reaction function shifts out less than the Democratic reaction function. Compared to the equilibrium that would result if $\theta=1$, the Democrats pay a lower bribe and receive a larger share of the vote. Figure 4b shows the effects of increasing G when $\theta>1$. When G increases the equilibrium moves from A to B'; B is the point that would have been the

equilibrium is θ had been equal to 1.

The graph shows that when G increases, the Democrats utility increases more when $\theta > 1$ than when θ . Examining the equilibria depicted in Figure 4b, the Democrats could lower their bribe from B' to C , and receive the same number of votes as when the equilibrium is at point B .²⁹ Democratic utility will be higher, however, at the lower bribe level. Since B is preferred to C , and B' is preferred to B , B' is preferred to C .

When θ is very large, the Republican reaction function shifts very little in response to an increase in G . In this case, an increase in G moves the equilibrium up the Republican reaction function. If θ is large enough, an increase in G will raise the relative utility of the open ballot to the secret ballot.

To see the details of this more generally, examine the change in relative utility as G increases. From (3)' $U_d^0 - U_d^s = G[V_d(B_d, B_r) - 1/2] - B_d V_d(B_d, B_r)$. $d(U_d^0 - U_d^s)/dG = \partial(U_d^0 - U_d^s)/\partial G + (\partial(U_d^0 - U_d^s)/\partial V_d)(\partial V_d/\partial B_r)(dB_r/dG)$; the partial derivative with respect to B_d is omitted since it equals 0 by the first order conditions. Substituting in $dV_d/dB_r = -1/2T$ yields: $[V_d - 1/2] - [(B_d - G)/2T][dB_r/dG]$. The first order conditions for an interior B_d^* require: $[G - B_d](dV_d/dB_d) - V_d = 0$, or $V_d = [G - B_d]/2T$. Substituting in this first order condition reveals that $d(U_d^0 - U_r^s)/dG = V_d[1 - dB_r^*/dG] - .5$.³⁰

For the case considered here, $\theta \leq 2$, the relative utility of the open ballot will never rise as G increases. When $\theta \leq 2$, $V_d[1 - dB_r^*/dG]$ is never far from zero. If, for example, $\theta = 1$, then $V_d[1 - dB_r^*/dG] = 0$, and if $\theta = 2$ then $V_d[1 - dB_r^*/dG] \leq [1/3]$.³¹ Since this increase is less than .5, this implies that as G/T increases the utility of the open ballot falls relative to the utility of the secret ballot. If θ is very large, the

²⁹The dashed line is at a 45 degree angle and therefore represents a set of points where V_d is held constant.

³⁰For convenience, the formulas for V_d^* and B_r^* stated in the previous section are repeated here: $V_d^* = [1/2T][T + G[\theta - 1]/3\theta]$ and $B_r^* = G(2 + \theta)/3\theta - T$.

³¹See the previous footnote for the equilibrium values of V_d and B_r .

utility of the open ballot increases faster than the utility of the secret ballot. When G/T is near 3, θ can be very large and the equilibrium will still be Type 3. In this case, as θ increases, V_d will approach 1, and dB_r/dG will be less than .5. This implies utility under open ballot will increase faster than the utility under secret ballot.

In the type 4 equilibrium, both parties offer bribes, but the Democratic bribe is so large that the Democrat wins all the bribable voters. As G/T increases further, the equilibrium changes from a type 3 equilibrium to a type 4 equilibrium. When $\theta < 2$, the relative utility of the secret ballot increases as G/T increases.³²

In this equilibrium $B_d^* = G/\theta + T$, and $B_r^* = G/\theta$. Since $V_d = 1$, the difference in utility under open and secret ballot is $(G/2) - B_d^*$.³³ Substituting in the equilibrium value B_d^* yields $G[1-.5] - (G/\theta + T)$. This expression can be used to see the effect of increasing G on the relative utility of open versus secret ballot. The "benefit" to the Democrats of the open ballot, that $V_d^* = 1$ instead of .5, grows at a rate of .5 as G increases. The "cost" to the Democrats of the open ballot, that $B_d^* = G/\theta + T$ instead of 0, grows at a rate of $1/\theta$ as G increases. B_d^* must increase faster when θ is low, since the value of B_r that leaves the Republicans satisfied not increasing their bribe grows faster when the cost of campaigning is low for the Republicans. This implies $d(U_d^O - U_r^S)/dG = [.5 - 1/\theta]$. It follows that if $\theta < 2$ the relative utility of the open ballot falls.

Figure 3 illustrates an implication of this finding. If $\theta < 2$ the relative utility of the open ballot falls, and eventually the Democratic utility level from the secret ballot will exceed the utility level from the open ballot. If $\theta > 2$ as G increases eventually the utility of the open ballot will exceed that of the secret ballot.

³²When $\theta = 2$, increasing G does not change the difference in utility between the open and secret ballot. The details of this are contained in the discussion.

³³See equation (3)'.

To summarize, the implication of this subsection is that, unless one party has an efficiency advantage that is "too large" ($\theta > 2$), a switch from the open ballot to the secret ballot can be explained by the effects of the political developments of the late 19th century on the equilibrium behavior of the political parties. When G is low, the political parties will be indifferent between electoral regimes. As G increases, the more efficient party will strictly prefer the open ballot, and will begin to use bribery. As G increases further, bribe levels will increase, and both parties will offer bribes. Further increases in G will lead to increased bribe competition, and even the party with the efficiency advantage at bribery will find the competition too costly. At this point the parties will both strictly prefer the switch to the secret ballot.

The finding that when elections are more competitive or the value to office is higher leads the more efficient party to prefer the secret ballot may appear counter intuitive. These factors increase the value of each vote, and as the marginal advantage of additional votes rises, the value of holding an advantage at winning those extra votes would seem to be even more critical. The more efficient party should therefore be ever less willing to switch away from the open ballot to the secret ballot, where their advantage is neutralized. This sounds rather plausible. For the reasons supplied by the analysis in this Section, this intuition is flawed. It fails to account for the strategic nature of political competition in general, and the effects of increasing the value of a vote on the marginal costs and benefits of the competitors in particular.

2. The effect of changing θ

The main focus of analysis has been on the effect of changing G . The results of Figure 3 can also be used to analyze the effects of changes in θ , the relative efficiency of the Republican campaign organization. To relate this to the political developments described in Section 2, suppose that the party that has the organizational advantage is the party that also enjoys the partisan advantage. As the partisan advantage diminishes, it is possible that the organizational advantage will

decrease as well. This would be the case if, for example, a decrease in the partisan advantage makes it easier for the minority party to recruit campaign workers.

It can be shown that as θ falls, the relative utility of open ballot for the Democrats never increases. Additionally, when the Republicans are offering positive bribes, a decrease in θ strictly lowers the Democrat's utility.

This can easily be shown using the equilibrium profit levels from Proposition 2. When θ falls, the Republican campaign becomes more efficient and provides more competition for the Democrats. A lower θ may induce the Republicans to begin offering bribes, or to raise the bribe they are offering. The details of this are provided for the case of Type 3 equilibria.

In type 3 equilibria, the Democratic utility under the open ballot falls as θ falls. Since the Democratic utility under the secret ballot is unaffected by a change in θ , a fall in Democratic utility levels under the open ballot implies that there will be a fall in the relative utility of the open ballot. To see the effect on the Democratic utility level under the open ballot of a change in θ , consider Figure 4b. An increase in θ shifts the Republican reaction curve back toward the y axis. The equilibrium moves toward the y-axis along the Democratic reaction function. From equation (1)', Democratic utility under the open ballot is $[G-B_d]V_d + G_d$. As the equilibrium moves toward the y-axis along the Democratic reaction curve, B_d falls, therefore $G-B_d$ rises. V_d rises as well; the slope of the Democratic reaction function is less than 1, which implies that B_r^* is falling faster than B_d^* .³⁴ Since G_d is fixed, U_d must rise as θ increases.

To summarize, the result of this subsection shows that, as the political parties become more evenly matched in their ability to run an efficient campaign, the more efficient party will find the open ballot less desirable. As the opposition becomes more efficient, the party with an efficiency advantage will eventually switch from preferring the open ballot to preferring the secret ballot. If one of the implication

³⁴For an explanation of the slopes of the reaction curves, see the discussion in Section 4, Result 2.

of more balanced partisan division of the electorate was more equal campaigning efficiency, the switch from the open ballot can be explained by the changes in party preferences predicted by the simple model of political competition.

Section 7. Comparing Total Utility under Open and Secret Ballot

Section 7 analyzes how the total amount spent on bribes by the parties changes as the political environment changes. The total amount spent by the parties on bribes equals:

$$(U_d^s + U_r^s) - (U_d^o + U_r^o) = B_d V_d + \theta B_r V_r.$$

Result 1. As G rises, total bribes paid out never fall. If the Democrats are offering a positive bribe, the total bribes paid out strictly increase in G .

Proof: See Proposition 2 and Appendix.

In a Type 1 equilibrium there are no bribes, therefore the total rents dissipated do not change in G .

In a Type 2 equilibrium the Democrats offer a bribe and the Republicans don't. As G increases, the marginal value of a vote increases, and therefore the optimal Democratic bribe increases. This implies that the Democratic share of the vote increases as well. Since the total amount spent on bribes is the Democratic bribe multiplied by the Democratic share of the bribable vote, the total amount spent on bribes increases in G .

In a Type 3 equilibrium the effect of increasing G on total bribe cost is not as straightforward as in the other types of equilibria. The change in the total cost of bribery can be broken down into three effects: 1. the change in the Democratic bribe level multiplies by the Democratic share of the vote, plus 2. the change in the Republican bribe cost (θB_r) multiplies by the Republican share of the vote, plus 3. the difference between the party bribe costs ($B_d - \theta B_r$) times the change in the Democratic share of the vote. From Figure 1, increasing G shifts the Republican reaction function outward and the Democratic reaction function upward. The equilibrium bribe level increases for both parties. Since $\theta \geq 1$, B_d increases more than B_r in equilibrium; this implies that V_d increases in G . If $B_d \geq \theta B_r$, then total

bribe cost would be increasing in G . This is not always true in type 3 equilibria. However, it can be shown that the first 2 effects will always outweigh the third effect. The details of this are shown in the appendix.

In Type 4 equilibria, the Democrats win all the bribable votes. The equilibrium Republican bribe level is the minimum bribe that leaves the Republicans satisfied not to increase their bribe to win some of the bribable votes. When G increases, the equilibrium Republican bribe increases. The size of the Democratic bribe is the Republican bribe plus T so the Democratic bribe increases in G . Since the Democrats win all the bribable votes, this implies the total amount spent on bribery increases as well.

The implication of Section 7 is that, regardless of the size of the efficiency advantage the more efficient party enjoys, the political developments of the late 19th century lead to an increase in the total cost of bribery to the political parties. The shift away from the secret ballot is consistent with the predicted changes in party preferences.

Section 8. Conclusion and Implications

On its face, the rapid success of ballot reform may appear somewhat paradoxical. If, as is commonly argued, the adoption of the secret ballot was an effort by reformers to curb the power of party organizations, then how did reforms pass through legislatures controlled by the political parties?

This paper resolves this paradox by positing that the ballot reforms were actually in the interests of the political parties. Conventional accounts of the adoption of the secret ballot have emphasized the role of outside reformers, who forced the political parties to adopt the secret ballot. The model constructed here reveals that it is not necessary to bring the outsiders into it; the political parties may have encouraged the adoption of the secret ballot to avoid strenuous political competition. The reforms were adopted following a period of increased value of office and close partisan competition. Analysis of a simple model of political competition show that if the relative efficiency of the parties organizations are not

too different, these are precisely the changes in the political environment that would cause a shift toward the secret ballot most desirable.

The conventional accounts of the adoption of the secret ballot give great importance to the role played by agitators "standing outside of the normal two party system". A simple extension of the model provided here could generate a story which integrates the "Mugwump" opposition to the open ballot with that of the political parties. Standard explanations of reformer motivation oppose the interests of the reformers to those of the established parties. It is possible, however, that in the case of ballot reform the interests of the reformers and the parties actually coincided.

If vote buying was concentrated among lower socioeconomic strata, the Reformers would not be among those receiving money for their votes. If eliminating bribery had any beneficial effect, such as reducing pressures toward government corruption, and if this resulted in lower taxation or more efficient government, by introducing the secret ballot the Reformers would experience a net gain. They would be gaining more efficient government without suffering from the loss in payments for their vote that would affect lower status voters.

This paper's new view of the adoption of the secret ballot has a number of important implications. First, it is not necessary to assume that outsider reformers played any role in the major political reforms of the 1880's and 1890's. It is easy to construct a theory in which outside reformers were of no consequence to the formation of the important political reforms of this period. This implies that the political reforms of the late 19th century should not be used as evidence of the political power of outside interests. The findings of this paper are therefore relevant to theories which attempt to explain the origins and purpose of the important economic legislation of this period, such as the Sherman Antitrust Act (1890) and the Interstate Commerce Act (1887).

Standard historical treatments of the ballot reforms of the late 1880's and early 1890's view the ballot reforms as a precursor to the Progressive movements initiated in the first decade of the 20th century. Joel Silbey explicitly links the ballot reforms

of the 1880's to the Progressive movement, and describes their early 20th century reform efforts as a continuation of "the efforts under way since the 1880's to reform election laws, especially to institute registration and government-controlled ballots (i.e. the Austrian ballot). The alternative interpretation offered here for the late 19th century ballot reforms parallels a more "cynical" view of the Progressive era economic regulations.

Analysis of the adoption of the Secret ballot has a number of other important implications. Election rules affect both the distribution of the rents associated with control of the government and the efficiency of the public sector. Vote buying transferred a significant portion of the rents associated with election victory to the voters. In the 1880's, the size of campaign war chests were quite large. Based upon anecdotal evidence, it is possible that the amount of money distributed on election day before the adoption of the Australian ballot totalled the modern day equivalent of several billion dollars in cash. In addition to cash on election day, other forms of compensation such as goods or assistance in dealing with government agencies also hinged on loyal support of a political party. Since this compensation appears to have been concentrated in the lower income segments of society, the adoption of the secret ballot may mark the termination of a significant social welfare program.

An additional implication of the change in election rules is the effect of the ballot reforms on the politician's demand for money for election campaigns. It is possible that altering the rules of political competition led to a more efficient public sector. The full implications of this possibility will not be detailed here. The basic logic of the argument, however, is not complicated.

The politician's demand for cash is a function of the uses to which the cash can be put. When votes could be purchased, the marginal product of campaign expenditures was high. This encouraged high levels of effort to extract funds for the campaign. Under the old rules, political parties were caught in a competitive spiral of increasing demand for campaign funds, which encouraged ever bolder attempts to provide sources of revenue for the party through the creation of patronage jobs,

increased graft, and less efficient public projects. Under the post-reform ballot system, the marginal value of campaign funds declined. Therefore after ballot reform, the parties would require a smaller payoff, or a smaller threat of voter punishment, to agree to abandon inefficient but campaign revenue producing government spending. According to this argument, the institutional reform of the ballot at the end of the 19th century was critical to the turn of the century professionalization of government.

There is some empirical evidence to support the timing that this argument implies, with reforms in the federal bureaucracy beginning soon after the widespread adoption of ballot reform. Keller notes that, by the end of the 19th century, the most partisan departments of the Federal bureaucracy, the post office and the Pension Bureau, became much less partisan. (Keller, 311). A case might be made the the adoption of the Australian ballot by the early 1890's made possible the civil service reforms of the early 20th century. The implications of this for current day debates over the importance of campaign finance in political outcomes is direct. The details of how this story might be formalized are left for future research.

APPENDIX

SECTION 4 Equilibrium Bribe Levels

RESULT 1

Recall a Nash equilibrium is defined as a pair (B_d^*, B_r^*) such that:

$$U_r(B_d^*, B_r^*) \geq U_r(B_d, B_r^*) \quad \forall B_d \geq 0 \text{ and}$$

$$U_d(B_d^*, B_r^*) \geq U_d(B_d^*, B_r) \quad \forall B_r \geq 0$$

First consider Case A, $B_d^* = B_r^* + T$. In Case A note that since $V_d = 1$ in equilibrium $U_r = G_r$. Is there any feasible change in B_r that will increase U_r , holding B_d fixed? If R decreases his bribe, U_r remains at G_r , as $V_d = 1$. If R increases by ϵ , then $U_r(\epsilon) = (G - \theta(B_r^* + \epsilon))[\epsilon/2T] + G_r$. $U_r(\epsilon) > G_r$ if $(G - \theta B_r^*) > \theta\epsilon$. This implies that a necessary condition for $B_d^* = B_r^* + T$ to be a Nash Equilibrium is $G \leq \theta B_r^*$. If $G \leq \theta B_r^*$ then any decrease in B_r leaves $V_d = 1$, while any increase in B_r can only decrease U_r . The condition $G \leq \theta B_r^*$ is therefore also sufficient for there to be no feasible improvement for the Republican candidate.

Now consider the situation for the Democrat. In equilibrium, utility is $G - B_d^* + G_d$. Any increase in B_d will not gain votes, but will cost money so this would strictly lower utility. Can utility be raised by decreasing B_d by ϵ , $2T \geq \epsilon > 0$? The utility after a decrease in B_d is $(G - B_d^* + \epsilon)[1 - \epsilon/2T] + G_d$. This implies that a decrease in B_d^* raises utility if $B_d^* - G + 2T > \epsilon$. A necessary condition for Nash equilibrium is therefore $B_d^* - G + 2T \leq 0$. This condition implies that there is no $0 < \epsilon \leq 2T$ that can improve U_d . For any decrease greater than $2T$, $U_d = G_d$, which is no better than $G - B_d^* + G_d$ as long as $G \geq B_d^*$. Since this is implied by $G - 2T \geq B_d^*$, $G - 2T \geq B_d^*$ implies that there is no feasible improvement for the Democratic candidate.

Combining the results for B_d and B_r reveals that for there to be a Nash equilibrium with $B_d^* = B_r^* + T$, it is necessary and sufficient that $G - 3T \geq B_r^* \geq G/\theta$. Therefore there will be Nash equilibria with $B_d^* = B_r^* + T$ iff $G \geq 3T$ and $\theta \geq G/[G - 3T]$.

Next, consider Case B ($B_r^* = B_d^* + T$). The arguments follow a similar logic to those of the previous case, and so will be omitted. The Democratic candidate can not benefit from a change in B_d if and only if $B_d \geq G$. The Republican candidate can not improve if and only if $B_r \leq (G/\theta) - 2T$.³⁵ Since in Case B, $B_d^* + T = B_r^*$, the necessary and sufficient conditions for an equilibrium are $(G/\theta) - 3T \geq B_d^* \geq G$. Since $\theta \geq 1$, there is no value of B_d that satisfies the conditions.

RESULTS 2-5

For any pair of bribes such that $|B_d - B_r| \leq T$, the utility function for the Democratic candidate is written:

$$U_d = [G - B_d][.5 + (B_r - B_d)/2T] + G_d.$$

This implies that the "best response" value of B_d , given B_r^* , is found by solving:

$$\text{MAX } U_d(B_d, B_r^*),$$

$$B_d$$

$$\text{s.t. } B_d \geq 0, |B_d - B_r^*| \leq T$$

The "best response" value of B_r , given B_d^* , is found by solving a similar problem:

$$\text{Max } U_r(B_d^*, B_r),$$

$$B_r$$

$$\text{s.t. } B_r \geq 0, |B_d^* - B_r| \leq T$$

A Nash Equilibrium is a pair (B_d, B_r) which simultaneously solves both of these constrained maximization problems.

Two features of the problem are important to note. First, since the objective functions U_d and U_r are strictly concave in the candidate's own bribe level, and the constraint set is convex the first order conditions are sufficient to isolate maximizing values of B_d and B_r .

Second, the constraints on the maximization problem limit the possible values of B_d to those within T of B_r^* , and the possible values of B_r to those within T of B_d^* .

³⁵A decrease of B_r by ϵ yields a utility level of $(G - \theta(B_r - \epsilon))(1 - \epsilon/2T) + G_r$. Comparing this to the equilibrium utility level of $G - \theta B_r + G_r$ yields the condition for improvement: $B_r + 2T - G/\theta > \epsilon$.

It can be shown that this constraint can be relaxed without losing any of the solutions to the constrained maximization problems. Suppose some pair of bribes (B_d^*, B_r^*) solves the maximization problem. The pair will be a Nash Equilibrium when the restriction $|B_d - B_r| \leq T$ is removed if removing the restriction does not open up new opportunities for the Democrat (Republican) to make a better response to B_r^* (B_d^*), since then the Democrat (Republican) will be content to play B_d^* (B_r^*) even when the new opportunities are available. It is easy to see that no better new actions are available when the restriction is removed. The reasoning is spelled out for the Democratic candidate.

Consider possible deviations from the equilibrium by the Democrat. Choosing $B_d = B_r^* + T$ is in the restricted feasible set, and strictly dominates all choices of $B_d > B_r^* + T$. This follows from the fact that when $B_d = B_r^* + T$, any increase in B_d will not win more votes for the Democrat, but will result in higher bribe payments to those who vote Democrat. Choosing $B_d = B_r^* - T$ is in the restricted set, and yields the same utility as $B_d < B_r^* - T$. This follows from the fact that when $B_d = B_r^* - T$, $V_d = 0$. No voter takes the Democrat's bribe in equilibrium, lowering the bribe level can not increase the utility of the Democratic candidate.³⁶

Since we are attempting to find interior pairs which solve the maximization problem, only the conditions relevant to the possibility that $|B_d - B_r| < T$ are listed below.

Solving the maximization problem yields the first order conditions for the Democrats problem of:

$$(3) \quad B_d^* = [G + B_r^* - T] / 2 + \mu_d T$$

$$(3)' \quad \mu_d \geq 0, B_d^* \geq 0, B_d^* \mu_d = 0, B_d^* > B_r^* - T, B_d^* < B_r^* + T$$

Similar calculations to determine optimal B_r as a function of B_d^* yield:

$$(4) \quad B_r^* = [G + \theta(B_d^* - T)] / 2\theta + \mu_r T / \theta$$

³⁶There is an epsilon problem here and above with corner solutions: When the bribes differ by exactly T, there will be a group of voters who are indifferent. Some comment about this is needed in the discussion of equilibrium

$$(4)' \quad \mu_r \geq 0, B_r^* \geq 0, B_r^* \mu_r = 0, B_r > B_d^* - T, B_r < B_d^* + T$$

RESULT 2:

There exists an interior equilibrium with $B_d^* > 0$ and $B_r^* > 0$ iff $T < G < 3T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$. The values of (B_d^*, B_r^*) are given by (5) and (6) below.

Proof:

Necessity:

$B_d^* > 0$ and $B_r^* > 0$ implies that $\mu_d = \mu_r = 0$. Therefore when both candidates bribe levels are strictly positive, the equations (3) and (4) can be simplified to:

$$(5) \quad B_d^* = G(2\theta + 1)/3\theta - T, \text{ and}$$

$$(6) \quad B_r^* = G(2 + \theta)/3\theta - T.$$

Since $\mu_r = \mu_d = 0$, and $\theta \geq 1$, therefore $B_d^* \geq B_r^*$. From equation (6), the condition that $B_r^* > 0$ is equivalent to the requirement that $2G > (3T-G)\theta$. This imposes the restrictions: if $G \geq 3T$ then any θ can take on any value $\theta \geq 0$, while if $G < 3T$ then $\theta < 2G/[3T-G]$. The condition that if $G < 3T$ then $\theta < 2G/[3T-G]$ can be rewritten as: if $G \leq T$ then never, and if $T < G < 3T$ then $\theta < 2G/[3T-G]$. Lastly, consider the condition that $|B_d^* - B_r^*| < T$. Since $B_d^* \geq B_r^*$, using (5) and (6), this condition is equivalent to $B_d^* - B_r^* = [G(\theta-1)/3\theta] < T$ or $(G-3T)\theta < G$. This imposes restrictions: it is always true if $G \leq 3T$, and is true if $G > 3T$ and $\theta < G/[G-3T]$. Combining the required conditions yields the result that if there exist $B_d^* > 0$ and $B_r^* > 0$, which satisfy the maximization conditions then: when $3T > G > T$ then $\theta < 2G/[3T-G]$ or when $G \geq 3T$ then $\theta < G/[G-3T]$.

Sufficiency:

Assume $T < G < 3T$ and $\theta < 2G/[3T-G]$. Using (3), $T < G < 3T$ implies that $B_d^* > 0$. This implies that $\mu_d = 0$ and $B_d^* = [G + B_r^* - T]/2$. Substituting B_d^* into (4), solving for B_r^* , and using $\mu_r \geq 0$ yields the condition that $B_r^* > 0$ if $2G/[3T-G] > \theta$, which is true by assumption. Whenever $B_d^* > 0$ and $B_r^* > 0$, the equilibrium values are given by (5) and (6). As was shown earlier, the final condition, that $B_d^* - B_r^* < T$, is satisfied whenever $G \leq 3T$.

Assume $G \geq 3T$ and $\theta < G/[G-3T]$. Following similar steps as in the previous case,

$B_d^* = [G + B_r^* - T]/2$. Substituting B_d^* into (4), solving for B_r^* , and using $\mu_r \geq 0$ yields the condition that $B_r^* > 0$ if $2G + \theta(G - 3T) > 0$, which is true by the assumption $G > 3T$. Whenever $B_d^* > 0$ and $B_r^* > 0$, the equilibrium values are given by (5) and (6). As was shown earlier, $B_d^* - B_r^* = [G(\theta - 1)/3\theta]$, which implies that $B_d^* - B_r^* < T$ is equivalent to $(G - 3T)\theta < G$. This is true by assumption.

RESULT 3

There never exists an interior equilibrium with $B_d^* = 0$ and $B_r^* > 0$.

Proof:

The equilibrium conditions $B_d^* = 0$, and $B_r^* > 0$ imply that $\mu_r = 0$ so (4) can be written as $B_r^* = [G - \theta(T)]/2\theta$. Since $B_r^* > 0$, this implies that $G > \theta T$. Given that $\theta \geq 1$, this implies that $G \geq T$. Equation (3) and $B_d^* = 0$ requires $B_d^* = [G - T + B_r^*]/2 + \mu_d T = 0$. But from this equation it can be seen that $G \geq T$ implies that, if $B_r^* > 0$ then $\mu_d < 0$. But this contradicts the condition that $\mu_d \geq 0$.

RESULT 4

There exists an interior equilibrium with $B_d^* > 0$ and $B_r^* = 0$ iff $3T > G > T$ and $\theta \geq 2G/[3T - G]$. $B_d^* = [G - T]/2$.

Proof:

Necessary:

The equilibrium conditions $B_d^* > 0$ and $B_r^* = 0$ imply that $\mu_d = 0$ and therefore (3) can be written $B_d^* = [G - T]/2$. Substituting this into (4) yields $B_r^* = [G + \theta[(G - 3T)/2]]/2\theta + \mu_r T/\theta = 0$, or $2G + \theta(G - 3T) + 4T\mu_r = 0$. This is combined with the requirement that $\mu_r \geq 0$ to produce some restrictions. If $2G + \theta(G - 3T) \leq 0$ then $\mu_r \geq 0$. If $G \geq 3T$ however, then $\mu_r < 0$. If $G < 3T$, then if $\theta \geq 2G/[3T - G]$ then $\mu_r \geq 0$.

The requirement that $B_d^* > 0$ implies that $\mu_d = 0$. This, combined with $B_r^* = 0$ reduces equation (3) to $[G - T]/2$. Therefore $B_d^* > 0$ requires $G > T$. Finally, the requirement that $|B_d^* - B_r^*| < T$, is equivalent to the requirement that $B_d^* < T$. This implies that $[G - T]/2 < T$, or $G < 3T$. Therefore if $(B_d^* > 0, B_r^* = 0)$ is a Nash Equilibrium then $3T > G > T$ and $\theta \geq 2G/[3T - G]$.

Sufficient:

Now assume that $3T > G > T$ and $\theta \geq 2G/[3T-G]$. Using (3), $T < G < 3T$ implies that $B_d^* > 0$. This implies that $\mu_d = 0$ and $B_d^* = [G + B_r^* - T]/2$. Substituting B_d^* into (4) and solving for B_r^* yields the condition that $3B_r^* = G[2/\theta + 1] - 3T + z\mu_r$. Suppose that $B_r^* > 0$. This implies that $\mu_r = 0$ and $G[2/\theta + 1] - 3T > 0$. This implies that $2G/[3T - G] > \theta$, which is a contradiction of the assumption.

RESULT 5

There exists an interior equilibrium with $B_d^* = 0$ and $B_r^* = 0$ iff $G \leq T$.

Proof:

Necessary:

The equilibrium conditions $B_d^* = 0$ and $B_r^* = 0$ imply that (3) can be written as (3)'' $[G - T]/2 + \mu_d T = 0$ and (4) can be written as (4)'' $[G - \theta(T)]/2\theta + \mu_r T/\theta = 0$. Equation (3)'' implies it is necessary that $G \leq T$. If not then $\mu_d < 0$ which contradicts the condition that $\mu_d \geq 0$. By equation (4)'', the condition $G \leq T$ implies $\mu_r \geq 0$. The requirement that $|B_d^* - B_r^*| < T$ is clearly satisfied. Therefore if (0,0) is a Nash Equilibrium, $G \leq T$.

Sufficient:

Now assume $G \leq T$. This implies that (3) and (4) can be rewritten as (3)'' $B_d^* \leq B_r^*/2 + \mu_d T$ and (4)'' $B_r^* \leq B_d^*/2 + \mu_r T/\theta$. Now suppose that $B_d^* > 0$. Since $B_d^* > 0$ implies $\mu_d = 0$, (3)'' implies $B_r^* > 0$. $B_r^* > 0$ implies $\mu_r = 0$. Therefore (3)'' and (4)'' can be rewritten and combined as $B_r^*/2 \geq B_d^* \geq 2B_r^*$, which implies that both B_d^* and B_r^* equal 0, a contradiction.

Therefore if $G \leq T$, $(B_d^* = 0, B_r^* = 0)$ is a Nash equilibrium. Thus (0,0) is a Nash Equilibrium iff $G \leq T$.

Section 5. Equilibrium Utility Levels

Result 1 (Type 1 equilibria)

If $T \geq G$ then $U_d^* = F(Z)G^*/\alpha_d$ and $U_r^* = [1 - F(Z)]G^*/\alpha_d$,

where U_i^* is the equilibrium utility level for candidate i .

$T \geq G$ implies the equilibrium bribes are $(B_d^* = 0, B_r^* = 0)$. This implies that $V_d = .5$. Substituting into the definitions of U_d and U_r yields the result.

Result 2 (Type 2 equilibria)

If $3T > G > T$ and $\theta \geq 2G/[3T-G]$ then $U_d^* = ((G+T)/2)((G+T)/4T) + G_d$ and $U_r^* = G[3T-G]/4T + G_r$.

$3T > G > T$ and $\theta \geq 2G/[3T-G]$ imply $(B_d^* = [G-T]/2, B_r^* = 0)$. This implies $V_d = .5 + [G-T]/4T = [T+G]/4T$ and $V_r = .5 - [G-T]/4T = [3T-G]/4T$. Substituting into the definitions of U_d and U_r yields the result.

Result 3 (Type 3 equilibria)

If $3T > G > T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$ then $U_d^* = [1/2T][G(\theta-1)/3\theta + T]^2 + G_d$ and $U_r^* = [1/2T\theta][G(1-\theta)/3 + T\theta]^2 + G_r$.

$3T > G > T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$ imply the equilibrium will be a type 3 equilibrium. This implies that $B_d^* = G(2\theta+1)/3\theta - T$ and $B_r^* = G(2+\theta)/3\theta - T$. This implies $V_d = .5 + G[\theta-1]/6T\theta = (3T\theta + G[\theta-1])/6T\theta = (1/2T)(T + G[\theta-1]/3\theta)$

and $V_r = (3T\theta - G[\theta-1])/6T\theta = (3T\theta + G[1-\theta])/6T\theta = (1/2T\theta)(T\theta + G[1-\theta]/3)$. Also, $G - B_d^* = [G(\theta-1)]/3\theta + T$ and $G - \theta B_r^* = [G(1-\theta)]/3 + T\theta$. Combining these yields the result.

Result 4 (Type 4 equilibria)

If $G \geq 3T$ and $\theta \geq G/[G-3T]$ then $U_d^* = G[\theta-1]/\theta - T + G_d$ and $U_r^* = G_r$.

$G \geq 3T$ and $\theta \geq G/[G-3T]$ imply equilibrium is Type 4. This implies $B_d^* = B_r^* + T$. Recall that there are a continuum of Nash equilibria in this case; equilibria are constructed by choosing a value of B_r in the interval $G-3T \geq B_r^* \geq G/\theta$ and then setting $B_d^* = B_r^* + T$. To generate a unique prediction of the equilibrium bribe levels in this case, some form of refinement is needed.

Suppose that there is some probability that a voter's hand will "tremble" and the voter does not accept the bribe-vote combination which provides the higher utility level. This means that there will be some chance that any offered bribe is accepted. This implies that R will never be willing to offer a bribe $B_r > G/\theta$, since if a voter accepts this bribe R loses utility. R will be willing to offer G/θ since in this case R is indifferent between whether the voter accepts or rejects the bribe offer. Therefore the equilibrium prediction is $B_r^* = G/\theta, B_d^* = G/\theta + T$. Since in

equilibrium $V_d=1$ the result follows.

SECTION 6. Comparing Utility Levels Under Open and Secret ballot

Result 1

If $T \geq G$ then profits are the same under open ballot and secret ballot.

Under secret ballot, offering a bribe will not win any votes. Since no bribes will be offered, the utility for the Democrats and the Republicans will be equal to the utility level of type 1 equilibria: $U_d^* = F(Z)G^*/\alpha_d$. $U_r^* = [1-F(Z)]G^*/\alpha_d$. When $T \geq G$, the equilibrium is a type 1 equilibrium.

Result 2

If $3T > G > T$ and $\theta \geq 2G/[3T-G]$ then Democratic profits are greater under open ballot than secret ballot.

Under the assumptions regarding G, T , and θ , $U_d^* = ([G+T]/2)([G+T]/4T) + G_d$. The condition for profits to be higher under open ballot is $([G+T]/2)([G+T]/4T) > G/2$, or $[G+T][G+T] > 4TG$.³⁷ This is equivalent to $(G^2 - 2GT + T^2) > 0$, or $(G-T)^2 > 0$. This will always hold, since $G > T$ by assumption.

Result 3

If $3T > G > T$ and $\theta < 2G/[3T-G]$ or $G \geq 3T$ and $\theta < G/[G-3T]$ then open ballot may or may not be preferred to secret ballot. The Democrats will prefer the open ballot iff $\theta > \theta^*$, where $\theta^* = G/[G-3Z]$, $Z = (TG)^{.5} - T$.

Under the assumptions about G, T , and θ $U_d = [1/2T][G(\theta-1)/3\theta + T]^2 + G_d$. The condition for profits to be higher under open ballot is $[1/2T][G(\theta-1)/3\theta + T]^2 + G_d > F(Z)G^*/\alpha_d$ or $[1/2T][G(\theta-1)/3\theta + T]^2 > G/2$. This is equivalent to $[G(\theta-1)/3\theta + T]^2 > TG$.

First note that the left hand side strictly increases in θ . When $\theta=1$, then the inequality is true only if $T > G$, which is not true for this case by assumption. When

³⁷This follows from the definition of $G_d = [F(Z) - f(Z)]G^*/\alpha_d$ and $G = 2f(Z)G^*/\alpha_d$. The utility under secret ballot is $F(Z)G^*/\alpha_d$. Subtracting G_d from the utility under secret ballot yields $f(Z)G^*/\alpha_d = G/2$. It is also shown at the beginning of the Section that the condition for open ballot to be preferred to secret ballot is $[G - B_d]V_d > G/2$.

θ increases to a very large value, the left hand side converges to a limit and the inequality becomes:

$[G/3 + T]^2 > TG$. It can easily be shown that if $G > T$ then this inequality holds. This implies that there is some cutoff value of $\theta(G, T)$ such that, for all $\theta > \theta^*$ the Democratic candidate is strictly better off when bribes are allowed, and for all $\theta < \theta^*$ the Democrat is strictly worse off. This cutoff value is simply the value of θ which solves $[G(\theta-1)/3\theta + T] = (TG)^{.5}$, which can be written as:
 $\theta^* = G/[G-3Z]$, where $Z = (TG)^{.5} - T$.

Result 4

If $G \geq 3T$ and $\theta \geq G/[G-3T]$ then open ballot may or may not be preferred to secret ballot. The Democrats will prefer the open ballot iff $\theta > 2G/(G-2T)$.

When $G \geq 3T$ and $\theta \geq G/[G-3T]$, $U_d = G[\theta-1]/\theta - T + G_d$. This is equivalent to $G[\theta-1]/\theta - T > G/2$, which is equivalent to $\theta(G-2T) > 2G$. Since by assumption $G > 2T$, this is equivalent to $\theta > 2G/(G-2T)$. When $4T > G \geq 3T$, $G/[G-3T] > 2G/[G-2T]$. Since $\theta \geq G/[G-3T]$, U_d is higher under open ballot than under secret ballot. When $G \geq 4T$, $2G/[G-2T] \geq G/[G-3T]$. This implies that, for $G \geq 4T$ the set of values of θ , $\theta \geq G/[G-3T]$ can be partitioned into two sets. When $\theta > 2G/[G-2T]$ then U_d is higher under open ballot than secret ballot. When $2G/[G-2T] \geq \theta \geq G/[G-3T]$, U_d is higher under secret ballot than under open ballot.

Section 7. Comparing Total Utility under Open and Secret Ballot

Under the Secret ballot, $U_i = G/2 + G_i$, where $i = d$ or r .

Total cost of bribery equals: $(U_d^s + U_r^s) - (U_d^o + U_r^o)$. In Type 3 equilibria, $U_d^{o*} = [1/2T][G(\theta-1)/3\theta + T]^2 + G_d$ and $U_r^{o*} = [1/2T\theta][G(1-\theta)/3 + T\theta]^2 + G_r$. Total cost of bribery is $TC = G - [1/2T][G(\theta-1)/3\theta + T]^2 - [1/2T\theta][G(1-\theta)/3 + T\theta]^2$. After simplification, $dTC/dG > 0$ if $1 - [A+B] > 0$, where $A = [(G/T)[(\theta-1)/3\theta]^2 + (\theta-1)/3\theta]$ and $B = [(G/T\theta)[(\theta-1)/3\theta]^2 + (1-\theta)/3] > 0$. $A+B$ can be further simplified to: $[G/T + \theta(G-3T)/T][(\theta-1)/3\theta]^2$. It can now be shown that $1 > A+B$.

1. $A+B < 1$ if $3T \geq G$.

This can be seen from the series of inequalities:

$$A+B = [G/T + \theta(G-3T)/T][(\theta-1)/3\theta]^2 \leq (1/9)[G/T][(\theta-1)/\theta]^2$$

$$(1/9)[G/T][(\theta-1)/\theta]^2 \leq (1/3)[(\theta-1)/\theta]^2 < 1/3.$$

2. $A+B < 1$ if $3T < G$.

It can be shown that, if $G > 3T$ the sum $A+B$ increases in θ .

For the equilibrium to be type 3, $G > 3T$ implies that $\theta < G/[G-3T]$.

$A + B < 1$ if the maximum value of $(A + B) < 1$.

Substituting the maximum value of θ into $A+B$ yields:

$$A+B = (1/9)(3T/G)^2(2T/G) = 2T/G < 2/3.$$

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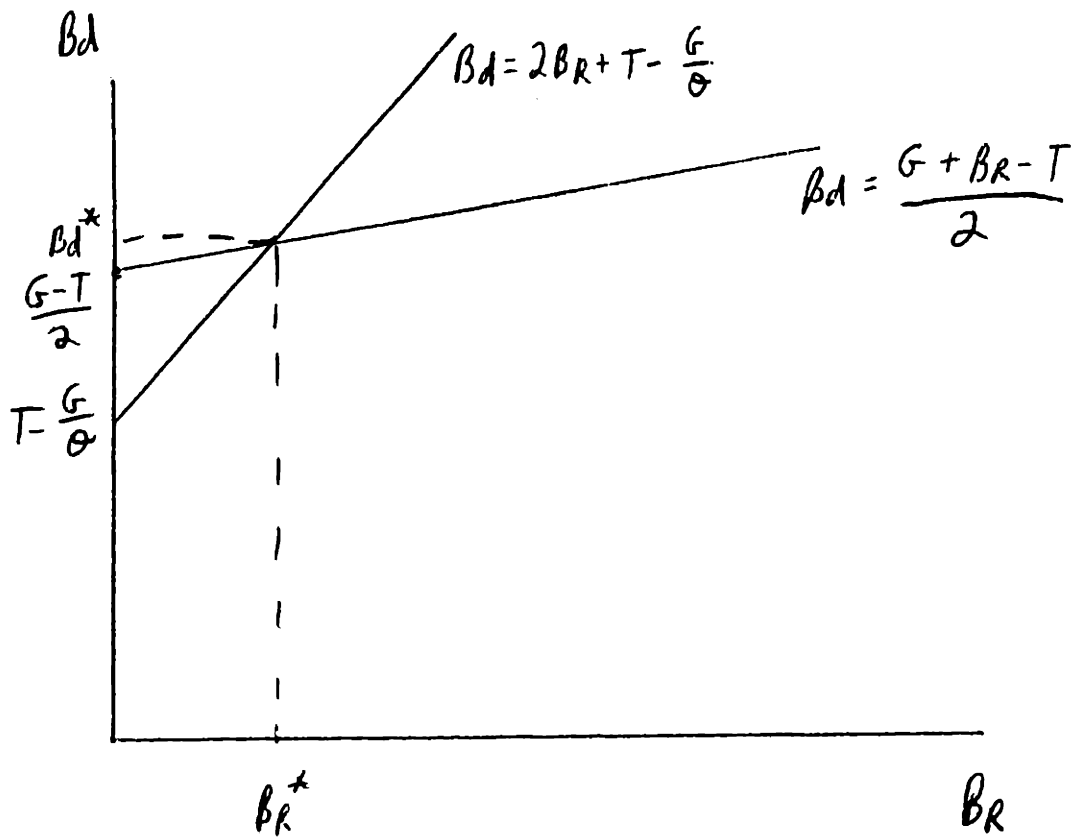


Figure 1

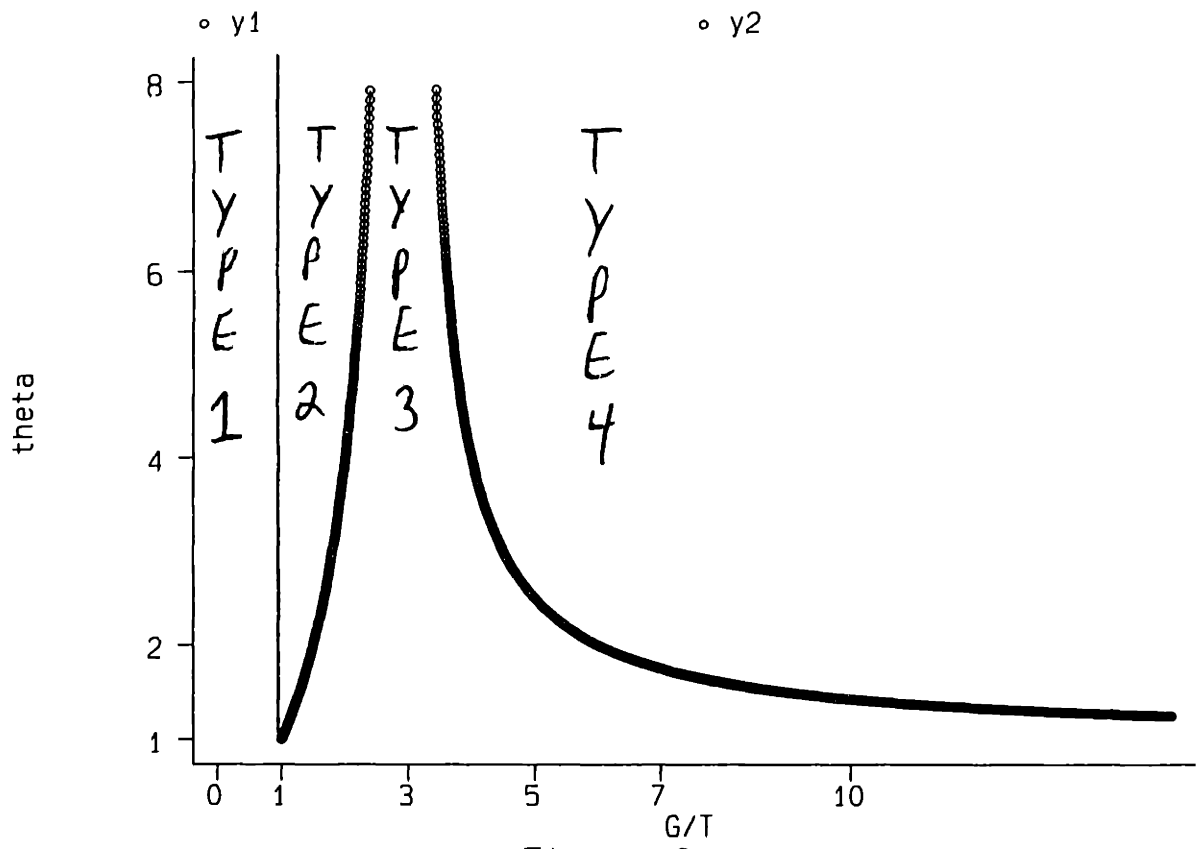


Figure 2

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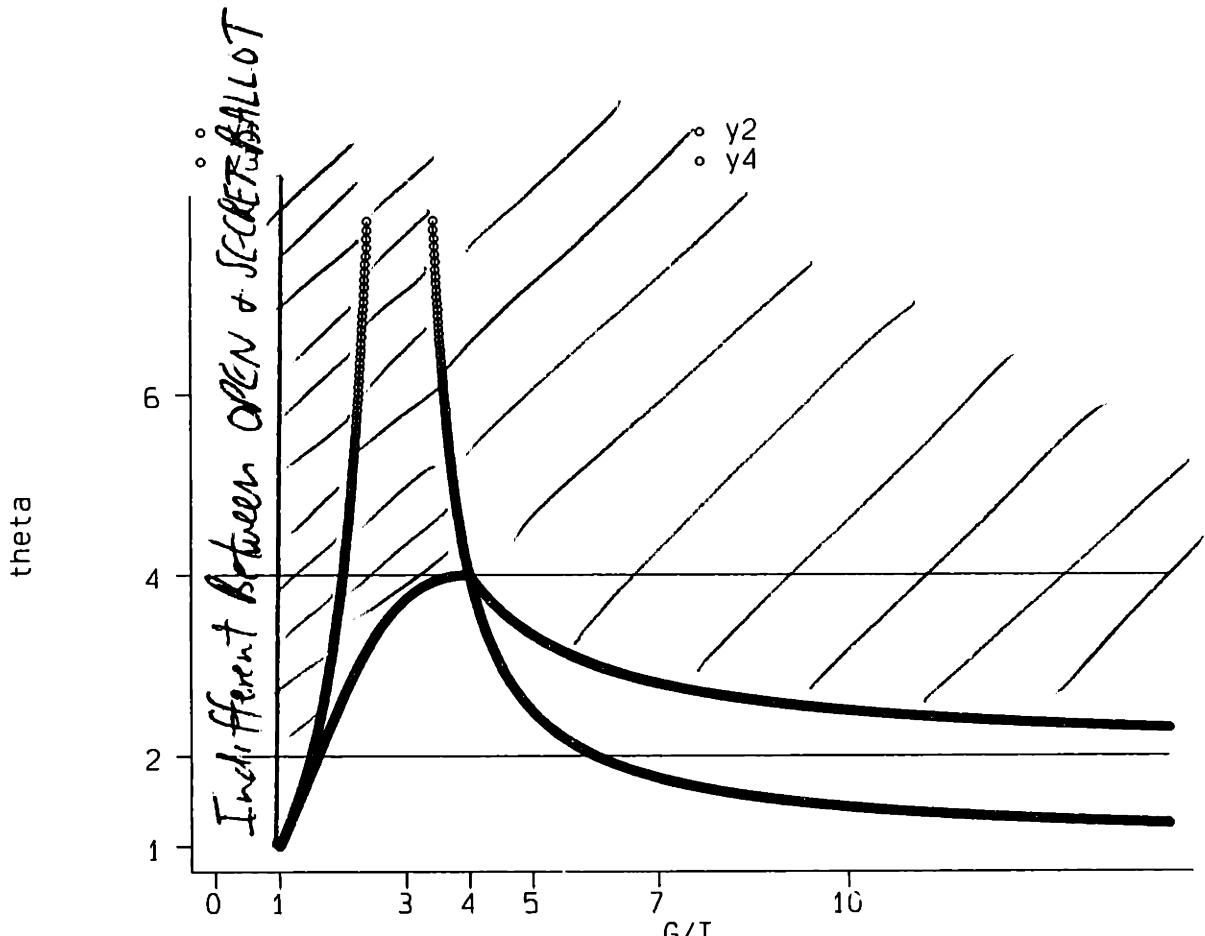


Figure 3

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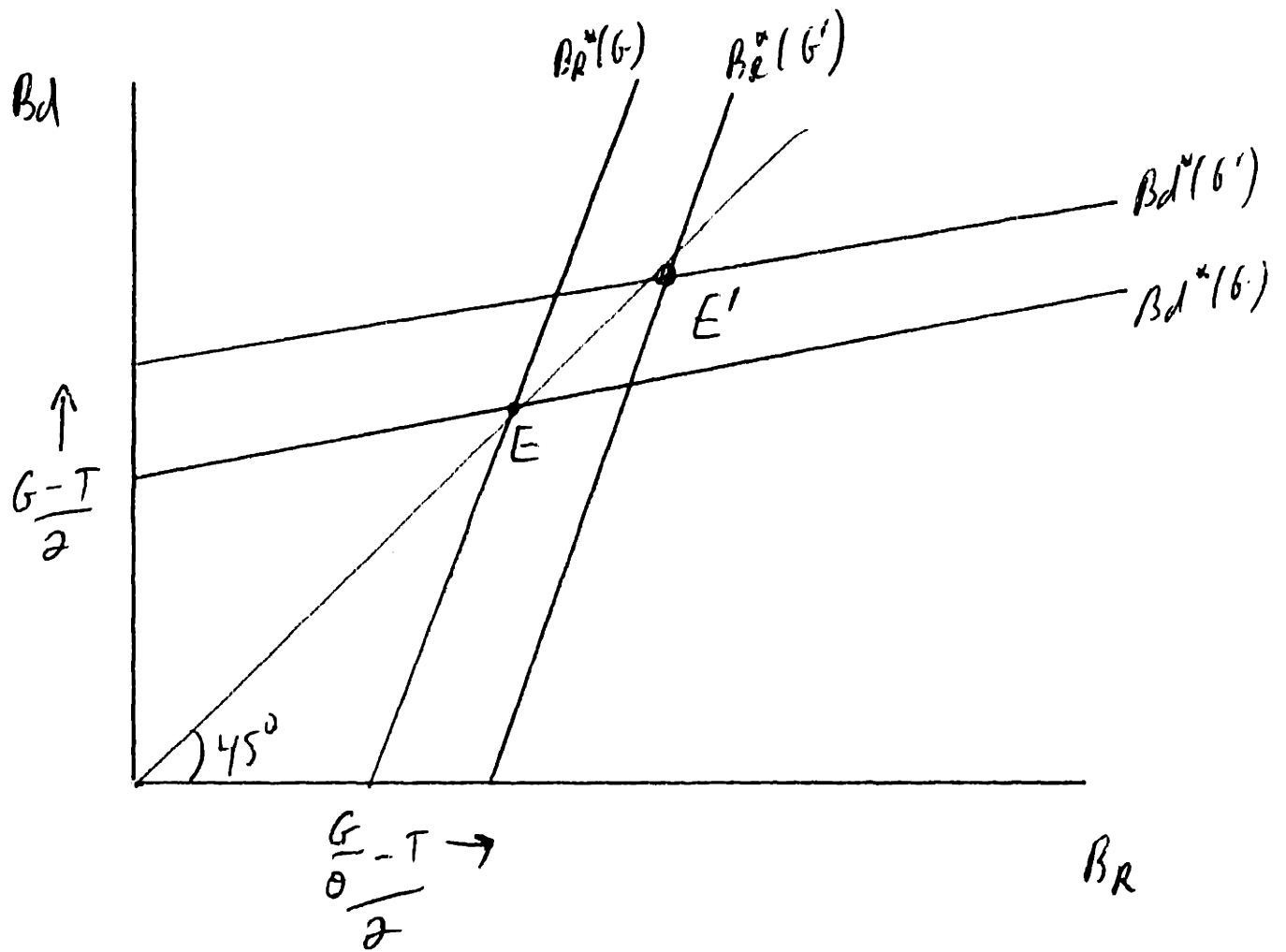


Figure 4a

When G increases to G' , the equilibrium shifts from E to E'

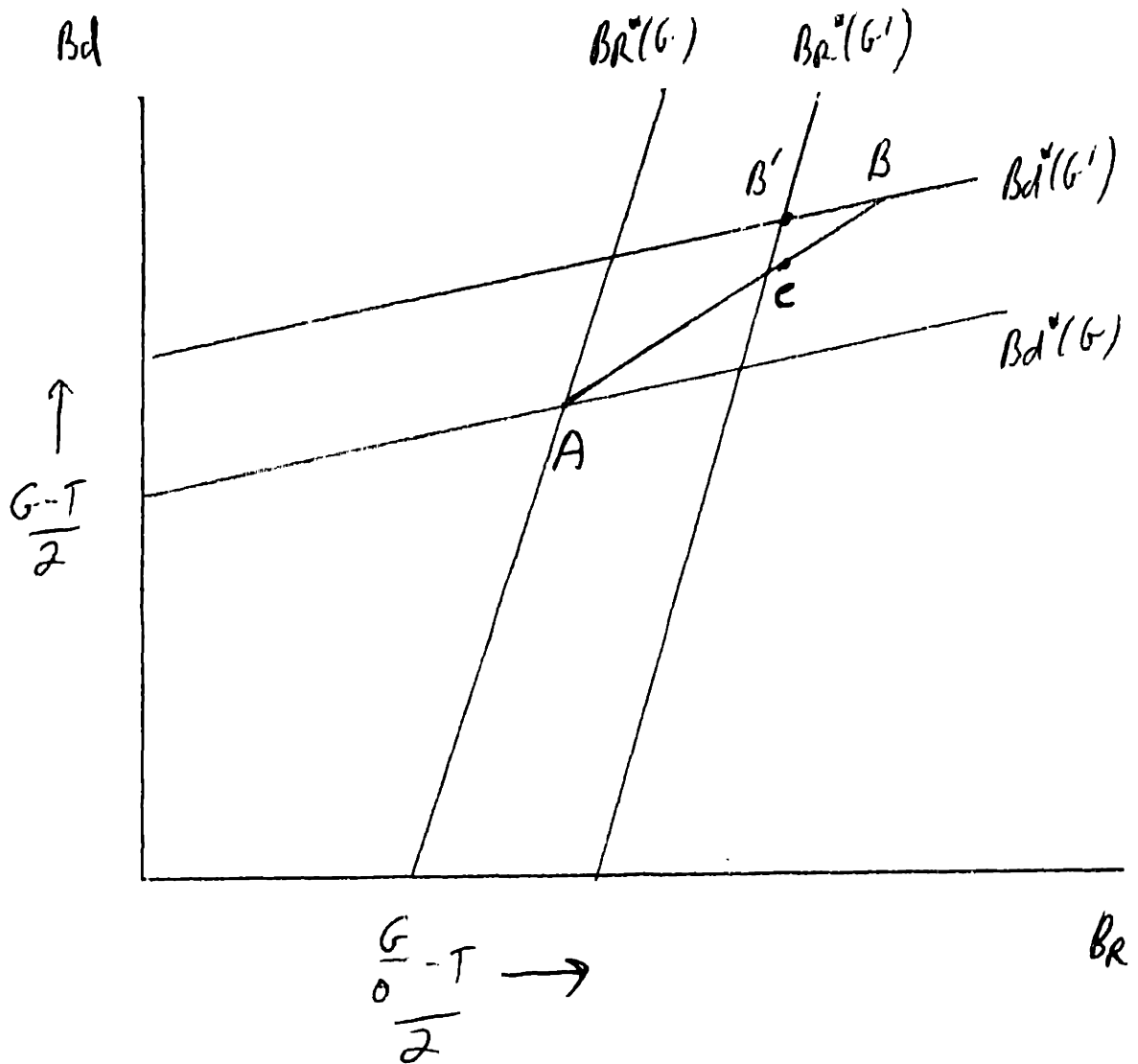


Figure 4b

When G increases to G' , the equilibrium shifts from A to B' .