A Spatial Model of Voting with Endogenous Proposals: Theory and Evidence from the Chilean Senate*

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Abstract

Proposers strategically formulate legislative bills before voting takes place. However, spatial voting models that estimate legislator's ideological preferences do not explicitly consider this fact. In our model, proposers determine the ideology and valence of legislative bills to maximize their objective functions. Approaching to the median legislator ideology and increasing costly valence increases the passing probability, but usually decreases the proposer's payoff. Using quantile utility proposer preferences, the model becomes tractable and estimable. In this way, we deal with the bill sample selection problem to estimate legislator's preferences and also, the ideology of proposers, the proposed valence change, and the ideological stance of the *statu quo* in a common scale. Using Chilean Senate 2009 - 2011 roll call data, our results suggests that (1) political party affiliation significantly affects Senators' ideology, (2) popular, young and male Senators are more extremist, and (3) proposers during Bachelet and Piñera's terms have similar ideologies.

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1 Introduction

Bill proposers typically choose the content of proposals to obtain legislators' support. Proposers jointly consider several variables to have a bill passed, including the current *statu quo*, the distribution of political forces in the Congress, and the institutional setup. In this paper, we provide a simple and estimable model of the legislative process, in which strategic proposers select bills' characteristics considering their effects on the voting behavior of legislators.

We essentially merge in a tractable model a simple agenda-setting process with a spatial legislative voting setup. We explicitly incorporate a strategic bill proposing stage to appropriately estimate the ideological preferences considering the proposer's endogenous choice of bills. Upon some parametric assumptions, our model provides a richer analysis of the legislative process in comparison to alternative setups.

Formal models of law-making represent legislators' preferences and bills in a multidimensional space of attributes. However, when estimating models, the related literature implicitly assumes that bills actually put for legislators' consideration are just randomly drawn from an unspecified set of possible proposals. A sensible model should consider that the observed legislative voting process takes place after the proposer strategically selects bills. Following Peress (forthcoming), in a typical one-dimensional setting as ours, there may exist a gridlock or even a censoring interval for a given proposal. In reality, a strategic proposer avoids presenting an bill with slim chances of passing. Thus, as researchers, we never consider how legislators vote for the unobserved bill when estimating models of legislative behavior. Hence, observed bills are a subset of potential proposals with relatively high likelihood of approval, as suggested by Clinton and Meirowitz (2001). Heckman (1976) pioneered the analysis of statistical models under non-random sample selection. However, unlike classical applications in labor economics, we do not observe characteristics of never proposed bills, so that Heckman's approach is unfeasible. Instead, the law-making process is a sample selection mechanism on its own. Integrating it into the process would make it possible to estimate legislators' preferences and other features characterizing the legislative process.

The basic setup of our model is similar to classic spatial voting models (Poole and Rosenthal 1985, 1997, Londregan 2000a, Poole 2005) which ignore sample selection con-

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siderations.[1] Our setup includes a strategic proposal stage implying additional constraints that allow us to recover proposal and *statu quo* locations, and to provide a more fleshed setup of the legislative process. The legislators and the proposer have preferences on the ideological spatial location (left or right) of the bill and on its *valence*. The latter concept has been primarily used in electoral models as a representation of candidate-specific characteristics, such as charisma or competence, that appeal to all voters (see Gilligan and Krehbiel 1987, 1990, and Groseclose 2001). In our paper, valence measures the quality of a proposal which represents universally desirable goals of legislation such as coherence and efficiency cost-effectiveness. Thus, our interpretation of valence is closer to the ones used by Londregan (2000b) and Hirsch and Shotts (2011).

Most of the previous literature has assumed that valence is exogenously given (with the exception of Hirsch and Shotts 2011). Londregan (2000b) discusses the strategic use of valence by the executive power, but in his empirical estimations, he considers the valence as a fixed attribute of the proposer. Arguably, in real legislative process valence is endogenous. The proposer, either the executive power or a group of legislators, strategically exerts effort to increase the valence and the likelihood of approval, considering costs and benefits involved. Moreover, in developing countries the executive power is able to provide more valence to bills than legislators because of its advantage in term of resources and capabilities (Londregan 2000b).

Formally, the legislative game consists of two stages. First, a proposer defines the proposal's ideological stance and the valence with two potentially conflicting goals: to make it as close as possible to his own ideological position, and to increase the probability that the bill gets approved. By generating sufficient valence, the proposer may make the Congress to approve bills that are distant from the median voter ideology. At the second stage, the legislators vote to accept or to reject the proposal. In the latter case, the *statu quo* policy remains.

While sensible, this approach is untractable if we use standard expected utility (Von Neumann-Morgensten) preferences because the probability of passing a bill roughly requires 2^{V-1} calculations, where V stands for the number of voters. However, if the proposer has a different kind of preferences, focusing on quantiles of possible outcomes instead of expected

[1] A large literature devoted its attention to the estimation of spatial voting models for the US Congress. More recent work has focus on the Supreme Court (Martin and Quinn 2006; Peress 2009), and Latin American chambers Londregan (2000a, 2000b); Desposato 2006

values (Manski 1988; Rostek 2010), the model becomes tractable. While this approach may sound too sophisticated, it is indeed much simpler than expected utility because it delivers a surprisingly easy problem to solve for a proposer: he only needs to maximize his own preference under a median voter approval restriction with a fixed probability. The solution of the model transpires into a simple non-linear model of dichotomic dependent variable (probit if we assume Gaussian idiosyncratic taste shocks) that can be easily estimated in canned statistical software such as STATA with little programming. We provide conditions under which the parameters of model are identified and compute bootstrapped standard errors since final estimates involve non linear transformations on the parameters of the model so that it is hard to derive an asymptotic variance matrix.

One important issue on the model identification is the impossibility of recovering ideological positioning of all the usual parameters of interest, i.e. the ideology of preferences and voted bills (Rivers 2003). We go beyond putting some restrictions or normalizations to secure identification by using an index parametrization strategy as in Londregan (2000a). This allows us to economize in the degrees of freedom, but also to obtain evidence on the determination of legislator preferences, importance of bills, and the *statu quo*. For the sake of comparison, we also pursue the usual approach of estimating fixed ideological preferred points of legislators.

We take the model to the data using roll-call data from the Chilean Senate during March 2009-March 2011. The data covers the last year of M. Bachelet and the first one of S. Piñera. In our approach, ideological preferred points of legislators depend on the political party affiliation, but also on individual factors such as age, gender, educational level, as well as in political career variables: previous experience, voting percentage in last election, and electoral district represented. We advocate a construction of a *statu quo* ideological index using previous voting record and public opinion approval of the President of the Republic. Among potential proposers we distinguish bills promoted by the Executive power, and those sponsored by the Senate, by the Representative chamber, or by a joint Committee of the Congress chambers.

Our results show that political party affiliation is the most relevant determinant of Senators' ideologies. By using our parameterization of indices, we find evidence of greater extremism in male, young, and highly voted Senators, especially for the Center-right. We also estimate fixed ideological effects for each Senator, with reasonable precision of bootstrapped confidence intervals. Nevertheless, our preferred parameterized approach

provides some novel insights of the ideology stance of Senators.

The results for the median voter, *statu quo*and proposer's ideology taking together suggest that the ideological scenario between Bachelet's and Piñera's periods did not change by much. The evidence could be interpreted in the way suggested by certain rightists Senators: Piñera's government has been quite close to the ideological stance of Center-left parties. The model's measurement of differential valence generated by proposers decreases after Piñera takes office, which may be attributed to the difficulties the first center-right government in 20 years, or to the great 8.8 Richter earthquake in central Chile occurred 12 days before Piñera's government started. Finally, our measurement of the ideological evolution of the *statu quo* suggests that Senate support for the previous bill moves the *statu quo* to the left during Bachelet's term, but has a less clear effect during Piñera's term. This finding is in line with the evidence on ideological preferences of proposers during the last period.

Our road map is the following: in the next section we present the model. In Section **??** we consider its estimation. In Section 4 we present the empirical findings. Finally, Section 5 concludes.

2 Model

In our setting, we assume that each proposal can be described as a combination of two characteristics: an ideological position, typically a left-right political position; and a proposal quality component known as valence. Londregan (2000a), Rivers (2003) and Clinton, Jackman, and Rivers (2004) point out that the traditional spatial model voting in the political science literature is unidentified. Since in these models there are two relevant dimensions per proposal, ideology and valence, it is generally impossible to learn whether a proposal is preferred due to a high valence, or because it strongly confronts extremist ideological positions. Londregan (2000b) uses these insights to analyze voting data from the Chilean Congress Committees.

However, in spite of the advances made by these works, an unappealing implicit assumption in Londregan's estimating procedure is that proposals put for voting are randomly drawn from a possible universe of them, or that every proposer will blindly advocate bills regardless of their possibility of approval. It is common sense that professional politicians assess the likelihood of approval of any proposal before putting it for others' scrutiny. This

means that: (i) the data on actual proposals is actually a non random sample of possible proposals and, consequently, the estimators relying on the aforementioned assumptions are biased; and (ii) we can use proposers' behavior, as well as voting behavior, to learn about legislator's preferences and other influencing factors.

Hence, the executive power in particular, and any proposer in general, wants to maximize two potentially conflicted dimensions of a proposal: (i) closeness to a preferred ideological point and (ii) probability of passing the proposal. We assume that the executive power or other proposers perfectly know the legislators preferred ideological points.

Consider that a proposer i, who can be either a legislator or the executive power, optimally determines the ideological content of a proposal z_p and its valence q_p. Since every legislator likes a higher valence, the proposer can make every proposal approved if he provides a sufficiently high valence. Therefore, an interesting model must include some force that prevents proposers from generate arbitrarily large valence. On the other hand, it is reasonably to assume that a higher technical level of the proposal demands more effort, time and monetary resources. Providing valence is costly.

Preferences over proposals are represented by a utility function $U(x_v, z_p, q_p)$ where x_v is the ideological preferred point of the legislator or proposer v, z_p is the ideological position of the proposal and q_p is the valence of the proposal. For instance, a well-known utility function is quadratic

$$U(x_v, z_p, q_p) = \alpha q_p - \frac{1}{2}(z_p - x_v)^2$$

2.1 A Traditional Approach

In this setup, the proposer deals with uncertainty in the way considered by the classic Von Neumann-Morgensten preferences. Simply put, the objective of the proposer i is to maximize the expected value of his proposal. Therefore the proposer i sets z_p and q_p to solve

$$\max_{z_p, q_p} \{U(x_i, z_p, q_p)P(X, z_p, q_p, z_s, q_s) + U(x_i, z_s, q_s)(1 - P(X, z_p, q_p, z_s, q_s)) - C(q_p)\}$$

where $C(q_p)$ is an increasing, weakly convex cost function of providing valence; z_s, q_s are the ideological position and valence of the *statu quo*; and $P(X, z_p, q_p)$ is the probability of approval of the proposal which depends on the vector of ideological preferred points of all committee members $X = (x_1, x_2, ..., x_V)$ and on the proposals characteristics (z_p, q_p).

A problem with the previous specification is that the probability of the proposal passes $P(X, z_p, q_p, z_s, q_s)$ is a mathematical object which is very hard to compute. The fact that the individual-voter probability of approval varies across legislators is the greatest complication.[2] To see the complexity, we elaborate this probability further.

$$P(X, z_p, q_p, z_s, q_s) = P\left(V \text{ aye}\right) + P\left(V-1 \text{ aye}, 1 \text{ nay}\right) + ... + P\left(\frac{V+1}{2} \text{ aye}, \frac{V-1}{2} \text{ nay}\right)$$
$$= \prod_{v=1}^{V} F_v + \sum_{k_1=1}^{V} (1-F_{k_1}) \prod_{v \neq k_1}^{V} F_v + \sum_{k_1=1}^{V} \sum_{k_2 \neq k_1}^{V} (1-F_{k_1})(1-F_{k_2}) \prod_{v \neq k_1, k_2}^{V} F_v + ...$$
$$+ \sum_{k_1=1}^{V} ... \sum_{k_{\frac{V-1}{2}} \neq k_1, ..., k_{\frac{V-3}{2}}}^{V} (1-F_{k_1}) ... \left(1-F_{k_{\frac{V-1}{2}}}\right) \prod_{v \neq k_1, k_2, ..., k_{\frac{V+1}{2}}}^{V} F_v$$

where F is the cumulative distribution of the idiosyncratic shock. Computing the above formula rapidly increases in complexity as the number of voters grows. Roughly, this probability computation involves considering $R(V) = \sum_{m=1}^{M} \binom{V}{M} \approx 2^{V-1}$ (with $M = \frac{V+1}{2}$ if V is odd and $M = \frac{V}{2} + 1$ if even) possible configurations of voting, quite a daunting task for a realistic number of voters of congressmen. For instance, in the case of the Chilean Senate, there are $V = 38$ so that $M = 20$. Then, $R \approx 1.374 \times 10^{11}$. Moreover, since $R(V+1) \approx 2R(V)$, the application of this approach quickly becomes impractical for a lifelike number of legislators or voters. Perhaps more importantly, we may call into question a decision-making process that implies such a burden of calculations. The setup implies that the proposer considers every single possible configuration of voting behaviors and fully understands how her own actions affect such configurations. On the other hand, our intention is to provide a tractable, easily implementable, yet richer voting model. A more convenient setup, that preserves the basic insights we have discussed so far, is presented next.

2.2 A more tractable setup

Instead of relying on the traditional Von NeumannMorgenstern expected utility theory of decision making, we propose a different kind of preferences that provides a much more

[2]Notice that if we assume that the proposer does not know the preferred ideological points would make our problem easier. However, in this setting seems unlikely because legislators have a well-known political affiliation.

tractable model in this case. It also describes a simpler and probably more realistic decision-making process of the bill proponent, which is the maximization of a particular quantile of the expected utility conditional on a particular median voter. This kind of behavior entails loss risk aversion defined by the level of targeted quantile in the distribution. Proponents who are willing reduce the risk of loss, target a higher quantile by modifying their choices accordingly. A complete treatment of this general theory could be found in Rostek (2010) with an ancestor in Manski (1988).

Our setup assumes that the proposer already knows who the median voter is before deciding on the ideology and valence of the bill. Since the proposer cares about a quantile and the distribution of the utility, the specific ranking is irrelevant to the decision as long as the median voter remains unchanged. In this setting, the proposer avoids the complex calculation of the approval probability of the bill. He only needs to compute the probability of that the median voter approves, a much simpler object. Instead of considering all possible rankings, the proposer determines a pair (q_p, z_p), that maximizes a quantile a of the expected utility random variable. In other words, the proposer ensures an *ex ante* probability of approval a given the valence costs, its preferred ideology x_i, and the preferred ideology of the pivotal legislator, x_m.

Since the problem is static, we do not use time subscripts t although the *statu quo* (q_s, z_s) or even the the ideological preferences x_v may change over time. The proposer maximizes the quantile a, Q_a of the utility

$$\max_{z_p, q_p} \{Q_a \left(\mathbb{I}[U_m(z_p, q_p) \geqslant U_m(z_s, q_s)|x_m]U_i(z_p, q_p) + \mathbb{I}[U_m(z_p, q_p) < U_m(z_s, q_s)]U_i(z_s, q_s) - C(q_p)\right)\}$$

where F is the cumulative distribution of the idiosyncratic shock of the median voter. This problem can is equivalent to

$$\begin{aligned} &\max_{z_p, q_p \geqslant 0} \{a(U_i(z_p, q_p) - U_i(z_s, q_s)) + U_i(z_s, q_s) - C(q_p)\} \\ &\text{subject to } U_m(z_p, q_p) - U_m(z_s, q_s) \geqslant F^{-1}(a) \end{aligned}$$

In particular, if we choose the traditional spatial linear-quadratic utility function (as in Londregan 2000a) and a linear cost function, we solve a Lagrangian to characterize the proposer's behavior

$$\begin{aligned} \mathcal{L}(z_p, q_p) = \Bigg\{ a \left(\alpha(q_p - q_s) + \frac{1}{2}\left((z_s - x_i)^2 - (z_p - x_i)^2\right) \right) - \gamma q_p \\ + \lambda \left[F^{-1}(a) - \alpha(q_p - q_s) - \frac{1}{2}\left((z_p - x_m)^2 - (z_s - x_m)^2\right) \right] \Bigg\} \end{aligned}$$

From the first-order conditions, the solution (z_p^*, q_p^*) necessarily satisfies the following conditions

$$z_p^* = a\eta x_i + (1 - a\eta)x_m \quad \text{with } \eta \equiv \alpha/\gamma \tag{1}$$

$$q_p^* = q_s + \frac{1}{\alpha}\left(F^{-1}(a) - \frac{1}{2}\left((z_s - x_m)^2 - (z_p^* - x_m)^2\right)\right) \tag{2}$$

A well-defined maximum is defined whenever $0 < a\eta < 1$.

A legislator $v = 1, 2, ..., V$ approves the proposal if $U_v(z_p, q_p) - U_v(z_s, q_s) > \epsilon_v$. If we replace the proposal z_p^* and valence q_p^*, we find the voter v votes *aye* if

$$\begin{aligned}
\alpha(q_p^* - q_s) + \frac{1}{2}\left((z_s - x_v)^2 - (z_p^* - x_v)^2\right) &> \epsilon_{v,t} \\
F^{-1}(a) + (z_p^* - z_s)(x_v - x_m) &> \epsilon_{v,t} \\
F^{-1}(a) + (x_v - x_m)(a\eta x_i + (1 - a\eta)x_m - z_p) &> \epsilon_{v,t}
\end{aligned}$$

where the second step follows from substituting (2) into the previous equation. Since it is hard to identify the parameter η, we set it to the value of 1. Therefore, if we consider that idiosyncratic shocks follow a standard normal distribution, the probability of the voter approves a particular bill is

$$\begin{aligned}
P_v(x_i, x_m, z_s, q_s) &= \Phi\left(\Phi^{-1}(a) + (x_v - x_m)(ax_i + (1 - a)x_m - z_p)\right) \\
&= \Phi\left(y + (x_v - x_m)(\Phi(y)x_i + (1 - \Phi(y))x_m - z_p)\right)
\end{aligned}$$

2.3 Taking the model to the data

Essentially, x_v for $v = 1, ..., V$ are individual fixed effects in a non-linear model in the usual jargon of panel data econometrics. Without loss of generality, we denote these parameters by a linear index of observed variables $x_v = \sum_{k=1}^{K} \xi_k l_{k,v} = \xi l_v$. In the particular case of individual fixed effects $K = V$ and the variables $l_1, ..., l_V$ are dichotomic variables taking 1 for voter k and 0 otherwise. However, following the insight of Londregan (2000a), we could also use a more economic parametrization by modeling individual preferences in terms of observable voters' characteristics, such as political party, age, gender, etc. Since this strategy allows us to a substantial reduction of the parameters to estimate, it is likely to improve our mean squared error in finite samples. Given this setup, the ideological point of the median or pivotal voter is $\text{med}(x_v) = x_m = \xi l_m$.

Proposer's preferences x_i and time-varying *statu quo* z_s could be parameterized similarly. Hence, $x_i = \varphi r_i$ and $z_{s,t} = \pi s_t$. Finally, we could also try to parameterize the probability of winning, which should depend on characteristics of the bill voted. In this case, since the probability has to be bounded between 0 and 1, we rather model the quantile of the distribution, i.e $\Phi^{-1}(a) = y = \delta u_t$. We also have to restrict the product $a\eta = \Phi(y)\eta$ to be bounded between 0 and 1. One simple way to do this is by substituting constraining $\eta = 1$.

Using all this nomenclature, we could write the complete likelihood in terms of the non-linear index $\theta_{itv}(w, \beta)$ with $w_{itv} = (l_v, r_i, s_t, u_t)$ as the vector of observable variables and $\beta = (\xi, \varphi, \pi, \delta, \psi)$ as the vector of parameters.

$$\theta_{itv}(w_{itv}, \beta) \equiv \delta u_t + \xi l_v - x_m \left(\Phi(\delta u_t)(\varphi r_i - x_m) + \xi l_m - \pi s_t\right) \tag{3}$$

$$\mathcal{L} = \sum_{i=1}^{I} \sum_{v=1}^{V} \sum_{t=1}^{T} \left\{ d_{itv} \log \Phi(\theta_{itv}(w_{itv}, \beta)) + (1 - d_{itv}) \log \Phi(-\theta_{itv}(w_{itv}, \beta)) \right\} \tag{4}$$

where d_{itv} is a dummy variable with value 1 whether the voter approves the bill, and 0 otherwise. As econometricians, we ignore who the pivotal voter considered by the proposer is. Since the median voter identity depends on the ideological points of all other legislators, we consider the possibility of changing the pivotal when the Senate composition changes, after a new election on roughly one-half of the Senatorial districts. This is the situation in our data. Jointly with the (first-round) Presidential election in December 2009, half of Senatorial districts also had elections. Consequently the composition of the Senate modified and the pivotal voter potentially changed.

For the Chilean data for 2009 and 2010, the proposers considered are the Executive Power, the Senate, and the Representatives Chamber under the composition 2009- March 2010 (Bachelet's term) and under the composition from March 2010 onwards (Piñera's term).

3 Identification

The structure of the model shows that there is no natural scale for ideological preferences, nor natural ideological direction of preferences, as stated by Rivers (2003). In order to achieve identification, one usually needs to normalize certain parameters of the model.

Rivers (2003) shows that in a one-dimensional setting, two independently linear constraints are needed to achieve identification. In our model we choose to constrain the standard deviation of the idiosyncratic shock to 1 (as any other probit model) and to normalize the median voter to an arbitrary value. The latter requires to normalize constants of the linear indices of our model.

The basic equation describing approval or rejection of a bill can be written as

$$P_v(x_i, x_m, z_s, q_s) = \Phi\left(y + (x_v - x_m)(\Phi(y)(x_i - x_m) - (z_s - x_m))\right)$$

which depends on three linear indices $x_v - x_m$, $x_i - x_m$, and $z_s - x_m$. Since x_m is constant for a legislative period (or for a period with an invariant composition of legislators), it is just a constant in these indices that can be set to an arbitrary value. This is true without loss of generality since there is no natural metric for the space of ideological preferences. Then, after estimating x_v as a linear combination of relevant legislator's characteristics (with no constant term), the value of the index can be adjusted by adding a constant A so that the index median coincides with our arbitrary value x_m. Hence if the median of our estimated preferences is $\tilde{m}$, then we need the following relation $\text{med}(\xi l_v + A) = \tilde{m} + A = x_m$. The latter clearly implies that $A = x_m - \tilde{m}$.

The situation becomes subtler when there are two or more legislative terms, each one with a potentially different median voter, as it happens in our sample. We handle this case by computing the median voter value for the second period after normalizing the median voter ideology of the first term to x_m^1. Hence, the constant A is computed using the following logic

$$\text{med}(\xi l_v^1 + A) = \tilde{m}^1 + A = x_m^1 \quad \Rightarrow \quad A = x_m^1 - \tilde{m}^1$$

where $\tilde{m}^1$ is the median value of the index for the first legislative period. We need to add the same constant to the index of the second legislative term since preferences are period-invariant. Thus, we have that $\text{med}(\xi l_v^2 + A) = \tilde{m}^2 + A = x_m^2$. Therefore, $A = x_m^2 - \tilde{m}^2$. The addition of the same constant to the indices in both periods implies that $x_m^2 = x_m^1 - \tilde{m}^1 + \tilde{m}^2$. To be consistent, the median voter of the second term is constrained to be x_m^2. Note that we implicitly constraint the median value for other terms by imposing an arbitrary value for the median of the first term.

Once the constant terms of the indices are normalized as explained above, the rest of the identification analysis consists in showing that the parameters of the model can be

uniquely determined given data characteristics and an infinite sample size. Rothenberg (1971) shows that a model is point-identified if the information matrix of the joint density of the observations is of complete rank. Since our model is essentially a probit model with a non-linear index, the information matrix in this case is

$$\mathcal{I}[\beta] \equiv \mathbb{E}\left[\frac{\partial^2 \mathcal{L}}{\partial\beta\partial\beta'}\right] = \sum_i \sum_t \sum_v \mathbb{E}\left[\frac{\phi(\theta_{itv})^2}{\Phi(\theta_{itv})\Phi(-\theta_{itv})}\frac{\partial\theta_{itv}}{\partial\beta}\frac{\partial\theta_{itv}}{\partial\beta'}\right]$$

If the quadratic form $\frac{\partial\theta_{itv}}{\partial\beta}\frac{\partial\theta_{itv}}{\partial\beta'}$ is a positive-definite matrix, Rothenberg's condition is met. The latter is guaranteed if the index gradient vector contains linearly independent items. Hence Rothenberg's result is useful because it shows that lack of identification will generate a singular information/Hessian matrix and no maximum likelihood estimator exists. If we can obtain a non-singular Hessian, the model must be point-identified.

An additional problem arises when the number of voters V is relatively large with respect to T, the number of elections. We face what is called the "incidental parameter" problem. Intuitively speaking, it is hard to accurately estimate a large number of individual ideological fixed effects while we have a reduced number of observations per legislator. The problem is even exacerbated when *statu quo* estimates (equivalent to time fixed effects) are also requested, as the traditional approach demands Clinton, Jackman, and Rivers (2004)). We believe this viewpoint is simply unrealistic: the incidental parameter problem essentially tells us that there is a trade-off between the amount of information we can learn from the data and its precision. In our view, the current approach advocates a nearly useless agnostic solution. With a tighter parametrization in the spirit of Londregan (2000a), and introducing sample selection considerations proposing behavior, our approach delivers more than do the agnostic traditional setup. In order to see the consequences of a largely parameterized model, we estimate a model with legislator fixed effects and compare the results to more succinctly parameterized models.

4 Data

4.1 Senator's information

We build a database of the Chilean Senate voting with data from March 2009 until March 2011. In December 2009, half of the Senators were elected or reelected in an election that

took place at the same time of the Presidential[3] Thus, there are two periods with different Senate composition: March 2009 - March 2010 (until the 11th) and March 2010 (since the 12th) until March 2011. We usually refer to the first term as Bachelet's term , and the second one as Piñera's term. We collect data of 870 legislative elections (476/394) elections during the period.

It is important to consider two terms in our analysis since the composition of the Senate substantially changed in March 2010. The Senate is composed by 38 members in each term. We have 49 listed in our data because eleven Senators in office during Bachelet's term were not reelected, or did not run for the reelection (Arancibia, Romero, Flores, Muñoz R., Zaldívar Ad., Gazmuri, Naranjo, Núñez, Ominami, Ávila and Vásquez). During the second legislative term, new Senators arrive: Chahuán, Pérez L., Rincón, Walker I., Walker P., Zaldívar An., Allende, Rossi, Lagos, Quintana and Tuma. In January 16th 2011, four right-wing Senators quitted to be appointed as Secretaries (Ministers) by President Piñera (Allamand, Chadwick, Longueira, and Matthei). This changed the Senate composition again, even though there Senators were replaced by legislators from the same parties. The new appointed Senators (Larraín, C., García-Huidobro, Von Baer, and Uriarte) are not included in our estimations.

Tables 1 and 2 show the voting records of all the Senators during the two periods, grouped by political parties. Albeit Democratic Independent Union (UDI) and National Renovation (RN) form the coalition of the President during the second period, it is not clear that their voting records tend to reject bills during Bachelet's term and to approve them during Piñera's term. By the same token, political parties forming the main opposition Concertación por la Democracia (Christian Democrat Party (PDC), Socialist Party (PS), Party for Democracy (PPD) and Social Democrat Radical Party (PRSD)) do not exhibit a clearly different opposite voting behavior. These facts suggests that there is some kind of previous negotiation about the content of the bills, or that the valence dimension of the proposals tend to minimize ideological disagreement.

In theory, our dependent variable for individual voting is approving (yea) or rejection (nay). However, in practice, there is a larger set of outcomes. For instance, a Senator may have chosen not to vote (abstinence), or he/she may have been absent. Yet other possibility

[3]Senators' term is eight years, but half of them are elected at a time. In November 2013, there will be a new Senatorial election for those who stay in office since 2005. At the same time, there will be a Presidential election for the period 2014-18.

may have been a "pareo" (matching) agreement, that is, a pact by which political adversaries avoid voting once the other is absent for some anticipated justified reason. Finally, some of them could not vote since they were not Senators by the time some proposals were voted. All these features are shown in Tables 1 and 2. Since approval conditional in voting is very high, it makes more sense to consider abstention and absenteeism as another kind of "nay".

Tables 3 and 4 exhibit the main characteristics of Senators. There are only five female Senators in the whole sample (Matthei, L. Perez, Alvear, Rincón and Allende). The Senators average age when initially took office is 58.5. Almost all of them have a college degree education or higher, and 17 of them hold some graduate diploma such as a Master or PhD. Given the binomial election system prevailing in Chile, senators may have gotten the first, second or even the third majority in their circumscription.

4.2 Chilean Senate Legislative Procedure

Legislative bills can be proposed by the President or by a group of congressmen. The law establishes that bills on certain subjects must exclusively been proposed by the President, including budgetary issues. It is well-known that the 1980 Constitution in Chile establishes a strong presidential system, in which the President has remarkable influence over the legislative process.

A bill must be initially presented to the Senate or to the chamber of Representatives. The initial chamber is named the original one. The other chamber becomes the bill reviewer. Bills on certain subjects (budget, public administration, etc.) must necessarily be presented to a particular chamber.

The first round at the original chamber starts when the bill is globally analyzed by the appropriate subject committee, which reports to the chamber. The conclusions contain a discussion of the bill and whether it is suitable or not as an admissible legislative idea and potential suggested modifications made by the President or congressmen. Once the debate finishes, the legislators vote the bill if the constitutional quorum requirement is met. If the bill is approved with modifications, it is sent again to the subject committee for a new, more detailed analysis. Once this is done, a second report is presented to the chamber. At this point, three possible outcomes may occur. (a) The chamber totally approves the bill, and passes it on to the reviewer chamber; (b) The chamber globally approves, but makes

modifications to be incorporated to the reviewer chamber's consideration; or (c) the bill is totally rejected.

The second legislative round starts once the bill is presented to the reviewer chamber. Subject committees do an analysis process that is similar to the first round. The reviewer chamber can approve, modify or reject the bill. In the first case, the bill is sent to the President for his or her approval. If there are modifications, the bill is sent to the original chamber for its consideration in a third legislative round. A joint committee of members of both chambers (*comisión mixta*) is appointed in case the reviewer chamber rejects the bill in the second round, or if the original chamber rejects the modified bill in the third round.

In our analysis, we explicitly consider the procedural information to identify the bill's proposer at each stage. We also consider that first, second or third legislative round as well as quorum requirements are determinants of the bill importance index, y. Hence, our model allows for a proposer who changes the probability of winning according to the bill's characteristics.

4.3 Results

We report specifications (1) to (5) in Tables 5 and 6. Our preferred specification is (4) which includes several Senators' characteristics to explain the ideological preferences.

Ideological preferences: In order to estimate equation (4), we propose variables that can account for the ideological stance of the senators, denoted by x_v. A natural candidate is the political party affiliation. We consider the parties with the highest number of Senators (UDI, RN, PDC, PS, PRSD, PPD, and MAS) and omit dummy variables for non-affiliated ones (independent). A broad view of the results shows that UDI and RN obtain values higher than the median voter ideology in Bachelet's term (normalized at 1). Hence, the larger the number, the more right-wing oriented. Since specification (5) in Table 5 includes senator fixed effects, we only report these estimates graphically in Figure 4. The ideological scale is reversed, but we have turned upside down to ease the interpretation. The overall estimation of this Senator ideology index of our preferred specification (4) is depicted in Figure 1. In our online Appendix, the reader can find similar figures for the rest of specifications. The results show a clear alignment in the left-right cleavage. In Chile, these poles represent similar ideological positions as in the US and most Western democracies.

Leftists advocate the liberalization of civic rights and an involved role of the State in the economy through redistributive policies. Rightists support a conservative view of civic rights and a limited influence of the State in the economy.

The legislative preferences in Figure 1 show a left-right order during Bachelet's term which is roughly consistent with *a priori* beliefs. Only Espina (RN) and Romero (RN) are a priori right-wing Senators whose ideological point shows up below the median voter ideology; Pizarro (PDC) and Sabag (PDC) are center-left Senators appearing with rightist ideology. There are a large concentration of points around the median voter normalized at 1, the closest being Gomez (PRSD) and Matthei (UDI). In Piñera's term, most of leftists moved to more central positions, and the median voter's ideology slightly shifts to the right. Some new senators in this period seem to have rightist preferences while they are affiliated to leftists parties (Tuma and Rossi, for instance). Senator Chahuán (RN) seems notably escaped to the right. Some Senators from rightist parties appear, in fact, to the left of the median voter (Matthei, Espina). Again, there are many legislators near the median voter. The two closest to this point are Allende (PS) and Walker P. (PDC).

For specification (2)-(4) we also considered Senators' age, age-squared and gender. We also interacted these variables with the *Alianza* dummy (Center-right coalition composed by UDI and RN) in order to capture gender and age-specific patterns of ideological stance. The results show that Alianza's male Senators are more right-wing oriented than their female counterparts. It also appears a milder extremist effect of center-left male Senators, even though it is not robust in all specifications. The effects of age suggest that the younger the Senator, the more extreme his/her ideological preferred point is (i.e. rightist leaning towards right and leftists doing the opposite). Since the quadratic age term has the opposite sign to the linear age term, the aging moderation process decays for older Senators.

In the case of specifications (3) and (4) we introduce North and South circumscription dummies. Earlier evidence suggests that North[4] citizens prefer left-wing candidates, whereas South[5] are right-wing oriented (Villena-Roldán 2003). Our evidence suggests that North Senators are marginally inclined toward the right, which may be explained through a model of strategic positioning of candidates. The opposite happens to the South Senators. Prior representative experience has a slight left-wing effect; while international experience

[4]Tarapacá, Antofagasta, Copiapó and Coquimbo

[5]Araucanía Norte, Araucanía Sur, Los Ríos, Los Lagos, Aysén and Magallanes

(former ambassador, etc.) usually exacerbates ideological stance at both sides of the political spectrum. In the case of Chile this may be partially explained by formerly exiled left-wing politicians during Pinochet's dictatorship (1973-1990). Finally, specification (4) introduces the share of voting in the previous election, which is included squared and interacted with the Alianza dummy. A larger share of voting moves the ideological stance of *Alianza* Senators to the right, but at a decreasing rate. In the case of Center-left Senators, the exacerbating effect seems to be much milder. Last election voting share captures popularity or reputation that may increase the independency of the senators from partisan directions.

Proposer ideology: Given the institutional features of the legislative procedure, there are four main origins for a bill: Executive power, Senate, Representative's chamber and joint committees (*Comisión Mixta*). Inasmuch as joint committees are formed by Senators and Representatives, we restrict the former to have preferences equal to a simple average between Senate and Representative's chamber ideological points. Our data restrictions do not allow us to identify individual proposers of bills in the Senate or in the Representatives' chamber. However, proposing a particular bill may not be interpreted as a nominally individual act, even if there were data about this. In most specifications, Bachelet's executive power proposes bills close to the median voter. Indeed, we cannot reject ideology being equal to the median voter using the bootstrapped confidence intervals for specification (4). Perhaps surprisingly, Piñera's executive power ideology indicates a slightly more leftist position than Bachelet's executive, even tough confidence intervals cover the median voter position. Our preferred specification (4) shows that both executive powers are very close to the median voter. This finding is in line with the view of some conservative politician's opinions claiming that Piñera's government has not consistently advocated truly rightist proposals.[6] Moreover, the Senate and the Representative Chamber exhibit more rightist proposals during Bachelet's terms, even though this difference narrows for the Senate in our preferred specification. A larger change of Representative's proposer point may be accounted by the complete election process in December 2009. While the whole representative chamber changes, only half of the Senators seats are under electoral dispute. Figure

[6]For instance, see Senator Novoa's interview in La Tercera, March 12th 2012. He said "If you look at the [Piñera's] government accomplishments, you have to make a very favorable balance after two years. But there is a complicated issue: the government has not made them with a political positioning which is proper of our side" (translation is ours). A recent book by Novoa "Con la Fuerza de la Libertad" (*With the force of the freedom*) also stresses these critiques.

2 shows the evolution over bills of the median voter, the proposer's ideology index, the *statu quo* index, and the bill proposer index for our preferred specification. The proposer's index clearly shifts to the left on average. The *statu quo* index also shifts to the left. In this way, the bill ideology index –according to the model a varying weighted average of median voter and proposer's ideology– marginally shifts to the left.

Importance Index: The variables in this index y measure the relative importance given by the proposer to the bill. It can also be interpreted as a relative high value-to-cost ratio for generating valence. In line to our expectations, absolute quorum or no-simple quorum requirements increase the index. This, in turn, implies that these bills have larger approval probability because the proposer cares more about them and is willing to provide larger valence. The estimates also suggest that first-round voting is more important that second- or third-round (which appear with negative sign). Finally, particular bills marginally increase the importance index; voting articles, appointments or agreements tend to generate negative effects, especially in the last case. The evolution of importance over time is depicted in Figure 3. This does not show a systematic difference between both legislative periods.

Statu quo: To estimate equation (4), we determine a set of time varying variables that represent a sensible measure of the ideological perception of the *statu quo*. One natural choice is the President approval percentage that is widely communicated through the media. Several poll companies generate different indices. We picked the one generated by ADIMARK[7]. We introduce this presidential popularity variable alone and interacting with a dummy for Piñera's term so that we capture the potentially ideological opposite effect on the *statu quo* once a Center-right President is in office. Given the high presidential power in the Legislative process in Chile, we try to explain the *statu quo* index by the result of the previous legislative voting. We interacted this variable with a dummy for Piñera's term to allow for a reverse effect in this case. We also coded an "current theme" dummy which subjectively label bill projects in this way.[8] Our approach substantially differs from the traditional Political Science ones, surveyed by Clinton, Jackman, and Rivers (2004). Those estimates attempt to measure the *statu quo* as a pure policy location parameter (e.g. an election fixed effect) with considerable less precision.

In all the specifications, the results show that a higher voting in the Senate for the last

[7]See in `www.adimark.cl`

[8]Exact definition of this variable is available on request.

bill moves the *statu quo* to the left during the first period examined, i.e. in favor of the ideology of President Bachelet. The effect of the previous bill share of voting is less clear for the second term. At best, a larger support to a bill moves the *statu quo* to the left less than it does during Bachelet's term. On the other hand, the popular approval of the President tends to move the *statu quo* to the right, except for the case of specification (5). Current topics shift the *statu quo* to the left.[9] Considering the results obtained regarding the ideological stance of proposers during Piñera's term, the result of moving the *statu quo* to the left when a bill is approved may not be contradictory at all. Our results suggest that proposers during Piñera's term are relatively inclined to leftist positions with respect to the ideology of many Center-right Senators. Some politicians of Bachelet's government have recognized they should have implemented certain public policies done in Piñera's term.[10]

Differential Valence: Figure 3 depicts the differential valence $q_p - q_s$ computed according to equation (2). Our estimates show that the differential valence is negative in many cases for both periods, especially Piñera's term. It is remarkable that just after Piñera's took office the differential valence went down for a large magnitude. This may suggest a certain drop in quality or in ideological consensus during that period. The latter may be plausible since Piñera's government face particularly difficult circumstances just after took office. Since it was the first Center-right government after 20 years of *Concertación* was in office, Piñera faced some problems to appoint new authorities to run the government. In addition, Piñera had to manage an extraordinary social demand after the 8.8 Richter earthquake in Central Chile on February 27th, 2010. These circumstances may have diverted government and Congress efforts from the generation of bill quality or consensus due to the emergency, or it may have caused a particularly high cost for generating valence.

5 Conclusions

We have presented a formal procedure for estimating spatial models of voting by considering the strategic nature of the ideological setting of the proposals and their associated valence.

[9] Exact definition of this variable is available on request.

[10] For instance in an interview in Radio Cooperativa on March 30th, 2010, Francisco Vidal, a former Secretary under Lagos and Bachelet governments asserted that the *Concertación* governments were not brave enough to raise profit tax rates once Piñera proposed this to finance reconstruction works after the earthquake in Central Chile.

This approach departs in several ways from the previous literature. We formally introduce a simple theory of strategic agenda setting, considering the configuration of political forces, institutional arrangements, and the *statu quo*. The result is a simple model that provides a characterization of several issues involved in the legislative process, but it is still amenable for estimation.

On technical grounds, we apply the theory of quantile maximization preferences to obtain an insightful and estimable non linear probit model. Our results are fairly intuitive. The optimal proposer's strategy is to generate a bill's ideology which is a weighted average between her own preferred point and the median voter's one. We allow for bill heterogeneity. The more important a bill is, the greater the weight on proposer's ideology, and the larger the valence generated. In our view, this theoretical construction proposes a structural sample selection mechanism of bills that has not been previously addressed by the literature, to the best of our knowledge. This sample selection mechanism is pervasive in many problems in social sciences, especially in Economics since the seminal work of Heckman (1976). Using the structure of the model, we can learn the evolution of the ideology of proponents, bill proposals, statu quo, as well as the importance of bills and the differential valence.

In our empirical application, we use roll-call data from the Chilean Senate from March 2009 to March 2011, covering two legislative terms: the last year of M. Bachelet and the first year of S. Piñera, both with different proposers and a different Senate composition. We follow the more realistic strategy of Londregan (2000a) consisting of parameterizing the Senator ideology, the proposers ideology, the statu quo, and the importance of bills, as linear indices of observable variables. The structure of the model itself corrects the sample selection problem in contrast to more general, but somewhat impractical empirical models advocated in this literature (Poole and Rosenthal 1985; Heckman and Snyder Jr 1997; Clinton, Jackman, and Rivers 2004) that try to identify fixed ideological points of legislators and bills at the same time. Our setup, in contrast, stresses the strategic behavior of proponents and incorporates it into a simple structurally estimated model.

Our results for Chile show that political party affiliations are an important determinant of Senator's ideology. There is evidence of more extremisms in ideological positions for male, young and highly voted Senators, especially for the Center-right. Despite the fact that estimating our model with Senator fixed ideological points is feasible as long as one keeps some parameterization in the *statu quo* index, the tightly parameterized approach

(4) is useful because we can learn more on the ideology preference formation. The joint results for the median voter, the *statu quo*, and the proposer's ideology suggest that the ideological scenario between Bachelet's and Piñera's periods did not change by much. The evidence could be interpreted as the way suggested by certain rightists Senators: Piñera's government has been quite close to the ideological stance of Center-left parties.

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6 Appendix

Table 1: Voting record of Chilean Senate: March 2009-March 2011 (Part 1)

		Bachelet's term						Piñera's term					
Senador	Party	Yea	Nay	Abst	Out	Match	% Yea	Yea	Nay	Abst	Out	Match	% Yea
Arancibia	UDI	265	56	5	150	0	55.7						
Chadwick	UDI	254	45	9	167	1	53.4	162	19	0	210	0	41.4
Coloma	UDI	270	54	8	142	2	56.7	245	31	1	114	0	62.7
Larrain H	UDI	294	42	13	127	0	61.8	254	19	0	113	5	65.0
Longueira	UDI	280	44	3	149	0	58.8	243	36	2	109	1	62.1
Matthei	UDI	294	59	11	110	2	61.8	157	20	2	185	8	42.2
Novoa	UDI	311	38	14	101	12	65.3	229	38	3	121	0	58.6
Orpis	UDI	345	51	6	73	1	72.5	276	37	4	74	0	70.6
Perez V	UDI	260	50	8	157	1	54.6	179	32	0	172	8	45.8
Allamand	RN	204	40	5	227	0	42.9	170	30	0	170	2	45.7
Chahuan	RN							281	33	1	70	6	71.9
Espina	RN	183	21	4	266	2	38.4	167	20	3	201	0	42.7
Garcia	RN	296	36	18	126	0	62.2	243	21	3	123	1	62.1
Horvath	RN	284	30	2	160	0	59.7	285	26	2	72	6	72.9
Kuschel	RN	293	63	23	96	1	61.6	258	35	8	89	1	66.0
Perez L	RN							211	18	1	157	4	54.0
Prokurica	RN	362	51	9	53	1	76.1	299	35	1	53	3	76.5
Romero	RN	233	40	17	186	0	48.9						
Bianchi	IND	361	20	15	80	0	75.8	193	19	6	172	1	49.4
Cantero	IND	262	31	10	172	1	55.0	183	17	3	185	3	46.8
Flores	IND	166	13	5	292	0	34.9						
Muñoz R	IND	132	25	15	304	0	27.7						

Note (a): In January 16th, 2011 several Center-right senators quitted to be appointed as new Secretaries. Former Senator Matthei undertook the Secretary of Labor Affaires. Former Senator Allamand undertook the Secretary of Defense. Mr Uriarte and Mr C. Larrain replaced them in the Senate.

Table 2: Voting record of Chilean Senate: March 2009-March 2011 (Part 2)

		Bachelet's term						Piñera's term					
Senador	Party	Yea	Nay	Abst	Out	Match	% Yea	Yea	Nay	Abst	Out	Match	% Yea
Alvear	DC	269	30	4	173	0	56.5	261	24	12	94	0	66.8
Frei	DC	174	13	7	282	0	36.6	170	17	5	199	0	43.5
Pizarro	DC	215	20	12	228	1	45.2	251	20	10	89	21	64.2
Rincon	DC							264	34	16	77	0	67.5
Ruiz-Esquide	DC	186	28	9	252	1	39.1	169	29	10	180	3	43.2
Sabag	DC	389	34	8	45	0	81.7	242	14	4	122	9	61.9
Walker I	DC							178	14	6	176	17	45.5
Walker P	DC							260	24	11	92	4	66.5
Zaldivar An	DC							223	13	7	114	34	57.0
Zaldivar Ad	PRI	169	30	6	271	0	35.5						
Allende	PS							188	33	7	163	0	48.1
Escalona	PS	314	29	5	128	0	66.0	259	26	12	94	0	66.2
Gazmuri	PS	281	35	8	152	0	59.0						
Letelier	PS	235	24	16	201	0	49.4	193	27	17	153	1	49.4
Muñoz P	PS	325	23	8	120	0	68.3	212	31	8	140	0	54.2
Naranjo	PS	243	24	4	205	0	51.1						
Nuñez	PS	281	29	20	146	0	59.0						
Ominami	PS	163	35	24	254	0	34.2						
Rossi	PS							132	17	6	235	1	33.8
Avila	PPD	182	23	24	247	0	38.2						
Girardi	PPD	201	34	26	215	0	42.2	152	14	12	213	0	38.9
Lagos	PPD							216	17	12	129	17	55.2
Quintana	PPD							244	32	22	93	0	62.4
Tuma	PPD							217	22	12	111	29	55.5
Gomez	PRSD	241	35	14	186	0	50.6	233	30	10	108	10	59.6
Vasquez	PRSD	262	16	5	190	3	55.0						
Navarro	MAS	157	40	28	250	1	33.0	198	51	11	130	1	50.6

Notes: UDI = Unión Demócrata Independiente (Democratic Union Party) ; RN = Renovación Nacional (National Renovation) ; PDC = Partido Demócrata Cristiano (Democratic Christian Party); PS = Partido Socialista (Socialist Party); PPD= Partido por la Democracia (Party for the Democracy); PRSD = Partido Radical Social Demócrata (Social Democratic - Radical Party) ; MAS = Movimiento Amplio Social (Wide Social Movement); IND = Independientes (No party affiliation).

Table 3: Senators individual characteristics (Part 1)

Senator	Party	Circuns	Sex	Age	Educ	Year elec	Vot	Position	Exper	Bachelet	Piñera
Arancibia	UDI	Valparaiso Costa	M	71	Grad	2001	38.4	2	N	Y	N
Chadwick(a)	UDI	O'Higgins	M	54	Coll	2005	25.4	2	N	Y	Y
Coloma	UDI	Maule Norte	M	54	Coll	2009	35.2	1	N	Y	Y
Larrain H	UDI	Maule Sur	M	63	Grad	2009	43.1	1	Y	Y	Y
Longueira	UDI	RM Oriente	M	52	Coll	2005	24.0	2	N	Y	Y
Matthei	UDI	Coquimbo	F	57	Grad	2005	28.5	2	N	Y	Y
Novoa	UDI	RM Poniente	M	65	Coll	2005	20.8	3	Y	Y	Y
Orpis	UDI	Arica - Tarapac	M	54	Grad	2009	33.5	1	N	Y	Y
Pérez V	UDI	Biobio Interior	M	56	Coll	2005	23.4	2	N	Y	Y
Allamand(a)	RN	de los Rios	M	53	Coll	2005	37.9	1	N	Y	Y
Chahuán	RN	Valparaiso Costa	M	39	Post	2009	28.3	2	N	N	Y
Espina	RN	Araucania Norte	M	54	Coll	2009	38.5	1	N	Y	Y
Garcia	RN	Araucania Sur	M	55	Post	2009	22.5	2	N	Y	Y
Horvath	RN	Aysen	M	60	Grad	2009	34.6	1	N	Y	Y
Kuschel	RN	de los Lagos	M	57	Grad	2005	20.7	3	N	Y	Y
Pérez L	RN	Valparaiso Interior	F	47	Post	2009	23.0	1	N	N	Y
Prokurica	RN	Atacama	M	52	Coll	2009	33.0	1	N	Y	Y
Romero	RN	Valparaiso Interior	M	72	Coll	2001	39.7	1	Y	Y	N
Bianchi	IND	Magallanes	M	50	Coll inc	2005	27.7	2	N	Y	Y
Cantero	IND	Antofagasta	M	54	Grad	2005	19.4	2	N	Y	Y
Flores	IND	Arica - Tarapac	M	67	Grad	2001	30.5	1	N	Y	N
Muñoz R	IND	Araucania Norte	M	74	Coll	2001	27.1	2	N	Y	N

Notes: UDI = Unión Demócrata Independiente (Democratic Union Party) ; RN = Renovación Nacional (National Renovation) ; IND = Independientes (No party affiliation). In January 16th, 2011 four Center-right senators (Allamand, Chadwick, Longueira, and Matthei) quitted to be appointed as new Secretaries.

Table 4: Senators individual characteristics (Part 2)

Senator	Party	Circuns	Sex	Age	Educ	Year elec	Vot	Position	Exper	Bachelet	Piñera
Alvear	PDC	RM Oriente	F	60	2deg	2005	43.8	1	N	Y	Y
Frei	PDC	de los Rios	M	68	Post	2005	35.9	2	Y	Y	Y
Pizarro	PDC	Coquimbo	M	58	Coll	2005	40.4	1	Y	Y	Y
Rincón	PDC	Maule Sur	F	42	Coll	2009	31.0	2	N	N	Y
Ruiz-Esquide	PDC	Biobio Interior	M	80	Grad	2005	39.3	1	N	Y	Y
Sabag	PDC	Biobio Costa	M	73	Coll inc	2005	25.6	2	N	Y	Y
Walker I	PDC	Valparaiso Interior	M	54	Grad	2009	21.1	2	N	N	Y
Walker P	PDC	Aysen	M	41	Coll	2009	27.6	2	N	N	Y
Zaldívar An	PDC	Maule Norte	M	74	Coll	2009	31.4	2	Y	N	Y
Zaldívar Ad	PRI	Aysen	M	67	Coll	2001	30.2	2	Y	Y	N
Allende	PS	Atacama	F	65	Post	2009	26.8	2	N	N	Y
Escalona	PS	de los Lagos	M	55	2deg	2005	28.7	1	N	Y	Y
Gazmuri	PS	Maule Norte	M	66	Coll	2001	30.5	2	Y	Y	N
Letelier	PS	O'Higgins	M	49	Grad	2005	41.5	1	N	Y	Y
Muñoz P	PS	Magallanes	M	66	Coll	2005	33.3	1	N	Y	Y
Naranjo	PS	Maule Sur	M	59	Grad	2001	28.1	1	N	Y	N
Núñez	PS	Atacama	M	71	Grad	2001	43.0	1	Y	Y	N
Ominami	PS	Valparaiso Interior	M	60	Grad	2001	28.7	2	Y	Y	N
Rossi	PS	Arica - Tarapac	M	40	Coll	2009	27.1	3	N	N	Y
Ávila	PPD	Valparaiso Costa	M	68	Grad	2001	38.5	1	N	Y	N
Girardi	PPD	RM Poniente	M	49	Grad	2005	35.3	1	N	Y	Y
Lagos	PPD	Valparaiso Costa	M	48	Grad	2009	33.2	1	N	N	Y
Quintana	PPD	Araucania Norte	M	43	Coll	2009	29.6	2	N	N	Y
Tuma	PPD	Araucania Sur	M	65	Coll	2009	29.1	1	N	N	Y
Gómez	PRSD	Antofagasta	M	57	Post	2005	40.2	1	N	Y	Y
Vásquez	PRSD	Araucania Sur	M	68	Coll	2005	4.2	0	N	Y	N
Navarro	MAS	Biobio Costa	M	52	Coll	2005	42.0	1	N	Y	Y

Notes: PDC = Partido Demócrata Cristiano (Democratic Christian Party); PS = Partido Socialista (Socialist Party); PPD= Partido por la Democracia (Party for the Democracy); PRSD = Partido Radical Social Demócrata (Social Democrat Radical Party) ; MAS = Movimiento Amplio Social (Wide Social Movement). In 2005, Senator Vásquez, who got the second place for the Concertación list in 2001 election, substituted Senator Lavandero when he was accused and incarcerated for child abusing.

Table 5: Estimated Models, Bootstrapped Results (Part 1)

	(1)	(2)	(3)	(4)	(5)
	x_v: Senator's ideology				
UDI	1.916	2.729	3.532	2.470	
	[1.818/2.015]	[2.184/3.310]	[2.769/4.397]	[1.652/3.383]	
RN	2.164	2.686	3.471	2.458	
	[2.063/2.268]	[2.163/3.254]	[2.736/4.303]	[1.675/3.353]	
PDC	1.793	0.175	0.265	0.389	
	[1.672/1.908]	[0.133/0.223]	[0.208/0.331]	[0.317/0.482]	
PS	1.716	0.130	0.304	0.432	
	[1.600/1.839]	[0.094/0.169]	[0.240/0.383]	[0.349/0.527]	
PPD	1.147	7.78E-4	0.189	0.339	
	[0.987/1.304]	[-0.036/0.037]	[0.139/0.249]	[0.270/0.430]	
PRSD	1.813	0.153	0.104	0.130	
	[1.609/2.016]	[0.104/0.213]	[0.059/0.160]	[0.069/0.198]	
MAS	1.082	-0.178	-0.161	0.032	
	[0.760/1.401]	[-0.239/-0.125]	[-0.233/-0.102]	[-0.050/0.121]	
Male		-0.047	0.019	-0.005	
		[-0.092/-0.009]	[-0.026/0.063]	[-0.060/0.044]	
Male x Alianza		0.177	0.193	0.297	
		[0.118/0.245]	[0.123/0.269]	[0.216/0.391]	
Age		0.044	0.040	0.045	
		[0.041/0.047]	[0.038/0.043]	[0.041/0.050]	
$Age^2/10$		-3.83E-4	-3.39E-4	-3.80E-4	
		[-4.17E-4/-3.55E-4]	[-3.69E-4/-3.15E-4]	[-4.24E-4/-3.43E-4]	
Age x Alianza		-0.087	-0.109	-0.108	
		[-0.106/-0.069]	[-0.136/-0.085]	[-0.139/-0.083]	
Age^2 /10 x Alianza		6.82E-4	8.16E-4	7.93E-4	
		[5.50E-4/8.36E-4]	[6.32E-4/0.001]	[5.90E-4/0.001]	
North			0.056	0.076	
			[0.032/0.086]	[0.048/0.110]	
South			-0.014	-0.037	
			[-0.040/0.011]	[-0.068/-0.008]	
Repr exp			-0.035	-0.094	
			[-0.065/-0.010]	[-0.130/-0.064]	
Internac exp			-0.233	-0.271	
			[-0.290/-0.185]	[-0.333/-0.221]	
Internac exp x Alianza			0.378	0.428	
			[0.303/0.468]	[0.348/0.523]	
share voting				1.27E-4	
				[-0.007/0.008]	
$(\text{share voting})^2$				-1.79E-4	
				[-3.31E-4/-4.28E-5]	
share voting x Alianza				0.068	
				[0.049/0.088]	
$(\text{share voting})^2$ x Alianza				-9.71E-4	
				[-0.001/-6.81E-4]	

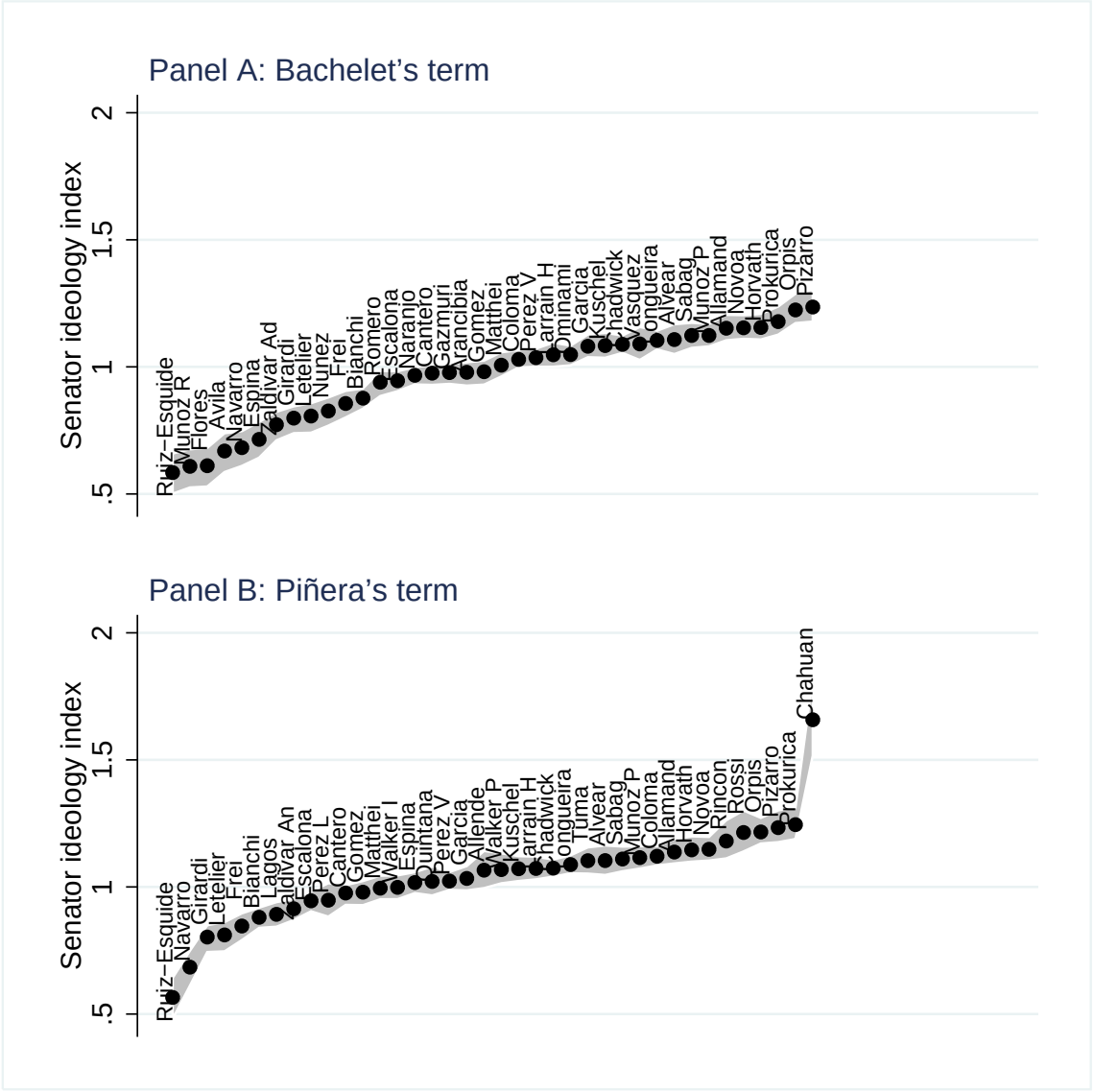
Coefficient reported is the bootstrapped average coefficient with 1000 repetitions. 95% bootstrapped confidence interval in brackets.

Table 6: Estimated Models, Bootstrapped Results (Part 2)

	(1)	(2)	(3)	(4)	(5)
	x_i: Proposer's ideology				
Executive Bachelet	0.694	1.676	1.253	0.931	-0.634
	[0.549/0.851]	[0.878/2.632]	[0.542/2.079]	[0.302/1.610]	[-0.826/-0.446]
Executive Piñera	0.522	0.610	0.913	0.956	-0.116
	[0.323/0.731]	[-0.011/1.325]	[0.297/1.617]	[0.381/1.650]	[-0.276/0.031]
Senate Bachelet	0.590	0.691	0.284	0.317	-0.466
	[0.430/0.751]	[0.009/1.439]	[-0.377/0.997]	[-0.307/0.947]	[-0.638/-0.279]
Senate Piñera	0.196	-0.368	-0.038	0.173	0.105
	[0.100/0.288]	[-0.773/-0.016]	[-0.413/0.305]	[-0.173/0.512]	[0.021/0.192]
Repres Bachelet	0.734	2.850	2.113	1.659	-0.870
	[0.583/0.887]	[1.864/4.049]	[1.239/3.122]	[0.884/2.474]	[-1.091/-0.658]
Repres Piñera	0.309	0.569	0.612	0.647	-0.015
	[0.185/0.434]	[0.198/0.956]	[0.252/1.009]	[0.318/0.981]	[-0.106/0.076]
	y: Bill importance index				
Type: Article	-0.004	-0.026	-0.048	-0.051	-0.063
	[-0.028/0.021]	[-0.050/-0.003]	[-0.073/-0.023]	[-0.077/-0.026]	[-0.079/-0.049]
Type: Particular	0.104	0.053	0.038	0.037	0.014
	[0.072/0.138]	[0.026/0.081]	[0.009/0.067]	[0.007/0.067]	[-0.005/0.033]
Type: Agreement	-0.405	-0.424	-0.458	-0.459	-0.280
	[-0.441/-0.369]	[-0.464/-0.384]	[-0.498/-0.420]	[-0.498/-0.423]	[-0.301/-0.260]
Type: Appointment	-0.009	-0.084	-0.101	-0.097	-0.093
	[-0.073/0.056]	[-0.141/-0.024]	[-0.161/-0.040]	[-0.158/-0.031]	[-0.130/-0.055]
Second round	-0.005	-0.192	-0.173	-0.142	-0.117
	[-0.030/0.020]	[-0.232/-0.148]	[-0.218/-0.124]	[-0.198/-0.078]	[-0.145/-0.088]
Third round	-0.164	-0.307	-0.284	-0.253	-0.183
	[-0.219/-0.105]	[-0.360/-0.252]	[-0.340/-0.223]	[-0.314/-0.182]	[-0.217/-0.147]
Absolute quorum	0.118	0.126	0.125	0.140	0.166
	[-0.057/0.308]	[-0.031/0.291]	[-0.032/0.295]	[-0.024/0.312]	[0.062/0.273]
No simple quorum	0.268	0.208	0.206	0.214	0.119
	[0.247/0.289]	[0.186/0.233]	[0.184/0.230]	[0.190/0.239]	[0.106/0.134]
	z: Statu Quo ideological index				
Last voting	-0.402	-1.499	-1.326	-1.112	0.400
	[-0.481/-0.321]	[-1.882/-1.141]	[-1.725/-0.985]	[-1.417/-0.849]	[0.335/0.466]
Last voting x Piñera	0.043	0.097	-0.042	-0.242	-0.120
	[-0.064/0.143]	[-0.232/0.425]	[-0.357/0.279]	[-0.541/0.042]	[-0.194/-0.044]
Aprob Gob	1.051	0.136	0.165	0.404	1.219
	[0.940/1.167]	[-0.219/0.493]	[-0.187/0.492]	[0.080/0.705]	[1.124/1.312]
Aprob Gob x Piñera	0.133	1.558	1.061	0.672	-0.701
	[-0.016/0.281]	[0.945/2.264]	[0.513/1.680]	[0.193/1.162]	[-0.834/-0.570]
Current	-0.011	0.025	0.035	0.031	7.36E-4
	[-0.050/0.027]	[-0.078/0.127]	[-0.057/0.129]	[-0.057/0.120]	[-0.022/0.023]
Highly popular	0.095	0.281	0.274	0.259	-0.066
	[0.060/0.132]	[0.178/0.396]	[0.165/0.392]	[0.162/0.363]	[-0.089/-0.042]

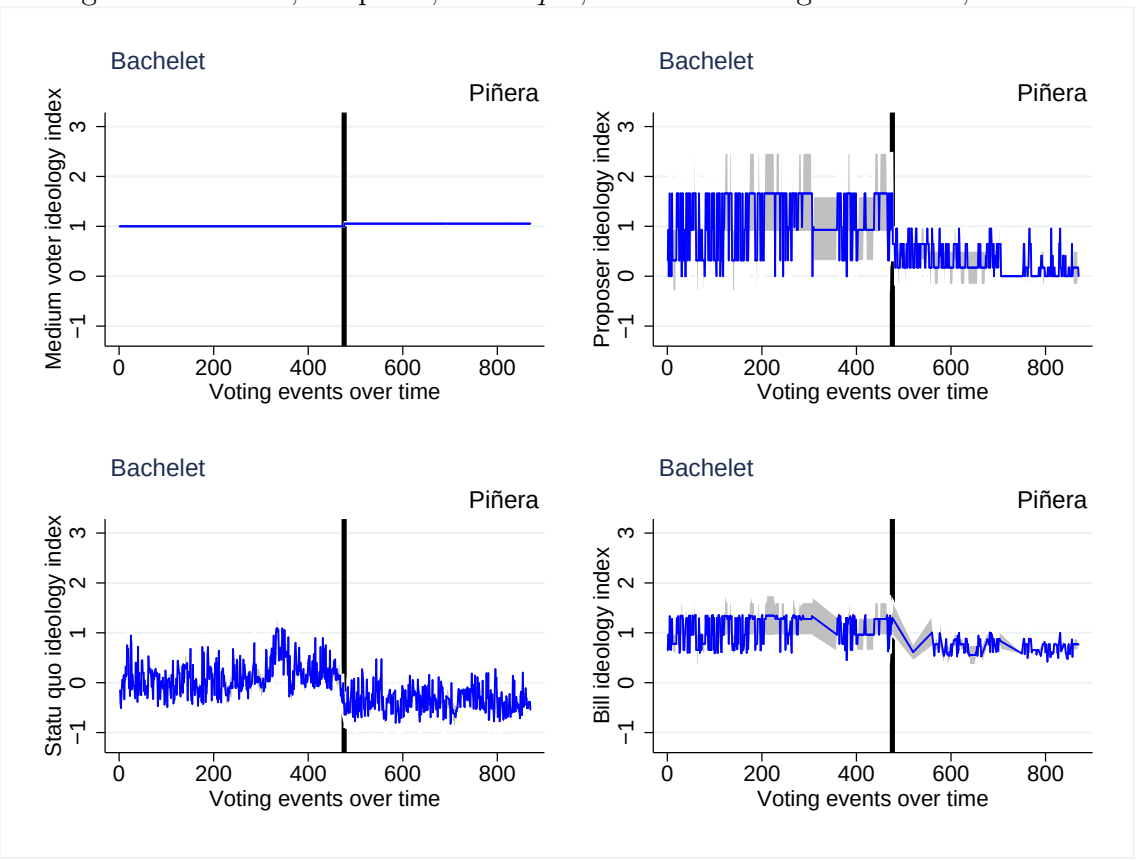
Coefficient reported is the bootstrapped average coefficient with 1000 repetitions. 95% bootstrapped confidence interval in brackets.

Figure 1: Legislator ideological indices, Model 4



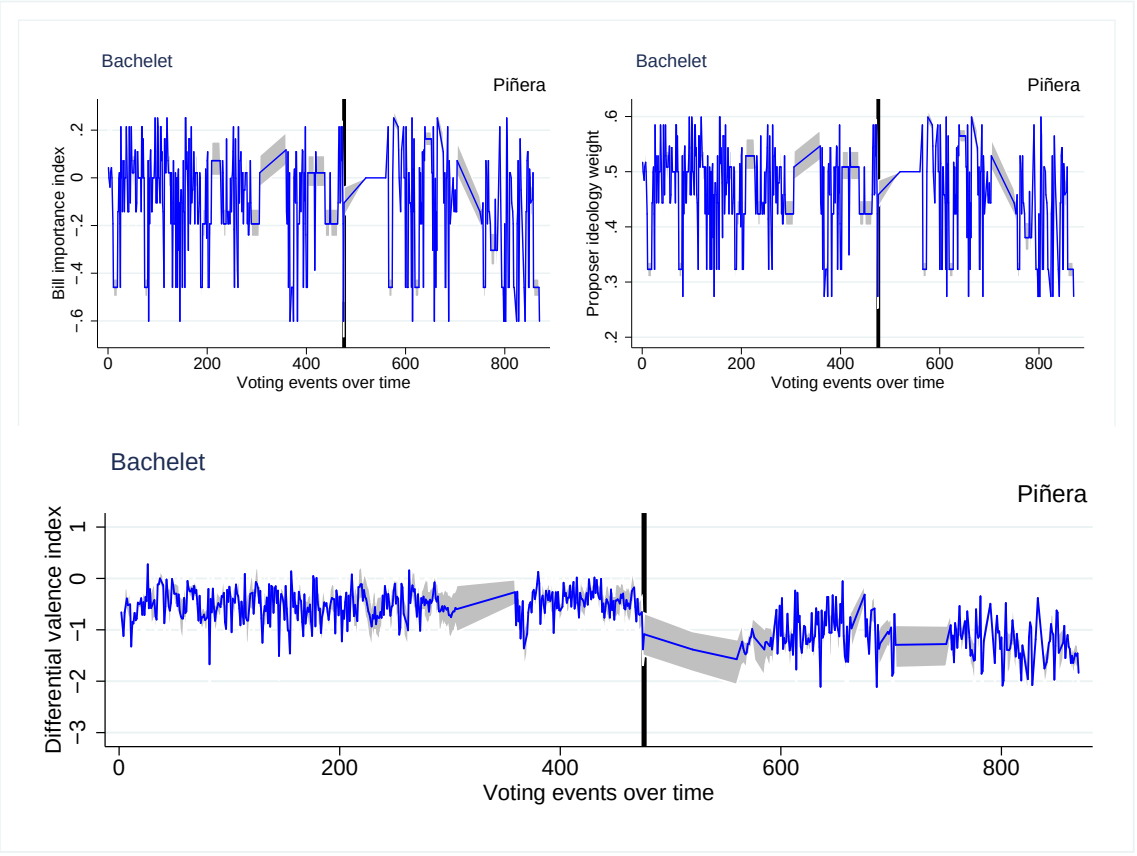
Notes: Grey area represents 95% bootstrapped confidence intervals (see details on text)

Figure 2: Median, Proposer, *Statu quo*, and Bill ideological indices, Model 4



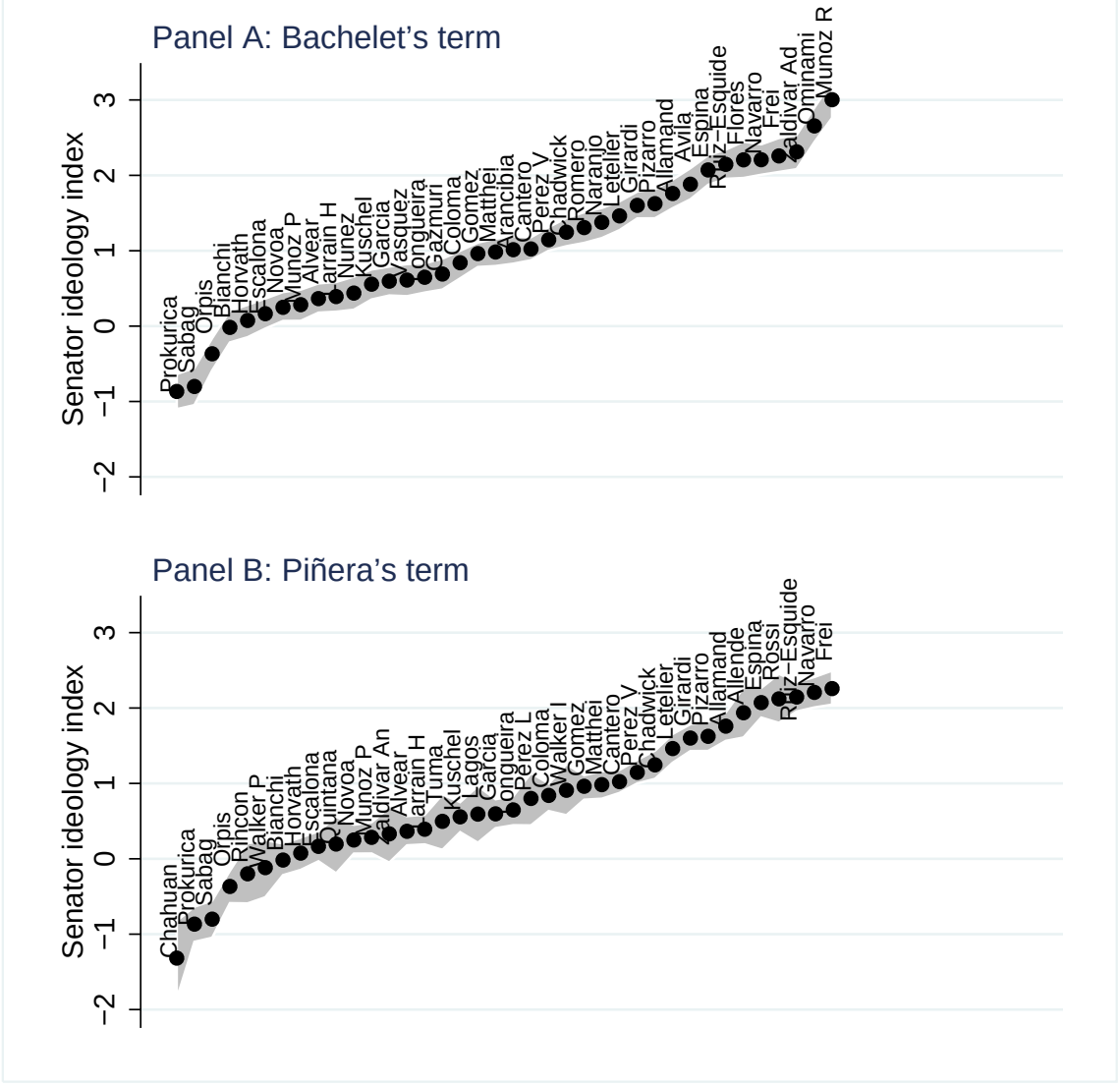
Notes: Grey area represents 95% bootstrapped confidence intervals (see details on text)

Figure 3: Importance and valence indices, Model 4



Notes: Grey area represents 95% bootstrapped confidence intervals (see details on text)

Figure 4: Legislator ideological indices, Model 5



Notes: Grey area represents 95% bootstrapped confidence intervals (see details on text)