Timing of Congressional Position Taking: An Estimator for a Spatial Duration Model with Competing Risks

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Abstract

Previous research on the timing of position taking has focused on the factors that lead a particular member of Congress to announce their position on a particular issue. It is obvious from these earlier works that position announcements are strategic in nature but for the most part none of this work has captured the interaction between legislators. Using position on NAFTA, this paper will adapt a log-normal spatial duration model, looking to see how ideologically similar legislators will signal to one another on when they should announce their position. Using the imputation algorithm developed in Boehmke, Hays, and Schilling (w.p.), this paper will be able to account for the competing risks. The imputation algorithm imputes values of the errors through rejection sampling to obtain draws of the dependent variable that are greater than the censoring point. Previous work on competing risks cannot be used in this situation since they do not allow for the spatial dependence that exists between legislators. Legislators at each time period can announce in favor or in opposition of NAFTA. When legislators announce their position, this will increase the likelihood that those legislators that are similar to them will announce their position as well.

Introduction

The focus of legislative research has often been on the decision making process that legislators go through on their way to the final vote. There are a variety of factors that go into whether or not a legislator will vote yea or nay on each particular bill. The influence can come from outside groups such as a legislator's constituency or an interest group/lobbyist. Although the final roll call vote is important, legislators do not necessarily arrive at their decision on the day that the vote is called. We know that there are a large number of decisions that must be made prior to the roll call. The opportunity to announce their position on an important issue or vote is just one of these many decisions. The focus of this application will be on the influence that insiders (i.e. other congressmen) have on one anothers decision-making process. In particular, this paper will focus on the dynamic process that occurs with position announcements on the North American Free Trade Agreement (NAFTA). Legislators are both signalers and receivers and the timing of ones position announcement is a perfect example of this (Krehbiel 1991). The receivers will often turn to those signalers in whom they trust or share similar beliefs with (Kingdon 1981). The communication and cue-taking that exists between legislators should lead to interdependence occuring in their individual decisions.

Thus, this paper hypothesizes that legislators who are ideologically similar to one another will tend to announce their position on NAFTA at similar times. In other words, receivers will use the signalers that are ideologically close to them as an indication of what position they should take on NAFTA, allowing them to announce their position earlier. Using DW-NOMINATE, ideological distance will be measured by taking the absolute distance between all legislators from one another. This paper will improve on previous studies of the timing of position announcements because it will allow for there to be spatial dependence between the observations. The hypothesis for this paper clearly indicates that it will be dealing with interdependent duration processes and without accounting for this in the analysis causes a bias in the effects each of the covariates have on the hazard (Darmofal 2009). Through the use of a log-normal spatial duration model and the imputation method discussed in this paper, one will be able to study the dynamic relationship that exists between legislators.

An issue that arises when looking at position announcements, it is necessary to control for the content of the position that legislators are taking. Are they planning on voting in favor of the bill or are they going to vote in opposition? The factors that lead for a legislators to declare a position on one side of the issue may not be identical for those legislators who are on the other side of the issue. With spatial analysis, the use of standard competing risks models are not applicable. The problem with these standard methods is that they require you to split the observations into two models for the two different types of position announcements and then treat all legislators who did not announce their position according to the model of interest (i.e. they were opposed to NAFTA but are in the favorable model) as right censored. Right censoring is problematic in survival analysis but these issues are only exacerbated when dealing with spatial analysis since the observation of each units duration has influence on all of the other units and vice versa.

The solution to this obstacle is based off an imputation algorithm developed by Hays, Schilling, and Boehmke (w.p.) where the authors have adapted an imputation estimator for censored regression data to account for the interdependence that exists in spatial duration processes. In the algorithm, rather than treating the censored observations as being unobserved, each of these observations are imputed by iteratively taking random draws from a censored normal distribution and estimating of the spatial duration model using the imputed values until the model cannot be improved. This imputation method allows the researcher to observe how long it would have taken for the censored cases to actually fail in addition to properly capturing the spatial interdependence that exists between all observations.

Discussion of the Literature

Much of the previous literature on the study of congressional decision making focused largely on the end of the legislative process, the final vote. 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 (VanDoren 1990, 311). Decisions are made are a 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 legislators 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 how many constituents were members of a union and whether or not the member resided in a district that was on the Mexican border. Both of these factors were found to increase the hazard of announcing ones 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.

This paper 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 spatial relationship, specifically, when a legislator in a district next to you announced their position you would actually delay their announcement.

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 lot of the previous literature on position timing has used the signaling literature to explain the relationship between the representative and their constituency or interest groups. They argue that there are signals sent back and forth between the constituency and their representative. Once the signals received by legislator have achieved a certain amount of consensus, s/he will time their position announcement and its content accordingly. This announcement is then a signal to the constituency.

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 which way they should vote on those issues in which they do not have a lot of expertise in. 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 committees 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).

The idea that congressmen rely on one another for information was not created when Krehbiel and his counterparts developed informational theory. The idea that legislators had motivations to specialize in their respective committee assignments stems back to Wilson's analysis of congressional government (1885). In his discussion of process that legislators go through in order to decide how to vote, Kingdon (1981) discusses the influence that fellow congressmen have on the final decision of the counterparts. In his interviews with legislators, fellow congressmen were found to be of some importance in the vote a majority of the time. This importance was classified as being of determinative or major importance in the decision slightly less than half the time, in 47 percent of the cases (p. 75).

Kingdon (1981) argues that there are a variety of characteristic that one could categorize the legislators that each congressperson turns to for advice and information (i.e. seniority, credibility, same state delegation, etc.). The most important of these characteristics though is the level of agreement between the two congressmen and the amount of expertise that the informant has in the issue at hand. It is hard to imagine that a Northern Democrat will turn to Southern Republican for information on which way they should vote. It makes sense that a congressman would consult a legislator with similar attitudes because first of all, he wants to vote as if he was informed and secondly, consulting legislators with similar voting records will be helpful in simplifying the decision-making process. In regard to those people that the legislator turns to for information since they agree with them, they will turn to those that have the most expertise on the vote in front of them, oftentimes committee members. Based off of this literature, in relation to the timing of position announcements, this paper expects that legislators with high levels of agreement will tend to announce their positions at similar times because they will use one another as a cue on how to vote. In this paper, agreement will be analyzed according to the ideological agreement between the two legislators measure according to ideological distance (i.e. DW-NOMINATE scores). The use of ideology scores is just one way to means of measuring agreement; you could also just use party ID as an indication that two legislators would agree with one another. The decision to use ideological distance is based off of two things. First and foremost, it is closer measure of agreement than party ID. Secondly, party ID may not be very helpful in this application because Democrats were receiving very conflicting signals during the debate over NAFTA. Traditionally, Democrats were opposed to free trade and have a lot of labor interests which should lead them to not want to sign onto NAFTA but they were also receiving pressure from President Clinton to agree to sign onto the bill.

Spatial Duration Models and Competing Risks

Spatial Duration Models

Spatial econometrics have become increasingly popular in the political science world. As David Darmofal (2006) said in his review of spatial analysis in political science, ”political science data are spatial data.” The world of political processes occurs in specific locations with actors often interacting with one another. Rarely is the process of political science studied with units that are in isolation of all other units. Earlier work trying to capture this relationship often depended on two different options. Most of the time spatial interdependence was considered to be a nuisance that 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 to be studied 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.

The idea that observations are spatially dependent can arise in two different types of models. The first of these is that ideas, beliefs, and decisions are diffused among 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

$$\mathbf{Y} = \rho\mathbf{WY} + \beta\mathbf{X} + \epsilon \tag{0.1}$$

where $\mathbf{WY}$ 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).

$$\mathbf{Y} = \beta\mathbf{X} + \lambda\mathbf{W}\epsilon. \tag{0.2}$$

$\mathbf{W}\epsilon$ is lagged error term weighted by matrix $\mathbf{W}$ and λ is the spatial autoregressive parameter for the lagged dependent variable. In both forms of spatial interdependence, 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. If the matrix wanted to study the spatial relationship between trade partners, 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.

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. The application presented in this paper focuses on the strategic timing of position announcements where prior research has often turned to a variety of models to analyze the predicted relationships. One of these has been the Cox proportional hazards model, which has the benefit of not imposing a specific parametric form for the distribution of the time until a position is taken. The Cox proportional hazards model assumes a hazard rate of the form

$$h(t|x) = h_0(t_i)e^{\beta' x_i}. \tag{0.3}$$

This model does 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. One way to account for the potential bias that results from omitting variables can be controlled for by including frailty terms, which can help account for the fact that some observations may be more frail than others due to variables not included into the model (Box-Steffensmeier and Jones 2004; Darmofal 2009).

In this paper, I assume that the data follows a log-normal duration processes which follows quite nicely with the standard spatial lag model for regression. [1] This leads to a full model in matrix notation that is as follows

$$\ln \mathbf{Y}^* \quad = \quad \rho \boldsymbol{W} \ln \boldsymbol{Y}^* + \boldsymbol{X}\beta + \mathbf{Lu}. \tag{0.4}$$

W is the matrix through which the spatial dependency enters this model. The matrix **L** contains the shape parameter (λ) for the duration process which in the case of the log-normal is equal to 1.

[1]Hays and Kachi (2009) have created a model for a Weibull distribution but the imputation method used in this paper is in the process of being adapted for this model.

Following from the structural form, the reduced form of the spatial model is

$$\mathbf{Y} = (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{X}\beta + (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{L}\mathbf{u}, \quad (0.5)$$

$$= \mathbf{\Gamma}\boldsymbol{X}\beta + \mathbf{\Gamma}\boldsymbol{L}\boldsymbol{u}, \quad (0.6)$$

$$= \mathbf{\Gamma}\boldsymbol{X}\beta + \boldsymbol{v}. \quad (0.7)$$

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 critical 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 from the change of variables theorem which derives 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.

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. In this paper, 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

$$h_k(t|\boldsymbol{x}) = \lim_{\Delta t \to 0} \frac{Pr(t \leq T \leq t + \Delta t | T \geq t, \boldsymbol{x})}{\Delta t} \tag{0.8}$$

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

$$\mathcal{L} = \prod_{k=1}^{r}\prod_{i=1}^{n} f_k(t_i|X_{ik},\beta_k)^{\delta_{ik}} S_k(t_i|X_{ik},\beta_j)^{1-\delta_{ik}} \tag{0.9}$$

where

$$\delta_{ik} = \begin{cases} 1 & \text{if } i \text{ failed due to } k \\ 0 & \text{otherwise} \end{cases} \tag{0.10}$$

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.

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. This means that want 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 (w.p.) 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, $\hat{u}$. Then, these reduced form residuals are decomposed such that $\boldsymbol{\Sigma^{-1}} = \boldsymbol{A'A}$ is the Cholesky decomposition.

The reduced form errors can be written as a linear combination if i.i.d. errors: $u = \boldsymbol{A^{-1}}\eta$ [2]. The algorithm them works through solving for the values of η starting with the last observation. [3] 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.

As stated above, for this application, I follow the latent survivor time approach and use the

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

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

imputation method developed by Hays and his coauthors in order to deal with the issues of right censoring. Thus, I run two separate spatial analyses; one for opposition position announcements and another for favorable position announcements. The analysis will treat all of the legislators who announced differently from the position of interest (i.e. all legislators who announced in favor in the opposition model and vice versa) as if they had announced that particular position and impute a value for when the time at which they announced this position.

Analysis

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. [4] 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 that is actually used 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 their position, declared his opposition to the passage of NAFTA. [5]

As mentioned above, this paper is hypothesizing that the interdependence between the different hazards arises from the fact that legislators rely on their ideologically similar colleagues to provide them with a signal on which side of the issue they should announce their position. In order to measure this, DW-NOMINATE scores for the 103rd Congress will be used as an indicator for the ideological position of each legislator. NOMINATE scaling procedures identify the ideological alignment of legislators by treating Congressional votes as expressions of their preferences (with

[4] In the analysis it actually turns out to be a study of 433 House members as a result of missing data in some of the independent variables.

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

error). This estimation assumes that the legislators have ideal points on each policy dimension and the vote on these dimensions to minimize the difference between their preferred policy and their ideal point (Poole and Rosenthal 1985; 1997). DW-NOMINATE scores are on a scale from -1 to 1, where more negative values indicate more liberal preferences and more positive values indicate a more conservative preference. Although NOMINATE scores themselves may not be the best measure to accurately represent how well legislators influence one another, like agreement scores do, NOMINATE scores do provide an accurate representation of a legislators ideological predilections (Sinclair, Victor, Masket, Koger 2011). The spatial weights matrix for this analysis will be constructed using the absolute distance between all 433 legislators in the 103rd Congress, creating a 433x433 matrix. The spatial weights matrix in this analysis are row-standardized.

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 will be controlled for in this analysis. First and foremost, it is important to control for constituency factors that would influence the timing of legislators 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 was expected to have a negative effect on support for NAFTA was 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. Members of Congress that reside along the Mexican border are expected to 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 was expected to affect constituency preferences on NAFTA and thus influence a legislators position announcement was socioeconomic conditions in the district, measured using household incomes as measured according to the districts median income. This was 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 are expected to have a positive effect on support for NAFTA. The second is contributions from labor-related PACs which are expected to have a negative effect on support for NAFTA. Individual characteristics of the legislators are also included in this analysis, in particular, the party affiliation of the legislator. The expectation of this variable is that Republican legislators will be more likely to support NAFTA than Democrats. Finally, the institutional position of each member was controlled for, in particular whether they were a party of the party leadership (Democrat and Republican).

Results

There are five different models presented in this analysis. The first is a log-normal duration model in that does not control for the potential spatial interdependence in the model. The next model is the naive spatial model where the issues of right censoring and competing risks are not addressed. The next three models use the imputation algorithm discussed in the previous section. The first of these models imputes the cases for the 23 legislators who never announced their position before the final roll call vote was taken. The next two models are those models that control for the competing risks. The first model is for those legislators who announced in favor of signing onto NAFTA and the second is for those who announced in opposition to NAFTA. There are some obvious distinctions between all of the models.

	Non-Spatial	Naive Spatial	Imputation of RC	CR: Support	CR: Opposition
Union Mem.	-0.320	-0.320	-0.386	0.417**	-1.736***
	(0.339)	(0.339)	(0.350)	(0.189)	(0.482)
Perot Vote	-1.149	-1.149	-0.842	-1.464*	0.138
	(1.524)	(1.524)	(1.573)	(0.851)	(2.166)
Perot Vote (sq)	2.686	2.685	1.551	2.064	-0.490
	(4.257)	(4.257)	(4.394)	(2.372)	(6.035)
Mexican Border	-0.456***	-0.456***	-0.478***	-0.370***	-0.347**
	(0.116)	(0.116)	(0.120)	(0.064)	(0.164)
Household Income	0.023	0.023	0.020	-0.009	0.082**
	(0.024)	(0.024)	(0.024)	(0.013)	(0.033)
Corp. PAC $	0.344*	0.344*	0.491*	0.038	0.730***
	(0.194)	(0.194)	(0.201)	(0.109)	(0.277)
Labor PAC $	0.106	0.106	0.108	0.666***	-0.518
	(0.194)	(0.194)	(0.202)	(0.125)	(0.321)
NAFTA Committee	0.014	0.014	0.005	-0.041*	0.085
	(0.040)	(0.040)	(0.041)	(0.022)	(0.056)
Rep. Leader	-0.113	-0.113	-0.142	-0.092*	0.007
	(0.093)	(0.093)	(0.096)	(0.052)	(0.133)
Dem. Leader	0.012	0.012	-0.003	-0.004	-0.062
	(0.084)	(0.084)	(0.087)	(0.048)	(0.122)
Constant	11.384***	11.384***	11.961***	4.713**	11.340***
	(3.397)	(3.397)	(2.970)	(2.074)	(1.871)
Ln(Sigma)	-0.952***				
	(0.035)				
Lambda		-0.934	-1.022**	0.210	-0.804***
		(0.571)	(0.498)	(0.337)	(0.298)
Sigma2		0.136***	0.144***	0.042***	0.272***
		(0.009)	(0.010)	(0.003)	(0.018)
Observations	433	433	433	433	433

Comparing across all of the models, there is only one variable that remains statistically significant. In every parameterization that is looked at in this analysis, being a legislator who represents a district that is on the Mexican border has a strong effect on the timing of their position announcement. These legislators were more likely to announce their position early on in comparison to their colleagues who were not going to directly benefit from the trade agreement. With the acception of the model of favorable position taking, corporate contributions also has an effect on position taking. Receiving larger amounts of corporate contributions in the previous election leads legislators to delay their announcement. An interesting finding for the proportion of union membership in one's district when looking at the competing risk models. For those legislators who were announcing their position in support, they were more likely to delay their announcement if they had high levels of union membership. On the other hand, legislators who were announcing in opposition of the agreement announced earlier when they had high levels of union membership.

When looking at the spatial parameter (lambda), there is some variation. The spatial parameter is not statistically significant when looking at the naive spatial model but this changes once I control for the small amount of right censoring that exists in this model. The negative relationship is consistent with the theory that legislators tend to announce their position after ideologically similar legislators have announced their position. Even from this preliminary evidence, it suggests that legislators do rely on one another for cues as to when they should announce their position. These effects actually wash out when looking at the competing risks models for legislators who are announcing in support of NAFTA. Legislators who are in support of NAFTA are not relying on their ideologically similar counterparts for cues as to when would be the best time to announce their position. Legislators who are announcing in opposition on the other hand are spatially interdependent. This is probably a result of the fact that it was those legislators who were most at risk at announcing in opposition to NAFTA who were receiving some of the more conflicting signals. Those that were in support of signing onto NAFTA were more likely to receive consistent signals across all of the other factors that influence the timing of their position announcements.

Conclusion and Discussion

By adapting the imputation algorithm developed by Hays and his coauthors to the issue of competing risks, I am able to 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 with their ideologcially similar counterparts when they are timing their announcements. This is not true for all legislators. When looking at the decision to announce their position on NAFTA, I find that this interdependence is conditional on the type of position that the legisaltor is making. It is only the legislators who are voicing their opinion in opposition to signing onto NAFTA that are spatially interdependent.

There are improvements that can be made with the substantive application. A future step that needs to be taken in this analysis of the NAFTA data is to look not only at ideological distance between all legislators but to focus on those legislators that one would expect to be experts on the issue of NAFTA since these are assumed to be the most influential on their fellow congressmens decision. One would expect that the experts in this situation would be those legislators that served on the committees that had a hand in the NAFTA proposal. Thus, in order to incorporate this into the model one would need to either focus solely on those relation that each legislator has with the one of the committee members or the committee members could be weighted in such a way in the spatial weights matrix that would help their reflect their increased influence. The second option is more appropriate because the theory does not argue that only committee members will have influence but that they will have increased influence over those legislators that were not members of a committee that had a hand in drafting the NAFTA legislation. Thus in future analyses, the spatial weights matrix will be altered to reflect the increased influence that this theory would expect from relevant committee members. Both matrices could be used in the future if this model was adapted further to allow for multiple spatial weights matrices as is done in the m-STAR (multiparametric spatiotemporal autoregressive) models (Hays, Kachi, and Franzese 2010). The use of multiple matrices would allow to not only test the relationship between legislators and those considered to be experts on NAFTA but to also not lose the potential influence that all other legislators have on one's position announcement.

In addition to considering other parametrizations of the spatial weights matrix, 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. I plan to collect information on the Affordable Care Act to compare how the spatial relationships that are important vary across different types 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.

Spatial duration models are a relatively new expansion in spatial econometrics. Their application to more duration processes is sure to grow. There are a variety of duration processes that could easily be adapted to include a spatial component. One example of this would be all of the literature on policy innovation and diffusion, having one state adopt a policy will increase the surrounding constituencies' exposure to this policy and if it is attractive to them could lead their respective states to also adopt this policy. It may not just be contiguous states that causes policy diffusion but it could diffuse across states with similar characteristics which could be used to construct a spatial weights matrix. As spatial duration models grow in popularity, efforts will have to be made to address the problems that arise with duration data. This paper attempts to deal with one of these issues, competing risks. It is obvious that the issue of competing risks is a large hurdle for spatial data to deal with since each observation relies on all other observations and models of competing risks generally treat some portion of the observations as being right censored. The same can be said with missing data in spatial analysis and how its impact may influence the estimates. This paper could be generalized in the future to solve problems of missing data in spatial econometrics. Even with these limitations this paper has provided evidence that spatial relationships need to not be ignored when it comes to position taking and that we need to be careful in how we implement these spatial models.

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