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Reassessing legislative relationships: capturing interdependence in legislative position taking and votes

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REASSESSING LEGISLATIVE RELATIONSHIPS: CAPTURING INTERDEPENDENCE IN LEGISLATIVE POSITION TAKING AND VOTES

by

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PH.D. THESIS

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To my parents, Joe and Sue, who have always supported me.

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ABSTRACT

Since Woodrow Wilson's (1885) analysis of Congress, researchers assumed that members of Congress look to one another for information, cues, and advice on unfamiliar policy areas. The amount of time and effort that each legislator and their staffers would have to put in to make all of these voting decisions would be insurmountable. Fellow legislators are a resource to turn to for guidance or assistance. Legislators are able to influence their colleagues above and beyond each of their individual preferences. The members of Congress that are most influential will not necessarily be the same for every bill. The significant legislators may be one's co-partisans and the party leadership or they may be a group of legislators with whom they share a common interest. Spatial analysis allows researchers to look more explicitly at the relationships between legislators and their colleagues.

I use spatial probit and a spatial duration model to study these issues by examining the factors that influence voting decisions and the timing of position announcements. I look at a variety of different policy areas, including foreign policy, education, and agriculture, over an extensive time period (1933-2014) to test which relationships are most influential on their decisions. I study the interdependence between three different relationships, same party, state delegation, and ideological similarity, and hypothesize that these ties will lead legislators to behave more similarly. The use of the spatial analysis provides an opportunity to test these relationships and see if even after controlling for other influences there is dependence between legislators. In my research, I find that legislators are interdependent regardless of their individual characteristics. When I analyze voting behavior, legislators' behave similarly from one another across all three relationships above and beyond what we would expect given their personal preferences. These positive findings do not hold when I study

the timing of position announcements where legislators behave dissimilarly from one another when interdependence exists. The study, overall, suggests that legislative ties are especially important in explaining voting behavior and that it is critical to account for these relationships.

PUBLIC ABSTRACT

Legislating is a social process. Legislators coalesce, cajole, and conspire with one another to draft and pass bills. Decades of congressional research emphasize how each legislator's decisions depend on those made by their colleagues. Yet extant empirical methods struggle to capture the resulting interdependent nature of legislators' actions. This disconnect constitutes a major failure of the literature to properly evaluate and test theories of legislative behavior such as the role of parties in binding members' fates together or whether legislators that share common interests based on their race, gender, or other characteristics achieve better outcomes when they work in concert than when they merely act independently.

My dissertation seeks to address this gap through the use of new statistical techniques that provide a more appropriate way to detect theoretically predicted forms of interdependence. Specifically, I use spatial regression techniques to explicitly model and estimate the presence of interdependence between legislators. Spatial econometrics breaks the restrictive assumption that actors' choices emerge independently of one another. Rather, it allows one legislator's choice to explicitly depend on choices made by other legislators. I analyze this interdependence by looking at voting behavior and the timing of position taking announcements. I find that the ties among legislators are critical in explaining voting behavior, leading legislators to behave more similarly to one another.

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CHAPTER 1
INTRODUCTION

> Some representatives may vote together because of the influence of their associates; but others may vote together without there having been interaction on the subject, simply because of similarity in the constituencies they represent, or the similarity of their personal backgrounds (MacRae 1954, p. 192).

One of the big questions in congressional research is what influences the decisions that legislators have to make every day. We want to know how legislators make decisions but deciphering the influential actors is difficult. In his summary of potential influences, Kingdon (1981) discusses an extensive list of actors inside and outside the government. He argues that legislators make decisions as a result of the pressures legislators feel from their constituencies, congressional and party leaders, the executive, interest groups, staff, media, and their colleagues within the legislature. In his interviews with the members from the 91st Congress, Kingdon finds that legislators mentioned their fellow congressmen as being important quite frequently (40% without prompting and 35% when prompted with a question). When looking at how important their fellow congressmen were in their decision, he finds that fellow legislators were determinative 5% of the time and were of major importance 42% of the time. To provide some measure with which to gauge this, we could look at constituency importance, which researchers often look to as a major determinant in decision making. Kingdon finds that the constituency was determinative 7% of the time and of major importance 31% of the time. Although fellow congressmen were not the sole determinant of a legislator's decision as often as their constituency was, the difference is only slight.

The importance of their colleagues is evident from these interviews. The issue is that the empirical tests for this influence are still lacking. The study of legislative

behavior for the most part has relied on the assumption of independence. This results from the empirical methods that have been used in the previous research. Through the use of traditional methods, researchers assume that legislators make decisions independent of one another. The implications of this is that the only factors that can have influence on one's decision making process are their own individual characteristics. One of the most commonly used measures of legislative behavior, their NOMINATE scores, assumes that each of the legislators is independent of one another and that each of the roll calls that are taken is also independent (Poole and Rosenthal 1997; Clinton, Jackman, and Rivers 2004).

Much of the research on legislative decision making implies that all individual decisions depend on the decisions made by the rest of the legislators. Outside pressures can influence votes through electoral results (constituents) as well as monetary and informational contributions (interest groups/lobbyists) but in order for any of these groups to see their preferred legislation passed, a majority of the members of Congress (MCs) must agree with them. One legislator, on their own, cannot do much. The decisions that MCs make in office result not only from their personal preferences and their constituency's preferences but also from the expectations that they have for the rest of their colleagues. The decisions are made simultaneously and the decision of one MC is influenced by their relational ties to other legislators.

To argue though that this relationship only goes one direction would not be an accurate depiction of the story because there is a feedback relationship in legislative behavior. Legislator i not only influences the decisions made by legislator j but the decisions made by i also influence the decisions of j. Legislators are looking to one another to share their opinions and understanding of the legislation at hand. This communication works in both directions; legislators do not just receive influence but give it as well through their responses and discussions. The cyclical nature of these communications make it difficult to parse out the influence through standard means.

My dissertation remedies this problem through the use of spatial econometrics. The structure of spatial analysis captures this type of discourse by allowing the dependent variable of each observation to depend on the decisions of the other observations and vice versa.

Position taking, voting, committee assignments, or any other individual decision made in Congress is dependent on the behavior of the other MCs in office. Congressional behavior is relational. When it comes to position taking, the decisions are made sequentially but at each time period (days in the case of this project) all those legislators who have not announced their position must decide whether or not today will be the day that they do. Voting, on the other hand, occurs simultaneously. It seems that both of these behaviors may depend on what an MC thinks other members are going to do. When a legislator decides to announce their position may depend on the behavior of legislators who have already announced and the behavior of those legislators that are still delaying their announcement. If an influential legislator announces their position in favor of a bill, this may be a signal that a similar legislator should also announce their position in favor of the bill. Although votes are simultaneous, votes may occur where a legislator may not want to vote their true preferences because their true preferences will find them on the losing side of a vote. Prior to the roll call, legislators have some idea of what will be the final result and may change their behavior accordingly.

The quote from MacRae above summarizes one of the difficulties of the standard models of legislative behavior. It is very difficult to separate out the similarity that exists in legislators' shared individual characteristics from the influence that they have on each other. This is a problem that continues to plague some of the bigger debates in congressional literature. Consider the debate about whether or not party matters. Researchers continue to argue over whether or not party has an independent effect on behavior (Krehbiel 1991; Krehbiel 1993; Aldrich 1995; Aldrich and Rohde

2001; Cox and McCubbins 1993; 2005). The party effect is often just an indicator variable (1 if Republican, 0 if Democrat) and preferences are controlled for by an interest group rating or ideological measure (commonly some NOMINATE score). Most measure of preferences are roll-call-based measures and as a result may not separate out party preferences from a legislators personal preferences. The same struggle that MacRae highlights in his analysis of legislative behavior continues to be problematic in the more recent literature. The inability to separate out the individual effect from the group effect makes it difficult to properly evaluate the influence of these groups of interest, such as party.

The congressional literature discusses the relationship that exists between MCs and their colleagues but this relationship has not been modeled empirically. This project will use spatial analysis to model this interdependence between MCs. Spatial modeling has been used quite extensively in other types of political relationships, in particular those relationships with geographic interdependence. Spatial modeling has rarely been used in the study of Congress, in particular legislative behavior.[1]

With spatial analysis, interdependence between MCs can enter the model through the stochastic component, indicating that the spatial relationship is a nuisance that must be controlled, or it can enter through the actual observation of the other MCs behavior. The focus of this project will be on the latter. My interest is in how some MCs behavior influences the rest of the legislators. I assume the relationships that MCs have with one another is more than just a nuisance in their decision making process that must be controlled. The decisions of one legislator are not independent of the decisions made by their colleagues and if this is not modeled

[1]There has been a strong focus on network analysis in the study of legislatures. Darmofal (2009) and Hays and Kachi (w.p.) both use spatial modeling to study how legislators relate to the geographic neighbors (districts within states) but use it only as a empirical example rather than focusing on theoretical foundations of the relationships.

properly, it can bias the rest of the results.

The spatial relationship enters the model through the structure of the spatial weights matrix. The entries of the spatial weights matrix are theoretically driven. For example, the interdependence may only exist between MCs and their co-partisans. This relationship could be just a simple indicator (0 or 1, if they are in the same party) or could be a measure of ideological similarity (DW-NOMINATE). In addition to partisan similarities, legislators may also have similar district interests that lead them to want to enact similar types of policy, such as agricultural districts or multiple districts being affected by a natural disaster. Legislators will also have descriptive similarities with one another (i.e. race or gender). All of these types of similarities may lead legislators behave like one another. Another way that legislators may behave similarly could be a result of particular legislators having influence over one another. They may also be dependent solely on those they see as leaders; either party or policy leaders (i.e. committee members or chairs).

1.1 Looking Ahead

In Chapter 2, I review the existing literature on interdependence in legislative behavior and show how the previous literature indicates the need to empirically model this interdependence more explicitly. I formulate the hypotheses that I test in the following empirical chapters. In Chapter 3, I provide an overview of spatial econometrics. Additionally, I discuss the two models, spatial probit model and spatial duration model, that I will use in the subsequent chapters. In Chapter 4, I select a few single roll call votes to study in depth and test three different measures of interdependence, same party, same state, and similar ideology. In Chapter 5, I expand the analysis conducted in Chapter 4 to look at a single issue area over time. I test the same three relationships but I can now demonstrate how the three relationships I test change over a long period of time. For this chapter, I study the dynamics of the

farm bill. In Chapter 6, I extend the hypotheses to look at another type of legislative behavior other than voting, position taking. I conclude by discussing a few of the extensions that could be made using this type of analysis in Chapter 7.

CHAPTER 2
LITERATURE REVIEW AND EXPECTATIONS

A large question in the congressional literature is how members of Congress make their decisions? And in particular, which political actors are influential or helpful in making these choices? As I discuss in the introduction, Kingdon (1981) provides a summary of the people that will influence the decisions legislators make on the floor, including constituents, interest groups, the administration, staff, the media, and fellow congressmen. I focus on the last group, fellow congressmen. Despite, all the discussion of fellow congressmen in the Kingdon's book and elsewhere there is little effort in the congressional literature to analyze this in an appropriate manner. The focus of this study is to look at how legislators influence one another through the use of spatial econometrics. In this chapter, I discuss the literature that speaks to which legislators will be most influential on each other's behavior. Although the primary legislative behavior that I study is their roll call patterns, I also analyze how this interdependence emerges in the timing of position announcements for comparison.

The amount of time and effort that each legislator and their staffers would have to put in to make all of these decisions with full information would be insurmountable. Fellow congressmen can help one another in this way. The theories differ on the conditions under which we would expect interdependence to occur. The expectation that drives all of these theories is that a part of the each decision that legislators make is dependent on the behavior of their fellow MCs. Legislators cannot dictate what is law all on their own; they must make decisions as a collective. Legislators are able to influence their colleagues above and beyond their individual preferences. The enactment of policy is dependent upon the legislators that are in office. The influence of their colleagues help determine the decisions of each legislator. The MCs that are most influential will not necessarily be the same for every bill. The relationships can

shift over time or they can shift as a result of the different contexts surrounding a particular bill (or assortment of bills). In order to test these relationships, I look at three different groups of people that will be most influential on their colleagues' votes because of their shared agreement or similar voting records. These three groups of legislators are co-partisans, ideologically similar legislators, and legislators from the same state.

2.1 Interdependence in Roll Call Votes

It has long been held that MCs turn to one another for information, cue taking, and for advice on how to vote. It is not a guarantee that all representatives will need the assistance of their colleagues but they all have the potential to influence one another. The sway of each individual legislator is conditional on the characteristics of the bill and the legislator's own predispositions. These predispositions determine which colleagues will interact with one another. These interactions are determined by a variety of things such as party, one's position in the leadership or committee structure (or lack thereof), and the likeness that exists between legislators (Cherryholmes and Shapiro 1969). According to Caldeira and Patterson (1987), "interpersonal ties among members define the legislature, laying the basis for the dynamics of legislative leadership, supplying the texture for the partisan and other aggregations of members, establishing channels of communication, and providing the connections through which bargaining, exchanges of cues, and decision making transpire (p. 954)."

The necessity of communication between legislators is a result of multiple problems that legislators confront when they have to make a decision on a roll-call. The first problem is the sheer number of decisions that legislators have to make in any given Congress. In the 113th Congress, despite its relative lack of productivity, there were over 10,000 bills introduced and 1,000 roll calls taken (congress.gov). With the increasing number of bills, the scope of decisions that must be made everyday is also

an insurmountable task especially given the time limitations that exist for legislators. Between doing research and work necessary for the committee assignments as well as the amount of time they have to dedicate to constituency interests legislators have very little time to spend on reading or researching the legislation that reaches the floor but is not pertinent to their areas of expertise. Finally, time constraints are exacerbated further by the fact that a lot of legislation requires specialized information. Without this specialized information it is difficult to ascertain how the policy will translate into outcomes. Even when the necessary information is readily available it may be too difficult to distill or the source may be unreliable. In order to solve these problems legislators need a source of information, a cue on how to vote, or someone to discuss their questions and issues. Their colleagues are generally the most accessible source that legislators have at their disposal (Kingdon 1981; Mathews and Stimson 1975). As Mathews and Stimson put it, "when a member is confronted with the necessity of casting a roll-call vote on a complex issue about which he knows very little, he searches for cues provided by trusted colleagues who – because of their formal position in the legislature or policy specialization – have more information than he does and with whom he would probably agree if he had the time and information to make independent decision (1975, pg. 45)."

Members of Congress want to "maximize their chances of being informed (Gomez 2001)." Not only is being informed electorally beneficial to legislators but having a reputation for being informed will increase their credibility and influence within Congress (Gomez 1999; Esterling, et. al. 1997). Arthur Lupia (1999) argues that the attributes of the "cue giver" (i.e. their ideology, partisanship, etc.) will "affect a cue's persuasiveness only if they are necessary to inform a cue seeker's perceptions of cue giver's knowledge or interest." I assume that the distribution of information occurs through social interaction. When legislators decide to acquire information, they have to seek out a particular group of legislators. Legislators are not

selecting one another at random which is why not accounting for this interaction is problematic when studying individual legislators.

The question then arises, who will a legislator look to for assistance or discussion? Many of the traditional studies of legislative behavior discuss the characteristics that we would expect these informants to have. With respect to which informants a MC turns to first, it usually comes down to two different but not necessarily distinct aspects, expertise and agreement. Expertise is important because legislators wants to make informed decisions; they want to be able to defend their decisions when asked and they may not feel comfortable with doing this without a strong understanding of how the policy will change the status quo. This expertise can generally come in two forms: the legislators from the reporting committee and the party leaders. Legislators from the committee will have the most hands on experience with the individual bill under consideration. The expertise from the party leadership comes from the fact that they may not know the particulars of this bill but they are senior members of the party who probably have some experience with the issue and this may be enough to provide assistance. The previous experience these legislators have helps ensure that they will process and react to the policy before other legislators who have less experience will have an opportunity. Legislators often list leaders or more senior members of their party as being especially important in social interactions among their colleagues (Patterson 1959; Wahlke, et. al. 1962; Kingdon 1981; Mathews and Stimson 1975).

2.1.1 Importance of Agreement

Legislators want to make decisions as if they were independently informed; legislators who will allow them to do this will be those who have the information and in particular those with the information that is the most helpful for them to vote consistently with their own personal views. They want to make an informed

decision but only if that informed decision fits with their voting record. Looking to the legislators with whom they share similar beliefs ensures that they can vote as if they were informed and can help by simplifying the the decision. The information provided will already be consistent with one's beliefs so it will not require any extra effort for them to use this information to make their decision (Kingdon 1981; Mathews and Stimson 1975).

Agreement between legislators can occur for a variety of reasons. First and foremost, legislators are likely to have similarity with their co-partisan colleagues. MCs spend the most time communicating with their co-partisans. They will be the people with whom you will have developed a friendship and a trust. Legislators form these friendships with their co-partisan because they foster "party unity (Ripley 1967 p. 197)" and "team spirit (Wahlke et al. 1962, p. 225)." Trust is an important quality because if legislators are unsure of how they should vote on an issue they want to receive information that they they know is not just someone trying to "con" them into voting a particular way. The large amount of communication between co-partisans will also help in ensuring that these relationships are not just a one-way relationship. In complex pieces of legislation, one legislator may not know all of the particulars and they may see the advantage of exchanging information with a colleague who can fill in the missing pieces (Cherryholmes and Shapiro 1969; Mathews and Stimson 1975; Kingdon 1981; Krehbiel 1991). In a dyadic analysis of roll-call voting agreement among Ohio Assembly members, Arnold, Deen, and Patterson (2000) find that co-partisans have a dominant impact on shared voting behavior (see also Peoples 2008).

It is important to note that cue-givers are not just individuals; cue-givers can be groups of people (Mathews and Stimson 1975). This includes political parties. Political parties are largely seen as a means of ameliorating collective action problems within as well as outside the government (Aldrich 1995). The party and its leaders have the ability and the means of influencing their members votes above and beyond

what we would expect given their individual preferences. There has been a large debate in the literature on how much party effects the behavior of legislators. The two sides of this debate focus on the preferences of the individual versus the preferences of party (Lawrence, Maltzman, and Smith 2006). On the individual preferences side, the argument is legislators enter office with personal policy preferences that derive from influences outside the party and they only work within those confines (Fiorina 1974; Brady 1988; Cooper and Brady 1981; Krehbiel 1993). Prior to the 1980s, congressional parties were seen as weak and ineffectual (Wilson 1885; Mayhew 1974; Dodd and Oppenheimer 1977; Weingast and Marshall 1988).

In opposition to these arguments, other scholars challenge the assumption that rank-and-file legislators restrict the party's preferences. There are two approaches to this argument; the conditional party government model and the party cartel model. Proponents of the conditional party government model argue that the formation of parties occur in order to reduce the transaction costs associated with building and maintaining a winning coalition. Under this model, parties are especially powerful when intraparty cohesiveness is high and interparty polarization is large (Rohde 1991; Aldrich 1995; Aldrich and Rohde 1997; 2001). Party cartel theory argues that party power is constant because the motivation of the party members to maintain a favorable position in the government does not change. Under this model, the majority party focuses on controlling the agenda and ensuring that legislation that is brought to the floor will win (Cox and McCubbins 1993; 2005; Kiewiet and McCubbins 1991). The party wants to ensure that their agenda is a successful one and in order to do so will induce loyalty from its members (Lawrence, et. al. 2006).

Homophily is an important consideration in determining which of their colleagues will be influential. Same party is a clear measure of homophily. The issue with focusing only on co-partisan is that if legislators are truly seeking out those with similar attitudes they may be more likely to turn to a smaller subset of legislators,

those with similar ideological viewpoints. Oftentimes, more agreement exists within blocs or subsets of the party (Truman 1959; Schneider 1979; Arnold et. al 2000). These are coalitions like Blue Dog Democrats or Southern Democrats who share similar opinions and ideology that are distinct from the rest of their party on particular issues. Across a wide range of policies, Schneider (1979) finds strong amounts of consistency among ideologically similar legislators and their voting behavior . Legislators are seeking out any "mechanism that reinforces and thus, promotes behavior stability (Kingdon 1981, 250)." In the case of Southern Democrats, there were situations in which turning to a Republican was more helpful in achieving that goal that a Northern Democrat.

Beyond party and ideological similarity, political friendship is especially important in determining the social interactions between legislators. Early on Congress was not a very stable community. The opportunities for social interactions were limited and once each session was completed those friendships that had been developed were usually separated by legislators returning to their homes. Even under these harsh circumstances, voting blocs were fostered through boardinghouses. Young (1966) argues that the networks fostered in the shared lodgings led to similar voting patterns. Other measures of proximity have also been found to be important. Seating arrangements are especially influential (Patterson 1972; Caldeira and Patterson 1987; Masket 2008).

Evidence from state legislatures also finds that geographic proximity was important in who legislators sought out. In these studies, as the geographic distance between legislative districts increases the amount of interpersonal interaction decreases. They argue that it is a result of familiarity with one another as well as the legislators being less likely to share similar interests and values (Patterson 1959; Caldeira and Patterson 1987; Clark, Caldeira and Patterson 1993). These friendship ties lead to changes in one's behavior even when controlling for legislators coming from the

same party or having similar ideological leanings (Arnold et. al. 2000). Within the House, Truman (1959) also finds evidence that geographic proximity was important. He argues that the state delegation will constitute a communication structure that is frequently used and leads to similarity in voting among its members. Across a sample of state delegations, he finds cohesion among the members without controlling for the diversity of factors that may also be influencing their decisions. The delegation generally faces a similar kind of electorate and thus has a reference base when looking towards these colleagues. In Mathews and Stimson's (1975) study, state delegation is the most frequently mentioned cue-giver regardless of delegation size.

2.1.2 Interdependence across Policies

In addition to which legislators are influential in the decision making process, there is also a large debate in the literature about when legislators will turn to one another. The first part of the debate is whether or not influence from their colleagues is constant. Most of the literature argues that it is only in certain situations that this interdependence will emerge (Clausen 1973; Mathews and Stimson 1975; Kingdon 1981). Schneider (1979) is one of the few pieces that finds a consistent relationship across a subset of policy areas (foreign policy, domestic liberalism, class allocation, race policy, and civil liberties). His focus was solely on the cohesion in voting among ideologically similar legislators but his findings suggest legislators tend to work together regardless of the policy issue.

On the other side of the argument, there is still some disagreement under which conditions legislators will be especially influential. In a similar study, Clausen finds that with some policies (government management, social welfare, and agriculture) legislators relied on one another (in particular, along party lines) while on other policies constituency or other Washington influences were much more important (civil liberties and international involvement). In addition to this focus on specific policy

areas, there has been a more general discussion in the literature as well. This debate splits on whether or not one's colleagues will be more critical in situations in which there is a lot of controversy or in those situations in which is none (Mathews and Stimson 1975; Kingdon 1981). The argument for controversial policies is that legislators will have more conflicting signals coming from their other sources (like the constituency, interest groups, President, etc.) and that is why they will look to one another (Kingdon 1981). On the other hand, those decisions without any controversy, the everyday decisions, there will often be no signals from the forces outside of the chamber and their colleagues will be the only people that they will be able to provide any type of assistance.

2.2 Interdependence in Position Taking

Much of the previous literature on the study of congressional decision making focused largely on the end of the legislative process, the final vote (MacRae 1958; Clausen 1973; Weisberg 1978; Poole and Rosenthal 1985; 1997; Cox and Poole 2002). The problem with the focus of congressional decision making being solely on roll-call voting that occurs on the floor is that "roll-call votes are not a random sample of Congressional decisions (Van Doren 1990, 311)." Decisions are made constantly throughout the legislative process and the factors that effect one stage of the process may not be consistent across all of the decision. Thus, looking at the timing of position announcements adds information to the study of legislative process.

Given the choice of when to announce their position on an important issue or vote, legislators are expected to choose the moment that maximizes the expected benefits from their announcement against their costs of staking their position at that point in time. There are variety of situations where it may be beneficial to commit to a position quickly and others where it may be more important for the legislator to delay their announcement for a few more days. The timing of position taking is calculated

and strategic (Box-Steffensmeier, Arnold, and Zorn 1997; Caldeira and Zorn 2004; Boehmke 2006). In the study of position taking, there have been a variety of factors that have been found to influence the timing of a legislator's position announcement.

Box-Steffensmeier, et. al (1997) found in their analysis of NAFTA position timing that the most influential factors were the constituency factors especially proportion of union members and whether or not the member represented a district on the Mexican border. Both of these factors were found to increase the hazard of announcing one's position, in other words they were more likely to announce their position early on. They also found that corporate and labor contributions were very important in determining when a legislator will announce their position. Finally, being a member of the Republican leadership increased the timing of the position announcement. Boehmke (2006) also studies this data and finds similar evidence for the observed factors found to be important in Box-Steffensmeier, et. al.'s initial analysis but through the use of a new estimator finds evidence that presidential lobbying and party loyalty oftentimes were very influential in deciding not only the vote but also when the legislator announced their position.

Previous literature has focused on how legislative signaling theory provides a basis for the expectations on the strategic timing of position announcements (Krehbiel 1991; Lohmann 1993). The basis of the literature is that legislators need information about the votes they will be making but often do not have the time or the resources to understand all of the decisions fully. Thus, they "devise strategies to cope with the uncertainty (Krehbiel 1991, p. 70)." Legislators are expected to specialize according to their committee assignments and based on this specialization are expected to provide cues and information to the fellow legislators who are not a member of the committee or an expert in the topic at hand.

A late announcement usually indicates that the legislator is receiving multiple conflicting signals and thus is trying to provide him or herself with time to collect

more information about the potential ramifications of their position announcement. This delay may have potential costs, alienating supporters who are observing other members announce their position earlier than their representative. An early announcement, on the other hand, indicates how seriously the representative takes the position of its constituency in hopes of increasing their electoral support and enhancing their role in shaping the final piece of legislation. The early announcement will also provide a cue to other legislators to follow (Box-Steffensmeier, et. al. 1997; Boehmke 2006). Although this is discussed in all of the previous research, this relationship in early announcements has yet to be actually studied.

It is obvious from the legislative signaling literature that one should expect legislators to look to one another for help on those issues in which they do not have a lot of expertise. This arises because there is incomplete information between the policies and the outcomes and that there is asymmetric information in the legislative arena. There are legislators that have better knowledge about a particular policy than others because committee members are given an opportunity to specialize in their issue area but often do no have time to specialize in those issue areas outside the scope of their committee's jurisdiction. Thus, there are senders (i.e. committee members) and receivers (i.e. fellow legislators) in Congress. The senders use their asymmetric information to signal to the receivers the private information they have obtained through specialization. The receivers on the other hand use these signals to determine what side they plan to vote on (Gilligan and Krehbiel 1989; Krehbiel 1991).

Although much of the literature discussed in the preceding section focuses on voting behavior (or cohesion/agreement with voting behavior) that is not to say that the same relationships would not apply to the other decisions that legislators are confronted with such as when to take a public stance on a bill or issue. Although there has been very little research on where interdependence will manifest among legislators

with respect to the timing of their position announcements, there has been considerable amount of evidence on cosponsorship in the networks literature.[1] Legislators from the same party and with similar ideologies are more likely to cosponsor legislation with one another (Gross 2009; Clark, Pelika, and Rigby 2010; Kirkland 2011). Additionally, geography is important for cosponsorship as well, legislators from the same region are more likely to collaborate on legislation with another (Pellegrini and Grant 1999). Though not explicitly about position taking, the interdependencies that exist on final votes do appear in other behaviors as well.

2.3 Expectations

Legislators will look to one another for help on some of the decisions that they have to make each day. Legislators do not have an endless supply of resources to address the multitude of decisions that they have to make each day. Their colleagues are an accessible resource to them. The interactions that occur in order to solve these issues will lead to interdependent behavior. Legislators are not making decisions independently of one another and it is important to consider which of their colleagues are the most influential. In this project, I focus on three groups that I expect to be especially influential, co-partisans, state delegations, and ideologically similar legislators. For the rest of this chapter, I will talk about how I expect these three relationships to influence their colleagues behaviors. Another factor that I take into consideration is the context under which this interdependence will emerge.

When it comes to considering the policy context, it is important to remember that without the help of other legislators and their cooperation, most legislators would never see much of their preferred legislation passed. Legislators all have distinct pref-

[1] As I mentioned in Chapter 1, Darmofal (2008) and Hays and Kachi (w.p.) do see spatial diffusion in position announcements across neighboring congressional districts but do not theorize as to why this occurs.

erences over what types of policy Congress should focus on and how Congress should implement that respective policy putting them often on the losing side of a vote. As a result of this legislators will make "trades" with one another so that as a collective they will be closer to their preferred policy. We should observe legislators trading influence and for coalitions or blocs that consistently work together. Thus, we would expect to see groups of people who tend to have very similar voting behavior above and beyond their individual preferences. This should be especially important for people who have very specialized interests, such as those members on the Committee on Agriculture or the Energy & Commerce Committee. These are committees will need the assistance of other members in order to pass their legislation and may require a more diverse coalition.

Another important part of contextual information that we have about each of the bills is the amount of information that the legislature as a whole has about the policy or policy area under consideration. There will be situations of low and high information. The amount of information that is available is dependent on the amount of technical detail there is in the bill. The more technical a bill is the more information that a legislator will have to obtain in order to be informed. When a bill is less technical, it will be easier for most legislators to use their own judgements about what the policy outcome will be but this option is not available when dealing with bills that are more complex. Legislators want to make decisions as if they have all the information available but if each MC were to try to learn everything about each bill they would only pass a small number of bills each year. Legislators have incentives to specialize in a limited number of issue areas that are important to them. In particular, the policy areas that one associates with their committee assignment(s). The influence of those members with the expertise will be more important when the bills Congress is considering are especially technical. Committee members have the most exposure to the bill and have listened to expert testimony given in committee

hearings. They are able to provide the rest of the MCs their best estimation of what the policy outcome will be on those bills that are more complicated in nature.

The type of bill or policy area that is being considered will also be an important factor. The amount of controversy in the bill can muddle the signals that a legislator receives which makes behaving independently difficult. Legislators want some form of consensus before they vote and I argue will become more reliant on one another in contentious situations. Their colleagues may be able to provide some harmony and assistance in how best to interpret these signals. Additionally, it is important to vary the type of policies since it is not clear if the interdependence among legislators will remain constant over different policy areas. Even if there is evidence of interdependence across all policies, the critical relationship (i.e. co-partisans, same state, or ideologically similarity) may vary across policies. The final contextual consideration that I take into account is the temporal context in order to prevent picking up something that is particular to a time period or a particular congress.

Temporal variation is especially important when considering the affect of co-partisans. Recently, parties have become especially important as the parties have grown farther apart from one another. For much of congressional history, the House was characterized as a committee government. At the height of committee government, all of the power was given to the reporting committees, in particular the committee chairs. During the 1970s, the implementation of reforms altered the way that the House operated, putting a large amount of power into the hands of the majority party. Further reforms were made in 1995 once Republicans gained control of the House that continued the increase in influence given to the majority party. As many of recent Congresses would indicate, the argument that parties do not matter would be particularly unfounded. That does not mean that this has always been the case and thus it is important that this study is conducted across time as well. Committee members were more likely to be influential in the years when committees

were the driving force behind Congress. As time has passed and the majority party has made gains in its ability to influence legislation, the effect of co-partisans has also probably become more of a contributing factor. Not only have parties become more important, but legislation has also grown in complexity. As legislation becomes increasingly complex, legislators will have to obtain additional information about each of the bills. Thus, in addition to party becoming more important, committees may have also made gains in influence as a result of legislation being more complex.

Thus, I expect that party will be especially significant in recent congresses. The expectations would be that there would only be a spatial relationship between those legislators that are in the same party if they are really dominant during this time. The focus of previous arguments is on the majority party making it unclear whether or not interdependence exists between members of the minority party. On the other hand, it is beneficial for the minority party to make sure that they show their solidarity with one another, specifically on very salient issues. Although they may be in the minority for the current Congress, this does not mean that they will be in the minority in future and if the bonds already exist it will not be necessary to develop them. For example, during the debates about the Patient Protection and Affordable Care Act, the Republicans, despite being in the minority, were trying to prevent members of their party from voting in favor of the ACA. This bill was especially salient and it was important for the Republican constituencies to show their solidarity for the party's position.

Party will be especially influential on issues that are very salient because of the importance during these situations to minimize the number of members that renege on their party position. On the salient issues, the majority party does not want to lose and the minority party wants to maintain its constituency base. In addition to saliency, for party to be especially influential, the bill will divide the party platforms. If the bill is one where Democrats and Republicans generally agree with one another,

we would not expect there to be any interdependence between co-partisans. On the other hand, those issues that are particularly divisive, is where party will really matter. Parties will exert more influence when the policies under consideration are important pieces of the party's platform. On those policies that each of the parties hold ownership over, legislators are more likely to take cues from their co-partisans.

Interdependence is especially influential for those members who are a part of the party leadership. They control the types of legislation that becomes law through their ability to manipulate the agenda and the shaping of the alternatives available. In order to maintain these capabilities, party leadership will focus their energy on the passage of procedural votes. The party leadership also are those members with the most invested into the the party's reputation. They are the people responsible for "whipping" their members to vote along party lines on the salient and divisive policy issues. The relational ties between a legislator and the party leadership is stronger than those ties that a legislator has with a rank-and-file co-partisan. I only look at ties among the party as a whole but this could easily be adapted to put more emphasis on the party leadership in these models. I expect that sharing a party with someone will result in a positive relationship between MCs and their co-partisans. This tie and the communication that occurs as a result will lead co-partisans to behave more similarly to one another. Thus, I expect a positive spatial parameter.

Although, I hypothesize legislators from the same party will be especially important, a shared party ID is a very broad measure of agreement. Theoretically, agreement was a very important quality, if not the most important quality, that legislators look for in their colleagues. Agreement comes from having similar interests or convictions. When dealing with controversial legislation, reinforcement of one's ideals is particularly important and something that legislators will try to find from their interactions with their colleagues. The entirety of one's party may not be able to do that. If one legislator is at one extreme of the party and the other legislator

is at the opposite extreme the likelihood that they can promote stability in each other's behavior is lower than if they were more homogenous. Consider the historical division in the Democratic party into Northern and Southern Democrats. During this time period, influence among Democrats did not cross regional lines because of their differences in values.

In addition to divisions like this within the party, moderate legislators may also look outside of their party. They are more likely to receive conflicting pressures. This may result from the legislator themselves being more moderate than their party as whole or because the outside pressures they are receiving, from constituencies or interest groups, may prefer policy to move in an opposing direction. Moderate politicians will have more beliefs in common with the legislators outside of their party and will experience situations where they do not necessarily agree with their party's position. By looking only at same party, I will miss out on the interdependencies that will cut across the aisle. In order to account for intra-party coalitions as well as more moderate inter-party interactions, I argue that ideological proximity will lead legislators to influence one another. The reinforcement provided by these interactions leads legislators to behave indistinguishably. This clustering will lead to a positive spatial relationship.

Legislators look towards those that are proximate to them. I have already hypothesized on the importance of ideological proximity but there are other standards of proximity. Proximate legislators may be those legislators who sit near one another on the floor or legislators who share the same office building or have their office on the same floor. Being close to one another is convenient and provides legislators with more opportunities to interact and develop a relationship. Professional ties are not the only ties that are important. Friendship can be equally important in determining where interdependence will occur. Outside of the chamber legislators can be influenced by their geography. As I discussed above, regional divisions were especially important

among Democrats. The issues over which region is important will be small. State interests, on the other hand, cover a wider range of policies.

State delegations will turn to one another for a variety of reasons. For certain policies, one's colleagues from the same state will have a better understanding of one's constituency and how the policy will influence your district. As with other proximate relationships, the state delegation is also convenient and a place where friendship is easily developed. Additionally, state delegations may have worked with one another in their state assembly or senate and already know one another. The influence of this group may vary according to party but for this project I am focusing on the state delegation as a whole. If party is the determining factor for intra-state interdependence, then any findings in my analysis will only become more pronounced once split along party lines. Looking at the state as a whole may also wash out some of the intricacies that may be found if I were to restrict the group to only those legislators that share a district border with one another. Communication among state delegations will lead legislators to behave more similarly to one another, leading to positive spatial autocorrelation.

To summarize, I hypothesize that the ties that exist between legislators who are from the same party, state delegation, or are ideologically similar will lead these groups to behave more alike. As a result of their empirical methods, the extant research on the influence of these relationships has struggled to parse out these group effects from the legislators individual characteristics. Thus, I use spatial econometrics to properly capture this interdependence. In following chapter, I walk through the intuition and empirics of spatial regression and the two methods I utilize in this project, spatial probit and spatial duration.

CHAPTER 3
SPATIAL ECONOMETRICS

Spatial modeling is the focus of this dissertation, so this section provides an overview of this method and the particular models that I use in the analysis (spatial duration and spatial probit models). Spatial econometrics have become increasingly popular in the political science world. As Robert Franzese and Jude Hays (2008) say in their review of spatial analysis in political science, "spatial interdependence is, in summary ubiquitous and often quite central throughout the substance of political science." Political processes occur in specific locations with actors often interacting with one another. Rarely is the process of political science studied with units in isolation of all other units. Measuring this interdependence "can seldom be taken into account by simply adding another explanatory variable (Huckfeldt 2009)."

Before going into the technical nature of spatial econometrics, I want to highlight the intuition behind this method for my project. My dissertation seeks to address the gap between decades of congressional research which emphasizes how the decisions of each legislator depend on those made by their colleagues and the existing empirical methods that continually struggle to capture this interdependent behavior. The use of spatial analysis allows me to explicitly model this interdependence, or the process through which the outcome of unit y_i influences the outcome in y_j and vice versa. For the most part, the extant empirical work on congressional behavior assumes independence. Spatial econometrics breaks this restrictive assumption, the choices of each legislator no longer emerge independently of one another but rather depend on those made by their colleagues. Further, this analysis allows for this interdependence to emerge while separating it from the legislator's individual characteristics making it easier to properly evaluate the influence of these ties. As a result of these non-random interactions, "the error terms are likely to be correlated across legislators in

any regression that treats legislators as units, and legislative scholars should explicitly account for this interdependence using (for instance) spatial lag terms (Rogowski and Sinclair 2012)."

Earlier work trying to capture this relationship often relied on two different options. Most of the time spatial interdependence was considered to be a nuisance and had to be corrected (through the use of robust standard errors) or was captured through the use of dummy variables such as those states (or countries) that were considered to be "neighbors" or a variable is included for all of the countries with whom country A shares an alliance. This type of modeling fails to capture the true interdependence between each pair of observations because it assumes that these relationships can be separated or ignored. This is problematic because in reality they are intertwined and often are substantively driven (Franzese and Hays 2007). Spatial modeling allows for a more dynamic relationship and there have been tremendous gains made in the study of political science in the spatial context. It is important to have a clear understanding of what spatial analysis actually means.

Spatial effects are generally assumed to fall into two general types: *spatial dependence* and *spatial heterogeneity*. Spatial dependence or spatial autocorrelation is determined by the belief that there is a lack of independence as a result of an observations relative location or space. The second type of spatial effect, spatial heterogeneity, is about the lack of homogeneity in parameters over space. The issues caused by spatial heterogeneity can generally be solved through the use of standard econometric techniques (Anselin 1988).

One may wonder what actually causes interdependence between units. There have been four different mechanisms that have been proposed that can lead units to be spatially linked. The first is *coercion*, which assumes that there are some units that are more powerful than others and they are able to force the weaker units into certain actions. An example of this would be that party leaders may be able to "whip" their

members into voting along party lines. The second mechanism is *competition* where interdependence occurs as a result of pressure actions from one unit place on another unit because the two units are in competition or are complements for one another. Committees have overlapping jurisdictions and with the multiple referral process may vie with one another over who will be the reporting committee. The third mechanism is *learning* where each unit learns from the actions taken by the others. An example of this is when legislators rely on one another to provide them with information or signals over legislation that they are not fully informed on. Finally, *emulation*, is distinct from all of the other three mechanism because it is assumed to ritualistic and more as a result of social constructs. The reliance on MCs with more seniority could be an example of this type of behavior (Simmons, Dobbin, Garrett 2006).

Spatially dependent observations can arise in two different types of models. The first of these is that ideas, beliefs, and decisions are diffused between neighboring or similar units. This means that the interdependence between units arises from a spatial lagged dependent variable that captures this influence. This is referred to as a spatial lag model

$$\mathbf{y} = \rho\mathbf{W}\mathbf{y} + \mathbf{X}\beta + \varepsilon \tag{3.1}$$

where $\mathbf{W}\mathbf{y}$ is lagged dependent variable weighted by matrix $\mathbf{W}$ and ρ is the spatial autoregressive parameter for the lagged dependent variable. The second form of interdependence argues that the dependence arises through the error term. This often occurs through the clustering of a specific behavior usually a result from an exogenous conditions or common shocks. This is called the spatial error model (Anselin 1988; Darmofal 2006; Franzese and Hays 2007).

$$\mathbf{y} = \mathbf{X}\beta + \rho\mathbf{W}\varepsilon. \tag{3.2}$$

$\mathbf{W}\varepsilon$ is lagged error term weighted by matrix $\mathbf{W}$ and ρ is the spatial autoregressive parameter for the lagged dependent variable. I will focus on the the first model, the spatial lag model, in the rest of this paper since my primary interest in this project is how legislators influence each others' behavior. The reduced form equation of 3.1 is:

$$\mathbf{y} = (\mathbf{I} - \rho\mathbf{W})^{-1}(\mathbf{X}\beta + \varepsilon) \tag{3.3}$$

where $\mathbf{I}$ is an N by N identity matrix. By looking at the reduced form equation, it is clear that the effects of any of the vectors in $\mathbf{X}$ on $\mathbf{y}$ depend on the spatial multiplier $(\mathbf{I} - \rho\mathbf{W})^{-1}$. For example, the effect of a district characteristic on a legislator's vote depends on the degree of spatial interdependence between legislators (ρ), the pattern of interdependence ($\mathbf{W}$), the pre spatial effects of the rest of the independent variables, and the intercept of other legislators ($\mathbf{X}\beta$). To put more simply, each legislator's vote choice depend on the vote choices made by the rest of their colleagues.

The spatial matrix $\mathbf{W}$ is a N by N symmetric matrix which expresses for each observation (the row) those units (columns) that are similar to that individual observation. The elements of the matrix not only tell whether or not the units have a relationship but also what type of relationship exists between them. The spatial weights matrix can tell the degree of the relationship. If the matrix is a contiguity matrix, element $w_{ij} = 1$ when observations i and j are neighbors and they are equal to 0 otherwise. The diagonal elements of the matrix are equal to 0 because obviously unit i cannot be a neighbor to itself. Another example is the relationship between trade partners. In this situation, it may be more important to put the degree of trade that Country A and B share rather than just that they are trade partners, demonstrating to what degree or the strength of their trade relationship (Anselin and Bera 1998).

The specification of the spatial weights matrix is up to the analyst. The most often used specification relies explicitly on geography or which states/countries are contiguous neighbors to one another. This generally creates a matrix with all of the elements equal to 0 or 1. Another use of geographic spatial relationships is through the use of distance between particular elements, whether this be the distance between capitals, voting precincts, or the distance from one's house to another house in their neighborhood.

It is necessary to understand the distinction between temporal autocorrelation and spatial autocorrelation. Although they are both dealing with types of dependent data and can be modeling via a lagged dependent variable or error term this does not mean that they are identical. Spatial autocorrelation implies that there is a non-zero covariance between the values of variable for neighboring or similar locations (depending on how the spatial relationship is constructed) while temporal autocorrelation assumes that the is a non-zero covariance between time periods such as t and $t-1$. Just as in other types of autocorrelation there is both positive and negative spatial autocorrelation. Positive autocorrelation means that spatially related variables share similar values on the variable of interest and negative spatial autocorrelation means that the spatially related variables actually have contrasting value when it comes to the variable of interest (Darmofal 2006).

The most important distinction between spatial dependence and temporal dependence is that spatial dependence occurs instantly in a multidimensional space. Temporal dependence on the other hand only goes in one direction – the past can influence the present, but the present does not have any influence on the past. In spatial dependence, those units that surround it influence each individual unit that surround it and that individual also influences all of its neighbors. The dependence flows in both directions. Another important distinction is the comparison of the two in relation to their OLS estimates. The OLS estimator is consistent in the time series

case because the time lagged dependent variable is not correlated with the errors but this is not true for spatial dependence in which each individual spatial lag is correlated with their respective error as well as with all the other errors. Thus, unlike when OLS is used in modeling temporal dependence, OLS estimators in the spatially dependent case will not be consistent (Anselin and Bera 1998).

3.1 Spatial Probit Models

Spatial interdependence can be found in many types of binary outcomes that are of interest in the study of political science. The study of legislative votes is one of these types of outcomes. This discussion has laid out how we might expect legislators to rely on one another in their decision making processes. The structural model for the latent variable of the spatial probit takes the form (under the assumption that it is a spatial lag model):

$$\mathbf{y^*} = \rho\mathbf{W}\mathbf{y^*} + \mathbf{X}\beta + \boldsymbol{\varepsilon} \tag{3.4}$$

which can be written in reduced form as:

$$\mathbf{y^*} = (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{X}\beta + (\mathbf{I} - \rho\mathbf{W})^{-1}\boldsymbol{\varepsilon} \tag{3.5}$$

The latent variable $\mathbf{y^*}$ links to the binary outcome, $\mathbf{y}$, through the following equation:

$$y_i = \begin{cases} 1 & \text{if } {y_i}^* > 0 \\ 0 & \text{if } {y_i}^* \leq 0. \end{cases} \tag{3.6}$$

The probability that y_i is one equals:

$$p(y_i = 1|\mathbf{X}) \quad = \quad \mathbf{\Phi_i} \left\{ [(\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{X}\beta]_i/\sigma_i \right\} \tag{3.7}$$

This gives the probability that the systematic component exceeds the error term, u_i. As a result of the lack of independence in $y_i{}^*$, the stochastic component is now distributed multivariate normal with mean 0 and variance-covariance $[(\mathbf{I} - \rho\mathbf{W})'(\mathbf{I} - \rho\mathbf{W})]^{-1}$. Unlike in the standard probit, $\sigma_i{}^2$ may not be constant across all observations, introducing heteroscedasticity into the model. This is why the standard probit model is not appropriate when trying to capture spatial interdependence. The joint distribution of the outcomes is not the product of n univariate marginal distributions because we cannot separate out the distributions. They must be jointly maximized.

A spatial error model is relatively more simple when compared to the spatial lag model with respect to modeling discrete choices. For the probit model, it takes the following form:

$$\mathbf{y^*} \quad = \quad \mathbf{X}\beta + \mathbf{u} \tag{3.8}$$

where $\boldsymbol{u} = (\mathbf{I} - \rho\mathbf{W})^{-1}\boldsymbol{\varepsilon}$ and the marginal probability of y_i being equal to 1 is:

$$p(y_i = 1|\boldsymbol{x_i}) \quad = \quad \mathbf{\Phi_i} \left\{ \boldsymbol{x_i}\boldsymbol{\beta}/\sigma_i \right\} \tag{3.9}$$

There is still heteroscedasticity in the spatial error model but since the dependence only operates through the stochastic term and not all of the $\boldsymbol{y^*}$, each observation depends on all observations of $\boldsymbol{\varepsilon}$ but only on their own independent variable values (i.e. $\boldsymbol{x_i}$).

Most of this research considers the spatial probit model with interdependence

in the latent variable or the unobserved variable that structures probability of a binary outcome. McMillen (1992) suggested an EM algorithm, which made the spatial probit's non-additively separable log-likelihood estimable, but the strategy did not provide standard errors for ρ and required arbitrary parameterization of the heteroscedasticity that exists in spatial probit models. LeSage (1999, 2000) introduced a Bayesian strategy of Markov-Chain-Monte-Carlo (MCMC) by Gibbs sampling. The big issue with this estimator is the need to confront the fact that it must integrate over a multidimensional truncated normal distribution. In this analysis, I use code developed by Franzese, Hays, and Cook (2013) which uses LeSage's estimator but also allows for temporal dependence to exist.

3.2 Spatial Duration Models

Spatial analysis fits well into the study of duration processes. It is easy to think of examples of these processes that may actually have units whose durations are interdependent with one another, such as policy diffusion across states or countries. This dependence can emerge in two different ways. The first is when the time to one political event depends on the time to a related event. The second kind is when the time to a particular political event for one actor is dependent on the timing of that same event for other actors (Hays and Kachi 2009). Most of the previous research done on duration processes has turned to the more traditional models such as the exponential model, Weibull model, or Cox proportional hazards model.

These models do not allow for spatial dependence to occur, thus potentially omitting factors that can affect the hazard. Omitted variables greatly affect the results found in the model, it will reduce the effect of those variables that increase the hazard and increase the effect of variables that reduce the hazard. The inclusion of frailty terms is one way to account for the potential bias. The assumptions of this method is that some observations may be more "frail" than others due to variables

not included into the model (Box-Steffensmeier and Jones 2004; Darmofal 2009).

These solutions still have not solved the problems of properly modeling the spatial interdependence that can arise in duration processes. The model that forms the basis of this analysis is the simultaneous equation full information maximum likelihood estimator that is developed by Hays and Kachi (2009). In this model the dependent variable follows a Weibull distribution such that

$$y_i^* \sim Weibull(\rho, \theta) \tag{3.10}$$

where ρ is the shape parameter and θ is the scale parameter. The errors are assumed to be distributed according to the standard Gumbel distribution.[1] A standard Gumbel variable is equal to a logged Weibull variable. Then it follows that

$$\begin{aligned} y = ln(y*) &= ln(\theta) + \frac{1}{\rho}\epsilon & (3.13) \\ &= X\beta + \frac{1}{\rho}\epsilon. & (3.14) \end{aligned}$$

This leads to a full model in matrix notation that is as follows

$$\mathbf{y} = \rho\mathbf{W}\mathbf{y} + \mathbf{X}\beta + \mathbf{L}\mathbf{u}. \tag{3.15}$$

As before, $\mathbf{W}$ is the matrix through which the spatial dependency enters this model.[2] The matrix $\mathbf{L}$ is multiplied by the error term $\mathbf{u}$ because as presented in

[1]The distribution and density functions of the standard Gumbel distribution are

$$f(u) = e^u e^{-e^u} \tag{3.11}$$
$$F(u) = 1 - e^{-e^u}. \tag{3.12}$$

[2]The description of this model follows Hays and Kachi's (2009) notation.

the equation 2.8 the error term in this model is multiplied by the inverse of the shape parameter λ from the Weibull distribution. Thus, matrix $\mathbf{L}$ has $\frac{1}{\rho}$ down the center diagonal so that each error term is multiped by the term. Following from the structural form, the reduced form of the spatial model is

$$\begin{aligned} \mathbf{y} &= (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{X}\beta + (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{L}\mathbf{u} && (3.16) \\ &= \mathbf{\Gamma}\boldsymbol{X}\beta + \mathbf{\Gamma}\boldsymbol{L}\boldsymbol{u} && (3.17) \\ &= \mathbf{\Gamma}\boldsymbol{X}\beta + \boldsymbol{v}. && (3.18) \end{aligned}$$

where $\mathbf{\Gamma} = (\boldsymbol{I} - \rho\boldsymbol{W})^{-1}$ and $\boldsymbol{v} = \mathbf{\Gamma}\boldsymbol{L}\boldsymbol{u}$. It is evident from the reduced form equation how important it is to include the potential spatial relationship in the model because now one can see that the spatial matrix actually has influence on all of the independent variables as well as the spatially lagged dependent variable since $\mathbf{\Gamma}$ is now multiplied by $\boldsymbol{X}\beta$. This equation shows that each β is now a linear combination of what would happen to the individual regardless of the other actors in the model and the sum of that individual's spatial relationship with all of the other actors. This shows that if the spatial dependence is not equal to 0 (i.e. $\rho \neq 0$) all of the β estimates will be biased. The likelihood function is developed by deriving the joint pdf of the y's from the joint pdf of the u's since the joint distribution of the u's is easier to obtain as a result of the fact that they are assumed to be i.i.d and the marginal distribution of u is known.

Through Monte Carlo simulations, the authors compared their estimator with other estimators that political scientists have used to model spatial interdependence. The authors find that even under small sample conditions, the FIML estimates are unbiased and the standard error estimates are correct, neither of which occurs simultaneously in their three other models examined (two stage least squares, ML-AIDM, and ML-AEDM). It is obvious that this model will be useful in conducting the anal-

ysis on the interdependent duration process of interest but it has no solution to the problem of right censoring that is often confronted in event history analysis.

3.2.1 Competing Risks

Spatial duration models become more complicated when the assumption that every observation will fail in the same way is broken. There are many situations in which we cannot assume that an observation is at risk of experiencing a single event. Traditional duration methods will not be appropriate in this situation because they assume that event times are independent of one another which is likely to be violated under situations in which an observation can experience multiple events at any given time.

"Multiple events" can either be ordered, where the sequence of events is important or unordered. Observations can also be at risk of experiencing the same event multiple times or they can be at risk of different events occurring within the time period of interest. I will be looking at the issue of competing risks within a spatial duration model. Competing risks are those models for which there is no order to the multiple events and they are not of the same type (Therneau and Grambsch 2000; Box-Steffensmeier and Jones 2004). With position taking, competing risks enter the model because each legislator can either announce their position in favor of the bill or in opposition. The interest in position taking is not just when legislators will announce their position but it is also about the content of the position announcement. The factors that may contribute to the position announcement of those that are in favor may not be the same factors that contribute to the timing of those legislators who are in opposition.

In competing risks models, the assumption is that there are K possible events that each observation is at risk of experiencing. This leads to the hazard rates for

each of these events being type-specific such that the hazard rate for event k is

$$h_k(t|\boldsymbol{x}) = \lim_{\Delta t \to 0} \frac{Pr(t \leq T \leq t + \Delta t | T \geq t, \boldsymbol{x})}{\Delta t} \tag{3.19}$$

With a competing risks model, each observation is assumed to only be able to experience one of these k events, but they are at risk of experiencing any of them at each time period until the occurrence one of the k possible events. Thus, each legislator can only announce their position in favor or in opposition to a bill, but they could decide to do either at any given time. There are a variety of modeling strategies that can be used in competing risks applications but I will be using the latent survivor time approach. In this approach, there are K specific outcomes for which there exists a latent failure time associated with each of the outcomes. The overall likelihood function is partitioned into the product of all K likelihoods. This is also divided according to the number of observations that failed by each of the K outcomes. The observations are then divided according to whether they failed as a result of a particular k or not. If they did not fail as a result of k they are right censored. This results in the following likelihood function

$$\mathcal{L} = \prod_{k=1}^{r} \prod_{i=1}^{n} f_k(t_i|X_{ik}, \beta_k)^{\delta_{ik}} S_k(t_i|X_{ik}, \beta_j)^{1-\delta_{ik}} \tag{3.20}$$

where

$$\delta_{ik} = \begin{cases} 1 & \text{if } i \text{ failed due to } k \\ 0 & \text{otherwise} \end{cases} \tag{3.21}$$

The implementation of this model requires the estimation of K separate models where all events other than the event of interest, k, are treated as being censored

(Box-Steffensmeier and Jones 2004). In the case of position taking, this results in two separate models; one for those legislators who announce in favor of the bill and one for those who announce in opposition. In both of these models, those legislators who never announce the position of interest are treated as right censored. Dealing with the issue of right censoring is relatively straightforward in standard duration analyses but it is made much more complicated once the spatial component is included.

3.2.2 Solution for Competing Risks in Spatial Duration Models

Traditional solutions to right censoring are not sufficient for dealing with spatial data. In order to solve the issue of right censoring within spatial data, one would may want to determine the the distribution of the error term for the censored values. More specifically, the goal is to find the conditional CDF for u given that u is greater than their censoring point. This is difficult to do when dealing with spatial data because of the dependence that exists in the model. In this model, each dependent variable is dependent on its own error term but it is also dependent on the observation of all of the other actors' y and each of these ys are dependent on their u, leading each individual y to be dependent on all other ys and us. When durations are censored, it becomes impossible to properly capture the interdependence that exists between each observation. This issue can be dealt with in one of two ways, it can either be derived mathematically which would be computationally burdensome or through the use of simulation which is the option that is chosen by Hays, Schilling, and Boehmke (2015) whose estimator is used in this analysis.

Hays, et. al. adapt Wei and Tanner's (1991) imputation algorithm for censored (nonspatial) regression data to models of spatially interdependent data for log-normal duration processes. This process alternates between multiple imputation of the censored observations and estimation of the spatial model using the imputed values. The adaption is result of the fact that we can no longer assume that the disturbances are

independent of one another. The algorithm starts by estimating a spatial regression model, treating the censoring point as the observed time of the event occurring. From this initial model, the estimator calculates a predicted value for the errors, $\hat{u}$. Using the covariance matrix of these errors, the Cholesky decomposition, $\boldsymbol{A^{-1}}$, is calculated.

$$\begin{aligned} E[\hat{\mathbf{v}}\hat{\mathbf{v}}'] &= E[(\boldsymbol{\Gamma L}\hat{\mathbf{u}})(\boldsymbol{\Gamma L}\hat{\mathbf{u}})'], && (3.22)\\ &= (\boldsymbol{\Gamma L})E[\hat{\mathbf{u}}\hat{\mathbf{u}}'](\boldsymbol{\Gamma L})', && (3.23)\\ &= (\boldsymbol{\Gamma L})(\boldsymbol{I})(\boldsymbol{\Gamma L})', && (3.24)\\ &= (\boldsymbol{\Gamma L})(\boldsymbol{\Gamma L})'. && (3.25) \end{aligned}$$

For a log-normal distribution $\boldsymbol{L}$ captures the standard deviation as a departure from the standard normal error $\mathbf{u}$ and has σ_u down its diagonal. Therefore, this is simplified for the log-normal case to $\sigma_u^2\boldsymbol{\Gamma\Gamma}'$.

The reduced form errors can be written as a linear combination of i.i.d. errors: $\hat{u} = \boldsymbol{A^{-1}}\eta$ [3]. The algorithm them works through solving for the values of η starting with the last observation. [4] For the uncensored cases, this results in the implied values of η but since we never observe η for the censored cases, it cannot be solved for directly. For the censored values, the censoring point is determined and then a random draw is taken from the censored normal distribution to obtain a value greater than the censoring point. These imputed (for the censored cases) spatial errors are then used to calculated an imputed Y which is run through another spatial lag model. This process is repeated M times with M different random distributions from which the censored errors are imputed from. The estimates from the M separate imputations are combined using Rubin's (2009) formula.

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[3] Where $\eta = \boldsymbol{A}\hat{u}$ and ηs are i.i.d draws from a linear combination of normal variables

[4] It starts with the last observation because $\boldsymbol{A^{-1}}$ is an upper triangular matrix.

$$\bar{\theta} = \frac{1}{M}\sum_{m=1}^{M}\hat{\theta}_m, \tag{3.26}$$

$$Var(\bar{\theta}) = \frac{1}{M}\sum_{m=1}^{M}Var(\hat{\theta}_m) + \frac{M+1}{M}\left(\frac{1}{M-1}\sum_{m=1}^{M}(\hat{\theta}_m - \bar{\theta})^2\right). \tag{3.27}$$

I adapt this algorithm for the purposes of dealing with competing risks spatial duration models. In order to do this, I run two separate spatial analyses; one for opposition position announcements and another for favorable position announcements. To illustrate what this looks like, let me explain for the favorable position announcements model. In the first run of the algorithm, all legislators who did not announce their position in opposition are treated as right censored. Their censoring points will be the time at which they actually announced their position so it may differ for each legislator. As the algorithm iterates back in forth between imputation and estimation, it generates new values for these opposition legislators, indicating at what point in time they would have announced their position in favor of the ratification. By imputing these values, I am able to control for the influence of these legislators and properly capture the interdependence that exists between the observations.

In the following empirical chapters, I use spatial probit and the competing risks spatial duration model I develop to test the interdependence in legislative voting and position taking. By using spatial econometrics, the decisions of legislators depend explicitly on those made by their colleagues (and vice versa). Further, I capture the influence of the three relationships of interest while separating out the influence of their individual preferences and other outside forces.

CHAPTER 4
INTERDEPENDENCE IN INDIVIDUAL BILLS

As I discuss in Chapter 2, a lot of attention in the literature has spent focusing on who influences legislators and their voting behavior. The question of interest in this project is how legislators influence one another. I use this empirical chapter to look at how they influence one another's votes by looking at two individual bills, the approval of the U.S. signing onto the North American Free Trade Agreement and the No Child Left Behind Act. These two bills will allow me to test how the interdependence among legislators varies across two different policy areas. The use of individual roll call votes is important because of the ability to control for specific bill effects that I cannot control for when pooling votes together. I will be able to control for the constituency and personal preferences that are salient for each particular bill and see what influence the three relationships I test, same party, same state, and ideological similarity, have on these votes. If there is communication and guidance that can be attributed to these legislators, then I would see clustering among legislators on these votes above and beyond what I would expect given their individual characteristics. I expect that these ties will lead legislators to behave more similarly to one another and will lead to positive spatial autocorrelation. In this chapter, I will discuss my bill selection procedure, highlight the important pieces of the bills that I use, discuss the data and results of the spatial probit models, and consider the conclusions that can be drawn from this chapter.

4.1 Empirical Testing Strategy

As the theory implies in Chapter 2, it is important to look at a variety of bills and see if there are any patterns that emerge in the types of relationships between legislators are influential in their voting decisions. Kingdon (1981) argues that fellow

congressmen will become influential to one another when the issue being considered is controversial and there is conflict in the signals the legislator is receiving from their constituency and other outside influences. This should be especially important when the legislator has no experience or has strong concerns about the issue at hand. In order to try and capture these dynamics, I vary important aspects of the individual bills used to test the interdependent nature of voting. The first is to vary the technical nature of the bills that I study. Specifically, will legislators have difficulty predicting the outcome that will result from passing this bill and is the means of implementing this bill straightforward? Bills that require large amounts of specific knowledge will be those bills in which legislators do not have clear signals from their constituencies and legislators will not necessarily have strong concerns about how the bill because they do not fully understand the bill.

In order to capture the controversial nature of the bills I am studying, I need to vary the saliency of the legislation. This is not a perfect measure since oftentimes salient bills are those in which you may have most information from your constituency but salient bills are also those bills in which you may have the most conflicting signals. Looking at only salient bills will be a strong test of the argument that legislators are influencing one another decisions if this is the case. It will be important to look at a bill that is not salient to see how this effects the influence of one's colleagues. This is particularly important because despite the arguments that Kingdon (1981) makes about the importance of controversy in legislators looking towards sources outside their constituency or personal opinions Matthews and Stimson (1975) argue the opposite. According to Matthews et. al., it is the normal (or non-controversial) decisions in which we would expect legislators to rely on one another more heavily. Additionally, it is important to not look at bills that fall under the same policy area. There may be policies in which party or ideological similarity is more important and those policies in which same state may be more important. In order to ensure that

the findings are not just an artifact of the individual policy or policy area that I am analyzing, I select bills that focus on different issues. Finally, it is important to select bills from different time periods. For this empirical chapter I focus my attention on the "contemporary" Congress. The variation that I focus on is centered on the 1994 elections. Empirical and anecdotal evidence indicates that the two parties have been becoming more and more distinct from one another since the 1994 elections in which Republicans gained control of the House and instituted a variety of reforms that placed even more power in the majority party. Party influence may still be important in the pre-1995 era but the expectation is that it will be even stronger post-1995.

In this paper, I look at two different bills that vary the technical nature of the bill or more specifically, the ability at the time for legislators to decipher the outcome given the passage of the bill. Additionally, the two bills I look at also vary according the time period when they were passed and the bill topic. The first bill I will look at is bill that authorized the United States signing onto the North American Free Trade Agreement (NAFTA) in 1993. The second bill I will look at is No Child Left Behind (NCLB) in 2001.

4.1.1 North American Free Trade Agreement

In order to test the interdependence between these groups, I examine the legislation that approved United States participation in the North American Free Trade Agreement (NAFTA) on November 17, 1993. NAFTA is an agreement between Canada, Mexico, and the US, that creates a multilateral trade bloc. In particular, it established open trade between the three countries and ended tariffs on a variety of goods. This bill was heavily supported by Republicans in Congress but President Clinton also backed the agreement upon entering office. There are a variety of reasons to consider this bill. NAFTA was a particularly salient bill and is arguably one of the most comprehensive free trade agreements considered by Congress (Quinones 1994).

The debate was largely between those members that were in favor of free trade and those that were more supportive of labor unions. The political dynamics of this bill also increased the salience of the bill. Clinton had just won the presidential election, running on the platform of being a "new" Democrat, or as a Democrat that was willing to face off against organized labor. Ross Perot also tried to use NAFTA as a way to show his political influence and despite being less than successful he helped keep the issues in the news. In addition to the organized interests and political debates that surrounded this bill, it was a complex piece of legislation and the outcomes that may result from signing onto the agreement were still unclear.

In the case of NAFTA, there were not clear divisions between the two parties. Republicans were very supportive of signing onto the agreement whereas Democrats were not as cohesive. NAFTA already fit into the agenda of most Republicans, since they are generally in favor of free trade and the agreement had been started by Bush but Democrats felt conflicting pressures. Democratic constituencies wanted them to vote against NAFTA but they also felt pressure from the President to vote in support. Thus, it may not be useful to just look at ties between co-partisans. In addition to looking at the relationship between co-partisans, I also will look at how ideologically similar legislators influence one another. This may be more appropriate given the divides between the Democrats. When looking at co-partisans, I do not expect to find a relationship because of the divisions between Democrats. On the other hand, I would expect there to be a positive effect for ideologically similar legislators.

Additionally, I examine those legislators who are from the same state. The few examples of spatial econometric studies of legislative behavior have looked at the influence of geography. Specifically, they have looked at how legislators are influenced by their neighboring legislators (by district) when it comes to the timing of their position announcement (Darmofal 2009; Hays and Kachi w.p.). The expectation is that legislators from the same state may have similar interests in whether or not the

U.S. signs onto NAFTA and may rely on one another for guidance on how they should vote. I would expect that legislators from the same state will tend to vote similarly to one another, regardless of their party affiliation.

4.1.2 No Child Left Behind

The No Child Left Behind Act reauthorized the Elementary and Secondary Education Act of 1965 and passed the House on May 23, 2001. Although NCLB was reauthorizing a previous piece of legislation, it radically transformed the role of the federal government in education. The major changes that resulted from this education policy were focused on testing and accountability, through the establishment of measurable goals with the intent to improve individual outcomes. Each state was required to develop an annual assessment and their own standards of success in order to receive federal funding. Each year the schools were expected to improve upon the tests to show that they were making progress. If schools failed to show that they were making progress, they were penalized according to how many years they were noncompliant. A large part of George W. Bush's tenure as governor and his presidential campaign focused on educational reforms, despite education being considered a "Democratic" issue. As governor, he promoted annual testing in grades 3-8 and made it clear during his campaigning efforts that he wanted to do something similar at the national level. The bill was coauthored by Representatives John Boehner (R-OH) and George Miller (D-CA), and Senators Edward Kennedy (D-MA) and Judd Gregg (R-NH) in order to establish a bipartisan coalition across both chambers as a result of the small margins that existed in both the Senate and the House (McGuinn 2006; Hursh 2007).

The role of party in this piece of legislation should be very important. First and foremost, education is seen as a Democratic issue and the expectation was that a large portion of Democrats would support this bill, in particular those New Democrats

that emerged during the Clinton years. Some Democrats may have experienced some conflicting pressures with the standard party platform and the interest group and constituency pressures. The Democrats who received a lot of contributions from teacher's unions or had a large portion of the eligible workforce employed in public education would have been less likely to vote in favor of NCLB, as a result of the dislike that teachers had for the new standards that they would have to meet. Republicans were surprisingly very supportive of the increased federal role in the education system. This shift in opinion was a result of the pressure that they felt from Bush really pushing this agenda. After a rather contentious election, many Republicans felt that it was important to show that Bush's legislative agenda could have undisputed success. That is not to say that all Republicans were on board with the bill. There was a large portion of the House Republicans who would never support this kind of testing reform without the inclusions of vouchers. These cross pressures for this bill may diminish the importance of party and increase the significance of those legislators who have similar ideological views to you which is why I still look at the relationship between legislators who are ideologically similar to one another. Those Democrats who receive large pressure from teachers and teachers' unions likely are similar to each other when it comes to their ideology. The same can be said for those Republicans who are supportive of the voucher systems.

Legislators who come from the same state are especially important in this example because the assessment and standards were not established in the bill itself. The bill only required that the state establish their own system. Thus, we would expect that legislators who come from the same state would have similar interests in whether or not this bill would be beneficial for their state and that this relationship should matter regardless of the party ID of the members in the state contingency.

4.2 Data

4.2.1 North American Free Trade Agreement

The data for NAFTA comes from Box-Steffensmeier, Arnold, and Zorn (1997) and I plan to use similar controls.[1] These controls capture the influences of constituency, interest group, institutional, and individual factors. The constituency factors that were included in their analysis were percentage of union membership in a representative's district, whether their district was on the Mexican border, the proportion of the district that voted for Perot in the 1992 presidential election, and the median household income in their district. The interest group factors controlled for the contributions made by corporate and labor-related PACs. The institutional factors were included to control for those members that were in a powerful institutional position such as the party leadership or a member of one of the committees that considered NAFTA. Finally, the party affiliation and ideology of the individual legislators were added in to control for their personal interests.

In addition to these controls, it is important to discuss how I plan to test the three relationships of interdependence: party influence, same state, and ideological similarity. As mentioned above, in order to analyze this interdependence, I have to structure my weights matrices in a particular way. The first relationship I will look at is the influence of party. The corresponding weights matrix connects legislators from the same party. For example, the ij entry in the spatial weights matrix will equal 1 if legislator i and legislator j are from the same party and it will equal 0 if legislator i and legislator j are from different parties. I will also look at ideological distance since the effect of co-partisans may not be as important on this bill as a result of the cross pressures Democrats experienced. I use DW-NOMINATE scores for the 103rd Congress to indicate the ideological position of each legislator. I calculate

[1]The data in this analysis focuses only on the House of Representatives.

ideological similarity by taking the absolute distance between each pair of legislators in the 103rd Congress. For interpretation sake, I transform each entry by a distance decay function that will make sure that it is the similar legislators that are most influential.[2] Finally, I look at representatives who are from the same state. The entries in the spatial weights matrix will then be equal to 1 if the two legislators are from the same state and will be equal to 0 otherwise. All of these weights matrices will be row-standardized so that each of the rows will sum to one.

4.2.2 No Child Left Behind Act

The controls for the No Child Left Behind Act are similar to those in NAFTA in that their intent is to capture the other potential influences on vote choice such as constituency influence, interest group influence, and individual factors. The individual factors that I control for in this vote was the legislator's party, their ideology (their DW-NOMINATE score), and whether or not they were on the committee. Unlike with NAFTA, I cannot control for whether or not the member was in the party leadership because all of the party leadership in both parties voted in favor of the bill and so they perfectly predicted success. In order to capture the influence of interest groups, I calculate the proportion of each member's PAC contributions that come from education and teacher's union PACs in the previous election. Finally, for constituency influence, I use two different variables. The first is the percentage of the school age population in each legislator's district that is enrolled in the public school systems. In the second variable, I calculate how much of the eligible population worked in the education system.

The spatial weights used in the analysis are similar to those used for NAFTA with the exception of the same party weights matrix. This is because there are not

[2]The distance decay function that I use was $e^{-8*distance_{ij}}$ where $distance_{ij}$ is the absolute distance between legislators i and j.

enough Democrats that voted against the bill. Of the 211 Democrats in the House at this time, only six of them voted against NCLB and seven of them abstained. As a result there was too much multicollinearity between the spatial weights matrix for same party and the legislator's personal party ID so the standard errors were inflated. Just as with NAFTA, I use the DW-NOMINATE scores from the 107th Congress for each legislator's ideological position. To capture ideological similarity, I calculate the absolute distance between each pair of legislators and reshape each element of this matrix by the same distance decay function. Finally, I construct a spatial weights matrix in order to represent whether or not legislators are from the same state.

4.3 Results

Table 4.1 reports the results of three separate spatial probit models for NAFTA, varying the spatial weight matrix in each of the analyses. The dependent variable indicates the member's vote on NAFTA, coded 1 for members who supported passage and 0 for those who are opposed. In the final vote on NAFTA, 234 legislators voted in favor of NAFTA and 200 legislators voted against NAFTA.[3]

In order to assess the degree and significance of spatial interdependence, consider the estimates of ρ. Recall from Chapter 2 that for all three spatial weights matrices, I expect that ρ will be positive. The results suggest that these relationships are very important in determining how a legislator would vote when it comes to signing onto NAFTA. Surprisingly, despite the strong divides in the Democratic party on the NAFTA vote, one's co-partisans had a strong and positive effect on the probability that a legislator will vote in favor of NAFTA. This finding is probably driven by the relationship between Republican legislators. The same relationship is found for legislators who were ideologically similar to one another. The similar economic

[3]I report the non-spatial probit results in the appendix.

interests that exists for members of Congress who are from the same state were also very influential on one's voting decision.

Table 4.1: NAFTA Model using Spatial Probit

	Party	Ideology Dist.	Same State
Union Mem.	-5.610***	-4.137***	4.167***
	(1.300)	(1.239)	(1.165)
Perot vote	0.970	-1.422	-0.238
	(1.160)	(1.081)	(1.032)
Mex. Border	0.290	0.428	-0.692
	(0.429)	(0.436)	(0.459)
Income	0.205***	0.217***	0.210***
	(0.090)	(0.087)	(0.082)
Corp. PAC	1.835***	1.087***	1.176***
	(0.740)	(0.711)	(0.716)
Labor PAC	-3.621***	-2.452***	-2.490***
	(0.926)	(0.867)	(0.844)
Ideology	-0.268	-0.775***	-0.097
	(0.309)	(0.292)	(0.305)
Party ID	1.355***	0.743***	-0.548
	(0.508)	(0.288)	(0.303)
Com. Member	-0.145	0.194	-0.015
	(0.314)	(0.302)	(0.307)
Rep. Leader	0.066	0.124	0.434
	(0.393)	(0.367)	(0.399)
Dem. Leader	0.160	0.238	-0.166
	(0.148)	(0.145)	(0.146)
ρ	1.772***	2.083***	1.610***
	(0.430)	(0.041)	(0.088)
Constant	-0.716	-0.233	0.416
	(0.421)	(0.320)	(0.329)
Observations	433	433	433

* p<0.1, **<0.05, *** p<0.01

The independent variables that are statistically significant in this model vary

across some of the models. Union membership is statistically significant across the models and for the most part it is in the expected direction with the exception of when I look at those legislators that are from the same state. Once I control for the relational ties that exist between legislators who are from the same state the relationship becomes positive. Household income and campaign contributions are also influence one's vote choice. Party ID was important in the first two models where I was looking at the influence of one's co-partisans or ideologically similar colleagues. These results are comparable to the naive probit model with the exception of the findings on party ID. There is no individual effect in the naive probit model but once I account for the spatial relationship among co-partisans and ideological similarly party does become statistically significant.

Table 4.2 reports the results of two separate spatial probit models for NCLB, varying the spatial weight matrix in each of the analyses. The dependent variable indicates the member's vote on NCLB, coded 1 for members who supported passage and 0 for those who are opposed. The final vote on NCLB was much more lopsided in NCLB with 381 legislators voting in favor and only 41 legislators voting in opposition to NCLB.[4]

The results from NCLB make it pretty clear that this was a party vote. With the exception of proportion of eligible population that was in public schools (K-12), the only variables that are found to be significant in these results are party ID and ideology and they are not consistent across both of the model. When looking at the same state model, the ideology of the legislator is important but once I control for ideological similarity among legislators that variable is no longer is significant. The opposite is found for the party ID variable, which was found to be significant when looking at ideological similarity but not when looking at the influence one's

[4]I report the non-spatial probit results in the appendix.

Table 4.2: NCLB Model using Spatial Probit

	Ideology Dist.	Same State
% K-12	-2.32*	0.104
	(1.435)	(1.234)
% Teachers	-8.712	-6.846
	(10.088)	(8.923)
Education PAC	0.109	0.004
	(0.165)	(0.025)
Ideology	0.135	-0.887*
	(0.378)	(0.479)
Party ID	0.886**	0.464
	(0.355)	(0.461)
Com. Member	-0.113	-0.155
	(0.260)	(0.263)
ρ	2.160***	1.915***
	(0.070)	(0.174)
Constant	-0.998	-0.233
	(1.106)	(0.320)
Observations	429	429

* p<0.1, **<0.05, *** p<0.01

state coalition has on one's vote. Comparing these models to the naive probit model, there are some differences. The naive probit model also finds that ideology and party id matter. The non-spatial model also finds that the proportion of educators in the district matters which is never statistically significant in the spatial models. The spatial parameters are both found to be positively and statistically significant indicating that there is some influence coming from these two groups of people.

The issue with looking NCLB is that is an asymmetrical vote making it difficult to parse out who was actually influential in determining each individual legislator's vote. Party was very influential on this bill and the only people who really voted against NCLB were those Republicans who were not going to support the bill unless there was a voucher program added to the bill (only 6 Democrats voted against the

bill and 7 abstained). Lopsided bills or those bills where people have a clear signal that they should vote in favor or against a bill are not the appropriate types of bills to be looking at since legislators are less likely to being having a discourse with one another over these particular bills.

4.3.1 Interpretation

In order to assess the degree and significance of spatial interdependence, consider the estimates of ρ. The results suggest when legislators were deciding whether or not to agree to the U.S. signing onto NAFTA, they relied heavily on their fellow Congress members. Surprisingly, despite the strong divides in the Democratic party on the NAFTA vote, one's co-partisans had a strong and positive effect on the probability that a legislator will vote in favor of NAFTA. The same relationship is found for legislators who were ideologically similar to one another. The similar economic interests that exists for members of Congress who are from the same state also influenced one's voting decision.

The independent variables that are statistically significant vary across some of the models. Union membership is statistically significant across of the models and for the most part it is in the expected direction with the exception of when I look at those legislators that are from the same state. Once I control for the relational ties that exist between legislators who are from the same state the relationship becomes positive. Household income and campaign contributions are also found to be influential on one's vote choice. Party ID was important in the first two models where I was looking at the influence of one's co-partisans or ideologically similar colleagues.

The interpretation of these coefficients is made more difficult than the traditional methods of interpreting binary outcomes because of the fact that each of the coefficients is filtered through the spatial parameter and spatial weights matrix during estimation. Within-unit interpretations – the influence of x_i on y_i – now involved

the feedback from i through the other units j back to i. Following Franzese, Hays, and Cook (w.p.) in order to interpret the spatial effects, I start by taking 10,000 draws from the standard normal distribution in order to calculate the structural errors. Then, these errors are multiplied by the spatial multiplier $(\mathbf{I} - \hat{\rho}\mathbf{W})^{-1}$, where $\hat{\rho}$ is the estimated value of spatial parameter from the analysis. Then, I construct two different $\mathbf{X}\hat{\beta}$ matrices, varying one of the independent variables for one of the legislators. This allows me to see how shifting one legislator's explanatory variable affects the legislators with whom they share relational ties. For illustration purposes, the results I present use the minimum value and the maximum value of the independent variable because the spatial spillover is minimal. After both of these matrices have been created, I multiply both of them by the spatial multiplier. I use these two components to create a predicted value of y^* such that

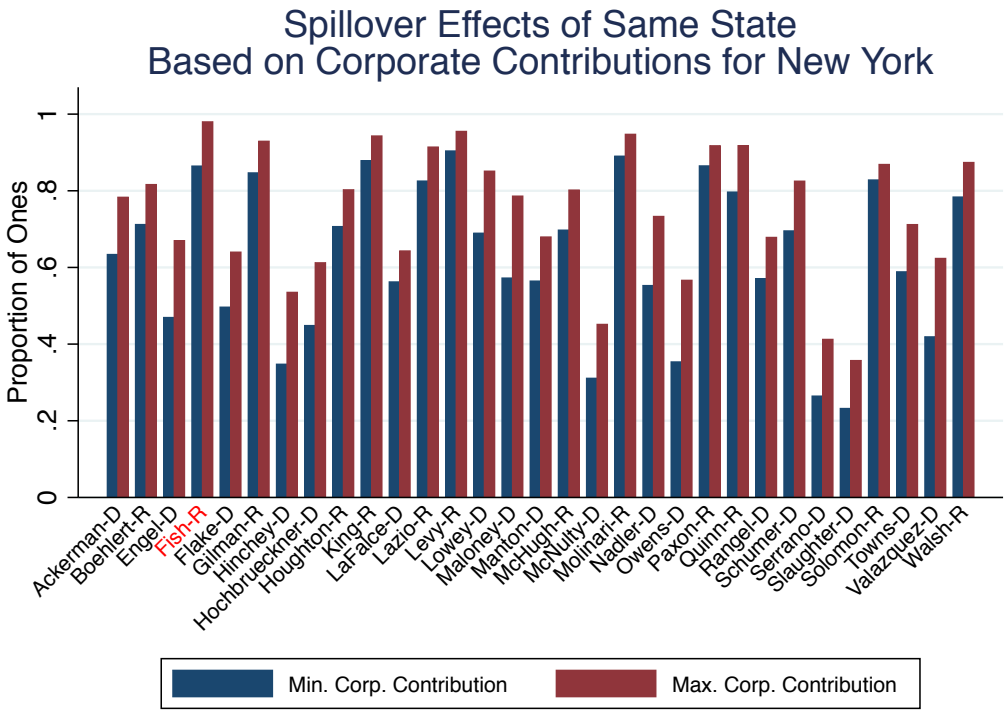
$$\widehat{\boldsymbol{y^*}} = (\mathbf{I} - \hat{\rho}\mathbf{W})^{-1}\mathbf{X}\hat{\beta} + (\mathbf{I} - \hat{\rho}\mathbf{W})^{-1}\boldsymbol{\varepsilon}$$

For each draw of the error term I have two different predicted latent ys, one for the minimum value of the independent and one for the maximum value. Each of these predicted values are then translated into the observed y. After the latent y is translated into 0s and 1s, the proportion of ones is calculated for each of the legislators across all 20,000 values of y (10,000 for the minimum, 10,000 for the maximum). Then, I take the difference between the two different proportions (the proportion of ones when the legislator is at the minimum value and the proportion of ones when the legislator is at the maximum).

For illustration of this interpretation method, I have selected a case to present from NAFTA. I manipulated one of the legislators from New York (Fish, highlighted in red), altering his corporate contributions from the lowest proportion of corporate

contributions to the highest proportion of corporate contributions that any legislator received. It is clear that from this graph that shifting the results for this one legislator influenced all of the rest of the legislators who come from his state. Some legislators experienced greater spillover from Fish's shift but the total change from this spatial model is much greater than with a non-spatial probit model where Fish where there is no spillover effect.[5]

Figure 4.1: Same State



[5]Under the non-spatial model, the first difference for Fish is 0.2658.

4.4 Conclusions

The evidence in this chapter suggests that legislators are spatially interdependent under some of the relational ties that I have hypothesized in this paper. Legislators received positive influence from their co-partisans or ideologically similar colleagues and from the legislators with whom they share the common interest of coming from the same state. This means that having these relationships make it more likely that these legislators will vote in favor of legislation under consideration. This is especially important because this influence is above and beyond their personal preferences and the preferences of their constituency. The inability of traditional methods to properly capture these effects is problematic. With the applications of spatial probit to the study of legislative behavior, I am better able to account for the influence of the relational ties that generations of scholars have theorized about.

CHAPTER 5
INTERDEPENDENCE IN A REAUTHORIZATION BILL OVER TIME

In this chapter of my dissertation I continue to look at how interdependence emerges in voting behavior but instead of looking at a variety of individual votes, I look at a single issue over time. By controlling the policy area, I am able to observe how the relationships themselves have changed over time. This is especially important considering the increasing polarization that exists in Congress. Over the last few decades, the two parties have become more homogenous within themselves and more heterogeneous from one another. There are very few, if even any, legislators that fall into the more moderate area between the two parties (on the ideological spectrum). This increase in polarization may alter the relationships that are important in influencing one another's voting decisions.

The policy area that I am using for this chapter is the Farm Bill. The United States Farm Bill is an interesting case to use for this type of study because covers a specific type of policy and it is reconsidered approximately every 5 years. the Farm Bill is the primary agricultural and food policy bill for the federal government. The first farm bill, the Agriculture Adjustment Act (AAA), was passed in 1933 as a part of FDR's New Deal project. In 1938, the Agricultural Adjustment Act was created in order to establish a more permanent farm bill that required an update every five years. The Agricultural Adjustment Act of 1938 and the Agricultural Act of 1948 are the basis for all future U.S. farm policy. the Farm Bill not only regulates the agricultural industry in the US but also manages the food stamps and other nutritional programs. I will use the Farm Bill to test the same three relationship (same party, same state, and ideological similarity) that I used in the previous chapter. Before the analysis, it is important to discuss how agricultural policy in the United States has changed over time.

5.1 United States Agriculture Policy and the Farm Bill

Up until early 20th century, the agricultural industry had received very few tangible benefits from the national government. During this time, the industry was labor intensive and took place on a large number of small, diversified farms in rural areas. These farms employed close to half to the U.S. workforce. In the 1920s, despite traditionally refusing demands to intervene in the agricultural marketplace, Congress approved two bills that fixed prices (Hansen 1991). Although clearly showing a shift in attitudes towards agricultural policy, neither of these measures actually stabilized farm prices, demonstrating that there was a need for additional production controls. President Hoover encouraged farms to voluntarily decrease production but no states implemented a reduction policy (McGranahan, Brown, Schulte, & Tyndall 2013).

Not until Franklin Delano Roosevelt's first 100 days in office did the federal government really make a concerted effort towards managing agricultural production with the Agricultural Adjustment Act of 1933, the first comprehensive farm bill. The 1933 Act focused on a specific list of commodity crops and livestock products, including wheat, cotton, corn, rice, tobacco, milk, and hogs. In the iterations to follow this list was amended to include rye, flax, barley, sorghum, peanuts, sugar cane, sugar beets, cattle, and potatoes (in the 1934 and 1935 amendments to the 1933 Act). Through this bill, the federal government established a payment system based on parity with commodity prices from 1909-1914 in order to ensure that farmers had the same purchasing power that they enjoyed during the "golden age of agriculture" as well as equalizing this power across industries (Olson 2001).

This payment system was maintained through a number of programs. The United States Department of Agriculture (USDA) was given considerable power over the system. In exchange for payments, the USDA established voluntary contracts with farmers to reduce their crop acreage. The intent of these agreements was to manage

the supply more efficiently and in effect reduce potential surpluses. In the cases where there was a surplus of particular commodity, the Commodity Credit Corporation (CCC) withheld the product from the market at the government's expense (Winders 2009). The USDA was also granted to the power to tax agricultural processors and use these proceeds to help with the payment system. Additionally, they mediated the agreements between the producers and processors in order to regulate marketing (Olson 2001).

From 1932 to 1935, farmers experienced a 50% increase in income. Despite these immediate benefits, the precedents that were set have lead to more specialized farms and little attention was paid to rural social reform. The Agricultural Adjustment of Act of 1933 was declared unconstitutional in 1936 in *United States v. Butler*. The Court argued that the use of processing taxes to regulate agricultural production was in violation of the Commerce Clause. Future iterations of the Farm Bill addressed this problem by eliminating the tax on processors (McGranahan, et. al. 2013).

As farm policy progressed in the 1930s, there were additional objectives built into the Farm Bill. Payments were conditioned on whether or not the farm was in compliance with soil conservation requirements in an attempt to control soil erosion. In addition to establishing conservation programs, the Farm Bill also added in a protection for consumers in order to assure that people had adequate supplies of food. This created a coalition between legislators from agricultural districts with those from more urban districts and also developed another source of funds for the parity payments (Olson 2001).

The Agricultural Adjustment Act of 1938 built upon and broadened the scope of the farm programs created with previous legislation. One expansion was the addition of the marketing quota which placed a limit how much corn, cotton, rice, tobacco, and wheat that a farm could supply to the market. Another addition that the 1938 Act added was the establishment of the first crop insurance program which was ini-

tially limited to wheat. The Act also reexamined the loan programs. The rates were set below parity payments and were decreased when there was a surplus. They were mandatory for corn, wheat, and cotton. For other commodities, this was left up to the inclination of the Secretary of Agriculture (Winders 2009). The parity payments were continued in this bill, ensuring that farmer would receive the different between the market price received by the producer and the parity price. Additionally, farmers were also rewarded for promoting soil conservation because they would receive payments when they transitioned away from more damaging crops.

As a result of World War II, there was a boom in demand for agricultural products requiring Congress to pass emergency farm bills in order to ramp up production of certain crops. The non-recourse loans were expanded to additional commodities and penalties on excess crops were relaxed. Post-WWII there had to be shift from these polices because farm prices started to fall. The 1949 Act was far more contentious than its predecessors (Olson 2001). The Secretary of Agriculture proposed moving away from the use of parity pricing towards a more income based standard. This proposal was designed more to ensure that farmers were receiving an equitable income relative to other industries rather than basing payments on previous market prices. The key issue with this proposal was that it would place a limit on the amount of support a farm could receive conditional on the size of typical family farm. This plan was defeated and parity prices were instituted again. A plan for supply management was also reinstated, through the use of acreage allotments and marketing quotas (Winders 2009).

All future farm bills are simply extensions of the Agricultural Act of 1938 and the 1949 Act. In the 1950s, it was clear that they needed to turn towards a more market based approach to making payments rather than parity because the demand for U.S. agricultural products was lower now that the European production had increased. The payments were based on more flexible price supports allowing them

to decrease the percentage of parity from 90% (Winders 2009). The Department of Agriculture would vary the price supports as the surpluses of a particular commodity fluctuated in the hopes that farmers would reduce their production of surpluses since they would receive lower payments. In an effort to reduce surpluses, Congress also created the Soil Bank which would pay farmers to take portions of their land out of production and put it towards conserving grass or trees. Although, this program was not promoted much beyond the 1950s due to its limited success. In addition to the shift in the policy on payments, legislation in the 1950s also permitted the sale of surplus agricultural commodities to foreign countries. This provided the US with an additional foreign policy tool, providing humanitarian aid to underdeveloped nations (McGranahan, et. al. 2013).

During the early 1960s, surpluses had become a large problem and the reduction of them became the focus of agricultural policies. Rather than focusing on market-oriented policies legislation focused on the supply management side. A new income support program was created and farmer were paid to withdraw land from production. During this period, the Food Stamp program was instituted in order to help with the negative effects of higher food prices. The 1970s continued with many of these programs, including the income supports and land diversions. The 1970 Act got rid of marketing quotas and added a cap on the amount of benefits that a producer could receive from the farm program. The 1973 Act created the concept of a target price, or "what ought to be the price," which were used to calculate the income support payments. These prices were based on the average of past crop prices rather than parity prices (Olson 2001).

During the 1980s, the agricultural market was falling apart. Farmers were filling for bankruptcy and farms were closing a rapid pace. The Food Security Act of 1985 attempted to protect farmers by keeping target prices high, increasing acreage reduction programs, and trying to increase agricultural exports. Prices were lowered

for select overseas customers in order to reduce the amount of commodities forfeited over to the government. The 1985 Act did not come cheap. In 1986, the federal government had spent $26 billion on farm and export subsidies. Farm income did rise between 1987 and 1989 and exports increased. By 1990, the farm program only cost $6.5 billion (in comparison to the $26 billion just four years before). A large push during this time period was conservation programs leading to the creation of the Conservation Reserve Program and the Environmental Benefits Index (McGranahan, et. al. 2013).

The two primary expansions in more recent agriculture policy is into biofuels and crop insurance. The expansion into the biofuel industry has provided agriculture with a new market. These programs focused on the development of the biofuel industry. This demand has increased crop production and as a result led to more environment degradation. Crop insurance subsidies have also increased. These reduce the need for additional payments after farmers have lost crops or revenue due to national disasters. It is clear that oftentimes the goals of farm policy are in conflict with one another. In particular, price support programs will only counteract supply management programs because the price supports will lead to crop surpluses. With high price supports, the federal government will always be forced to collect more and more surpluses and as these surpluses accumulate the market prices will fall. As a result supply management programs have never really been successful.

5.1.1 Political Background of Farm Bill

Throughout the history of the Farm Bill, there have been a variety of coalitions developed to ensure its passage. Early on a lot of focus and attention was given to making sure that Southern Democrats were supportive of the bill. For the agriculture policy in the U.S. this meant providing support towards cotton production.The partisan support of farm policy has fluctuated over the years. Republicans and Democrats

also cooperated with one another through the Farm Bloc. The Farm Bloc in both chambers has maintained its bipartisanship since their origins in the early 1921. This bipartisan nature allowed a interesting relationship to develop between legislators and the farm lobby which was especially influential in the formative years of federal agricultural policy. Many of the commodity specific interest groups have lost their influence in more recent years but some of the larger ones have maintained their influence such as the Farm Bureau (Hansen 1991). As expected, Democrats for the most part have been supportive, through legislation and implementation at USDA, have favored expanding supply management policy while Republicans, especially in the executive, have sought to reduce the federal government's role in the agriculture market. That is not to say that this relationship is black and white. Farm policy between 1950 and 1975 was very different from the New Deal policy and those that quickly followed. There were three significant cuts to the preexisting farm legislation. Two occurred under Republican administrations (1954 and 1973) but one occurred during a Democratic administration (1965). Price supports were lowered in the 1954 and 1973 bills while production controls were relaxed in the 1965 bill (as well as the 1973 Act).

Additionally, in Congress, there were also vigorous debates within political parties; often along regional lines and whether or not one represented a farm state. These divisions continued despite the decrease in support of supply management as a part of agricultural policy from the corn and wheat segments as well as the cotton segment losing power in the South. During the Reagan administration, he made agricultural policy a target in his reduction plan for the federal government but was unsuccessful because of the lack of support about Democrats in the House and Republican leaders in the Senate. Agricultural spending was actually expanded during Reagan's tenure. While Clinton was in office, just as before in the 1960s, a Democratic administration pared down agricultural policy. There were two differences

that contributed to this shift. First, Republicans had control of both chambers in Congress and the leaders at this time were largely in support of these cutbacks. Secondly, market prices were above price supports for the three major agricultural products (corn, wheat, and cotton). This back and forth continued with the passage of the Farm Security and Rural Investment Act of 2002 which expanded farm policy again during a Republican administration and Republican controlled Congress. This expansion continued with the 2008 farm bill which had so much support in Congress that they were able to overrule Bush's veto of the bill. The Agricultural Act of 2014 was passed but without any House Democrats voting in support of it as a result of the cuts that were made to the nutritional programs (Winders 2009). The expectations for the three relationships that I am interested in looking at are mixed. First and foremost, because these coalitions were built on regional and state interest, I would expect that legislators from the same state will rely on and influence one another. The effect of coming from the same party or being ideologically similar is more muddled with respect to agricultural policy since oftentimes bills passed with large amounts of bipartisan support but in more recent years farm bill legislation has become more contentious and partisan. I expect that these relationships may become more important with the more recent pieces of legislation.

5.2 Data

In this analysis, I will look at how these relationships have shifted over time on agriculture policy. I will look at 14 different farm bills. Some of the Farm Bills have been excluded because they were approved with unanimous consent[1] or because the vote data were unavailable. Early on the Farm Bill passed easily through the House but the vote margins have become closer and closer with each year. The most

[1]101st House approved the Food, Agriculture, Conservation, and Trade Act of 1990 unanimously

recent piece of legislation splitting almost perfectly along party lines with 216 of the Republicans voting in favor and all of the Democrats voting in opposition.[2] It is clear that the legislative environment that agricultural policies are considered under has changed greatly from it origins. The following table reports the Farm Bills that I look at in chronological order:

Table 5.1: Farm Bills

Farm Bills	Vote Results
Agricultural Adjustment Act of 1933	315-98
Agricultural Adjustment of 1938	264-135
Agricultural Act of 1949	384-25
Agricultural Act of 1954	228-170
Agricultural Act of 1956	314-78
Food and Agricultural Act of 1965	221-172
Agricultural Act of 1970	212-171
Agricultural and Consumer Protection Act of 1973	226-182
Food Security Act of 1985	282-141
Federal Agriculture Improvement and Reform Act of 1996	270-155
Farm Security and Rural Investment Act of 2002	291-120
Food, Conservation, and Energy Act of 2008	231-191
Agricultural Act of 2014	216-208

For the analysis, I collected a variety of independent variables in order to control for some individual or constituency factors that would lead legislators to vote for the Farm Bill regardless of the information or cues that they receive from their fellow congressmen. The bills in which I can get full coverage on the independent variables is restricted, limiting the number of controls I will have on the earlier farm

[2]12 Republicans voted in opposition, 6 Republicans and 5 Democrats abstained from the vote.

bills. For each bill, I am able to control for whether or not the legislator was in the House Committee on Agriculture, the legislator's party ID[3], and the legislator's ideology score, their DW-NOMINATE score.[4]

The first set of controls I use captures the agricultural interest that a legislator may have. The first variable is the amount of PAC contributions that an individual receives from any agribusiness interests in the election prior to their congressional session. This includes agricultural services, food processing, forestry, crop production, dairy, livestock, and tobacco (OpenSecrets.org). In addition to campaign contributions, I also control for farm production in the district. I collect data on the number of farms, number of farm employees, and the average (per farm) market value of production from the Census of Agriculture. Number of farms and number of farm employees are highly correlated with one another so I use the number of farm employees since one farm may have many people working on it. This measure is better at capturing how much of their constituency has a vested interest in farm production. I do not use the average market value because it is missing for a lot of districts and I do not want to have to drop any more districts from the analysis than necessary.[5]

The second set of independent variables focuses on the food and nutritional programs portion of the Farm Bill. There are two measures that I use in my analyses, the poverty rate and the percentage of the district that uses SNAP (or food stamps). I do not use these measures at the same time since they are highly correlated with one another. The amount of people on SNAP or food stamps is only easily collected for a small number of the Farm Bills so I use the poverty rate to extend the time period in

[3]I code this 1 if Republican and 0 if Democrat

[4]The party ID and committee variables sometimes had to be removed from the analysis when they perfectly separated the data

[5]The agricultural variables only cover the last four bills. Both of the variables I use were also recoded so that they are in thousands of dollars.

which I can control for this factor. From the Census' FactFinder, I am able to collect data on SNAP for the 2014 bill and the 2008 bill and then data on food stamps for the 2002 bill. After that point, I switch to using the poverty rate in my analysis. I control for the poverty rate until the Agricultural and Consumer Protection Act of 1973 which was when the nutritional programs were first included in the Farm Bill.

I use the same spatial weights matrices that I used in the previous chapter. They are constructed in the same fashion. For the same party matrix, legislators are connected to their co-partisans only (i.e. each element is 1 if the two legislators are from the same party and 0, otherwise). The same state matrix connects legislators in a similar fashion such that it is a series of 1s and 0s where a 1 means that legislators represent the same state. The last matrix for ideological similarity takes the absolute distance between all legislators and uses that as the elements of the matrix. In order to make interpretation easier, I use a distance decay function to put more weight on those legislators with similar DW-NOMINATE scores.[6] I row standardize each of these weights matrices.

5.3 Method

Since I am dealing with votes in this chapter, I will continue to use the spatial lag probit model as I did in the previous chapter. I do not want to spend more time discussing the particulars of a spatial probit model but it is important to discuss the complications that arose with this model and the code that I am using when dealing with the same party models. In order for the code that I am using to properly work, I need good starting values from a naive spatial model. This was normally done by including the spatially lagged dependent variable as an independent variable (i.e. calculating $\mathbf{W} \times \mathbf{y}$ and including that on the right hand side) in a standard probit

[6]The distance decay function that I use was $e^{-8*distance_{ij}}$ where $distance_{ij}$ is the absolute distance between legislators i and j.

model. When it came to the same party models, the starting values I received would cause the spatial probit model to fail to converge. In order to solve this problem, for all of the independent variables I took starting values from a standard probit model and then imposed a relatively low amount of spatial interdepedence for the starting value of ρ.[7] This solves the problem of non-convergence in this model and does not restrict the value of ρ as evidenced from the final results which can be found in the appendix.

5.4 Results

The following are the results for the spatial parameter for the three relationships across all of the Farm Bills that I include in this analysis. The full model results can be found in the appendix as well as the results from the non-spatial probit models. Remember from my expectations in Chapter 2 that I hypothesize that all three relationships will be positive. For simplicity, I have graphed these relationships over time to show how they fluctuate.

It is clear from the table and the graphs that same state is the strongest relationship in these models. This makes sense given the nature of the Farm Bill and how closely tied legislators' interest from the state will be for economic reasons. This relationship is not constant over time since the value of ρ fluctuates. In order to parse out the significance of these changes, in the future, I plan to use the interpretation method that I employed in Chapter 4 across time. It is important to note that I am probably picking up some of the agricultural or district interests in the earlier farm bills where I am unable to include those variables but this relationship persists into those models which have more information indicating that legislators are interdependent with their state contingency.

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[7]For all of the models, I set $\rho = 0.2$.

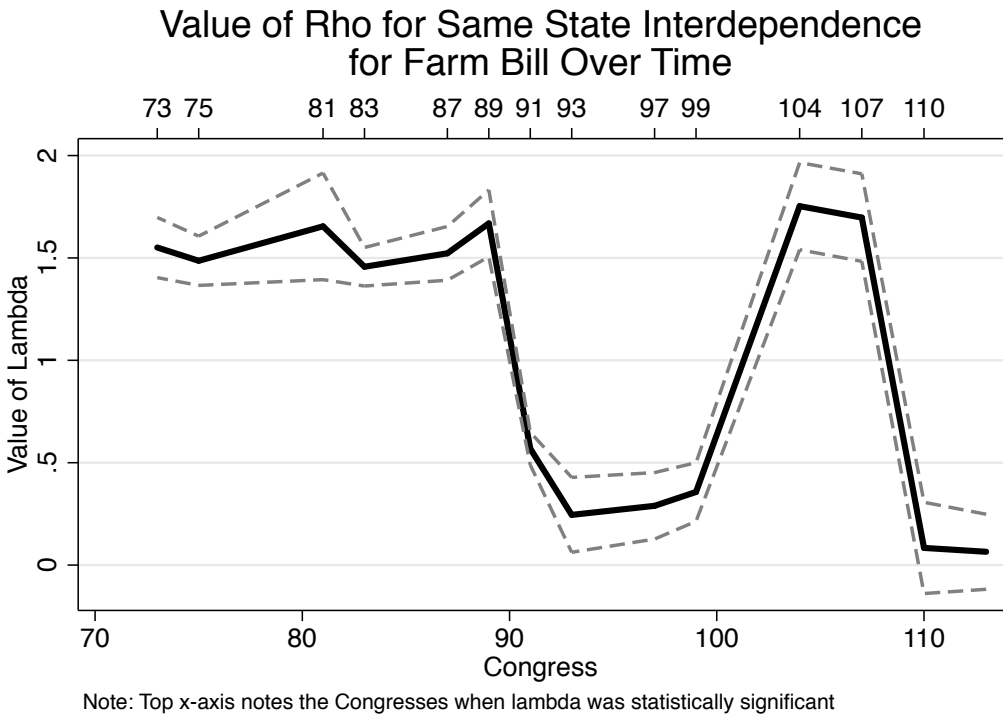
Table 5.2: Interdependence in Farm Bills

Farm Bills	Same Party	Same State	Ideological Similarity
Agricultural Adjustment Act of 1933	-	+***	-
Agricultural Adjustment of 1938	-	+***	-
Agricultural Act of 1949	-	+***	+***
Agricultural Act of 1954	-	+***	-
Agricultural Act of 1956	-	+***	-
Food and Agricultural Act of 1965	-	+***	-***
Agricultural Act of 1970	-	+***	+***
Agricultural and Consumer Protection Act of 1973	-	+***	+
Agriculture and Foot Act of 1981	-	+***	-
Food Security Act of 1985	-	+***	+
Federal Agriculture Improvement and Reform Act of 1996	-	+***	-
Farm Security and Rural Investment Act of 2002	-	+***	+***
Food, Conservation, and Energy Act of 2008	-	+	-***
Agricultural Act of 2014	+***	+	+***

For the other two relationships, they have increased in importance in the more recent iterations of the Farm Bill. The interdependence in the votes on the Farm Bill is clearly not a result of legislators being from the same party. With the exception of the most recent farm bill (where I had to exclude the individual party ID variable from the analysis), same party is never statistically significant. the Farm Bill has not often been a partisan issue and with the exception of the most recent bill, a large number of legislators from both parties have voted in favor and in opposition. There does not appear to be any clustering among legislators who share their party ID above and beyond what we would expect given their individual characteristics.

When looking at ideological similarity and the interdependence that exists in this relationship, it is more complicated than the other two groups. There are periods of time when legislators are relying on those legislators with similar beliefs for guidance or information regardless of their individual characteristics but it is not as consistent as the relationship with same state. The only clear pattern to emerge is

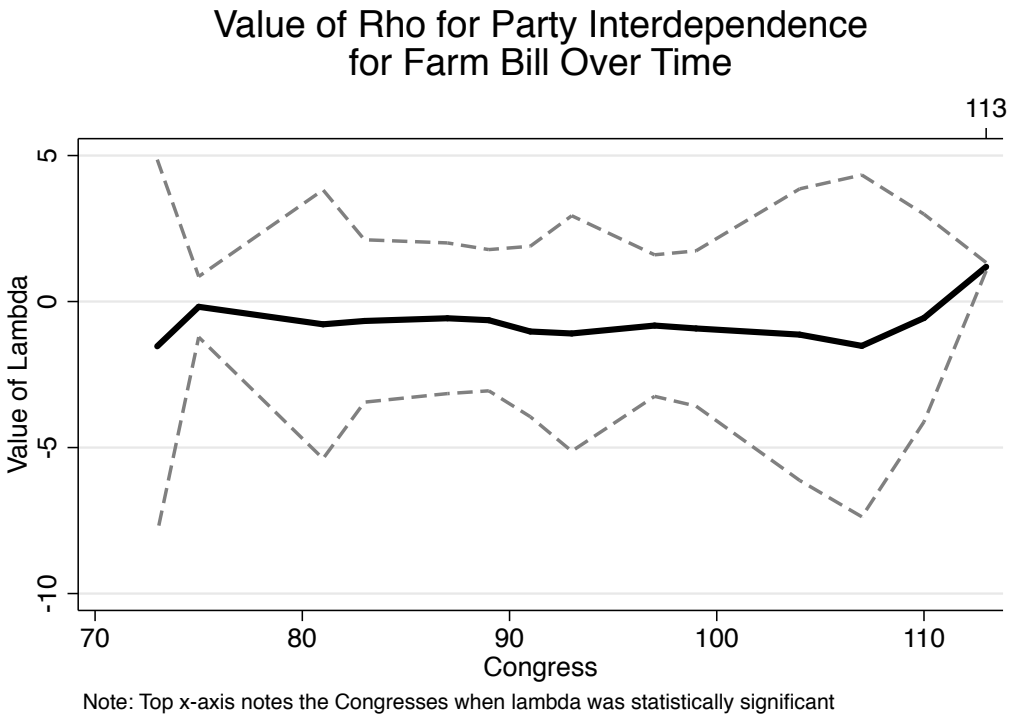
Figure 5.1: Same State



that these groups of legislators have become more interdependent in the more recent Congresses. With increasing polarization, legislators may have to rely on people with consistent beliefs more than they had to before. Also, interestingly, there are two bills (89th and 110th Congresses) in which there is a negative spatial parameter indicating that legislators are behaving dissimilarly from those legislators that they are close to on the ideological scale.

The findings for the rest of the covariates are in the expected direction for the most part. When they are statistically significant, the measures for agriculture and food programs increase the probability that a legislator will vote in favor of the Farm Bill. Similarly, legislators who serve on the agriculture committee are more likely to support the Farm Bill. The relationship across party ID and DW-NOMINATE tend

Figure 5.2: Same Party

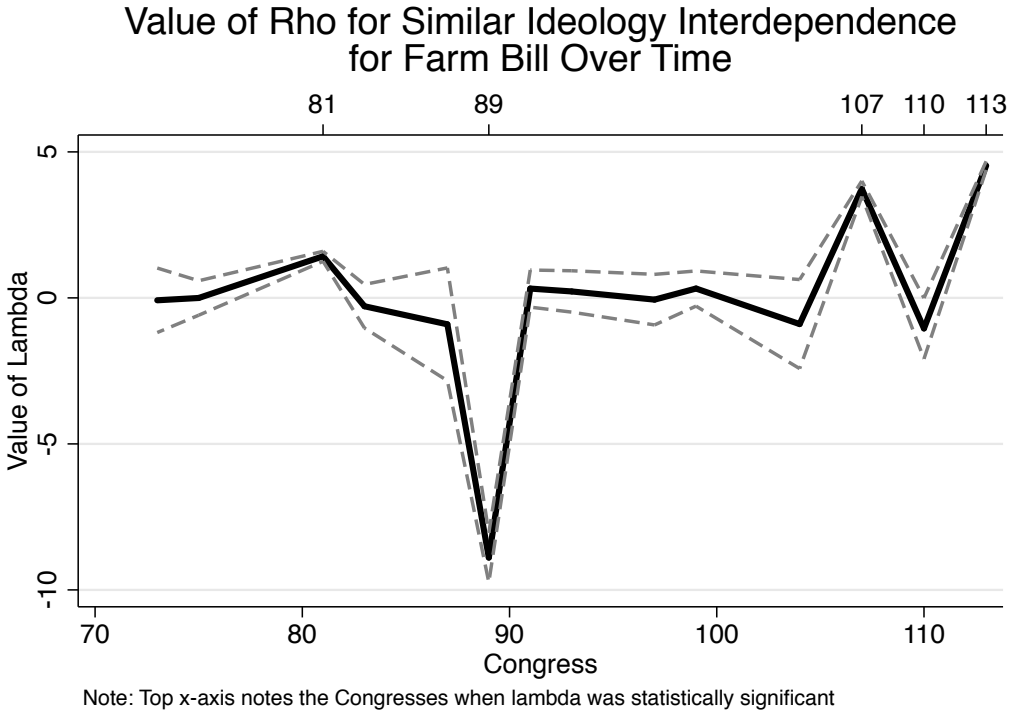


to fluctuate the most. Generally, ideology was negatively related to voting behavior, indicating that conservative legislators were less supportive of the Farm Bill. Often, the same could be said for party ID, Republicans were less likely to vote in favor. This was not constant across every congress and even within congresses.

5.5 Conclusions and Future Research

The ability to look at a single policy area over time allows for me to see how the importance of these relationships have changed over an extensive time period. I have taken this opportunity to look at the Farm Bill since it is a reauthorization bill, meaning it comes up frequently enough to not have too many gaps in the time series. It also covers a long time period, from the New Deal era in 1933 to the 113th Congress. I have found strong evidence that there is interdependence among legisla-

Figure 5.3: Ideological Similarity



tors from the same state even when controlling for the agricultural interests of their district. In addition, I can also see the effects of the increasing polarization on these relationships. In the last three farm bills, there has been evidence of interdependence among ideologically similar legislators (2002, 2008, and 2014) and co-partisans (2014) where there had not been a consistent finding before.

CHAPTER 6
INTERDEPENDENCE IN POSITION TAKING

In the final empirical chapter, I take the opportunity to look at a different decision that legislators must make beyond the final roll calls during their tenure in office. Roll call votes are often the sum of multiple decisions that legislators make in the process of passing legislation and often do not reflect the entirety of lawmaking activity (Kingdon 1981; Clinton and Lapinski 2008). Hall (1996, 2) argues, "floor voting is only one and probably not the most important form of participation in the legislative process." Legislators make a choice to sponsor or cosponsor a bill. If a legislator is on the committee that considers a particular bill, they must decide what they want to contribute to the hearings or the mark up. On the floor, legislators must decide whether or not to pursue offering their own amendments or trying to speak during the debate.

Another criticism of the focus on roll call votes is that they are not random (Van Doren 1990). Only a small fraction of bills that are introduced will reach the roll call stage. Inferences from voting behavior can only be generalized to other decisions if legislators come about those decisions in the same way. It is important to test if that is the case when it comes to how interdependent legislators are with one another. It is clear from the previous two empirical chapters that legislators do cluster together regardless of their individual characteristics when they are casting their roll calls. The decision to announce their position on how they will vote on a bill or how they feel about a particular issue may be one where they rely on their colleagues for guidance. I assume that legislators will still rely on the same legislators for this decision as they did for their votes and that the signals that they receive from one another will lead them to announce their positions at similar times. This will allow me to study not only a different decision but will also allow me to see if the same interdependencies

do exist outside of roll call votes.

For this analysis, I look at the example of when legislators decided to announce their position on whether or not they would support the U.S. signing onto the North American Free Trade Agreement. The negotiations started in 1990 between the U.S., Canada, and Mexico but Congress did not ratify the agreement until 1993. This provided legislators with ample amount of time to announce their position and with the growing controversy over the agreement increasing during the 1992 presidential election there was pressure on them to let their constituency know. Legislators had the opportunity to announce their position in opposition or in favor of ratifying the agreement which is why I use a competing risk spatial duration model.

This chapter is an improvement on other studies of position announcement timing because it incorporates the spatial interdependence that could exist between legislators, but it is not the first paper to do so. Hays and Kachi (2009) also looked at NAFTA position timing and the potential for interdependence. They found that legislators from contiguous districts had a negative spatial relationship. Specifically, this geographic proximity lead legislators to delay their announcements when someone near them announced their position. In the rest of this chapter, I will discuss the data, briefly work through the method that I use, and present the findings.

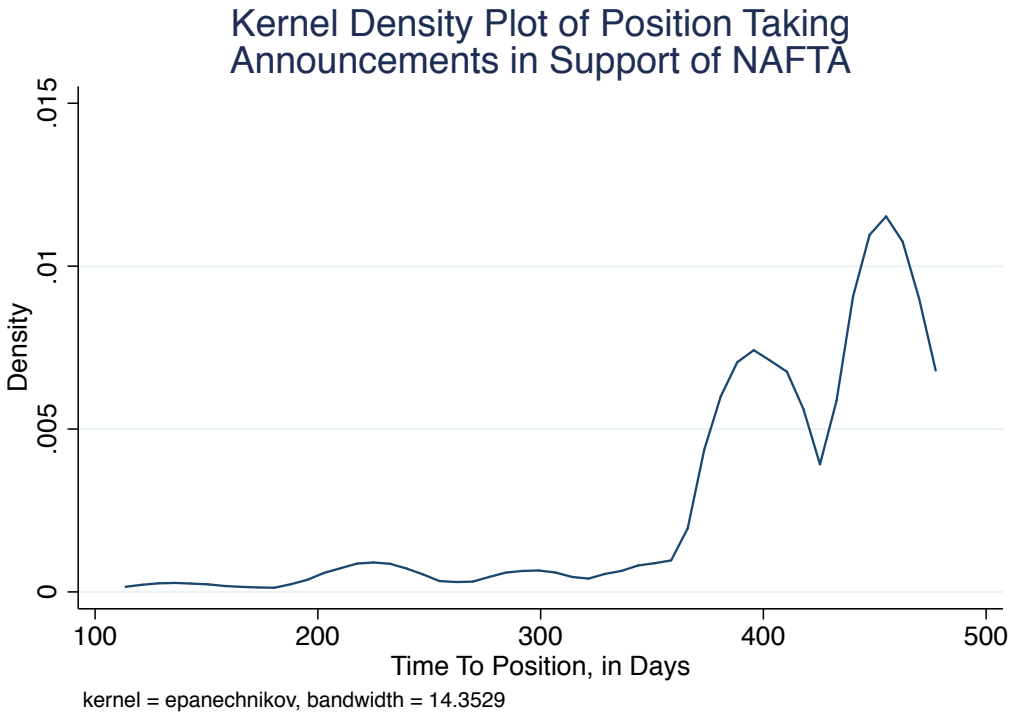
6.1 Data

The data was collected on the position taken and the timing of the announcement for all 435 House members in the 103rd Congress for the dependent variable.[1] The announcement date is the first day that any news source published an article about each member, indicating that the member was no longer undecided and had announced whether or not they were planning on supporting the bill. The variable

[1]The analysis only covers 433 House members as a result of missing data in some of the independent variables.

I use in this analysis is coded as the number of days after August 11, 1992, which was when Peter Visclosky (D-IN), the first representative to announce his position, declared his opposition to the passage of NAFTA.[2]

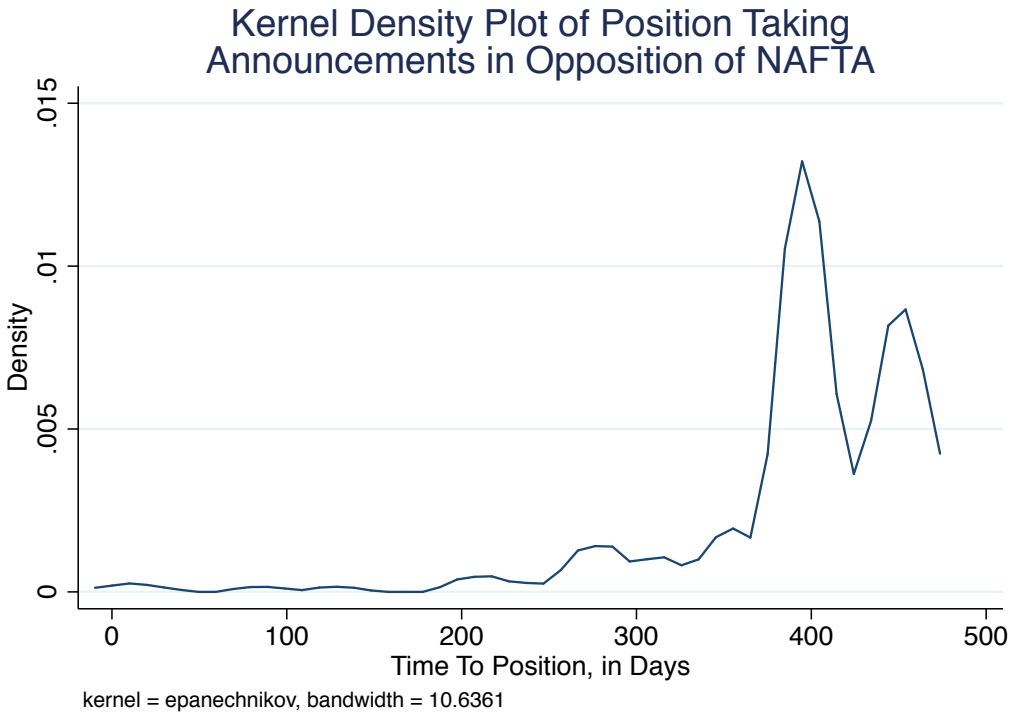
Figure 6.1: Kernel Density Plot of Position Announcements in Support



The kernel density plots of the dependent variable in figures 6.1 and 6.2, split according to the direction of the announcement, shows the distribution of when legislators announce their position. Visclosky's announcement was especially early in comparison to his colleagues. The majority of legislators postponed their decision

[2]Since I am using a log-normal duration process, I actually take the natural log of the number of days after Visclosky's announcement.

Figure 6.2: Kernel Density Plot of Position Announcements in Opposition



until the last 200 days before NAFTA's ratification. There is some variation in the densities based on whether or not legislators were in support or opposition. There was a large amount of opposition announcements approximately 100 days before the vote was taken. The support announcements did not have as drastic of a jump at the same time. Rather, the largest number of announcements came closer to the vote.

Using the model constructed by Box-Steffensmeier, Arnold, and Zorn (1997) in the original analysis of the timing of position announcements on NAFTA, there are a variety of other covariates that I control for in this analysis. First and foremost, it is important to control for constituency factors that would influence the timing of legislator's position announcement. Legislators are expected to be more opposed and to announce their opposition earlier when they represent a district that has

high levels of unionization. This variable is coded as the percentage of all private-sector workers who belong to a union in each district. Another constituency factor that I expect to have a negative effect on support for NAFTA is the percent of the district that voted for Ross Perot in the 1992 election because Ross Perot was very vocal about his anti-NAFTA sentiments. In contrast, members of Congress that reside along the Mexican border will be more supportive of NAFTA and to announce their position early on. To capture this, the variable was coded 1 for those districts that fell on the Mexican border and 0 otherwise. The final constituency factor that affects constituency preferences on NAFTA and thus influence a legislator's position announcement was socioeconomic conditions in the district, measured using household incomes as measured according to the district's median income. This is expected to have a positive effect on support for NAFTA and should cause a legislator to announce his position earlier.

In addition to constituency factors, two factors will be included in the analysis to control for interest group influence. The first is campaign donations from corporate PACs which will have a positive effect on support for NAFTA. The second is contributions from labor-related PACs will have a negative effect on support for NAFTA. Additionally, I include the individual characteristics of the legislators in this analysis. In particular, I take into account the party affiliation of the legislator and their institutional position (i.e. whether they were on a committee that considered the ratification or if they are in the party leadership).

I use the same spatial weights matrices that were discussed in the previous empirical chapters. The same party matrix connects co-partisans with one another. I construct the same state matrix in a similar fashion, the only connections that exist are between legislators who represent the same state. The ideological similarity matrix connects all legislators with one another, taking the absolute distance between each pair of legislators. Again, I alter the elements of the ideology matrix so that the

emphasis is put on those legislators that are closer to one another. I row-standardize all three of the spatial weights matrices in this analysis.

6.2 Methods and Results

The interest of this project is not just how interdependence emerges in the decision for legislators to announce their position but additionally, how this differs according to the content of the announcement. When announcing their position, legislators are not just telling the public that they plan to vote on this issue but how they are going to vote. In the case of NAFTA, legislators are announcing whether they plan to vote in favor or in opposition of the ratification of the agreement. This calls for the use of a competing risk model since all legislators are at risk of announcing their position in either direction. The use of spatial analysis renders the standard fix, right censoring, inadequate. Removing the information of some observations from the analysis is counterintuitive to the exploration of whether or not legislators are interdependent with one another. In order to solve this problem, I use an algorithm created by Hays, et. al. (2015) that I discussed in Chapter 3. This algorithm imputes the right censored values by translating the correlated reduced form errors into a linear combination of i.i.d. normal errors. For the censored cases, this produces the minimum value of the i.i.d error term which the algorithm uses to take a draw from a truncated normal distribution. This solution can be adapted to competing risks models by treating all those observations that did not announce their position in the direction of the model of interest as right censored and then imputing the value that they would have announced their position in that direction. For example, in support model, all those legislators who announced in opposition would be right censored and then the algorithm will obtain the time at which they would have announced their position in favor. By keeping all of this information in the model, I am properly able to capture the interdependence.

Table 6.1: Interdependence in Position Taking

	Co-Partisans		Same State		Ideology	
	Support	Opposition	Support	Opposition	Support	Opposition
Union Mem.	0.55**	-1.94***	0.69**	-1.43**	0.80	-1.66***
	(0.23)	(0.672)	(0.31)	(0.61)	(0.56)	(0.63)
Perot Vote	-0.467	-0.30	-0.60**	-0.04	-0.54*	-0.15
	(0.23)	(0.62)	(0.25)	(0.60)	(0.28)	(0.61)
Mex. Border	-0.36***	-0.36	-0.39***	-0.50***	-0.42***	-0.41*
	(0.07)	(0.24)	(0.07)	(0.19)	(0.10)	(0.24)
Income	-0.02	0.09	-0.02	0.07	-0.02	0.07
	(0.02)	(0.05)	(0.02)	(0.05)	(0.02)	(0.04)
Corp. PAC $	-0.05	1.28***	-0.06	0.98***	-0.13	1.24***
	(0.13)	(0.45)	(0.13)	(0.35)	(0.20)	(0.40)
Labor PAC $	0.55***	-0.37	0.68***	-0.37	1.09*	-0.44
	(0.17)	(0.41)	(0.20)	(0.41)	(0.66)	(0.40)
Ideology	-0.01	0.28	-0.02	0.21	-0.19	1.86**
	(0.07)	(0.24)	(0.07)	(0.21)	(0.21)	(0.81)
Party ID	-0.01	-0.08	-0.03	-0.08	0.04	-0.28
	(0.06)	(0.17)	(0.05)	(0.15)	(0.09)	(0.28)
Committee	-0.04	0.13*	-0.04	0.08	-0.04	0.09
	(0.03)	(0.08)	(0.03)	(0.08)	(0.04)	(0.08)
Rep. Leader	-0.08	0.22	-0.07	0.03	-0.06	0.07
	(0.05)	(0.24)	(0.06)	(0.26)	(0.07)	(0.24)
Dem. Leader	0.02	-0.03	0.01	-0.02	0.02	0.00
	(0.06)	(0.15)	(0.06)	(0.15)	(0.09)	(0.15)
Constant	6.27***	6.08***	6.29***	6.07**	14.79*	27.65
	(0.37)	(0.58)	(0.11)	(0.22)	(8.55)	(11.12)
ρ	-0.03	0.03	-0.03*	0.03	-1.42	-3.33**
	(0.06)	(0.09)	(0.02)	(0.04)	(1.41)	(1.73)
Observations	433	433	433	433	433	433

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.10.

Thus, there are six different models presented in this analysis; two for each of the spatial weights matrices. The first column for each matrix is the model for legislators who announced in support of the ratification of NAFTA and the second column is the model for those who were in opposition. There are some obvious

distinctions between all of the models.[3]

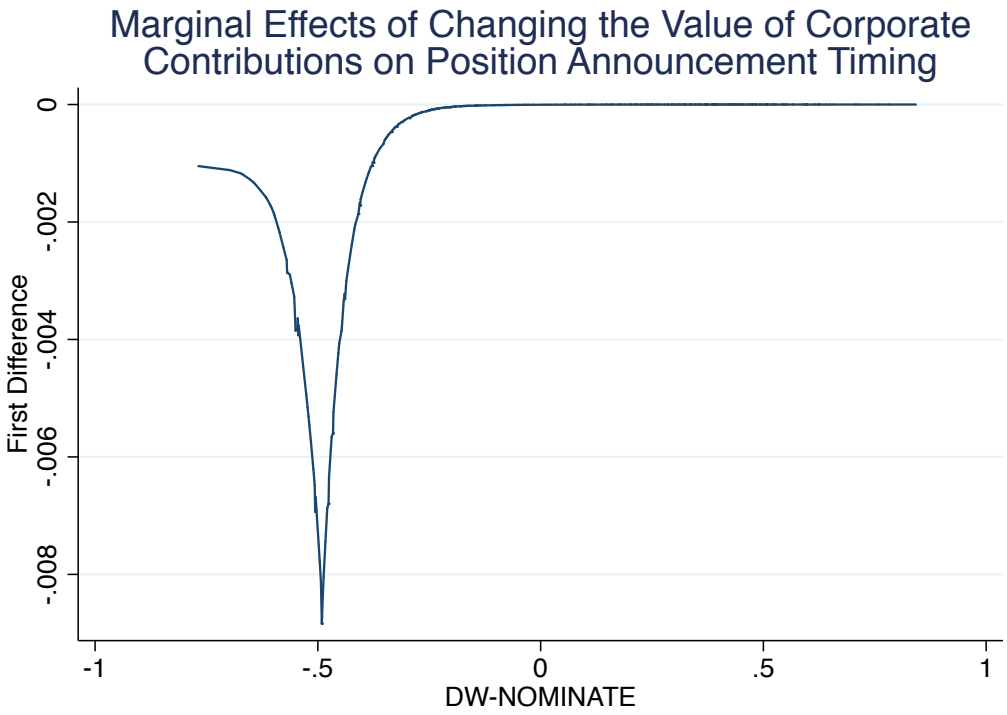
Comparing across all of the models, there is considerable variation across the spatial parameter. The first interesting finding is that for the majority of the models there is no significant spatial relationship. There are only two significant ρs and they are both negative. This is surprising since this means that legislators are not behaving more similarly to those legislators with whom they share ties. This negative spatial autocorrelation is very unusual in political science studies in general and usually indicates free riding behavior (Franzese and Hays 2008). In this case, it means that legislators are delaying their announcements after a legislator that they are connected to has announced their position. To make these results even more complicated, the two statistically significant findings are for two different spatial weights matrices and are for opposite positions. The first statistically significant relationship is with legislators from the same state are announcing their position in support of the NAFTA ratification.

The second statistically significant relationship is with ideologically similar legislators who are announcing in opposition to the agreement. A potential reason for this finding is that there was some benefits to be gained from delaying their announcement. In particular, President Clinton was highly motivated to have the U.S. sign onto this agreement and was offering rewards to legislators that would side with him. This can explain both findings since legislators may be able to free ride on their same state counterparts once they have announced in support in order to gain a larger offer from the administration. The same could be said for ideological similarity since it was those legislators who were most likely to announce in opposition (i.e. Democrats) were the targets of much of Clinton's effort (Palazollo and Swinford

[3]I have run the log-normal duration model and non-spatial competing risks models and they can be found in the appendix

1994; Kollman 1998; Boehmke 2006).[4]

Figure 6.3: Ideological Similarity Interpretation



To illustrate this relationship, I have plotted the marginal effects of shocking the corporate contributions of one legislator in the opposition model for ideological similarity. The legislator that I shock in this example is Representative George Brown Jr. from California's 42nd district. Varying corporate contributions from the minimum to maximum, I calculate the implied y for each legislator and then take the

[4]An example of this was a deal that Esteban Torres (D-CA) made with Clinton in which money was given to finance loans for poor areas along the Mexican border. This ended up being a decisive factor in swaying multiple Democrats who also had large Hispanic constituencies (Pelosi (D-CA), Becerra (D-CA), Roybal-Allard (D-CA), Pastor (D-AZ), and English (D-AZ).

difference between y^h and y^l. In this model, large corporate contributions will lead a representative to delay their announcement which is why the change to Congressman Brown causes everyone around him to announce their position earlier.

It is important to compare these results to the naive models in the appendix. There are very few differences between the non-spatial competing risks models and each of the spatial competing risks models (with the exception of the spatial parameter). There is clearly a lot to be gained from using a competing risks model from the comparisons to log-normal duration model where the only statistically significant relationship was whether or not the district was on the Mexican border. Across the other models, the independent variables are in the correct direction given the bend of the position announcement of interest. Take the value of union membership in the district. It is significant across all of the models, with the exception of one. For the support models, having large amounts of union membership causes representatives to delay their announcement. For the opposition models, it is exactly the reverse; legislators who represent districts with a large proportion of their constituents in unions will announce their position in opposition to the ratification earlier. Representing a district on the Mexican border leads legislators to announce their positions more quickly regardless of the direction of their announcement. Interest group contributions are only significant in explaining delays in position taking. For example, corporate PAC contributions only provide significant influence to those legislators who are opposition to the ratification of NAFTA. Within this group of legislators, considerable corporate contributions lead them to delay the declaration of their position. The same relationship exists for those legislators announcing in support and labor contributions.

6.3 Conclusion

In this chapter, I take the opportunity to look at a different legislative decision rather than roll call voting and see if the same interdependencies are as influential. I use the timing of position announcements as the alternative decision. My expectations were that legislators who were connected with one another would announce their positions at similar times, clustering together. The fact that legislators announce their position on a particular side, in support or opposition, added a complication to the modeling process. Previous spatial duration models were not convertible to competing risks models and so I adapt an imputation algorithm that accounts for right censoring to solve this problem (Hays, Schilling, and Boehmke 2015). Thus, I am able to properly study how the interdependencies between legislators arise during their decision to make a position announcement. In this analysis, I find that legislators are spatially interdependent but it is conditional on the relationship that I am controlling for and on the type of position that legislator is making. It is clearly important to look at a variety of legislative decisions because they will not all produce the same results. The positive clustering that exists when looking at voting behavior does not translate to position announcements because when there is spatial autocorrelation in this analysis it is negative. The incentives that Clinton provided for those who were on the fence led legislators to delay the announcements, taking advantage of their colleagues who had already voiced their opinion. This is consistent with the findings from Hays and Kachi (2009) who studied only the influence of neighboring districts and also found evidence of negative spatial autocorrelation. The influences of one's colleagues on the decision of when to announce one's position is clearly different from the influence of the same legislators on voting behavior.

CHAPTER 7
CONCLUSIONS

Legislating is a social process. Legislators coalesce, cajole, and conspire with one another to draft and pass bills. Decades of congressional research emphasizes how each legislator's decisions depend on those made by their colleagues, whether through logrolling, sharing information, or coalition formation. Yet extant empirical methods struggle to capture the resulting interdependent nature of legislators' actions such as votes and pre-vote position taking. This disconnect constitutes a major failure of the literature to properly evaluate and test theories of legislative behavior such as the role of parties in binding members' fates together or whether legislators that share common interests based on their race, gender, or other characteristics achieve better outcomes when they work in concert than when they merely act independently.

My dissertation addresses this gap through the use of new statistical techniques that provide a more appropriate way to detect theoretically predicted forms of interdependence. Specifically, I use spatial regression techniques to explicitly model and estimate the presence of interdependence between legislators. Spatial econometrics is a burgeoning technique in political science but has rarely been applied to legislative behavior. Yet, it offers the opportunity to decipher the structure of interdependence in legislative decision making. Researchers want to know how legislators make decisions but it is difficult to untangle the identity of the influential actors. Typically, scholars attempt to capture fellow legislators' influence by controlling for the partisan composition of the chamber but this assumes that legislators make decisions independently whereas the theories emphasize interconnectedness. Spatial econometrics allows one to capture the simultaneous and interdependent nature of legislative decision making.

Using spatial econometric models in this analysis offers a better way to link

the empirical analysis to these theoretical relationships. Spatial econometrics breaks the restrictive assumption that actors' choices emerge independently of one another. Rather, it allows one legislator's choice to explicitly depend on choices made by other legislators. My dissertation focuses on parsing out how influential co-partisans, representatives from the same state, and ideologically similar colleagues are on each others' decisions. I examined these three ties by looking at a variety of roll call votes and the timing of position announcements on the ratification of NAFTA.

It is clear from my findings that legislative behavior is interdependent in nature. I find evidence for all three relationships when looking at voting behavior. Representatives from the same state cluster together on those issues that will directly affect their state, like the farm bill legislation. In more recent years, there is an emergence of interdependencies between legislators from the same party and those with ideological similarity. I see this in in the individual bill analysis were I find evidence of these relationships but it is particularly highlighted in the over time analysis since it is only during the most recent farm bills that there has been a consistent relationship among these groups of legislatures. Legislators are clustering together along these ties when they are voting above and beyond what we would expect given their individual characteristics (their preferences and their constituency's preferences) and it is necessary to control for this.

My findings also highlight the importance of looking at a variety of decision making processes. Although the evidence for positive spatial autocorrelation is strong when looking at voting behavior, the same can not be said when looking at position taking announcements. If there is a relationship for these models, it is negative, indicating that legislators are free riding on one another.

In sum, my dissertation contributes by ascertaining how legislators influence each others' decisions. Spatial econometrics offers a more appropriate method of analysis for answering this question and allows my work to add to the literature

by uniting the theories that argue for attention to the interconnectedness between legislators with appropriate empirical methods for detecting this interdependence.

7.1 Future Work

Throughout my dissertation, I mention some specific improvements but there are more general plans and extensions of this project. First, I plan to collect more bills. In Chapter 4, the two bills I analyze are both very salient and it is important to also look at an assortment of bills that are less salient. This will allow me to look at the influence of these relationships on "normal" decisions. My expectation is that one's colleagues become even more influential on these normal issues because most legislators will not be receiving cues from people outside of the chamber (i.e. their constituency or other people in Washington). In addition to exploring more bills on the saliency dimension, it also is important to look at more policy areas and in particular, those policy areas that are generally less technical. The bills that I have looked at do vary in their complexity. Comparing NAFTA and NCLB, legislators seemed to have a better idea of what the policy outcome would be once they passed NCLB versus what would occur when they ratified NAFTA. The farm bill, on the other hand, was more technical early on and later versions built on or amended the previous versions but kept very similar structure. These three areas can still be very technical so considering a moral issue may be lower on that scale since policies that fall under that umbrella tend to be more straight forward. Another parameter that all the bills in this project have in common is they were all successful. One of the reasons that this interaction between legislators occurs is because they need to build coalitions and it may be interesting to study bills that were not successful in establishing a large enough coalition.

In addition to considering other bills for the voting analysis, I also plan on collecting the position taking announcements for another bill. The relationships that

are important for one bill may not be what is important in other bills. This is particularly important considering the fact that I do not find as consistent findings with position announcements that I do with voting. Beyond consistency, it is important to see if these negative findings are generalizable to position taking or not. In order to collect the type of data that is necessary for this analysis, I can only look at salient bills or issues since it is only under those conditions that I will be able to find out when legislators decide to announce their position. Currently, I plan to collect information on the Affordable Care Act to compare how the spatial relationships that are important vary across different pieces of legislation. I have decided to select the ACA because the data will be readily available on when each of the legislators announced their position. Additionally, it provides some interesting variation on the bill topic in comparison to NAFTA. Although, the ACA will provide some important comparisons to NAFTA, the partisan divisions on this issue may be problematic.

As I move forward with Chapter 5, I plan to make some improvements. It is not just same state or regional effects that are important when it comes to the farm bill. Oftentimes, the most important relationship is about what farm product one's district produces (i.e. do they come from the corn belt, wheat belt, etc.?). This may be an relationship that I should consider including in my spatial weights matrices. This would allow for interdependence to emerge across larger groups of legislators. Additionally, I need to improve the independent variables that I am using. I mentioned above that I collected information on the average market value of the farms in a particular district but I think I could improve upon that measure by collecting data on the average amount of government payments per farm since that is directly a result of the farm bill. I do not have full coverage of the agricultural variables which are especially important for this analysis. The Census of Agriculture has the data available but in order to collect it I have to scrap a considerable amount of information. An additional problem with this data is that it delineates according to

county rather than congressional district. In most states, congressional districts and counties do not perfectly overlap and so this will make the data even more difficult to use. In addition to extending the coverage of number of farm employees, I also need to collect data on PAC/interest group contributions for the earlier farm bills. This could be done by downloading their filings from the Federal Election Commission but again this would require an extensive amount of time for a single variable.

Outside of collecting more data, I plan to adapt both of the models that I used in this project so that I can include multiple spatial weight matrices in the analysis at once. The ability to include all of the spatial weights matrices in the analysis at once will allow for me to test and see if one of the relationships is more important than the others in determining which legislators hold the most influential ties. For those bills that I find more than one statistically significant spatial relationship, once I am able to put them all into one model the three relationships can compete with one another.

7.1.1 Ideal Point Estimation

There are additional extensions beyond the current project that I plan to pursue in the future. The most prevalent method to describe the preferences of legislators and how we can relate legislators to one another is an item-response theory, or IRT, model called NOMINATE (NOMINA1 Three-step Estimation) created by Keith Poole and Howard Rosenthal (Poole and Rosenthal 1985, 1997). The approach is based on a set of assumptions that legislators are fully-informed, autonomous, and they vote according to whichever option is the closest to their ideal point. Previous literature, however, illustrates that this does not occur. Legislators are definitely not fully informed of where all of the policies lie and as a result do not work completely on their own. Parties are influential and that oftentimes they look to one another for informative signals.

Prior to the development of NOMINATE scores, the measures of legislator behavior focused on the cohesion between legislators and their parties. The idea behind these measures was that as long as legislators are voting together, we could assume that they are similar to one another (Rice 1927; Truman 1959; Sinclair, Masket, Victor, and Koger 2011). In David Truman's (1959) analysis, he created "agreement" scores based on the voting patterns of every pair of legislators. Through this measure, he was able to identify clusters of legislators who voted together during the session of Congress that he studied. The NOMINATE scaling methods developed by Poole and Rosenthal was an advancement in this literature. Through the use of a spatial voting model, they sought to identify the ideological alignment of legislators. In addition to the legislators being mapped on to a single dimension, the issues can also be placed along this dimension. The legislators are each represented by an ideal point, or their preferred amount of liberalism that they would like to see in any particular issue. Their preferences are also assumed to be single-peaked around their ideal point and that as one moves away from the ideal point the legislator is made worse off. The preferences are symmetric around his ideal point. The issues with all of these models are that they fail to incorporate the degree to which legislators influence one another. The use of these scores assumes that the social interaction between members has no consequence on their voting behavior. This dissertation is focused explicitly on this relationship and the use of these measures fail to capture this relationship in their calculations. They assume that each of the votes is independent of one another and that the outcomes that result are solely based on the number of people on each side of the cutpoint. A more appropriate measure would account for the interdependence.

The extension that I would like to add is to adapt the methods that Clinton, Rivers, and Jackman (2004) use to calculate their ideal points to allow for spatial interdependence. This adaption will use spatial probit to account for interdepen-

dencies. This will provide us with more accurate representation of what occurs in Congress. The assumption that legislators are independent of one another is a very stringent assumption and the use of spatial methods will allow me to relax this assumption. The ability to incorporate spatial interdependence will be an advancement over the previous NOMINATE methods (i.e. Poole and Rosenthal 1997 and Clinton, et. al. 2004). This will also be an advancement over the work done with cohesion or agreement scores because these measures are still measuring individual behavior and as a result researchers can use these spatial NOMINATE scores for more than just aggregate behavior. In this analysis, I will use a party spatial weights matrix since this will be the clearest line along which legislators will divide ideologically. In the future, this could be adapted further to incorporate more of the relationships that are also influential in legislative decisions.

7.1.2 Varying Group and Institution

Finally, the last two extensions would be look at different groups of legislators and different institutions. In this project, I focus on three relationships – party, same state, and ideological similarity. These are not meant to be exhaustive. There are a multitude of different ties that one could study. The next group that I plan to look at is women in Congress. There has been considerable amount of research on whether or not women are different from men when it comes to representing women's interests in Congress and state legislatures but there has been less research on how women work together (Thomas 1994; Reingold 2000; Swers 1998; Swers 2002; Bratton and Haynie 1999; Bratton, Haynie, and Reingold 2007; Osborn 2012). Limited evidence suggests that women behave differently in deliberative bodies; they are more collaborative (Kathlene 1994). I plan to look at how the Congressional Caucus for Women's Issues has changed over time, focusing on the more recent congresses where there has been an emergence of conservative women. If women are more collaborative, I expect that

their decisions, on women's issues in particular, will be interdependent making spatial analysis an appropriate tool. The CCWI was bipartisan in nature but in recent years has struggled to maintain the cohesiveness that it had in the past.

Not only do I plan to look at a different group of legislators I also want to look at how interdependent legislative behavior is outside of the House of Representatives. Given the amount of variation that exists in state legislatures, they would provide an interesting comparison to my findings from this project. I would not be able to look at each chamber but instead would select a few to focus on. I will select my cases based on their legislative professionalism, leadership power, and party control. Using these three measures will allow me to look not only at chambers that are similar to Congress but also at those chambers that are distinct. Unprofessional legislatures are often only in session for a short period of time, the representatives have other forms of employment, receive little to no compensation, and rarely have a large enough staff to support them. These are areas where legislators may rely heavily on one another since they have fewer places to gain the necessary information on their own. The study of legislative behavior lends itself to spatial analysis given the large amount of literature that focuses on the importance of these interdependencies. The future plans with this project that I have discussed here are only just the start of what research could benefit from further exploration of the intersection of spatial econometrics and legislative studies.

CHAPTER 8
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APPENDIX A
ADDITIONAL MODELS FOR CHAPTER 4

A.1 Non-Spatial Probit Vote Models for NAFTA and NCLB

Table A.1: NAFTA

	NAFTA
Union Member	-5.083***
	(1.299)
Perot Vote	0.626
	(1.164)
Mexican Border	0.346
	(0.431)
Income	0.211**
	(0.090)
Corporate PAC $	1.915***
	(0.739)
Labor PAC $	-3.804***
	(0.931)
Ideology	0.071
	(0.310)
Party ID	-0.194
	(0.310)
Committee	0.096
	(0.149)
Republican Leader	0.121
	(0.397)
Democratic Leader	-0.150
	(0.316)
Constant	0.240
	(0.334)
N	433

* p<0.1, **<0.05, *** p<0.01

Table A.2: NCLB

	NAFTA
% K-12	0.946
	(1.391)
% Teachers	19.735*
	(10.683)
Education PAC $	0.030
	(0.166)
Ideology	-2.206***
	(0.584)
Party ID	1.415**
	(0.589)
Committee	-0.274
	(0.248)
Constant	-0.813
	(1.209)
N	433

* p<0.1, **<0.05, *** p<0.01

APPENDIX B
ADDITIONAL MODELS FOR CHAPTER 5

B.1 Naive Probit Models

Table B.1: Modeling Farm Bill using Probit

	113th Congress	110th Congress	107th Congress	104th Congress
Ideology	3.622***	-0.346	-0.212	1.488***
	(0.285)	(0.403)	(0.432)	(0.385)
SNAP benefits	-0.018	0.048**	0.096***	
	(0.020)	(0.024)	(0.036)	
Agriculture PAC	0.004**	0.000	0.011***	
	(0.001)	(0.002)	(0.003)	
Farm Operators	0.002	0.014	0.023**	
	(0.013)	(0.010)	(0.010)	
Committee		0.831**	0.646*	0.166
		(0.365)	(0.377)	(0.272)
Party ID		-2.813***	0.208	1.126***
		(0.350)	(0.370)	(0.308)
Pov. level				0.055**
				(0.024)
Constant	-0.444	0.925***	-0.363	-0.844**
	(0.291)	(0.260)	(0.245)	(0.383)
N	423	421	406	399
LL	-83.76	-102.05	-216.21	-149.57

* p<0.1, **<0.05, *** p<0.01

Table B.2: Modeling Farm Bill using Probit (continued)

	99th Congress	97th Congress	93rd Congress	91st Congress	89th Congress
Ideology	0.259	-1.283***	-2.805***	0.696	-3.035***
	(0.195)	(0.388)	(0.479)	(0.435)	(0.527)
Committee	0.122	0.561**	0.705**	1.200***	0.561**
	(0.222)	(0.235)	(0.302)	(0.358)	(0.285)
Party ID	-0.605***	-0.524*	-0.190	-0.403	-0.100
	(0.146)	(0.268)	(0.295)	(0.309)	(0.311)
Pov. level	0.061***	0.083***	0.046***	0.150***	0.029***
	(0.021)	(0.027)	(0.016)	(0.020)	(0.008)
Constant	-0.140	-0.732*	-0.290	-1.678***	-0.858***
	(0.307)	(0.396)	(0.325)	(0.347)	(0.315)
N	425	378	405	409	425
LL	-254.85	-204.47	-169.26	-214.63	-198.99

* p<0.1, **<0.05, *** p<0.01

Table B.3: Modeling Farm Bill using Probit (continued)

	84th Congress	83rd Congress	81st Congress	75th Congress	73rd Congress
Ideology	-1.350**	-0.698*	0.606	-1.736***	-2.191***
	(0.539)	(0.423)	(0.534)	(0.415)	(0.537)
Committee	1.023**	-0.931***	0.183	0.538	0.882**
	(0.504)	(0.302)	(0.464)	(0.353)	(0.389)
Party ID	0.135	2.517***	-0.473	-1.192***	-0.653**
	(0.386)	(0.287)	(0.366)	(0.275)	(0.325)
Pov. level	0.054***				
	(0.014)				
Constant	-0.260	-0.925***	1.781***	0.490***	0.892***
	(0.411)	(0.150)	(0.208)	(0.120)	(0.153)
N	401	415	409	396	416
LL	-166.01	-168.22	-90.34	-174.13	-147.06

* p<0.1, **<0.05, *** p<0.01

B.2 Full Spatial Probit Models

Table B.4: Modeling 113th and 110th Congress' Farm Bills using Spatial Probit

	113th Congress			110th Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee				0.830**	0.834**	0.790
				(0.365)	(0.363)	(0.349)
DW-NOMINATE	-1.444***	3.569***	-10.380	-0.347**	-0.318	-2.732*
	(0.502)	(0.293)	(0.568)	(0.403)	(0.403)	(1.408)
Party ID				-4.582	-2.826***	-3.736***
				(5.747)	(0.350)	(0.669)
SNAP benefits	0.021	-0.019	0.031**	0.048**	0.049**	0.053**
	(0.035)	(0.020)	(0.013)	(0.024)	(0.024)	(0.025)
Agriculture PAC	0.005*	0.004**	0.000	0.000	0.000	0.001
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Farm Operators	0.006	0.001	0.003	0.014	0.013	0.016
	(0.018)	(0.013)	(0.008)	(0.010)	(0.010)	(0.010)
λ	1.191***	0.065	4.531***	-0.563	0.084	-1.045**
	(0.073)	(0.093)	(0.075)	(1.814)	(0.114)	(0.531)
Constant	-0.363	-0.406	0.390*	1.894	0.908***	1.544***
	(0.488)	(0.292)	(0.233)	(0.473)	(0.257)	(3.156)
N	423	423	423	421	421	421

* p<0.1, **<0.05, *** p<0.01

Table B.5: Modeling 107th and 104th Congress' Farm Bills using Spatial Probit

	107th Congress			104th Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee	0.645*	0.094	0.278	-0.202	-0.440*	-0.201
	(0.376)	(0.255)	(0.279)	(0.320)	(0.259)	(0.323)
DW-NOMINATE	-0.218	-0.854**	0.067	1.055**	-0.732*	3.356
	(0.432)	(0.430)	(0.440)	(0.411)	(0.388)	(2.170)
Party ID	0.573	0.586*	-0.278	4.046	1.916***	1.630***
	(0.823)	(0.362)	(0.366)	(5.986)	(0.339)	(0.377)
SNAP benefits	0.096***	0.038	0.141***	0.058**	-0.007	0.061**
	(0.036)	(0.031)	(0.035)	(0.025)	(0.018)	(0.025)
Agriculture PAC	0.011***	0.002	0.001	0.001	0.001	0.001
	(0.003)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)
Farm Operators	0.023**	0.006	0.005	0.094***	0.030	0.088***
	(0.010)	(0.007)	(0.008)	(0.031)	(0.023)	(0.032)
λ	-1.518	1.697***	3.737***	-1.133	1.753***	-0.897
	(2.986)	(0.093)	(0.136)	(2.547)	(0.109)	(0.778)
Constant	0.592	-0.897***	-2.211***	-2.002	-1.213***	-0.906
	(1.922)	(0.233)	(0.283)	(1.711)	(0.324)	(0.557)
N	406	406	406	399	399	399

* p<0.1, **<0.05, *** p<0.01

Table B.6: Modeling 99th and 97th Congress' Farm Bills using Spatial Probit

	99th Congress			97th Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee	0.123	0.150	0.118	0.560**	0.605**	0.561**
	(0.222)	(0.226)	(0.222)	(0.235)	(0.241)	(0.235)
DW-NOMINATE	0.253	0.253	0.255	-1.282***	-1.233***	-1.359**
	(0.195)	(0.189)	(0.177)	(0.388)	(0.377)	(0.693)
Party ID	-1.132	-0.622***	-0.588***	-1.646	-0.570**	-0.531*
	(0.812)	(0.146)	(0.145)	(1.723)	(0.262)	(0.296)
Poverty Level	0.061***	0.035*	0.061***	0.083***	0.060**	0.083***
	(0.021)	(0.019)	(0.021)	(0.027)	(0.025)	(0.027)
λ	-0.922	0.357***	0.320	-0.823	0.289***	-0.059
	(1.356)	(0.073)	(0.307)	(1.236)	(0.083)	(0.442)
Constant	0.500	0.081	-0.304	-0.099	-0.468	-0.714*
	(0.983)	(0.273)	(0.342)	(1.028)	(0.367)	(0.416)
N	425	425	425	378	378	378

* p<0.1, **<0.05, *** p<0.01

Table B.7: Modeling 93rd and 91st Congress' Farm Bills using Spatial Probit

	93rd Congress			91st Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee	0.703**	0.782**	0.708**	1.263***	1.578***	1.283***
	(0.302)	(0.311)	(0.302)	(0.329)	(0.393)	(0.333)
DW-NOMINATE	-2.800***	-2.772***	-2.319**	2.028***	1.585***	1.871***
	(0.479)	(0.478)	(0.913)	(0.382)	(0.372)	(0.406)
Party ID	-2.313	-0.208	-0.113	-1.737***	-1.152***	-1.352***
	(4.024)	(0.396)	(0.320)	(0.561)	(0.259)	(0.267)
Poverty Level	0.046***	0.035**	0.046***			
	(0.016)	(0.015)	(0.016)			
λ	-1.093	0.245***	0.221	-1.025	0.568***	0.319
	(2.057)	(0.093)	(0.361)	(1.489)	(0.041)	(0.324)
Constant	1.189	-0.244	-0.403	1.105**	0.586***	0.703***
	(2.798)	(0.307)	(0.371)	(0.496)	(0.148)	(0.177)
N	405	405	405	409	409	409

* p<0.1, **<0.05, *** p<0.01

Table B.8: Modeling 89th and 84th Congress' Farm Bills using Spatial Probit

	89th Congress			84th Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee	0.591**	0.047	0.494*	1.132**	-0.264	1.109**
	(0.292)	(0.258)	(0.256)	(0.488)	(0.368)	(0.483)
DW-NOMINATE	-1.945***	-2.158***	-26.543**	-0.288	-2.828***	-0.932
	(0.408)	(0.380)	(1.878)	(0.459)	(0.476)	(0.891)
Party ID	-1.879	-0.344	-0.113	-1.379	0.991***	-1.079***
	(2.234)	(0.240)	(0.290)	(1.301)	(0.287)	(0.407)
λ	-0.639	1.669***	-8.893***	-0.573	1.522***	-0.905
	(1.234)	(0.093)	(0.433)	(1.316)	(0.067)	(0.986)
Constant	0.601	-0.227*	-1.127***	2.112	-1.027***	2.306**
	(0.923)	(0.132)	(0.355)	(1.906)	(0.182)	(1.130)
N	425	425	425	401	401	401

* p<0.1, **<0.05, *** p<0.01

Table B.9: Modeling 83rd and 81st Congress' Farm Bills using Spatial Probit

	83rd Congress			81st Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee	-0.930***	0.034	-0.907***	0.184	-0.068	0.229
	(0.302)	(0.280)	(0.303)	(0.463)	(0.448)	(0.483)
DW-NOMINATE	-0.697*	2.819***	-0.331	0.607	-1.378***	0.253
	(0.423)	(0.380)	(0.668)	(0.533)	(0.520)	(0.356)
Party ID	3.951	-1.077***		-0.572	1.142***	-0.271
	(3.093)	(0.229)	(0.393)	(0.528)	(0.353)	(0.217)
λ	-0.665	1.457***	-0.286	-0.779	1.654***	1.424***
	(1.418)	(0.048)	(0.381)	(2.348)	(0.133)	(0.087)
Constant	-1.480	0.340***	-0.950***	3.060	-1.530***	-0.581***
	(1.214)	(0.120)	(0.163)	(3.880)	(0.270)	(0.201)
N	415	415	415	409	409	409

* p<0.1, **<0.05, *** p<0.01

Table B.10: Modeling 75th and 73rd Congress' Farm Bill using Spatial Probit

	75th Congress			73rd Congress		
	Same Party	Same State	Ideological Similarity	Same Party	Same State	Ideological Similarity
Committee	0.538	0.488	0.538	0.878**	0.049	0.882**
	(0.352)	(0.356)	(0.353)	(0.388)	(0.311)	(0.388)
DW-NOMINATE	-1.735***	-2.876***	-1.743**	-2.184***	-2.409***	-2.370*
	(0.415)	(0.402)	(0.761)	(0.537)	(0.424)	(1.363)
Party ID	-1.573	0.907***		-3.634	1.102***	-0.684*
	(1.156)	(0.251)	(0.304)	(6.406)	(0.284)	(0.390)
λ	-0.180	1.486***	-0.003	-1.532	1.551***	-0.082
	(0.529)	(0.061)	(0.301)	(3.261)	(0.074)	(0.563)
Constant	0.659	-0.795***	0.492***	3.189	-0.907***	0.967*
	(0.516)	(0.125)	(0.164)	(4.930)	(0.142)	(0.541)
N	396	396	396	416	416	416

* p<0.1, **<0.05, *** p<0.01

APPENDIX C
ADDITIONAL MODELS FOR CHAPTER 6

C.1 Non-Spatial Duration Models for NAFTA Position Taking

Table C.1: Analysis of Non-CR and CR Models

	Non-CR	Support	Oppose
Union Member	-0.320	0.591**	-1.531***
	(0.344)	(0.244)	(0.564)
Perot Vote	-0.333	-0.479**	-0.184
	(0.318)	(0.215)	(0.534)
Mexican Border	-0.452***	-0.384***	-0.408**
	(0.117)	(0.074)	(0.205)
Income	0.015	-0.017	0.069*
	(0.024)	(0.015)	(0.042)
Corporate PAC $	0.313	-0.080	1.005***
	(0.197)	(0.125)	(0.358)
Labor PAC $	0.324	0.635***	-0.317
	(0.236)	(0.187)	(0.368)
Ideology 0.114	-0.007	0.247	
	(0.113)	(0.075)	(0.194)
Party ID	-0.027	-0.027	-0.079
	(0.085)	(0.055)	(0.147)
Committee	0.026	-0.038	0.094
	(0.040)	(0.026)	(0.070)
Republican Leader	-0.129	-0.084	-0.024
	(0.094)	(0.055)	(0.206)
Democratic Leader	0.039	0.000	0.017
	(0.087)	(0.059)	(0.139)
Constant	5.913***	6.108***	6.229***
	(0.060)	(0.040)	(0.013)
N	433	433	433

* p<0.1, **<0.05, *** p<0.01