In its final months, the Pinochet regime engineered a number of institutional reforms with the intent of bolstering the right side of the spectrum and of promoting centripetal political competition once democratic procedures were reinitiated in 1989. One of the most important reforms created 60 double-member districts for elections to the lower house. Although some analysts have claimed that the new system does in fact promote centrist position taking, using game theory and spatial modeling, the authors demonstrate that the incentives of the Chilean electoral system encourage politicians to take noncentrist positions along a left-right spectrum. The combination of double-member districts with the d'Hondt seat allocation method and open-list voting creates a Rival Partners Game, creating perverse incentives for Chilean candidates. The authors' theoretical results help clarify the debate about the effects of post-authoritarian institutional reforms in Chile and should encourage empirical research on the same issues.

ON THE ABSENCE OF CENTRIPETAL INCENTIVES IN DOUBLE-MEMBER DISTRICTS
The Case of Chile

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In the wake of Chile's 1988 plebiscite against General Pinochet's continued rule, the authoritarian regime initiated major electoral reforms that took effect with the 1989 legislative elections, the first democratic elections in Chile in 16 years. The primary effect of the reform was to redraw

AUTHORS' NOTE: *The authors wish to thank Gary Cox for his invaluable support, Peter Siavelis and Daniel Kaufman for sharing their data, and three anonymous reviewers for their helpful comments.*

COMPARATIVE POLITICAL STUDIES, Vol. 31 No. 6, December 1998 714-739

Chile's electoral map from one with 28 electoral districts, ranging in district magnitude from 1 to 18, to one with 60 districts, each with a magnitude of 2. Prevailing opinion is that the military regime enacted these reforms to ensure (or augment) representation of rightists and to encourage the emergence of bipolar, centripetal electoral competition (Garretón, 1991; Rabkin, 1996; Scully, 1995). In sum, when its exit from power became imminent, the military government strove to preserve its base of support and to reduce the probability of a recurrence of polarized pluralism in Chilean politics.

Scholars have made two specific claims about the new electoral system: (a) The new system promotes bipolar competition, instead of multipolar competition, and (b) the system promotes centrist position taking. In this article, we will address the question of whether the new electoral system in fact promotes centripetal competition, in contrast to the more permissive pre-1973 electoral system, which allegedly permitted the emergence of polarized pluralism. Although we do not dispute the claims that the electoral reforms promote bipolar electoral competition, we argue that the effect of the reforms is not, in fact, to encourage centripetal competition; rather, we argue that candidates have incentives to adopt positions away from the median voter.

The actual effect of the electoral reforms is important because conventional wisdom has it that the breakdown of democracy in 1973 resulted from extreme polarized pluralism, which was encouraged by the pre-reform electoral system (Sartori, 1976; Valenzuela, 1978); a crucial issue in Chilean party politics has historically been whether the "center can hold" (Scully, 1994). Furthermore, there is a broad consensus that centripetal, bipolar competition encourages democratic stability (Downs, 1957; Haggard & Kaufman, 1995; Mainwaring, 1993; Shugart & Carey, 1992).

An emerging literature has begun to address the effects of the 1989 reform (e.g., Guzmán, 1993; Rabkin, 1996; Siavelis, 1993; Valenzuela & Siavelis, 1991). Thus far, analysts have concluded that the new electoral system has not significantly affected the number of parties but that the reform tends to reduce the number of lists running candidates in a given district to two. That is, instead of each party running an independent list of candidates, parties now engage in feverish preelection negotiations over the distribution of the two candidacies on the two dominant lists in each district.

There is disagreement, however, about the degree to which this institutional change has fundamentally altered the post-authoritarian party system. At root of the disagreement lies empirical ambiguity: Although some have argued that "the center had become the most habitable space within the Chilean political landscape" (Scully, 1995, p. 134), others claim that the center of the party spectrum contains "the most important intra-alliance tensions" (Rabkin, 1996, p. 349). To date, the effects of the new institutions

on Chile's political system remain unclear. Consequently, although some scholars claim that the new electoral system enhances democratic stability (Rabkin, 1996), others are not so confident in this conclusion (Siavelis, 1993).

Central to the debate is the issue of the electoral reform's alleged centripetal effects, a claim that scholars have yet to rigorously analyze. Guzmán (1993) claims that the double-member district system "introduces a moderating element on political platforms" and that the Chilean electoral system encourages politicians[1] to adopt positions at the median voter's ideal point (pp. 307-308). Rabkin (1996) agrees, stating that the double-member district system "fosters centripetal competition" (p. 353). Both also conclude that because the current system encourages centrist position taking, it consequently contributes to democratic stability.

But significantly for our purposes, no analyst—including Rabkin or Guzmán—has demonstrated that the Chilean electoral system actually does promote centripetal competition. Rabkin (1996) does not specifically take up this issue, arguing instead that the links between the presidential and legislative campaigns promote centripetal competition (pp. 347-348). She points out, for example, that in 1993, the Christian Democratic Party (DC) agreed to nominate candidates for legislative positions in only 48 of the 60 districts in exchange for the support in the presidential race of parties to its left, sacrificing their legislative goals to capture the executive branch. Although it is likely that the presidential and legislative campaigns are linked in some way,[2] it does not follow that this type of preelectoral coalition agreement promotes centripetal competition; in addition, it is not necessarily likely that opposing parties who share a list will adopt similar platforms.

Guzmán (1993) directly addresses our question with an attempt to apply the logic of spatial competition to the current Chilean system, but his effort is flawed because he treats Chile's double-member district system as if it were a single-member district system. Therefore, he naturally arrives at the same conclusion as Downs (1957) for Anglo-American-style single-member district plurality elections: Parties will compete for the attention of the median voter. However, this conclusion does not follow for the Chilean case: To deduce the existence of electoral equilibria in the Chilean system, one would have to take into account the effects of competition for two seats, not one. Moreover, Chile uses open-list proportional representation (PR), which introduces an element of intralist candidate competition on top of the list competition. Guzmán does not address the effects of these variables.

1. The author uses the word *blocs*. It is not clear if he refers to parties, candidates, or lists of candidates.

2. Elections for Senate resemble those in the United States: They use double-member districts with staggered elections.

Two key characteristics of the Chilean system create peculiar incentives for candidates: (a) seats are allocated to lists within the double-member districts according to the d'Hondt divisor method[3] and (b) voting is open list. We will explain the implications of these factors in turn. The effects of the d'Hondt rule in Chile's double-member districts is that the leading list wins both seats in a district if, and only if, it carries twice as many votes as its nearest competitor. Thus, if two lists compete, each list guarantees itself one seat by winning one third plus one of the total votes, and a list wins both seats only if it wins two thirds of the total vote. The obvious effect of this situation is that in most districts, seats are split between the major rightist and leftist lists. In fact, in the 1989 and 1993 elections to the Chamber of Deputies, seats were allocated to two different lists in 49 and 48 out of 60 districts, respectively.

The significance of the major lists each winning one and only one seat in most districts is especially high given the second key characteristic of the Chilean system—voting for lists is conducted under an open rule. That is, voters use their single vote to choose not only their preferred list but also their preferred candidate from within the list. After a list wins a seat, it is allocated to the candidate within that list who obtained the most votes.[4]

Therefore, a distinction must be made between parties and lists. In most electoral districts under the post-reform rules, two parties come together to form an electoral list (or coalition). In the 1993 elections to the lower house, for example, of the 165 cases in which a list ran two candidates in a district, in only 16 cases (9.7%) were the two candidates from the same party. Moreover, in 13 of those 16 cases, the lists in question were the minor lists of *Pacto Alternativa Democrática de Izquierda* and *Pacto la Nueva Izquierda*. In other words, looking only at the two main lists (*Unión por el Progreso* and *Concertación*), of the 120 cases in which they ran two candidates, in only 3 cases (2.5%) were both candidates from the same party.

3. Under the d'Hondt divisor method, the first seat in a district goes to the list with the most votes, and vote totals are divided by increasing integers (1, 2, 3, . . .) for each additional seat for which a winning list competes. That is, after a list wins a seat, its vote total is divided by 2 before it competes for a second seat, by 3 before competing for a third seat, and so forth (see Editorial Américo Vespucio, 1989).

4. Consider two examples to clarify these rules. Suppose first that two lists, L and R, receive 60 and 40 votes, respectively. L wins the first seat because $60 > 40$. In competition for the second seat, *L's vote total is divided by 2, and R* wins the second seat because $40 > 30$. For a second example, suppose that lists A and B receive 70 and 30 votes, respectively. A wins the first seat because $70 > 30$, and A also wins the second seat because $35 > 30$. Returning to the first example, when each list wins one seat, it raises the question of which candidate from each list occupies the seat. Suppose that L_1 and L_2 (the candidates from list L) received 35 and 25 votes and R_1 and R_2 received 17 and 23 votes. In this case, L_1 and R_2 obtain seats even though L_2 garnered more votes than did R_2.

Likewise, in the 1989 campaign, in only 13 of the 144 instances (9%) in which lists ran two candidates were both candidates from the same party (see Appendix B).

Taken together, then, the use of the d'Hondt seat allocation method in double-member districts and open-list voting creates an interesting dilemma for candidates, which we call the Rival Partners Game. Although each candidate ideally would prefer that his or her own list win both seats in a district, he or she reasonably expects that the list will only win one. Therefore, a candidate has a strong incentive to compete with his or her listmate—who is usually from a different party with a different constituency—to win the list's single seat. Especially given that it is relatively easy for lists to win at least one seat, it is unreasonable to assume that candidates sacrifice their own probability of winning for the sake of their listmates. However, if candidates take this intrateam competition too far, they may end up losing both seats. In sum, Chile's open-list system suggests that lists may not behave as unitary actors; our model takes this fact into account.

The result of this tension between interlist and intralist competition is that candidates are likely to position themselves away from the median voter. We use game theory and the logic of spatial competition to show that, contrary to Guzmán's and Rabkin's claims, the current Chilean electoral system exhibits clear centrifugal tendencies, up to a point. In fact, we will show that not only does the center not hold but that in formal game-theoretic terms, given relatively innocuous assumptions, the electoral system provides incentives for candidates to take positions away from that held by the median voter. Thus, the logic of spatial competition suggests that the Chilean electoral system does not solve one of the problems it was designed to address.

THE USE OF SPATIAL MODELING AND GAME THEORY

In the analysis below, we apply the logic of spatial modeling to demonstrate that under Chile's current electoral system, candidates possess incentives to adopt policy positions away from that of the median voter. In this section, we provide a brief description of our formal methodology and the assumptions it implies and we define the game theoretic concept of equilibrium that we employ.

The use of spatial modeling assumes that the outcomes of politics may be mapped into a policy space, which represents the range of possible alternatives. Thus, for example, American legislative politics may be conceived of

along a liberal-to-conservative spectrum anchored by Ted Kennedy on one end and Jesse Helms on the other.[5] Policy space may be modeled in more than one dimension, but doing so vastly complicates analysis;[6] we assume one dimensional policy space in this article.

Second, spatial modeling depicts voters as single points within policy space. Technically, it is not voters but rather their ideal policy points that can be mapped this way. Candidates—or their platforms—may also be described in the same manner. Thus, assuming voters are instrumental, it is straightforward that a voter chooses the candidate closest to his or her ideal point.[7] Following conventional approaches, we assume that voters are automatons who choose the nearest candidate and that candidates are strategic actors who take voters' preferences as well as the other candidates' positions into account when designing their platforms.

Given this simplified notion of politics, the question becomes where candidates will choose to position themselves. Drawing on game theory, we assume that candidates will reposition themselves as long as doing so improves their welfare. When no candidate has an incentive to change his or her position given the positions of his or her competitors, a *Nash equilibrium* has been reached.

It is useful to identify and describe Nash equilibria because, all other things being equal, candidates will always continue to reposition themselves in policy space until such an equilibrium has been reached. A Nash equilibrium may be thought of as a stable end to the electoral game. Note that this equilibrium concept relies on abstract simplifications of reality and as such it is only expected to predict general tendencies that may be confirmed by the empirical record.

The best-known equilibrium result is Downs's (1957) median voter theorem, which applies only to single-member district systems. Cox (1984, 1985,

5. See, for example, Sniderman, Brody, and Tetlock (1991), who argue that a single left-right continuum is an appropriate characterization of politics and that most people evaluate the world based on this single continuum. The authors assert that some people—those who are better educated—tend to have more polarized views on issues, thereby explaining apparent multiple dimensions.

6. There is a wide literature on the use of spatial modeling in more than one dimension. In general, theorists have demonstrated that with more than one policy dimension, majority rule may lead to endless preference cycling (McKelvey, 1976; Schofield, 1978).

7. Cox (1997) notes that although Chile's system offers the theoretical possibility of strategic voting (by voting for the preferred candidate of the unpreferred list in cases in which the voter is indifferent between candidates of the preferred list but has strong preferences over the candidates of the opposition list), there is no evidence that such voting takes place.

1987, 1990a, 1990b) has pioneered the search for convergent (i.e., median-voter or centripetal) and/or nonconvergent (i.e., centrifugal) electoral equilibria when more than two parties compete. In general, Cox (1990b) concludes that when more than two candidates compete, systems that give voters only one vote, such as Chile's pre- and post-Pinochet electoral systems, "give election-seeking candidates an incentive to disperse over the political spectrum" (p. 196). Furthermore, for the set of all closed-list PR systems, "there is no central clustering result" (Cox, 1990a, p. 922).

However, this does not mean that no equilibria exist; in addition, it does not mean that political competition in Chile (or any PR system) should necessarily be termed *centrifugal* in Sartori's (1976) sense of the word. Cox (1990a) shows that under certain conditions, parties may in fact have incentives to cluster at certain points in the policy space (p. 922) but that these points will typically be on both sides of the median voter's ideal; we will call these *dispersed* electoral equilibria. Cox's results hold for electoral systems that give the voter one vote and do not allow for intraparty preference voting; Cox does not analyze open-list PR systems, such as Chile's. Later in this article, we will show similar results for candidate competition in the Chilean case, in which voters can influence candidates' rank-ordering on the list.

A FORMAL MODEL OF THE CHILEAN ELECTORAL SYSTEM: THE ABSENCE OF CENTRIPETAL COMPETITION

ASSUMPTIONS

Assumption 1: There are two lists of pairs of candidates, denoted L and R; c_1 and c_2 (i.e., Candidates 1 and 2) are the members of list L, c_3 and c_4 are the members of list R: $L = \{c_1, c_2\}$, $R = \{c_3, c_4\}$.[8]

Assumption 2: A small v denotes the proportion of the votes that a candidate gathers. The subscript identifies the actors introduced in Assumption 1, yielding: v_L, v_R, v_1, v_2, v_3, and v_4, where $v_1 + v_2 = v_L$ and $v_3 + v_4 = v_R$. It can also be noted that because only two lists are competing in this model, $v_L + v_R = 1$.

Assumption 3: Political competition occurs along a single dimension, denoted by the interval $X = [0, 1]$. Candidates will choose a location for their electoral platform in X. A small x denotes a specific position in X adopted by the candidate identified by a subscript: x_1, x_2, x_3, and $x_4 \in X$.[9]

Assumption 4: Candidates may freely reposition themselves in X, subject to one restriction: Candidates from list L can choose any position from the median to the left (i.e., in the interval $[0, \frac{1}{2}]$ of X), whereas candidates from R can choose any position from the median to the right (i.e., in the interval $[\frac{1}{2}, 1]$ of X). We assume for ease of exposition that $x_1 \leq x_2 \leq x_3 \leq x_4$.[10]

Assumption 5: Voters' ideal points are uniformly distributed along X.[11] Utility functions are strictly single-peaked and symmetric.[12]

Assumption 6: The uniform distribution of voters' preferences allows one to calculate the proportion of votes for each candidate by simply taking half of the distance separating him or her from the closest candidate to the left or right. For simplicity, suppose momentarily that there are only 3 candidates, in positions $x_1 < x_2 < x_3$. The following formulae give the candidates' vote shares:

$$v_1 = (x_1 + x_2)/2$$

$$v_2 = [(x_2 + x_3)/2 - (x_1 + x_2)/2] = (x_3 - x_1)/2$$

$$v_3 = 1 - (x_2 + x_3)/2.$$

Assumption 7: All ties are broken equiprobably.

Assumption 8: Voters never abstain. They vote for the candidate whose electoral position is closest to their ideal point.

Assumption 9: A small p denotes the probability that the candidate identified by a subscript wins a seat: p_1, p_2, p_3, and p_4. These probabilities depend on the

8. It would be interesting to generalize our results to races with more than two lists. Although in many districts more than two lists do compete, we wish to analyze the case that most analysts have implicitly addressed, with bipolar competition. The assumption that each list runs at least two candidates is justified in Appendix A. Lists are not allowed to run more than two candidates under the Chilean electoral code (see Editorial Américo Vespucio, 1989, p. 41).

9. In this fashion, if Candidate 1 decides to present himself or herself to the electorate as an extreme rightist, then he or she is choosing $x_1 = 1$; if he or she made up his or her mind for an extreme left position, then $x_1 = 0$; intermediate positions correspond to positions within these borders.

10. This distribution means that Candidate 1's position is to the left or equal to Candidate 2's position, and so on. Stating that $x_1 \leq x_2$ and $x_3 \leq x_4$ has no substantive effect on our results because the candidate's numbers within each list are arbitrary. Assuming that x_1 and x_2 are never to the right of x_3 and x_4 is a substantive assumption and is discussed in the text that follows.

11. We make this simplification, which does not affect the generalizability of our results, so that we are able to deduce candidates' vote shares without having to make use of integrals. Although we acknowledge that this distribution is not the only way to portray the Chilean electorate, the uniform distribution roughly approximates the traditional assumption that the Chilean electorate divides into three thirds. Moreover, as we will demonstrate later in this article, only one (very restrictive and unrealistic) distribution of voter preferences allows for a centrist result.

12. This restriction on the voters' utility functions is threefold: (a) single-peakedness assures that each voter has only one preferred location in X; (b) this single-peakedness is strict, so that the area of preference of each voter is reduced to a single position in X; (c) symmetry makes utility decrease equally as the position departs from the voter's ideal point in any direction. The first and second restrictions are necessary to eliminate the possibility of cycles of preferences among voters. The third restriction is a simplification of the model without loss of generalizability.

overall distribution of votes as follows. For any candidate i (i = 1, 2, 3, or 4) who is a member of list j ($j = L$ or R) along with candidate k (k-i) and a vote distribution $V = (v_1, v_2, v_3, v_4)$:

$$p_i(V) = \begin{cases} 0 \text{ if } v_j \le 1/3 \\ 0 \text{ if } 1/3 < v_j < 2/3 \text{ and } v_i < v_k \\ 1/2 \text{ if } 1/3 < v_j < 2/3 \text{ and } v_i = v_k \\ 1 \text{ if } 1/3 < v_j < 2/3 \text{ and } v_i > v_k \\ 1 \text{ if } v_j \ge 2/3. \end{cases}$$

Assumption 10: Candidates choose a position in X to maximize their individual expected utility, labeled u_1, u_2, u_3, and u_4, where u_i is equal to candidate i's probability of winning a seat plus his or her list-mate's probability of winning multiplied by b, $0 < b < 1$.[13] That is, for candidate i with list-mate k,

$$u_i(V) = p_i(V) + bp_k(V).^{14}$$

Although most of these assumptions are straightforward and uncontroversial, Assumption 4, that candidates cannot cross the median voter point, deserves special attention. We make this assumption primarily for theoretical reasons because without placing restrictions on candidate mobility, no equilibrium exists and the game has no end.[15] The absence of any equilibrium without imposing some limit on candidate mobility in itself supports our central claim that there is no centrist equilibrium. That is, our basic argument holds even without Assumption 4, but we are only able to make an interesting counterargument by assuming limited candidate mobility.

Technically, for our equilibrium to hold, it is not necessary to assume that candidates cannot cross the median precisely but rather that leftist candidates cannot cross the 7/12 quantile and that the rightist candidates cannot move to

13. The letter b reflects a bonus that any candidate receives from seeing his or her list-mate elected. If a candidate is not elected, then he or she would still be better off if his or her list-mate were elected than he or she would be if both members of the other list win the seats. If a candidate is elected, then he or she would also rather see his or her list-mate elected. The candidate gets less utility by seeing his or her list-mate elected than by being elected himself or herself (i.e., $b < 1$), however, he or she gains some utility from it ($b > 0$).

14. Given that the probability function (or winning a seat) is discontinuous, the utility function that we have posited is discontinuous as well. This is a highly unrealistic assumption and, as Simon and Zame (1990) point out, it would be more accurate to assume monotonically decreasing utilities. However, assuming discontinuous probabilities and utilities dramatically simplifies the exposition without changing the results in any way.

15. A proof of this claim, which has not been included due to its length, is available from the authors.

the left of the 5/12 point. Thus, our model holds given a less restrictive assumption, but we choose to assume that candidates are restricted to their half of policy space to simplify the exposition.

Although this assumption may seem restrictive, it also has intuitive appeal. Chilean parties historically and in the current period have strong national policy reputations (Bolívar Espinoza, 1996; Valenzuela, 1977). Thus, the costs of moving in political space are related to a politician's attachment to national party reputation, not to his or her local reputation. Especially given Chile's history of strong partisan politics, a rightist (leftist) candidate who attempts to adopt a leftist (rightist) position risks losing the allegiance of voters on both sides of the political spectrum.

With this set of assumptions, we define the following electoral game, which models the current Chilean electoral system. This game allows us to develop and prove propositions regarding electoral outcomes.

THE RIVAL PARTNERS GAME

Players: Candidates c_1, c_2, c_3, c_4, who are chosen from lists L and R.
Actions/strategies: Candidate i selects a position $x_i \in X$.
Information: Information is imperfect, certain, complete, and symmetric.[16]
Payoffs: Players seek to maximize their expected utility.
Order of play: Candidates simultaneously select their strategies.

Proposition 1: In a two-list, four-candidate race in the Chilean electoral system, there is no centrist equilibrium with all four candidates at the median voter.

The proof of this proposition will be demonstrated by contradiction. Suppose that at the start of the campaign, all four candidates are located at the median voter's ideal point, such that $x_1 = x_2 = x_3 = x_4 = 1/2$. Figure 1 illustrates this scenario, in which $v_1 = v_2 = v_3 = v_4 = 1/4$, yielding $p_1 = p_2 = p_3 = p_4 = 1/2$ and $u_1 = u_2 = u_3 = u_4 = 1/2 + b/2$. If no candidate were able to improve his or her utility by changing his or her position, this situation would be a Nash equilibrium, and Guzmán's and Rabkin's claim would be technically correct.

16. These terms come from Rasmusen (1989, pp. 45-48). Imperfect information means that players do not know exactly where they are on the game tree, in this case because players move simultaneously (i.e., information sets are not singletons). Information is certain and complete because nature (or chance) plays no role in this game either after (certain) or before (complete) players move; there is no random element to this game. Information is symmetric because all players possess the same information.

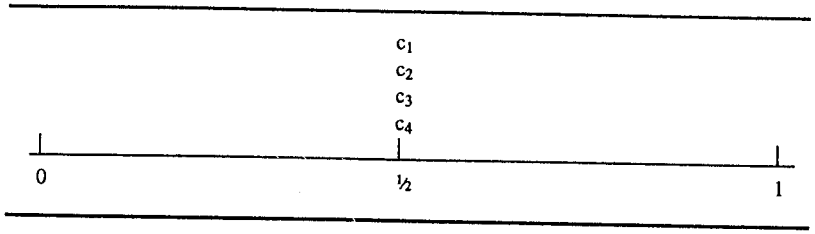

Figure 1. **A centripetal arrangement of candidates.**

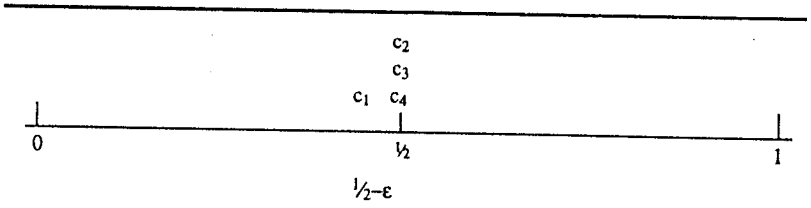

Figure 2. **The centripetal arrangement is not an equilibrium.**

However, this is not a Nash equilibrium. Suppose that candidate c_1 makes an infinitesimally small hop to the left, moving from $x_1 = ½$ to $x_1' = ½ - \varepsilon$, where $\varepsilon > 0$. Because all voters to the left of the point $½ - \varepsilon$ have c_1 as their closest candidate, they will vote for him or her. Figure 2 illustrates this case.

$$If\ x_1' = ½ - \varepsilon,\ x_2 = x_3 = x_4 = ½,\ \text{then}$$

$$v_1' = (½ + (½ - \varepsilon))/2 = ½ - (\varepsilon/2)\ \text{and}$$

$$v_2' = v_3' = v_4' = (1 - (½ + (½ - \varepsilon))/2)/3 = ⅙ + (\varepsilon/6).$$

Using the probability and utility functions defined above, $u_1' = 1$, $u_2' = 0$, $u_3' = u_4' = ½ + b/2$. Because $u_1' > u_1$, c_1 was able to improve his or her situation by unilaterally defecting from the median. The remaining candidates face exactly the same incentives. Thus, $x_1 = x_2 = x_3 = x_4 = ½$ is not a Nash equilibrium. *QED*.

Contrary to Rabkin's and Guzmán's claims, no equilibrium exists in which all four candidates are at the median voter's position. We now turn to the question of whether any equilibria exist at all in the Chilean system.

Proposition 2: In a two-list, four-candidate race in the Chilean electoral system, only noncentrist equilibria can exist.

Proof

To build the proof of this proposition, we need to introduce the following two lemmas. They involve only list *L*, but by symmetry, the results hold for list *R*.

Lemma 1: In a two-list, four-candidate race in the Chilean electoral system, if there is an equilibrium, it cannot involve one list winning two seats.[17]

Proof

Given Assumption 4 (that candidates cannot cross the median voter's ideal point), a candidate can always guarantee his or her list at least one third of the vote by positioning himself or herself anywhere between the median voter and the ⅙ (or ⅚) point. With at least a third of the vote, the list is guaranteed a seat and, therefore, the other list cannot win two seats. *QED*.

Lemma 2: In a two-list, four-candidate race in the Chilean electoral system, if an equilibrium exists and if $x_1 \le x_2 \le x_3 \le x_4$, then (a) both candidates from a given list will always occupy the same point in policy space and (b) that point will be a third of the distance between either extreme and the position of the other list's candidates. Formally, in equilibrium, $x_1 = x_2 = ⅓(x_3)$.

Proof

Following from Lemma 1, assume that $⅓ < v_L < ⅔$, regardless of the positions of Candidates 1 and 2 between 0 and the median. Four possible cases exist:

Case 1. Suppose that $v_1 > v_2$. In this case, $p_1 = 1$ and $p_2 = 0$, such that $u_1 = 1$ and $u_2 = 0$. However, c_2 can jump to $x_2' = x_1$ so that each will have a probability of .5 of winning the seat ($u_2' = ½ + b/2 > u_2$).

Case 2. Suppose that $v_1 < v_2$. In this case, c_1 will want to jump to $x_1' = x_2$ to increase his or her utility from 0 to $½ + b/2$.

17. In a few districts over the last two elections, one list has won both seats, which would appear to be out of equilibrium behavior according to our model. We expect that these districts represent outliers relative to the national distribution of voter preferences. Because candidate mobility is limited by national reputational concerns, large majority leftist or rightist districts will produce double victories for these lists.

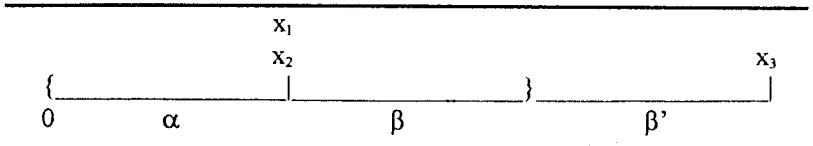

Figure 3. **Location of candidates from the same list.**

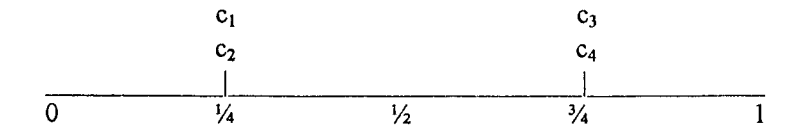

Figure 4. **Dispersed equilibrium.**

Case 3. Suppose that $v_1 = v_2$ but that $x_1 \neq x_2$. In this case, $p_1 = p_2 = .5$. Note, however, that each candidate receives votes from ½ of the voters located between x_1 and x_2. Thus, c_1 has an incentive to move toward his or her right, "stealing" some of c_2's votes for himself or herself so that $p_1' = 1$ ($u_1' > u_1$). Likewise, c_2 has an incentive to move toward his or her left so that each candidate will move toward the other until $x_1' = x_2'$.

Case 4. Suppose that $v_1 = v_2$ and $x_1 = x_2$. The candidates together gain all of the votes between themselves and 0 and half of the votes between themselves and x_3; see Figure 3, in which Candidates 1 and 2 each receive half of segment α and half of segment β (with Candidate 3 receiving all of β').

Whenever $\alpha \neq \beta$, then each candidate has an incentive to move to the larger of the two spaces (α or β) so that he or she receives all of the larger segment instead of half of the larger segment and half of the smaller segment. Thus, if an equilibrium exists, then the distance to the left of $x_1 = x_2$ must equal ½ the distance between $x_1 = x_2$ and x_3. Referring to Figure 3, $\alpha = \beta = \beta'$. The only alignment that satisfies this requirement is when $x_1 = x_2 = \frac{1}{3}(x_3)$. *QED.*

Based on Lemma 2, Figure 4 describes the only potential Nash equilibrium in the Chilean electoral system, a dispersed equilibrium in which $x_1 = x_2 = \frac{1}{4}$ and $x_3 = x_4 = \frac{3}{4}$. This proves Proposition 2. *QED.*

When candidates occupy this position, each gains ¼ of the total vote and has a probability of .5 of winning a seat. Here, no candidate can improve his or her probability of winning a seat by moving to the right or to the left (unless he or she violates the assumption that no candidate from the left can compete on the right side of the spectrum, and vice versa). For example, if Candidate 1 moves ε to the left, then he or she would receive ¼ minus ε/2, whereas Candidate 2 would receive ¼ plus ε/2. Thus, Candidate 2 would win the seat with probability 1 and Candidate 1 would win the seat with probability 0. By moving to the right, Candidate 1 accomplishes the same end.[18] Thus, in the Chilean electoral system, when two lists compete, only a dispersed electoral equilibrium exists. The system does not promote a Downsian, centripetal equilibrium.

CONCLUSION

We have shown through the use of spatial modeling and game theory that the equilibrium that follows from Chile's 1989 electoral reforms is noncentrist, with candidates positioning themselves at a given distance on either side of the median voter.

Our finding is significant for three reasons. First, for those interested in designing electoral systems to promote a certain outcome, our results show that Chile's version of a double-member district system fails to encourage the centrist position taking with which it is typically credited. Assuming that centrist position taking is desirable for democratic stability, Chilean-style reforms should be avoided.

Second, our use of spatial modeling to demonstrate the absence of a centrist equilibrium is an important contribution to the ongoing discussion of the effectiveness of Chile's electoral reforms, cast in terms of Chile, per se. Doubtless, much of the ambiguity that currently exists regarding the effects of the 1989 reforms stems from the fact that the institutional reforms coincided with significant social changes wrought by 17 years of harsh authoritarianism and the subsequent transition to democracy. Thus, it is difficult for analysts to judge whether recent changes in party and candidate behavior relative to the pre-Pinochet period result from institutional reforms, socialization, or some combination of the two. Through spatial modeling, we are able to isolate the effects of the institutional reforms and to show that their theoretical result is to encourage two lists that compete away from the median voter. It remains to be seen what long-term empirical effect the reforms will have on the number and types of parties in the Chilean system.

18. Note that, in effect, this situation is equivalent to two races under single-member plurality rules, one on each side of the median voter. Thus, median voter results hold, but they hold separately on each side of the policy space.

Third, this study makes an important contribution to the comparative analysis of incentives created by different electoral institutions. Although the literature on spatial competition has examined party competition in multimember district systems (Cox, 1984, 1985, 1987, 1990a, 1990b; Lacy & Niou, 1996; Myerson, 1993; Snyder, 1990), this article is among the first to examine electoral equilibria under open-list proportional representation. The combination of open-list voting and d'Hondt seat allocation in double-member districts, as noted previously in this article, creates an unusual Rival Partners Game that appears to be unique to Chile. It is the combination of double-member districts and open-list competition that prevents a centripetal result. Changing the Chilean system by introducing either single-member districts or closed-list competition would create a Downsian median voter result.

Several caveats are in order. First, the equilibrium is driven in part by the restriction we place on candidate mobility at the median. If this restriction is removed, the game has no equilibrium (i.e., there is no centrist equilibrium in the Chilean system). Similarly, the introduction of a third list in the model also invalidates the equilibrium result unless additional restrictions on list/candidate mobility are also introduced.

Finally, the noncentrist equilibrium that we have described may take quite different forms depending on the actual distribution of voter preferences in Chile. Lists will always adopt positions at the first and third quartile points but the actual location of these quartiles in policy space depends on the underlying distribution of voter preferences. Thus, for example, if voters' preferences follow a normal distribution (a bell curve) instead of a uniform distribution, then these positions will be closer to the median voter; a steeper bell curve means the quartiles will be even closer to the median.

This relationship between the distribution of voter preferences and candidate/list strategies points to an important area for further research, which would provide empirical support for our primary claim. Specifically, an investigation of survey research could estimate the distribution of voter preferences, which, in turn, could be compared to a study of the actual positions adopted by lists and candidates. Such an investigation would also allow a comparison of candidate and list strategies before and after the Pinochet regime. Another question prompted by our study that we do not address here is the extent to which the electoral coalitions (i.e., lists) hold in the postelection stage. If it appears that electoral lists are, in fact, short-term coalitions of convenience, then the current Chilean system still faces the possibility of polarized pluralism during the governing stage. There is no institution (other than the specter of Pinochet's army) that prevents this outcome. Our theoretical finding that spatial competition in Chile's double-member districts should, ceteris paribus, be noncentrist should encourage future research into the past and present strategies of Chilean political elites and the preferences of Chilean voters.

APPENDIX A
Proof of the Assumption That Each List Will Nominate Two Candidates

THE NOMINATION GAME

Players: Lists L and R

Actions/strategies: Let NC_L and NC_R be the number of candidates that lists L and R, respectively, nominate for election. $NC_L \in \{0, 1, 2\}$ and $NC_R \in \{0, 1, 2\}$.

Information: Information is complete, imperfect, symmetric, and certain.

Payoffs: Lists seek to maximize their expected number of seats, denoted s_L and s_R.

Order of play: Lists simultaneously choose NC_L and NC_R.

Claim: This game has a unique weakly dominant strategy Nash equilibrium, in which $NC_L = NC_R = 2$.

Proof

Case 1.[a] Suppose $NC_L = NC_R = 1$. In this case, each list is guaranteed exactly one seat. With $NC_R = 1$, list L is guaranteed at least one seat whether $NC_L = 1$ or $NC_L = 2$, so running two candidates is never a worse strategy for list L. Furthermore, by running two candidates, there is some positive probability that list L will win the second seat as well, making $NC_L = 2$ a weakly dominant strategy.

Case 2. Suppose $NC_L = 2$ and $NC_R = 1$. The following three vote distributions exhaust the set of possible outcomes: (a) If $v_L \geq \frac{2}{3}$ and $v_R \leq \frac{1}{3}$, then $s_L = 2$ and $s_R = 0$, regardless of how many candidates R runs; (b) if $\frac{1}{3} < v_L < \frac{2}{3}$ and $\frac{1}{3} < v_R < \frac{2}{3}$, then $s_L = 1$ and $s_R = 1$, regardless of how many candidates list R runs; and (c) if $v_L \leq \frac{1}{3}$ and $v_R \geq \frac{2}{3}$, then $s_L = 0$ and $s_R = 2$. In this case, list R fills both of its seats if and only if $NC_R = 2$: if $NC_R = 1$ they fill one seat.

Thus, running two candidates never hurts list R, and it sometimes helps, making it a weakly dominant strategy. Therefore, in equilibrium, both lists always have an incentive to run two candidates. *QED*.

a. We omit the trivial case of lists nominating no candidates.

APPENDIX B
Preliminary Data

Our intention in this article has not been to make an empirical study but to make the theoretical argument that Chile's electoral reforms of 1989 failed to promote centripetal competition. A brief look at basic data from the 1989 and 1993 Chamber of Deputies campaigns and electoral results provides general support for our intermediate claims and suggests that further empirical research on our overall argument is in order.

Tables 1 and 2 present the number of candidates and parties nominated by each major list in the 1989 and 1993 elections; Tables 3 and 4 summarize these data.

Table 1
Number of Candidates and Parties by List and District: 1989 Diputado Elections

	List[a]							
	Concertación de Partidos por la Democracia[b]		Democracia y Progreso[c]		Alianza de Centro[d]		Liberal-Socialista Chileno[e]	
District	No. of Candidates	No. of Parties[f]	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties
1	2	2	2	2	0	0	2	2
2	2	2	2	2	1	1	0	0
3	2	2	2	1	1	1	1	1
4	2	2	2	2	1	1	1	1
5	2	2	2	2	2	2	1	1
6	2	2	2	2	0	0	1	1
7	2	2	2	2	2	2	0	0
8	2	2	2	2	2	2	0	0
9	2	2	2	2	1	1	0	0
10	2	2	2	1	0	0	0	0
11	2	2	2	1	1	1	0	0
12	2	2	2	2	2	2	0	0
13	2	2	2	2	2	2	1	1
14	2	2	2	2	2	2	1	1
15	2	2	2	2	2	2	1	1
16	2	2	2	2	1	1	1	1
17	2	2	2	2	2	2	1	1
18	2	2	2	2	2	2	2	2
19	2	2	2	2	0	0	2	2
20	2	2	2	1	1	1	1	1
21	1	1	2	2	1	1	2	2
22	2	2	2	2	0	0	2	2
23	2	2	2	2	1	1	1	1
24	2	2	2	2	1	1	2	1
25	2	2	2	2	1	1	2	2
26	2	2	2	2	2	2	1	1

Table 1

	List[a]							
	Concertación de Partidos por la Democracia[b]		Democracia y Progreso[c]		Alianza de Centro[d]		Liberal-Socialista Chileno[e]	
District	No. of Candidates	No. of Parties[f]	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties
27	2	2	2	2	2	2	1	1
28	2	2	2	2	1	1	2	2
29	2	2	2	2	1	1	2	2
30	1	1	2	2	1	1	1	1
31	2	2	2	2	1	1	2	2
32	2	2	1	1	1	1	0	0
33	2	2	2	2	2	2	1	1
34	2	1	2	2	0	0	1	1
35	2	2	2	2	2	2	1	1
36	2	2	2	2	0	0	0	0
37	2	2	2	2	1	1	0	0
38	2	2	2	2	2	2	0	0
39	2	2	2	2	0	0	0	0
40	2	2	2	2	0	0	0	0
41	2	2	2	2	2	2	0	0
42	1	1	2	2	0	0	0	0
43	2	2	2	2	1	1	0	0
44	2	2	2	2	1	1	0	0
45	2	2	2	2	1	1	0	0
46	2	2	2	2	0	0	0	0
47	2	2	2	2	2	2	0	0
48	2	2	2	1	1	1	0	0
49	2	2	2	1	2	2	0	0
50	2	2	2	1	0	0	0	0
51	2	2	2	1	1	1	0	0
52	2	2	2	1	0	0	0	0
53	2	2	2	2	1	1	0	0
54	2	2	2	1	2	2	0	0
55	1	1	2	2	0	0	0	0
56	2	2	2	2	0	0	0	0
57	2	2	2	1	0	0	0	0
58	2	2	2	2	0	0	0	0
59	2	2	2	2	2	2	1	1
60	2	2	2	2	1	1	0	0

Source: República de Chile (1989).
a. Only the four largest lists have been included in this table.
b. English translation = Concertation of Parties for Democracy.
c. English translation = Democracy and Progress.
d. English translation = Center Alliance.
e. English translation = Chilean Liberal-Socialist.
f. In the No. of Parties columns, independent candidates are counted as their own party. For example, in the first district, the *Liberal-Socialista* list is composed of two independent candidates.

Table 2
Number of Candidates and Parties by List and District: 1993 Diputado Elections

	List							
	Concertación de Partidos por la Democracia[a]		Unión por el Progreso de Chile[b]		La Nueva Izquierda[c]		Alternativa Democrática de Izquierda[d]	
District	No. of Candidates	No. of Parties[e]	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties
1	2	2	2	2	1	1	1	1
2	2	2	2	2	1	1	2	2
3	2	2	2	2	1	1	2	2
4	2	2	2	2	0	0	2	2
5	2	2	2	2	1	1	2	2
6	2	2	2	2	1	1	2	2
7	2	2	2	2	0	0	2	1
8	2	2	2	2	0	0	2	1
9	2	2	2	2	0	0	2	1
10	2	2	2	2	0	0	2	2
11	2	2	2	2	1	1	2	2
12	2	2	2	2	0	0	1	1
13	2	2	2	2	1	1	1	1
14	2	2	2	2	1	1	1	1
15	2	2	2	2	0	0	2	1
16	2	2	2	2	2	2	1	1
17	2	2	2	1	1	1	2	1
18	2	2	2	2	2	2	2	1
19	2	2	2	2	1	1	2	2
20	2	2	2	2	1	1	2	1
21	2	2	2	2	2	1	2	1
22	2	2	2	2	1	1	1	1
23	2	2	2	2	2	2	2	2
24	2	2	2	2	2	1	2	2
25	2	2	2	2	2	1	2	2
26	2	2	2	2	2	2	2	2
27	2	2	2	2	0	0	2	1
28	2	2	2	2	2	2	2	2
29	2	2	2	2	1	1	2	2
30	2	2	2	2	2	2	1	1
31	2	2	2	2	1	1	2	2
32	2	2	2	1	2	2	2	2
33	2	2	2	2	1	1	2	2
34	2	2	2	2	0	0	1	1
35	2	2	2	2	0	0	1	1
36	2	2	2	2	0	0	2	1

Table 2

	List							
	Concertación de Partidos por la Democracia[a]		Unión por el Progreso de Chile[b]		La Nueva Izquierda[c]		Alternativa Democrática de Izquierda[d]	
District	No. of Candidates	No. of Parties[e]	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties	No. of Candidates	No. of Parties
37	2	2	2	2	0	0	2	2
38	2	2	2	2	1	1	1	1
39	2	2	2	2	0	0	1	1
40	2	2	2	2	1	1	1	1
41	2	2	2	2	0	0	0	0
42	2	2	2	2	0	0	0	0
43	2	2	2	2	1	1	2	2
44	2	2	2	2	1	1	1	1
45	2	2	2	2	1	1	1	1
46	2	2	2	2	0	0	2	2
47	2	2	2	2	0	0	1	1
48	2	2	2	2	0	0	2	2
49	2	2	2	2	1	1	1	1
50	2	2	2	2	2	2	1	1
51	2	2	2	2	1	1	1	1
52	2	2	2	2	1	1	1	1
53	2	2	2	2	1	1	1	1
54	2	2	2	2	0	0	1	1
55	2	2	2	2	0	0	1	1
56	2	2	2	2	0	0	0	0
57	2	2	2	2	0	0	1	1
58	2	2	2	2	0	0	2	2
59	2	2	2	1	0	0	2	1
60	2	2	2	2	1	1	2	1

Source: República de Chile (1993).
a. English translation = Concertation of Parties for Democracy.
b. English translation = Union for the Progress of Chile.
c. English translation = The New Left.
d. English translation = Left Democratic Alternative.
e. In the No. of Parties columns, independent candidates are counted as their own parties. For example, in the first district, *Unión por el Progreso* list is composed of a candidate from *Renovación Nacional* and an independent candidate.

Table 3
Number of Candidates and Parties Run by Lists, 1989 Diputado Elections

No. of Candidates-No. of Parties	Concertación de Partidos por la Democracia[a] Frequency	%	Democracia y Progreso[b] Frequency	%	Alianza de Centro[c] Frequency	%	Liberal-Socialista Chileno[d] Frequency	%	Overall %
0-0	0	0	0	0	17	28	32	53	20
1-1	4	7	1	2	24	40	18	30	20
2-1	1	2	11	18	0	0	1	2	5
2-2	55	92	48	80	19	32	9	15	55
Total	60	101	60	100	60	100	60	100	100

Source: República de Chile (1989).
a. English translation = Concertation of Parties for Democracy.
b. English translation = Democracy and Progress.
c. English translation = Center Alliance.
d. English translation = Chilean Liberal-Socialist.

Table 4
Number of Candidates and Parties Run by Lists, 1993 Diputado Elections

No. of Candidates-No. of Parties	Concertación de Partidos por la Democracia[a] Frequency	%	Unión por el Progreso de Chile[b] Frequency	%	La Nueva Izquierda[c] Frequency	%	Alternativa Democrática de Izquierda[d] Frequency	%	Overall %
0-0	0	0	0	0	24	40	3	5	11
1-1	0	0	0	0	25	42	23	38	20
2-1	0	0	3	5	3	5	10	17	7
2-2	60	100	57	95	5	13	24	4	62
Total	60	100	60	100	60	100	60	100	100

Source: República de Chile (1993).
a. English translation = Concertation of Parties for Democracy.
b. English translation = Union for the Progress of Chile.
c. English translation = The New Left.
d. English translation = Left Democratic Alternative.

These data provide support for Assumptions 1 and 4. The two main lists (i.e., those that won the vast majority of seats) were *Concertación* and *Democracia y Progreso* in 1989, with the latter changing its name to *Unión por el Progreso* in 1993 (see Columns 1 and 2 in Tables 1 and 2). Regarding Assumption 1, that lists run two candidates, note that the primary lists ran two candidates in all but 5 of 120 cases in 1989 and in every case in 1993. The two smaller lists tended not to always run two candidates. Our model does not account for the fact that running candidates is costly; these lists were apparently deterred by campaign costs given their small likelihood of winning seats.

Regarding Assumption 4, that candidates may freely position themselves, and our more general assertion that intralist competition exists, these assumptions are based on the assertion that candidates are not restrained by any central authority within their lists. In particular, we suppose that although parties may be able to restrain their own candidates, lists exercise no such discipline when candidates from competing parties share a list label in a single district.

Note from Tables 3 and 4, when the major parties ran two candidates in a district, that the candidates were from two different parties 220 out of 236 times (93%). Taking the two minor parties into account as well, this ratio remains unchanged, with the lists consisting of two different parties 277 out of 297 times in which two candidates were offered.

Tables 5 and 6 provide district data on the electoral results from 1989 and 1993. These data provide support for Lemma 1, that in equilibrium no list wins both seats in a district. Specifically, in 1989, the two lists split the seats in 49 out of 60 cases; in 1993, two lists split the seats in 48 out of 60 cases. That is, a single list won both seats in a district in only 19% of the cases overall. Given that the *Concertación por el No* (*Concertación's* predecessor) won the plebiscite in 11 out of 13 regions, these numbers are surprisingly low. We hypothesize that the districts in which a list won both seats have a higher number of extremist voters than the national distribution.

Table 5
Seats Won by Major Lists, 1989 Diputado Elections

District	Concertación de Partidos por la Democracia[a]	Democracia y Progreso[b]	District	Concertación de Partidos por la Democracia	Democracia y Progreso
1	1	1	31	1	1
2	1	1	32	1	1
3	1	1	33[c]	0	1
4	2	0	34	1	1
5	1	1	35	1	1
6	1	1	36	1	1
7	1	1	37	2	0
8	1	1	38	1	1
9	2	0	39	1	1
10	1	1	40	1	1
11	1	1	41	1	1
12	1	1	42	1	1
13	1	1	43	1	1
14	1	1	44	2	0
15	2	0	45[c]	1	0
16	1	1	46	2	0
17	2	0	47	1	1
18	1	1	48	1	1

(continued)

Table 5

District	Concertación de Partidos por la Democracia[a]	Democracia y Progreso[b]	District	Concertación de Partidos por la Democracia	Democracia y Progreso
19	1	1	49	1	1
20	1	1	50	1	1
21	1	1	51	1	1
22	1	1	52	1	1
23	1	1	53	1	1
24	1	1	54	1	1
25	1	1	55	1	1
26	1	1	56	1	1
27	2	0	57	1	1
28	2	0	58	1	1
29	2	0	59	1	1
30	1	1	60	2	0

Source: Valenzuela & Siavelis (1991).
a. English translation = Concertation of Parties for Democracy.
b. English translation = Democracy and Progress.
c. Districts that do not add to 2 had a seat won by *Partido Amplio de Izquierda Socialista* (PAIS, translated as Ample Party of Socialist Left), which is a smaller party.

Table 6
Seats Won by Major Lists, 1993 Diputado Elections

District	Concertación de Partidos por la Democracia[a]	Unión por el Progreso de Chile[b]	District	Concertación de Partidos por la Democracia	Unión por el Progreso de Chile
1	1	1	31	1	1
2	1	1	32	1	1
3	1	1	33	1	1
4	2	0	34	1	1
5	1	1	35	1	1
6	1	1	36	1	1
7	1	1	37	2	0
8	2	0	38	1	1
9	2	0	39	1	1
10	1	1	40	1	1
11	1	1	41	1	1
12	1	1	42	2	0
13	1	1	43	1	1

Table 6

District	Concertación de Partidos por la Democracia[a]	Unión por el Progreso de Chile[b]	District	Concertación de Partidos por la Democracia	Unión por el Progreso de Chile
14	1	1	44	2	0
15	1	1	45	2	0
16	1	1	46	2	0
17	2	0	47	1	1
18	2	0	48	1	1
19	1	1	49	1	1
20	1	1	50	1	1
21	1	1	51	1	1
22	1	1	52	1	1
23	0	2	53	1	1
24	1	1	54	1	1
25	1	1	55	1	1
26	2	0	56	1	1
27	1	1	57	1	1
28	1	1	58	1	1
29	1	1	59	1	1
30	1	1	60	1	1

Source: República de Chile (1993).
a. English translation = Concertation of Parties for Democracy.
b. English translation = Union for the Progress of Chile.

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