Decreasing Electoral Risk and Strategic Retirement to Avoid Losing Election: Survival Analysis of Legislators' (Political) Life at Systematically Dependent Competing Risks *

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Abstract

Legislators exit the legislature due to death, retirement, electoral defeat or ambition. This paper demonstrates what factors affect the first three risks. Once age is controlled for, electoral risk decreases with the number of terms the legislator serves, while retirement risk is constant. This is because the seniority system brings about decreasing electoral risk and professinalization of the legislature results in constant retirement risk. Also, I hypothesize that, when they expect to be defeated at the next election, legislators strategically retire so as to avoid cost of electoral campaign and losing face. For testing these hypotheses, a currently available frailty model does not work, because it is extremely difficult for the model

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to identify more than two risks. Instead, I propose a systematically dependent competing risks model of survival analysis and also consider non-random censoring and nested risks structure. Using a Japanese Diet members' dataset from 1947 to 1990, this paper confirms my hypotheses.

INTRODUCTION

Many scholars have studied what factors encourage candidates to enter the legislature, though few have shown what elements force them to exit the legislature. Considering when, how and why lawmakers cease to be in the legislature, however, enables us to understand their individual activity and collective organization better.

Legislators exit the legislature due to death, retirement or electoral defeat. This paper demonstrates what factors increase or decrease these risks. Especially, I pay attention to different time dependence of these risks and dependence between risks. Once we control for age, electoral risk decreases with the number of terms the legislator serves, while retirement risk and death one are constant. This is because the seniority system brings about decreasing electoral risk, professionalization of the legislature results in constant retirement risk and politicians are not biologically different from citizens. Also, when lawmakers expect they would lose election even if they ran again, they will strategically choose to retire to avoid cost of electoral campaign and losing face. Since preceding studies have not taken into consideration this dependency or selection bias, it has underevaluated effects of some covariates on electoral hazard.

Methodologically, for studying dependence of competing risks, I propose a systematically dependent competing risks model of survival analysis. Previous works use frailty model, but it is extremely difficult to model more than two risks like the present case. My model can take into account any number of risks. I also customize the model so that it captures the data generation process of legislators' exit more appropriately, considering non-random censoring and nested risks structure.

In this way, the present paper intends to contribute to better understanding of legislators' behavior and improvement of political methodology. The remainder of the paper is organized as follows. In the first section, I submit a theory that explains legislators' exit from the legislature and derive seven hypotheses. The next section develops a systematically dependent competing risks model of survival analysis. The third section applies the model to a Japanese Diet members' dataset from 1947 to 1990 and confirms the hypotheses. Finally, I conclude.

1 A THEORY OF LEGISLATORS'DEPARTURE FROM THE LEGISLATURE

Legislators exit the legislature for various reasons. In the U.S. Congressional case, Box-Steffensmeier and Jones (1997, 2004) identify four: retire, ambition (running for other public offices such as senator and governor), electoral termination at primary or general. In Japan, exit due to ambition is rare because no office is more highly appreciated. And comprehensive data is not available now.[1] Also, there is no primary. Instead, 10.3% of members died while they serve, which is too frequent to ignore. Thus, I study three risks to terminate legislators' (political) life: death, retirement (24.6%), and electoral loss (59.3%) (Fukumoto, 2004). In this paper, I define retirement as decision not to run again at the end of term and distinguish it from early exit before the end of term.[2] Lawmakers are at these competing risks while they work at the Diet. This paper studies what factors affect these risks. My primary interests lie in different time dependence of these risks and dependence between risks.

[1] According to my preparatory research, only 2.3% of legislators are found to leave the Diet for ambition. Though there may be more cases, the rate is not so larger than this.

[2] Though legislators may "retire" (in ordinary sense of this word) in the middle of term, reasons will be different from those why they retire at the end of term and early exits are much rarer (5.7%) than retirement in my sense.

1.1 Different Time Dependence of Competing Risks

I posit that electoral risk decreases with the number of terms the legislator serves, while retirement risk and death one are constant. This is because the seniority system brings about decreasing electoral risk, professionalization of the legislature results in constant retirement risk, and politicians are biologically the same as other people.

The seniority system provides senior members with fringe benefit such as pork and committee chairmanship. As a result, they can afford to reward their own district so that they are more easily reelected. On the other hand, junior members are deprived of these perks and should see more severe electoral competition. At the same time, due to limited amount of benefits, this system would not be sustainable unless many junior lawmakers are hindered from being promoted to senior ones. Thus, once age and other factors are controlled, the longer they serve, the smaller their electoral risk.

You can think of anogher cause. Basically, incumbents have advantages because they can deliver district service. How much they bring depends on their abilities. Constituencies try to find and expel lower skill lawmakers. Accordingly, higher skill representatives are more likely to remain as incumbents and, as a result, win elections. This selection process also decrease electoral risk.

Before the legislature is professionalized, its membership was not attractive enough for members to run for again (King, 1981; Moony, 1994; Polsby, Gallaher and Rundquist, 1969; Squire, 1992). Only a few members remain for a long time. Thus, retirement risk should be decreasing as they accumulate terms. On the other hand, this is not the case if the legislature is the professionalized as it is. Then, there is no reason retirement risk is time varying. It is predicted to be constant.

Death risk for politicians is the same as ordinary people. Once age and length of term are controlled, why is not death risk constant through terms? From the above, I derive the following three hypotheses.

H1a: Seniority System Hypothesis: Electoral loss risk decreases with the number of

terms the legislator serves.

H1b: Prefessionalization Hypothesis: Retirement risk is constant through the number of terms the legislator serves.

H1c: Ordinary Mortality Hypothesis: Death risk is constant through the number of terms the legislator serves, once age is controlled.

1.2 Dependence between Competing Risks

These three risks are related. First, when lawmakers expect they would lose an election even if they ran again, they will strategically choose to retire to avoid cost of electoral campaign and losing face. Thus, the higher electoral risk is, the higher retirement risk is. Since the literature have not taken into consideration this dependency or selection bias, it has underevaluated the effects of some covariates on electoral risk.

Second, when death risk is large, Diet members decay physically. They may not be healthy enough to run for reelection and stump energetically. Or voters may well shun such candidates because they appear less vigorous. As a result, larger death risk leads to larger retirement risk and electoral defeat one. These two predictions are summarized this way:

H2a: Strategic Retirement Hypothesis: Electoral loss risk increases retirement risk.

H2b: Health Hypothesis: Death risk increases retirement risk and electoral loss risk.

1.3 Party

If members belong to opposition parties, they have fewer government resources to take advantage of than governing party members. They can not boast of governments' achievement, either. On the other hand, they can blame governing parties for current social problems and mobilize unsatisfied voters. Here, however, comes the Japanese one party

dominant regime. During the period studied (1947 to 1990) except before 1948, the Liberal Democratic Party (LDP) (or its predecessors) kept the majority status of the House of the Representatives and monopolized the Cabinet, and all elections were held under the LDP government. Thus, since all other parties were always opposition parties, they are expected to be weaker at the ballot box.

Also, there are two types of parties: cadre party and organizational one (Duverger, 1954; Sartori, 1976). The organizational party has more power over its parliamentarians than cadre party where all member can decide their own way. Though members are not willing to retire by themselves (at least in Japan), organizational parties are able to force members to retire for recruiting new members than cadre parties. Hence, I propose two more hypotheses.

H3a: Opposition Party Hypothesis: Members of opposition parties are at higher electoral loss risk.

H3b: Organizational Party Hypothesis: Members of organizational party are at higher retirement risk.

2 MODEL

For studying timing and type of end of duration such as legislators' political life, survival analysis is appropriate. To examine dependence between risks, a dependent competing risks model is necessary. First, I introduce a general model of competing risks and propose a systematically dependent competing risks model. I then specify a custom version of the model so that it fits legislators' (political) life.

2.1 A General Model of Survival Analysis of Dependent Competing Risks

2.1.1 Competing Risks

I consider the case where there are three risks ($r \in \{1, 2, 3\}$, for example, 1=early exit before the end of term (such as death), 2=retirement at the end of term, 3=electoral loss), though it is easy to model any number of risks. y indicates type of exit or censoring. When an event E_r due to risk r occurs, $y = r$. If duration of a subject is right censored without any event (e.g., reelected), $y = 0$. y_r is a dummy variable which is one when an event E_r happens ($y = r$) and otherwise zero. $y_1 + y_2 + y_3 \in \{0, 1\}$ because only one event due to one risk is observed. T_r is the potential time when E_r would happen if other types of events did not happen and a subject (e.g., a legislator) were not censored. T is the observed time when a subject exits ($T = min(T_r)$) or is censored.

Once any event occurs on a subject, it exits (from all risk sets) and no more event happens. The probability density that an event E_r occurs at time t given that a subject "survives" at that time ($T_r \geq t$), $p(y_r = 1, T_r = t | T_r \geq t) \geq 0$, is called hazard and denoted by $h_r(t)$. Let $h(t) = p[(y_1 + y_2 + y_3) = 1, min(T_r) = t | min(T_r) \geq t]$, then,

$$h(t) = B[y_1|h_1(t)] \times B[y_2|h_2(t|y_1)] \times B[y_3|h_3(t|y_1, y_2)] \tag{1}$$

where $B(y|\theta)$ is the Bernoulli distribution with mean $0 < \theta < 1$, $B(y|\theta) = \theta^y (1 - \theta)^{1-y}$.

2.1.2 Non-Random Censoring

If censoring of every risk r duration by any other type of event E_s ($y = s \neq r$) or non event ($y = 0$) is uninformative (i.e., at random or statistically independent of $h_s(t)$), then, $h_2(t|y_1) = h_2(t)$, $h_3(t|y_1, y_2) = h_3(t)$ and the conditional probabilities in Eq. (1) are reduced to marginal ones.

$$h(t) = B[y_1|h_1(t)] \times B[y_2|h_2(t)] \times B[y_3|h_3(t)] \tag{2}$$

Most of the previous studies (sometimes implicitly) assume random censoring and use this equation. In not a few cases, however, this assumption of random censoring is dubious. For example, (in continuous time model) retirement may be more likely to occur when electoral loss is more prospective (even if conditioned on covariates). In this case, censoring electoral defeat risk duration by retirement (y_2) is not at random but positively correlated with electoral defeat hazard ($h_3(t)$):

$$\frac{\partial h_3(t)}{\partial y_2} > 0 \tag{3}$$

If they are negatively correlated, the left hand side of Eq. (3) is less than zero. If they are not lineally correlated, it is equal to zero. Therefore, when censoring is not independent of other types of event occurrence, Eq. (1) should be used instead of Eq. (2).

2.1.3 A Systematically Dependent Competing Risks Model

In the present subsection, I model hazard for risk r as proportional to baseline hazard for risk r, $h_{r(0)}(t)$, and make the rate the exponential function of linear predictor of covariates x_r (proportional hazard model): $h_r(t|x_r) = \exp(x_r\beta_r)h_{r(0)}(t)$.[3] The most common way to model dependent competing risks is frailty model, which is a kind of random effect model (Box-Steffensmeier and Jones, 2004; Gordon, 2002):

$$\begin{aligned} h_r(t|x_r) &= \exp(x_r\beta_r + \nu_r)h_{r(0)}(t) \\ h_s(t|x_s) &= \exp(x_s\beta_s + \nu_s)h_{s(0)}(t) \\ (\nu_r, \nu_s) &= \text{Multivariate Normal}\big((0,0), \Omega\big) \end{aligned}$$

where νs are random variables independent of covariates and are called frailty, and Ω is a variance-covariance matrix. To estimate, one needs to integrate out frailties through Markov Chain Monte Carlo or numerical integration. In the case of more than two risks,

[3] If you do not employ proportional hazard model, you only have to replace β_r with $\beta_r(t)$. I discuss baseline hazard shortly.

however, it is very difficult to identify estimates (Gordon, 2002). In addition, frailty model takes into consideration stochastic dependence only, not systematic dependence.[4]

Instead, I propose a systematically dependent competing risks model, where the hazard for one risk is conditional on the same linear predictor of covariates for other hazards and, unlike stochastically dependent models, is conditionally independent of other hazards. For two risks,

$$\begin{aligned} h_r(t|x_r) &= \exp(x_r\beta_r)h_{r(0)}(t) \\ h_s(t|x_s, x_r) &= \exp[x_s\beta_s + \gamma_{rs}(x_r\beta_r)]h_{s(0)}(t) \end{aligned} \tag{4}$$

where γ_{rs} is dependence parameter.[5] The more variables in x_r are contained in x_s, the more severe multicollinearity becomes a problem (not vice versa). Also, for every pair of hazards, at most one hazard may have dependence parameter for the same reason. These limitations, though, pay because it forces us to consider the directions of causality carefully. In contrast to the standard frailty model, this model can handle more than two risks and is easier and faster to estimate by maximum likelihood.

2.2 The Specific Model for Congressional Careers

So far, I have introduced dependent competing risks models in general terms. In this subsection, I tailor the model so that it captures the data generation process of legislators' exit more appropriately.

[4]When dependent variables are not duration but just natural number, one may use Seemingly Unrelated Regresson (SUR) model which assumes that the two dependent variables follow bivariate normal distribution (King, 1989). This model does not work when there are more than two dependent variable exactly for the same reason.

[5]To put it differently, this is a constrained model as follows:

$$\begin{aligned} h_r(t|x_r) &= \exp(x_r\beta_r)h_{r(0)}(t) \\ h_s(t|x_s, x_r) &= \exp(x_s\beta_s + x_r\beta_{rs})h_{s(0)}(t) \\ \beta_{rs} &= \gamma_{rs}\beta_r \end{aligned}$$

2.2.1 Discrete Time

I use a discrete time model, rather than a continuous one. There are a few reasons. First, quantity of interest is not the exact duration of legislators' political life in months or days but the number of terms they serve in the legislature. Seniority, for example, is determined by the number of terms a member serves. Second, it is easier and more flexible to incorporate time varying covariates such as age and electoral strength into discrete time model Box-Steffensmeier and Jones (2004). Third, a discrete time model enables us to use the inverse logistic link with which more political scientists are familiar (Beck, Katz and Tucker, 1998). In this case, the hazard is not probability density which has only a lower bound of zero but a true probability that ranges from zero to one.

2.2.2 Nested Competing Risks

In the present case, a subject becomes at one type of risk after it ceases to be at the previous types of risks. I call this structure nested competing risks. For instance, only after lawmakers reach the end of term ($y_1 = 0$ is confirmed), they are at retirement risk.[6] Therefore, in the case where they dies ($y_1 = 1$), there is no possibility of retirement or electoral loss: $h_2(t|y_1 = 1) = h_3(t|y_1 = 1) = 0$. Similarly, they become at risk of election failure only if they decide not to retire ($y_2 = 0$). By contrast, when incunmbents retire ($y_2 = 1$), they can never lose election: $h_3(t|y_1 = 0, y_2 = 1) = 0$. Therefore, I abuse notation and redefine $h_2(t)$ and $h_3(t)$ as $h_2(t|y_1 = 0)$ and $h_3(t|y_1 = 0, y_2 = 0)$,

[6]Please note that, in this paper, I defined retirement as exit from the legislature at the end of term.

respectively.[7] Hence, according to Eq. (1), marginal hazard, $p(y_r = 1, T_r = t | T_r \geq t)$, is

$$h(t, y = 1) = h_1(t)$$

$$h(t, y = 2) = [1 - h_1(t)] \times h_2(t)$$

$$h(t, y = 3) = [1 - h_1(t)] \times [1 - h_2(t)] \times h_3(t)$$

In the multinomial logit model, these are modeled with covariates. Quantities of my interest are, however, not that but conditional hazard, $h_r(t) = p(y_r = 1, T_r = t | T_r \geq t, y_s = 0 \quad \forall \quad s < r)$, which I parameterize as the binary logit model:

$$h_r(t) = \frac{1}{1 + \exp[-\{g_r(x_t) + h_{r(0)}(t)\}]}$$

where $h_{r(0)}(t)$ is log odds of baseline hazard, $g_r(x_t)$ is a proportinality function and x_t is time varying covariates. Here, odds of hazard, not hazard itself, is made proportional to odds of baseline hazard.

2.2.3 Within-Nest Competing Risks

To be accurate, early exit before the end of term (E_1) is composed of two events: death ($y = 1a$) and the other events such as resignation due to scandal ($y = 1b$). Let the hazard of death and that of the other early exits denoted by $h_{1a}(t)$ and $h_{1b}(t)$, respectively. Though Box-Steffensmeier and Jones (2004, 168-75) introduce multiple binomial logistic regressions and single multinomial logistic regression using all observations for independent competing risks, the former is not appropriate. Multiple binary logistic regressions

[7] A general remark is in order. If nested risks are independent conditioned on previous events, that is, if covariates of any hazard never share those of other hazard in Eq.(4), each hazard is parametrically independent and possible to estimate by nested (multinomial) logistic regression, using those observations only which are at the risk (e.g., for primary loss hazard, only analyzing legislators who run for primary). Box-Steffensmeier and Jones (1997) take this strategy, though without mentioning non-random censoring and insufficiently in the sense that they do not omit primary election losers when they study general election defeat. In their latest work, Box-Steffensmeier and Jones (2004) do not even introduce this nested logistic regression. That is regrettable because nested (multinomial) logistic regression is easily available through any canned software (e.g. estimate separate regressions by selecting observations which are at that risk) and is appropriate only if scholars can assume that competing risks are nested and parametrically independent.

do not constrain the data generation process so that only one event is observed. Thus, I use single multinomial logistic regression. It is reasonable to consider that death and the other early exits are independent of each other (Are death and scandal correlated?). I parameterize the two conditionally independent risks as follows.

$$
\begin{aligned}
h(t, y = 1a) &= h_{1a}(t) \\
&= \frac{\exp[g_{1a}(x_t) + h_{1a(0)}(t)]}{1 + \exp[g_{1a}(x_t) + h_{1a(0)}(t)] + \exp[g_{1b}(x_t) + h_{1b(0)}(t)]} \\
h(t, y = 1b) &= h_{1b}(t) \\
&= \frac{\exp[g_{1b}(x_t) + h_{1b(0)}(t)]}{1 + \exp[g_{1a}(x_t) + h_{1a(0)}(t)] + \exp[g_{1b}(x_t) + h_{1b(0)}(t)]} \\
h_1(t) &= h_{1a}(t) + h_{1b}(t) \qquad (\because \text{the two risks are conditionally independent})
\end{aligned}
$$

2.2.4 Dependence between Risks

According to the Strategic Retirement Hypothesis (H2a), I expect that election hazard (h_3) increases retirement one (h_2, $\gamma_{32} > 0$). It has nothing to do with early exit (h_1, $\gamma_{31} = 0$). Also, the Health Hypothesis (H2b) predits that death risk (h_{1a}) deteriorates retirement risk and electoral risk ($\gamma_{1a2} > 0, \gamma_{1a3} > 0$). Since I divide the early exit risk (h_1) to purge the death risk of the other early exit risk (h_{1b}), the latter is not a quantity of political interest and is modeled as constant baseline hazard. Therefore, a proportionality function for every risk is as follows (I omit time subscript t from x's):

$$
\begin{aligned}
g_{1a}(x) &= x_{1a}\beta_{1a} \\
g_{1b}(x) &= 0 \\
g_2(x) &= x_2\beta_2 + \gamma_{32}(x_3\beta_3) + \gamma_{1a2}(x_{1a}\beta_{1a}) \\
g_3(x) &= x_3\beta_3 + \gamma_{1a3}(x_{1a}\beta_{1a})
\end{aligned}
$$

where x_r is covariates for risk r and $x = x_{1a} \cup x_{1b} \cup x_2 \cup x_3$.

2.2.5 Baseline Hazard: The Log Odds Quadratic Time Dependence

In discrete time model, if one uses dummy variables for every term (Cox model), one does not have to assume any shape of baseline hazard. Since events may be relatively rare for some terms, however, estimates of these dummies are less efficient. Besides, my (or, hopefully, our) primary interest does not lie in the exact shape of baseline hazard but in whether it increases or decreases as a legislator serves for more terms, or in the quadratic relationship between term and hazard. For example, against my own anticipation (H1b), some readers may expect that neither too fresh nor too senior legislators are most likely to retire: freshmen Representatives are not powerful enough to retire and run for the other higher offices such as Governor and seniors accumulate too much stake in Congress to retire and exchange even for these higher offices. Then, it suffices to model log odds of baseline hazard as the quadratic function of the number of terms:

$$h_{r(0)}(t) = \alpha_r + \tau_r t + \upsilon_r t^2$$

where α_r is a constant term, τ_r is a linear time dependence parameter and υ_r is a quadratic time dependence parameter. We can make a more complicated model, though no theory requires us to do so. Thus, this parametric restriction is worth to save efficiency. From the Seniority System Hypothesis (H1a), I anticipate $\tau_3 < 0$. The Prefessionalization Hypothesis (H1b) leads to $\tau_2 = 0$. According the Ordinary Mortality Hypothesis (H1c), we should see $\tau_{1a} = 0$. There is no theory which denies $\upsilon_r = 0$.

2.2.6 Repeated Events: The Conditional Variance-Corrected Model

Even if lawmakers retire or are defeated, they may be elected and enter the risk set again. Thus, we may observe repeated events per a single subject. Among a few methods to model repeated events, I follow the conditional variance-corrected model (Box-Steffensmeier and Jones, 2002, 2004). In this model, a subject belongs to different dura-

tion levels[8] that depend on the number of previous failures and where baseline hazards are different (The same covariates are used for the same risk hazard even if duration levels are different). Also, a subject begins to be at a higher duration level only after it experiences the previous duration level event (this is called left truncation). For example, consider a legislator who loses an election at $t = 2$ is elected again at $t = 3$ and retires at $t = 4$. I denote baseline hazard of duration level l by $h_{r(0|l)}(t)$. Then, this lawmaker survives $h_{r(0|l=1)}(t = 1)$, fails to overcome $h_{r=3(0|l=1)}(t = 2)$, enters the second duration levels at $t = 3$, not restart from $t = 1$, and survives $h_{r(0|l=2)}(t = 3)$, and fails to overcome $h_{r=2(0|l=2)}(t = 4)$. The Diet member is never at risk of $h_{r(0|l=2)}(t = 1, 2)$.

Here, I use elapsed time since entry to the first duration level, not inter-event time since exit from the previous duration level; that is, the time counter in the next duration level restarts from the time when the previous duration level ends, not anew. The duration time "clock" just stops, it is not reset (Box-Steffensmeier and Jones, 2002). It is reasonable (at least in Japanese politics) to assume that a legislator who serves five terms, retires, and gets elected again, faces the same risk as another who serves one term, retires, get elected again, and serves four more terms (the same elapsed time, $t = 6$), not as one who serves one term, retires, gets elected again (the same inter-event time, $t = 1$).

I assume the odds of baseline hazards of the same risk but different duration levels are proportional to each other. I also suppose that, for whatever reason representatives exit once, they would enter the second duration level for all risks except early exit. I assume that there is only one duration level for death because men can not die twice. In the above example, the legislator is at risk of $h_{r=1,2(0|l=2)}(t = 3)$, not $h_{r=1,2(0|l=1)}(t = 3)$ even if the legislator has experienced neither death nor retirement up to the third term. Then,

$$\exp(h_{r(0)}(t)) = \exp(\lambda_r l)\exp(\alpha_r + \tau_r t + \upsilon_r t^2)$$

$$\therefore h_{r(0)}(t) = \alpha_r + \tau_r t + \upsilon_r t^2 + \lambda_r l$$

[8] In the conventional term of survival analysis, what I refer to as different duration levels are called strata.

where l is an indicator of duration level and λ_r is a level effect parameter.

2.2.7 Likelihood and Left Truncation

Generally speaking, in a discrete time model, an observation of a legislator i at term t appears in the dataset only if the legislator survives the previous terms. I denote the likelihood of legislator i's exit type y at term t by $\mathscr{L}_i(y|t)$. When any event occurs,

$$\begin{aligned}\mathscr{L}_i(y > 0|t) &= p[(y_{1i} + y_{2i} + y_{3i}) = 1, min(T_{ri}) = t|min(T_{ri}) \geq t] \\ &= h(t)_i\end{aligned}$$

By contrast, when no event occurs during the term, the lawmaker is reelected and survives and the term is right censored. Then,[9]

$$\begin{aligned}\mathscr{L}_i(y = 0|t) &= 1 - \sum_{r=1}^{3}[h(t|y_r = 1)_i] \\ &= [1 - h_1(t)_i] \times [1 - h_2(t)_i] \times [1 - h_3(t)_i]\end{aligned}$$

Besides, the present data observation begins in 1947 and prior terms are not observed (left truncation). Thus, prewar legislators' terms count from greater than one, even though that term is the first appearance in the dataset. Suppose a legislator i is observed from t_{Si} to t_{Ei} and there are n legislators. Then, total likelihood $\mathscr{L}$ is

$$\mathscr{L} = \prod_{i=1}^{n} \prod_{t=t_{Si}}^{t_{Ei}} \mathscr{L}_i(y|t)$$

3 AN APPLICATION TO THE JAPANESE CASE

3.1 Data

The dataset includes all members of the House of Representatives in the Japanese Diet from the 1947 general election (when the current constitution was established) to the

[9] This is equivalent to a conditional survival function.

1990 general election. There are 16 electoral terms, $n = 1939$ members, and $N = 7805$ observations (member-term).[10]

TYPE represents exit type (y). Among all observations, death (TYPE=1(a)) is 2.7%, other early exit (TYPE=1(b)) is 1.1%, retirement (TYPE=2) is 4.7%, Electoral defeat (TYPE=3) is 21.0%. Censored cases (reelection, TYPE=0) is 70.4%.[11]

TERM (t) is the number of terms for which the legislator has served. *LEVEL* (l) is zero if the legislator has never exited (the first duration level). Otherwise (the second or higher order duration levels), it takes one. Since there are not so many observations of the third or higher order duration levels and they would make estimation inefficient, I collapse all of them into the second duration level. Among all members (not observations), mean of maxima of TERM is 4.5 and 64.3% of them experience at most one exit (LEVEL=0).

3.1.1 Covariates for Death Hazard

I control two covariates for death hazard (x_1). *AGE* is measured by year (and by month divided by 12) at the time when the legislator enters the Diet in the term (which is not the same as the general election if they are elected through by-election). *EXPOSURE* is length of the term from members' entry into the Diet to the next general election by year (not to the actual early exit, e.g., due to death). I expect that, the older they are or the longer they are exposed to death risk during the term, the more likely they are to die. Thus, both coefficients should be positive.

3.1.2 Covariates for Retirement Hazard

As for retirement hazard covariates (x_2), I use five opposition party dummies: from left, *COMMUNIST* (3.1%), *SOCIALIST* (22.4%), *CENTRIST* (the Democratic Socialist Party, 6.1%), *BUDDHIST* (the Clean Government Party, a.k.a. *Komeito* in Japanese,

[10] I make this dataset by referring to Shugiin and Sangiin (1990), which is the official record of Diet members and most comprehensive in this kind. Basic summary and detailed coding scheme of the dataset is introduced in Fukumoto (2004). Fukumoto (2003) performs survival analysis of discrete time of year to figure that the difference between members of both houses which is caused by institutional design.

[11] Here, the unit of analysis is member-term. In the first section, too, I showed distribution of TYPE, where the unit of analysis was member.

4.6%), and *OTHERS* (other miscellaneous parties and independents, 3.7%). The reference party is the LDP (60.0%), which is the most right party. All parties include their predecessors. According to the Organizational Party Hypothesis (H3b), I predict that members of COMMUNIST, SOCIALIST and BUDDHIST tend to retire more frequently than other parties and coefficients of these three dummies are positive.

3.1.3 Covariates for Electoral Loss Hazard

The same five opposition party dummies as retirement hazard covariates are included as covariates (x_3) for electoral loss hazard, too. These test the Opposition Party Hypothesis (H3a), which expects these coefficients are positive.

Other covariates are controlled to study baseline hazard. First, the number of votes the legislator gets in the previous election, v, seems to be a promising factor. We should, however, pay attention to the electoral system, the single non-transferable voting system (SNTV). Here, each district returns $3 \leq M \leq 5$ members though a voter has one non-transferable vote. Thus, the same number of votes means different electoral strength depending on the district size. Though a few measurement of electoral strength are proposed, I pick up Cox and Rosenbluth's (1995) proportion of the number of votes to Droop quota and define it as *VOTE*:

$$VOTE = \frac{v}{\left(\frac{\sum v}{M+1}\right)}$$

where $\sum v$ is the total number of votes all legislator in the district get. Droop quota is the sufficient number of votes to be elected.[12] If a lawmaker is elected through by-election, VOTE may be overevaluated reliable because only one seat is fought over. Hence, a dummy variable *BY-ELECTION* is included. Those who have held local elected office may have stronger hold on votes. A dummy variable *LOCAL* is one if the legislator used to be members of local parliament, mayor, or governor before coming to the Diet.

[12] As the data source of the number of votes, I refer to Kawato and Kawato (1997) and Reed (1992).

Last, representatives who are born and grown up in the district have more stable social network to mobilize in the electoral campaign. *OUTSIDER* is a dummy variable which indicates the lawmaker's registered original address (*honseki*, in Japanese) is not in the same prefecture as the district.

From the above, coefficients of OUTSIDER are expected to be positive, while others are expected to be negative.

3.2 Results

(Note: Due to computational problems, I can not report results of the model described above. Instead, I show results based on an earlier model of mine, which excludes quadratic terms and includes a level term for death hazard. Fukumoto (2005) shows that, in the case of U.S. House members, coefficients of quadratic terms are not significantly different from zero even at 10% level except for ambition risk.)

Table 1 reports the results.[13] In the following, I refer to those parameters only which are significantly different from zero. Quantities of most interest are time dependence parameters of baseline hazard, τ_r's and υ_r's, and between-hazards dependence parameters, γ's.

3.2.1 Different Time Dependence of Competing Risks

Figure 1 depicts baseline hazards along electoral TERMs by duration LEVELs when covariates are set at its mean values (for continuous variables) or zero (for dummies) (which are referred to in the fourth column in Table 1 as x_{from} and I call the reference values). As Hypothesis H1s predicted, among time dependence parameter of baseline hazard, τ_r's, only τ_3 for electoral defeat is negative. That is, the longer Diet members serve (larger TERM, t), the less likely they are to fail to be reelected (smaller hazard, $h_3(t)$), even if the portion of VOTEs is cotrolled. Therefore, the Seniority System Hypothesis (H1a) is confirmed. Baseline Hazards for death or retirement ($h_{1(a)}(t)$ and $h_2(t)$) are

[13] I write codes and estimate parameters of the model on a statistics software `R`.

	Est.	St.D.	p	x_{from}	x_{to}	Δh_1	Δh_2	Δh_3
Baseline Hazard								
Early Exit								
$\alpha_{1(b)}$ (Constant)	−4.44	0.11	0.00					
Death								
$\alpha_{1(a)}$ (Constant)	−9.20	0.76	0.00					
$\tau_{1(a)}$ (TIME)	0.03	0.03	0.23					
$\lambda_{1(a)}$ (LEVEL)	−0.01	0.15	0.96					
Retirement								
α_2 (Constant)	−9.02	0.59	0.00					
τ_2 (TIME)	0.01	0.02	0.56					
λ_2 (LEVEL)	−0.27	0.12	0.03					
Electoral Loss								
α_3 (Constant)	0.32	0.25	0.21					
τ_3 (TIME)	−0.14	0.01	0.00					
λ_3 (LEVEL)	0.41	0.07	0.00					
Dependence b/w Risks								
γ_{12} (die → retire)	1.56	0.27	0.00					
γ_{13} (die → not elected)	0.42	0.08	0.00					
γ_{32} (not elected → retire)	0.81	0.10	0.00					
Covariates								
Death (β_1)								
AGE	0.08	0.01	0.00	54.50	64.50	1.90	4.50	6.40
EXPOSURE	0.33	0.06	0.00	2.70	3.70	0.60	1.30	2.60
Retirement (β_2)								
COMMUNIST	−0.02	0.33	0.96	0.00	1.00	0.00	1.60	15.70
SOCIALIST	0.54	0.15	0.00	0.00	1.00	0.00	1.70	1.60
CENTRIST	−0.01	0.28	0.96	0.00	1.00	0.00	−0.10	−0.30
BUDDHIST	1.43	0.28	0.00	0.00	1.00	0.00	6.00	−0.10
OTHERS	0.17	0.34	0.61	0.00	1.00	0.00	1.10	6.40
Electoral Loss (β_3)								
VOTE	−3.81	0.19	0.00	0.90	1.10	0.00	−1.00	−11.60
BY-ELECTION	−0.53	0.38	0.16	0.00	1.00	0.00	−0.70	−8.50
NEIGHBOR	0.02	0.09	0.80	0.00	1.00	0.00	0.00	0.40
LOCAL	0.03	0.06	0.65	0.00	1.00	0.00	0.00	0.50
COMMUNIST	0.73	0.15	0.00					
SOCIALIST	0.09	0.07	0.23					
CENTRIST	−0.01	0.13	0.91					
BUDDHIST	−0.01	0.15	0.97					
OTHERS	0.32	0.15	0.03					

Table 1: A Systematically Dependent Competing Risks Model of Japanese Legislators' Exit

constant (once AGE is controlled). Thus, the Ordinary Mortality Hypothesis (H1c) and the Professionalization Hypothesis (H1b) are verified. Besides, once they exit, they get more vulnerable at the election ($\lambda_3 > 0$) but less willing to retire ($\lambda_2 < 0$).

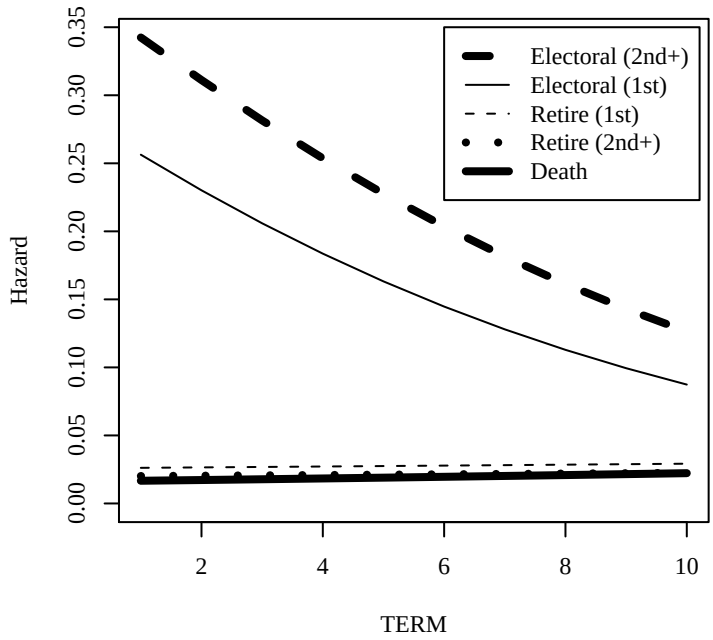

Figure 1: Time Dependence of Baseline Hazards by Risk

3.2.2 Dependence between Competing Risks

All between-hazards dependence parameters, γ's, are positive. Figure 2(1) shows how each hazard at the first term (TERM=1) of the first duration level (LEVEL=1) changes when the linear predictor of covariates for death hazard ($x_1\beta_1$) moves from its empirical minimum to maximum and covariates for other hazards (x_2, x_3) are set at their reference values in the previous paragraph. Those who are at higher risk to die (larger h_1) also are prone to retire (larger h_2 and positive γ_{12}) and not to be reelected (larger h_3 and positive γ_{13}. Since γ_{13} is smaller, h_3 is flatter than other hazard curves). The Health Hypothesis (H2b) is concluded. Figure 2(2) is the case where $x_3\beta_3$ moves and both x_1 and x_2 take

the reference values. The more likely legislators are to fail to be reelected (larger electoral hazard, h_3), the more likely they are to retire (larger h_2 and positive γ_{32}). The Strategic Retirement Hypothesis (H2a) is affirmed.

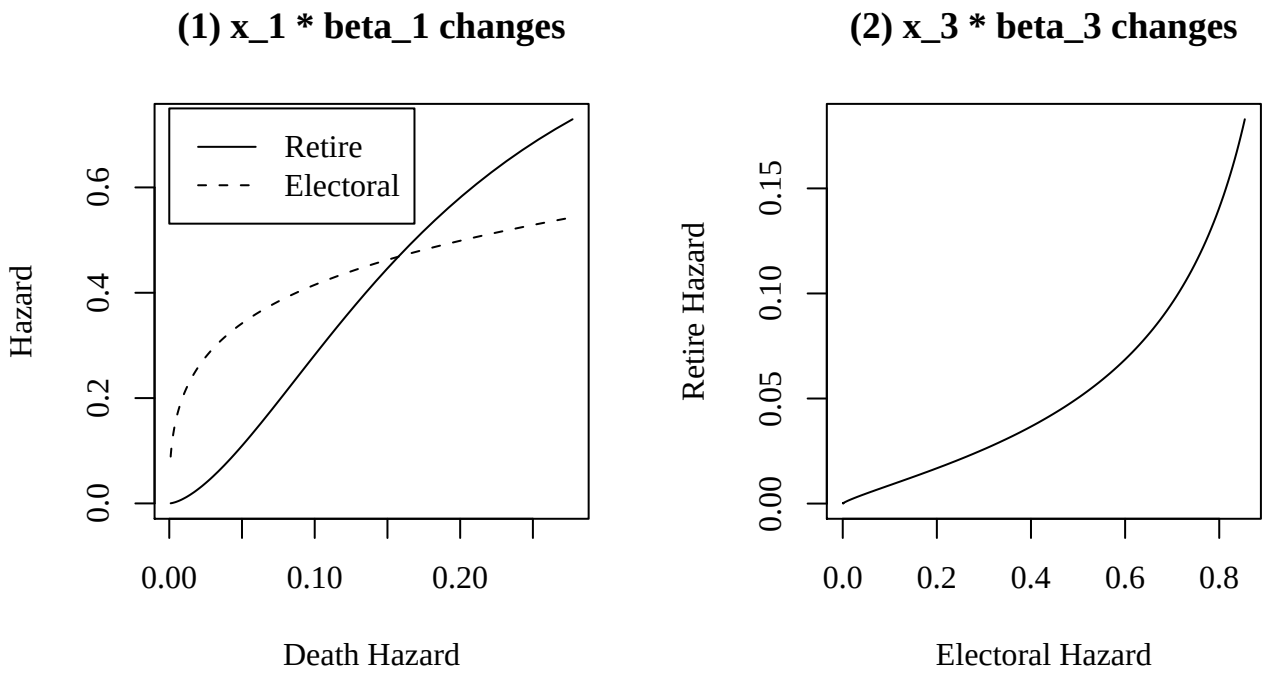

Figure 2: Dependence between Competing Risks

3.2.3 Covariates

How about covariates for each hazard? Signs of all coefficients are as expected if they are significantly different from zero. Table 1 includes first differences (Δh_r's, in percentage) which is change in hazard at the first term (TERM=1) of the first duration level (LEVEL=1) when one covariate moves from its reference value (x_{from}) by one standard deviation (to x_{to}, for continuous variables) or from zero to one (for dummies) and other covariates remains at the reference values:

$$\Delta h_r = h_{r(0|l=1)}(t = 1|x_i = x_{to}, x_{-i} = x_{from}) - h_{r(0|l=1)}(t = 1|x_{from})$$

A 10 years older (AGE) representative has 1.9 points larger death hazard ($\Delta h_1(a)$). AGE also has effects on retirement and electoral hazards, though these are indirect one through between-hazards dependence parameters. Since I have already examined them, I do not repeat them here and similar cases in the following. One year longer term (EXPOSURE) increases death hazard by 0.6 points.

Retirement hazards (Δh_2) of members of BUDDHIST party and SOCIALIST are 6 points and 1.7 points higher than the LDP, respectively. The Organizational Party Hypothesis (H3b) is supported.[14]

When the number of VOTEs increases from 90% of the sufficient number (Droop quota) to 110%, the electoral hazard (Δh_3) dramatically lessens by 11.6% points. COMMUNISTs and OTHER minor parties members have 15.7% points and 6.4% points higher hazards than the LDP, respectively. Other opposition parties are as electorally strong as ever dominant LDP. The Opposition Party Hypothesis (H3a) is not well supported by the data. Legislators who are elected through BY-ELECTION, are OUTSIDERs, and have LOCAL politician experience, also do not have different electoral hazard from the others.

CONCLUSION

When, how and why do legislators exit the legislature? All of my hypotheses are confirmed analyzing the Japanese case except the Opposition Party Hypothesis (H3a).

Time dependence of exit risks are different. First, electoral loss risk decreases as they serve for a long time. This is caused by the seniority system, which allocates fewer resources to junior members and make them more vulnerable in the election. Second, in the age of professionalized legislature, retirement risk is constant, not high in the initial stage as it used to be, because membership is too attractive to quit. Third, death risk

[14]The effect of COMMUNIST on electoral hazard reaches retirement hazard through dependence parameter γ_{32}. That may be why the coefficient of COMMUNIST on retirement hazard does not seem to be significant.

has nothing to do with political career, once age is controlled. Politicians are just as biologically mortal as ordinary people.

These three risks are dependent on each other. Lawmakers strategically retire when they find their electoral prospect to be bad. Those who come near dying also can neither afford to run nor win in the election due to physical decay.

Organizational parties are more likely to force members to retire than cadre parties. The former has more political power over their members, while the opposite is the case in the latter. Against my expectation, even perpetual opposition party members are successful electorally, once they enter the legislature.

In another paper Fukumoto (2005), I analyze U.S. Congress data. The Seniority System Hypothesis (H1a) and the Strategic Retirement Hypothesis (H2a) are supported but the Prefessionalization Hypothesis (H1b) is not. Rather, retirement risk in the House increases with the number of terms.

In order to test whether these hypotheses are true, I constructed a systematically dependent competing risks model of survival analysis. This enables us to estimate more than two dependent competing risks, which is almost impossible for currently popular frailty model. My model also distinguishes covariates' direct effects from their indirect ones and takes into consideration non-random censoring and nested risks structure. Political science is full of cases whose data generation process is well represented by dependent competing risks model. To name only a few, cabinet resolution (Diermeier and Stevenson, 1999), war or peace duration, end of litigation, and survival of administrative organization (Carpenter and Lewis, 2004) are promising applications.

I hope this paper contributes to legislative studies as well as political methodology, though there remain a lot of problems. I just mention a few here. Causal mechanisms among risks has to be studied more deeply and there should be other covariates to explain hazards' variation. Especially, politicians' activity during the term such as legislation, pork, or public office holding (say, ministership) may well affect their returnablity. In pursuing them, methodologically, it is desirable and (probably) possible, but not yet

done, to combine my systematically dependent risks model and stochastically one such as frailty model. They are not exclusive. But these are future agendas.

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