

# The Effect of Dual Candidacy on Voting Decisions

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## **Abstract**

This article conducts a decision theoretic analysis of the effect of dual candidacy on voting decisions in the Japanese variant of the mixed electoral system, where each candidate can run in both a single-member district (SMD) and a proportional representation (PR) block, and dual candidates can be ranked either individually or equally in parties' PR lists: their post-election ranking is determined by their SMD votes. The model shows that dual candidacy differentiates the mixed system from merely the simultaneous use of the SMD and PR systems. That is, if an SMD candidate also runs in the PR block, it lowers voters' utility increment obtained by casting their SMD votes for him. If he is ranked equally in the PR list, however, SMD votes for him may help him win a PR seat against other equally ranked dual candidates, which enables dual candidacy accompanied by equal ranking to attract more SMD votes.

## **1. Introduction**

During the 1990s, many countries adopted mixed systems for their national elections, which are hybrids of proportional representation (PR) and majoritarian systems. According to the classification made by Massicotte and Blais, no less than 29 countries are currently using mixed systems for their first or single chamber, which covers one-fifth of the world's population.<sup>1</sup> Mixed systems have variations in how the two tiers are combined, and some of the countries, including Germany, Italy, Japan, New Zealand, and Russia, allow candidates to run in both tiers. Dual candidacy

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<sup>1</sup> Louis Massicotte and Andre Blais, 'Mixed Electoral Systems: A Conceptual and Empirical Survey', *Electoral Studies*, 18(1999): 341–66.

complicates voters' decisions because dual candidates can win seats in PR blocks even though they lose in their single-member districts (SMDs). For example, voters may not cast their SMD votes for a dual candidate – even though they prefer him most – when there is high expectation for him to win a PR seat. In order to confirm this type of intuition formally, this paper formulates a decision theoretic framework of a voter and analyzes how parties' way of ranking their candidates in their PR lists affects voting decisions.

The mixed system we deal with is the one used by the Japanese House of Representatives, which is a type of *superposition*, defined by Massicotte and Blais as a mixed electoral system 'in which all electors are subjected to the two formulas and independent sets of districts are established for each formula'; it is the most popular type of mixed system and used in 15 countries.<sup>2</sup> One characteristic of the Japanese variant is that parties can rank dual candidates either individually or equally in their PR lists, and SMD votes determine the post-election ranking among equally ranked dual candidates who lose in their SMDs. This option makes the mixed system more than merely the simultaneous use of PR and majoritarian systems and thus makes it more interesting to analyze.<sup>3</sup>

More specifically, the Japanese mixed system is described as follows. The House of Representatives consists of 480 members, 180 of whom are elected from PR blocks and 300 of whom are from SMDs. The whole country is divided into 11 PR blocks, and they are independent of each other: candidacy, voting, and seat allocation cannot be made beyond PR blocks. Hence, we can focus on one PR block. Each PR block is

<sup>2</sup> Massicotte and Blais, 'Mixed Electoral Systems', p. 349.

<sup>3</sup> Whether the PR and majoritarian tiers are completely separated or not in the system, their simultaneous use seems to create different incentives for parties and voters from pure PR and pure majoritarian systems. For example, the presence of *contamination effects* (also called *interaction effects*) is empirically recognized in the national elections of Japan by Mizusaki Tokifumi and Mori Hiroki, 'Tokuhyo deta kara mita Heiritsu-sei no Mekanizumu' ['The Impact of the New Electoral System on Voting Behavior and Campaign Strategies in 1996'], *Senkyo Kenkyu* [Japanese Journal of Electoral Studies], 13(1998): 50–9 and Steven R. Reed, 'Heiritsu-sei ni okeru Shosenkyoku-Kohosha no Hireidaihyo-Tokuhyoritsu eno Eikyo' ['The Effect of the PR Tier on SMD Nomination Strategies in Mixed Member Systems: Some Evidence from Japan'], *Senkyo Kenkyu* [Japanese Journal of Electoral Studies], 18(2003): 5–11, Russia by Nikolai Petrov, 'Analiz Rezul'tatov vyborov 1995 g. V Gosudarstvennuu dumu Rossii po okrugam i regionam', in Michael McFaul and Nikolai Petrov (eds), *Parlamentskie vybory 1995 goda v Rossii* (Moscow, Russia: Moscow Carnegie Centre, 1996), pp. 7–57 (in Russian, which is explained in English by Grigorii V. Golosov and Nataliya Yargomskaya, 'The Impact of Russia's Electoral System on the Competitive Strategies of Political Actors in the Duma Elections', in Vladimir Gel'man and Grigorri V. Golosov (eds), *Elections in Russia, 1993–1996: Analyses, Documents and Data* (Berlin, Germany: Edition Sigma, 1999), pp. 150–71), Japan and Russia by Erik S. Herron and Misa Nishikawa, 'Contamination Effects and the Number of Parties in Mixed-Superposition Electoral Systems', *Electoral Studies*, 20(2001): 63–86, and Germany, Japan and Italy by Karen E. Cox and Leonard J. Schoppa, 'Interaction Effects in Mixed-Member Electoral Systems: Theory and Evidence from Germany, Japan and Italy', *Comparative Political Studies*, 35(2002): 1027–53. That is, running candidates in SMDs itself attracts PR votes to the party. For the details of mixed systems used in different countries, see Matthew Soberg Shugart and Martin P. Wattenberg, *Mixed-Member Electoral Systems: The Best of Both Worlds?* (New York, NY: Oxford University Press, 2001).

currently assigned 6–29 PR seats and consists of 12–48 SMDs. Each candidate can run in the PR block and/or in one SMD within the block. In advance of voting, parties rank their candidates (i.e., pure PR candidates and dual candidates) in their PR lists. Pure PR candidates must be ranked individually, while dual candidates can be ranked either individually or equally. Each voter has two votes: she casts an SMD vote for a candidate running in her SMD and casts a PR vote for a party list in the PR block. After voting, the names of dual candidates who win SMD seats are removed from their PR lists. For each of the equally ranked dual candidates who lose in their SMDs, we calculate the ratio of his SMD votes to the winner's SMD votes in his SMD. This ratio, which takes a value between 0 and 1, is a measure of how well he competed relative to the winner in his SMD, and candidates with higher ratios are assigned higher post-election ranks among the equally ranked dual candidates of the list. The allocation of PR seats among party lists is not affected by the SMD results but determined by only PR votes under the d'Hondt method. In each party list, candidates fill the seats allocated to their party list from the top of the post-election ranking.

The Japanese House of Representatives has experienced three elections (in 1996, 2000, and 2003) under the mixed system. McKean and Scheiner discuss how parties ranked their candidates in their PR lists in the 1996 election.<sup>4</sup> Table 1, based on their Table 3, but including additional information, summarizes parties' strategies regarding the use of dual candidacy in the previous three elections: the figure in each cell represents the number of PR lists provided by the party in the row, the characteristic of which is described in the column. As they point out, three strategies were employed by parties. First, the New Frontier Party (NFP), which disbanded in 1997, and New Komeito, which formed part of the NFP at its inception and became independent again when the NFP disbanded, did not use dual candidacy.<sup>5</sup> McKean and Scheiner enumerate three reasons for the NFP's choice of the strategy, and one of them is related to strategic voting:

[a concern of the NFP leader] may have been that strategically inclined voters would assume that the duals did not need votes as badly as pure SMD candidates, and might also vote so as to maximize the number of representatives with a link to the SMD rather than to maximize representation from a particular party. (pp. 454–5)<sup>6</sup>

<sup>4</sup> Margaret McKean and Ethan Scheiner, 'Japan's New Electoral System: La plus ça change . . .', *Electoral Studies*, 19(2000): 447–77.

<sup>5</sup> The Socialist Party did not use dual candidacy either. However, since it ran candidates only in one PR block (Tokyo) and had no pure SMD candidates, it is hard to figure its main strategy due to the shortage of samples.

<sup>6</sup> The other two reasons are related to the NFP's internal structure and the leader's personal preference. That is, ex-Komeito candidates were hardly expected to win in SMDs because their supporters were thinly spread over cities, and so the NFP ran them as pure PR candidates, while others as pure SMD candidates. The leader also disliked the idea of dual candidacy: it might weaken the campaign incentive of candidates (McKean and Scheiner, 'Japan's New Electoral System', p. 454).

**Table 1.** *The number of lists by characteristic*

Party	All candidates ranked equally (no pure PR candidates)	<i>x</i> clumps of equally ranked dual candidates				All dual candidates ranked individually	Only one dual candidate	No dual candidates
		<i>x</i> = 1	<i>x</i> = 2	<i>x</i> = 3	<i>x</i> = 4			
Liberal League	9	1 (1)						
Social Democratic Party	20	8 (1)				1	3	
New Socialist Party	2	3 (2)						
Democratic Party of Japan	12	17 (4)	3 (1)		1 (1)			
Sakigake		2 (2)						
Liberal Democratic Party		28 (9)	5 (2)					
Liberal Party		3 (3)	4 (3)	1 (0)		1	1	1
Japanese Communist Party						26	3	4
New Frontier Party		1 (0)					5	5
New Komeito		2 (0)					2	18
Socialist Party								1
Sum	43	65 (22)	12 (6)	1 (0)	1 (1)	28	14	29

*Notes:* This table is made based on McKean and Scheiner's Table 3 regarding the 1996 election. We add the observations from the 2000 and 2003 elections, and distinguish the lists which include only one dual candidate so that there is no way of ranking more than one dual candidate equally and the lists which include no dual candidates. Some of the lists that contain clumps of equally ranked dual candidates also include individually ranked dual candidates, whose number is in parentheses. Lists which contain only one candidate are removed.

*Sources:* Ministry of Public Management, Home Affairs, Posts and Telecommunications, Self-Government Administration Bureau, Election Division, *Shugiin Giin Sosenkyo Saikosaibansho Saibankan Kokuminshinsa Kekka Shirabe* [Reports on the House of Representatives Election and the Popular Review of the Supreme Court Justices] (1996, 2000, and 2003).

Our decision theoretic model obtains a result consistent with this concern: as explained in the next paragraph, dual candidacy has a negative effect on voters' utility increment obtained by casting their SMD votes for the candidate.

Second, the Japanese Communist Party (JCP) made use of dual candidacy and ranked dual candidates individually. To consider the effect of dual candidacy, suppose that for an individually ranked dual candidate there is high expectation for this candidate to win a PR seat even though he loses in his SMD. Then, when it is pivotal, an SMD vote for him changes not only an SMD winner from another candidate of the same SMD to him but also a PR winner from him to another candidate of the same party list. As the above concern of the NFP leader suggests, therefore, voters can vote away from the dual candidate if they prefer another candidate of the same SMD to another candidate of the same party list. In fact, the JCP won only two SMD seats in 1996 and zero SMD seats in 2000 and 2003.<sup>7</sup>

Finally, seven parties made use of dual candidacy and ranked dual candidates equally. If dual candidates are ranked equally in their PR lists, it creates a possibility for an SMD vote to affect which of them fill the PR seats allocated to their party list when they lose in their SMDs. This increases the value of casting SMD votes for the dual candidates. The net effect of this positive effect of equal ranking and the above negative effect of dual candidacy is determined by voters' preferences regarding candidates, probabilities of a vote affecting the electoral outcome (i.e., pivot probabilities), and winning probabilities of each candidate, given the order of candidates in each party list and other voters' behaviors. Hence, the use of dual candidacy accompanied by equal ranking, as well as no use of dual candidacy, can attract SMD votes to the party's dual candidates.<sup>8</sup>

Mixed electoral systems are recently attracting researchers' attention and empirical examinations have been conducted.<sup>9</sup> However, there are only a few formal analyses. Wada constructs a game theoretic model to consider whether Duverger's law holds in an SMD under a mixed system.<sup>10</sup> He shows that it does not necessarily hold as a result of parties' strategic candidacy. Bawn and Thies construct a decision theoretic model to analyze candidates' incentives to allocate their efforts between serving unorganized

<sup>7</sup> We may also explain the JCP's strategy in the opposite direction: since the JCP rationally expected to win few SMD seats, it ranked dual candidates individually. Of course, there could be some other reasons for the use of individual ranking: for example, the JCP might want to choose by itself which candidates fill its PR seats instead of letting SMD votes determine it, and it might also want to avoid intraparty competition among dual candidates seeking higher post-election ranks during election campaigns. We can only say that our result does not contradict the actual observation.

<sup>8</sup> Ranking dual candidates equally is also useful for parties in encouraging their candidates to campaign harder in SMDs and in saving the cost incurred in the negotiation over higher ranks among factions or candidates (McKean and Scheiner, 'Japan's New Electoral System', pp. 461–2).

<sup>9</sup> For a conceptual and empirical survey of mixed systems, see Massicotte and Blais, 'Mixed Electoral Systems'.

<sup>10</sup> Junichiro Wada, *The Japanese Election System: Three Analytical Perspectives* (London and New York, NY: Routledge, 1996).

**Table 2.** *The structure of the model*

	L	R
SMD 1	1	5
SMD 2	2	6
PR block (2 seats)	(1, 2,) 3, 4	(5, 6,) 7, 8

voters and serving organized interest groups under PR, plurality, and mixed systems.<sup>11</sup> They show that candidates running in PR blocks under a mixed system may serve interest groups more easily than candidates under a pure PR system. Finally, Mudambi and Navarra construct an equilibrium model (which is also regarded as a one-shot game model) to analyze incentives for parties in a coalition to allocate their resources between SMD (coalition-focused) and PR (party-focused) campaigns.<sup>12</sup> They show that parties allocate more resources to SMD campaigns as the inter-coalition race is more serious in the SMD and as one party is more dominant than others in the coalition. Their model is supported by empirical tests using Italian data. In contrast, our focus is on voters' decisions regarding how they cast their SMD and PR votes according to the order of candidates chosen by parties in their PR lists.

This paper is organized as follows. Section 2 constructs a model. Section 3 analyzes how the order of candidates affects voting decisions. Three propositions are obtained. Section 4 applies the model to the 2003 Japanese House of Representatives election. Section 5 concludes.

## 2. The model

### *Preferences*

We consider the simplest case: we assume the smallest numbers of electoral districts, parties, and candidates necessary for our analysis. A more complicated situation is examined in Section 4. The basic structure of the model is summarized in Table 2. There is a two-member PR block, consisting of two SMDs. There are two parties, left and right. The left party consists of candidates 1, 2, 3, and 4, while the right party consists of candidates 5, 6, 7, and 8. Candidates 1 and 5 compete in SMD 1, and candidates 2 and 6 compete in SMD 2. Candidates 3, 4, 7, and 8 are pure PR candidates, that is, they run in the PR block only. Candidates 1, 2, 5, and 6 can also run in the PR block as dual candidates.

<sup>11</sup> Kathleen Bawn and Michael F. Thies, 'A Comparative Theory of Electoral Incentives: Representing the Unorganized Under PR, Plurality and Mixed-Member Electoral Systems', *Journal of Theoretical Politics*, 15(2003): 5–32.

<sup>12</sup> Ram Mudambi and Pietro Navarra, 'Electoral Strategies in Mixed Systems of Representation', *European Journal of Political Economy*, 20(2004): 227–53.

Ideology (i.e., left or right) and locality (i.e., SMD 1 or 2) generate four types of voters, that is, leftist voters in SMD 1, leftist voters in SMD 2, rightist voters in SMD 1, and rightist voters in SMD 2. Let  $u_i$  ( $i = 1, \dots, 8$ ) denote the utility each voter receives from candidate  $i$ 's winning in either an SMD or the PR block, where we omit the index of voters. Utility is additive so that the total utility she receives from each set of four winning candidates (i.e., two SMD winners and two PR winners) is measured as the sum of utilities she receives from each candidate.<sup>13</sup> Her objective is to maximize her total utility with respect to her SMD and PR votes. We assume that leftist voters in SMD 1 (2, respectively) prefer candidate 1 (2) most, who is the left-party candidate running in SMD 1 (2). Similarly, rightist voters in SMD 1 (2) prefer candidate 5 (6) most. In other words,  $u_i > u_j$  for  $j \neq i$  where  $i = 1, 2, 5, 6$  for leftist voters in SMD 1, leftist voters in SMD 2, rightist voters in SMD 1, and rightist voters in SMD 2, respectively. We also assume that leftist (rightist, respectively) voters prefer left-party (right-party) pure PR candidates to right-party (left-party) pure PR candidates. In other words,  $\min\{u_3, u_4\} > \max\{u_7, u_8\}$  for leftist voters and  $\max\{u_3, u_4\} < \min\{u_7, u_8\}$  for rightist voters. Note that inequality  $\min\{u_1, u_2, u_3, u_4\} > \max\{u_5, u_6, u_7, u_8\}$  ( $\max\{u_1, u_2, u_3, u_4\} < \min\{u_5, u_6, u_7, u_8\}$ , respectively) does not necessarily hold for leftist (rightist) voters because locality also affects their preferences. As we see later, locality plays an important role under dual candidacy.

### *The electoral system*

The Japanese mixed system is described as follows if applied to the above setup. The left (right, respectively) party decides whether to run candidates 1 and/or 2 (5 and/or 6) also in the PR block and how to rank its candidates in its PR list. The choice set for the left (right) party consists of the permutations of 1, 2, 3, and 4 (5, 6, 7, and 8), where 1 and 2 (5 and 6) can be ranked equally. Note that if candidates 1 and/or 2 (5 and/or 6) are dual candidates, they must be ranked higher than at least one of candidates 3 and 4 (7 and 8), because otherwise they never win in the PR block.

Each voter has one SMD vote and one PR vote. Every voter casts her PR vote for either the left-party list or the right-party list, or she abstains. If she lives in SMD 1 (2, respectively), she casts her SMD vote for either candidate 1 or 5 (2 or 6), or she abstains.

In each SMD, the candidate who obtains more SMD votes than the other wins a seat. If the winner is a dual candidate, his name is removed from his party list. In the PR block, PR votes are converted into the allocation of PR seats between the two parties by the d'Hondt method: a party wins no seats if its share of valid PR votes is less than 1/3, one seat if it is between 1/3 and 2/3, and two seats if it is more than 2/3. In each party

<sup>13</sup> The additiveness of utility makes the models of multimember electoral districts tractable. Building a game theoretic model with this assumption, Gary W. Cox, 'Strategic Voting Equilibria Under the Single Non-Transferable Vote', *American Political Science Review*, 88(1994): 608–21 analyzes single nontransferable voting, and Elisabeth R. Gerber, Rebecca B. Morton, and Thomas A. Rietz, 'Minority Representation in Multimember Districts', *American Political Science Review*, 92(1998): 127–44 analyze straight voting and cumulative voting.

list, candidates fill the seats from the top of the post-election ranking. Suppose that a party has two dual candidates, both of them lose in their SMDs, and only one PR seat is available between them. Then, for each of them, we calculate the ratio of his SMD votes to the winner's SMD votes in his SMD. The candidate with a higher ratio is given the higher post-election rank between them and wins the PR seat. Any tie is broken randomly.

### *Voting decisions*

Each voter perceives subjective probabilities of each SMD candidate winning an SMD seat ( $p_i$ ,  $i = 1, 2, 5, 6$ ) and the left party winning zero, one and two PR seats ( $p_R$ ,  $p_{LR}$  and  $p_L$  respectively). Note that  $p_1 + p_5 = p_2 + p_6 = p_R + p_{LR} + p_L = 1$ . She cares about only how her votes affect the electoral outcome. Her SMD vote for candidate  $j$  changes  $p_i$  by  $\partial p_i / \partial n_j$ , where  $n_j$  is the number of SMD votes candidate  $j$  obtains except her vote. Because the two SMDs are separated from each other, we must have  $\partial p_i / \partial n_j = 0$  if  $i$  and  $j$  run in different SMDs. Voting for candidate  $j$  never decreases  $p_i$  if  $j = i$ , and voting for  $j$  never increases  $p_i$  if  $j$  is another candidate of  $i$ 's SMD. Hence, we assume that each voter perceives  $\partial p_i / \partial n_j > 0$  if  $j = i$ , and  $\partial p_i / \partial n_j < 0$  if  $j$  is another candidate of  $i$ 's SMD. That is, we eliminate the trivial case that voters perceive  $\partial p_i / \partial n_j = 0$  for all  $i$  and  $j$  so that any voting behavior is optimal. In fact, if there is some uncertainty about other voters' behaviors, each SMD vote must change  $p_i$  in each SMD, although the change may be very small.

Suppose that, for example, candidates 1 and 2 are dual candidates ranked equally in their PR list, both of them lose in their SMDs, and only one PR seat is available between them. Conditional on this event happening, each voter perceives that, except her SMD vote, candidate  $i$  ( $i = 1, 2$ ) wins the PR seat with probability  $q_i$  ( $q_1 + q_2 = 1$ ). If she casts her SMD vote for candidate  $j$ ,  $q_i$  changes by  $\partial q_i / \partial n_j$ . We eliminate the trivial case again and assume that she perceives  $\partial q_i / \partial n_j > 0$  if  $(i, j) = (1, 1), (2, 5), (2, 2), (1, 6)$  and  $\partial q_i / \partial n_j < 0$  if  $(i, j) = (1, 5), (2, 1), (2, 6), (1, 2)$ . For example, each SMD vote for candidate 5 decreases 1's ratio and decreases the probability of candidate 1 winning a PR seat against 2 (i.e.,  $\partial q_1 / \partial n_5 < 0$ ), which must be accompanied by a higher probability of 2 winning a PR seat against 1 (i.e.,  $\partial q_2 / \partial n_5 = -\partial q_1 / \partial n_5 > 0$ ).

Similarly, her PR vote for party  $j$  ( $j = L, R$ ) changes  $p_i$  ( $i = L, LR, R$ ) by  $\partial p_i / \partial n_j$ . We assume that each voter perceives  $\partial p_i / \partial n_j > 0$  if  $j = i$ , and  $\partial p_i / \partial n_j < 0$  if  $i$  is the opposite party to  $j$ . In the case of  $i = LR$ , the sign of  $\partial p_i / \partial n_j$  can be either positive or negative.

In this way, given the order of candidates in each party list, each voter perceives subjective probabilities of each event happening and calculates the expected utility except her votes. Then she partially differentiates the expected utility with respect to the number of SMD votes each candidate of her SMD obtains and with respect to the number of PR votes each party obtains. Finally, she casts her SMD vote for a candidate of her SMD and her PR vote for a party list if voting for them results in the largest positive change of her expected utility.

### 3. Analysis

We consider how voters' decisions are affected by the order of candidates in each party list. By symmetry, we focus on the decision made by a leftist voter in SMD 1, who prefers candidate 1 most and prefers left-party pure PR candidates to right-party pure PR candidates. Hereafter, when we write 'voter', it means a leftist voter in SMD 1 unless specified differently. The decisions of other types of voters can be dealt with in the same way.

#### *No use of dual candidacy*

First let us examine how a voter votes if parties do not use dual candidacy. This case might be regarded as what happens under the electoral system in which SMDs and PR blocks coexist, but they are completely separated so that dual candidacy is not allowed.

Suppose that the left and right parties choose  $3 > 4$  and  $7 > 8$  respectively, where  $x > y$  means that candidate  $x$  is ranked higher than  $y$ . Note that this pair of candidate ordering implies that candidates 1, 2, 5, and 6 are pure SMD candidates. The representative voter's expected utility generated by other voters' behaviors is written as

$$p_1 u_1 + p_5 u_5 + p_2 u_2 + p_6 u_6 + p_L(u_3 + u_4) + p_{LR}(u_3 + u_7) + p_R(u_7 + u_8).$$

The first two terms come from SMD 1's result, the next two terms come from SMD 2's result, and the last three terms come from the PR block's result.<sup>14</sup> If the voter casts her SMD vote for candidate  $j$  ( $j = 1, 5$ ), the expected utility changes by

$$\frac{\partial p_1}{\partial n_j}(u_1 - u_5). \tag{1}$$

Since  $\partial p_1 / \partial n_1 > 0$ ,  $\partial p_1 / \partial n_5 < 0$ , and  $u_1 > u_5$ , this value is strictly positive for  $j = 1$ , while strictly negative for  $j = 5$ . Hence, the voter votes for candidate 1.

Similarly, her PR vote for party  $j$  ( $j = L, R$ ) changes her expected utility by

$$\frac{\partial p_L}{\partial n_j}(u_4 - u_7) + \frac{\partial p_R}{\partial n_j}(u_8 - u_3). \tag{2}$$

Since  $\partial p_i / \partial n_j > 0$  for  $i = j$ ,  $\partial p_i / \partial n_j < 0$  for  $i \neq j$ , and  $\min\{u_3, u_4\} > \max\{u_7, u_8\}$ , this value is strictly positive for  $j = L$ , while strictly negative for  $j = R$ . Hence, the voter votes for the left party. As we can see in equations (1) and (2), voting decisions are completely separated between the SMD and the PR block. That is, how to cast her SMD vote depends on her relative preferences between the two SMD candidates only, while

<sup>14</sup> Another way of expressing the representative voter's expected utility is to group four winning candidates together and multiply their winning probabilities. Under no use of dual candidacy, the equation is written as  $\sum_{i=1,5} \sum_{j=2,6} [p_i p_j p_L(u_i + u_j + u_3 + u_4) + p_i p_j p_{LR}(u_i + u_j + u_3 + u_7) + p_i p_j p_R(u_i + u_j + u_7 + u_8)]$ .

**Table 3.** *Post-election PR lists under 1 > 2 > 3 > 4 and 7 > 8*

	2	6
1	3 > 4 7 > 8	2 > 3 > 4 7 > 8
5	1 > 3 > 4 7 > 8	1 > 2 > 3 > 4 7 > 8

*Notes:* The left party chooses 1 > 2 > 3 > 4 ex ante, while the right party chooses 7 > 8. Each cell contains the order of candidates in two parties' post-election PR lists when the SMD candidates in the row and column win in SMDs 1 and 2 respectively.

how to cast her PR vote depends on those between the left-party pure PR candidates and the right-party pure PR candidates only. We obtain:

**Proposition 1:** *Suppose that no party uses dual candidacy. Then each voter votes sincerely: she casts her SMD vote for the candidate she prefers most, and she casts her PR vote for the party she supports.*

*Individually ranked dual candidates*

Next let us consider whether dual candidacy helps parties attract more votes when it is accompanied by individual ranking.

Suppose that now the left party uses dual candidacy selecting 1 > 2 > 3 > 4, while the right party keeps not using dual candidacy staying with 7 > 8. In this case, the post-election PR list of the left party changes as in Table 3 according to whether candidates 1 and 2 win SMD seats, and each voter needs to take it into account when she decides how to vote. In the table, the row and column represent SMD winners in SMDs 1 and 2 respectively, and each cell contains the post-election PR lists of the two parties according to SMD winners. For example, if candidates 1 and 6 win SMD seats, candidate 1 is removed from the left-party PR list, which leads to 2 > 3 > 4 ex post, while candidate 6's win does not affect the right-party PR list because he is a pure SMD candidate. Referring to this table, we obtain the representative voter's expected utility as

$$\begin{aligned}
 & p_1 u_1 + p_5 u_5 + p_2 u_2 + p_6 u_6 + p_1 \{ p_L [ p_2 (u_3 + u_4) + p_6 (u_2 + u_3) ] \\
 & + p_{LR} [ p_2 (u_3 + u_7) + p_6 (u_2 + u_7) ] + p_R (u_7 + u_8) \} + p_5 \{ p_L [ p_2 (u_1 + u_3) \\
 & + p_6 (u_1 + u_2) ] + p_{LR} (u_1 + u_7) + p_R (u_7 + u_8) \}.
 \end{aligned}$$

If the voter casts her SMD vote for candidate  $j$  ( $j = 1, 5$ ), the expected utility changes by

$$\begin{aligned}
 & \frac{\partial p_1}{\partial n_j} (u_1 - u_5) + \frac{\partial p_1}{\partial n_j} \{ p_L [ p_2 (u_4 - u_1) + p_6 (u_3 - u_1) ] + p_{LR} [ p_2 (u_3 - u_1) \\
 & + p_6 (u_2 - u_1) ] \}
 \end{aligned} \tag{3}$$

The first term expresses the utility increment caused by the change of the SMD outcome, which is the same as the case of no use of dual candidacy (equation (1)). In addition to this *SMD effect*, dual candidacy enables SMD votes to affect the PR outcome, which is expressed by the second term and which we call *PR effect*. For example, a higher probability of candidate 1 winning in SMD 1 implies a higher probability of his name being removed from the left-party PR list (i.e.,  $\partial p_1 / \partial n_1 > 0$ ), which results in other left-party candidates becoming more likely to win PR seats instead of candidate 1. Since the voter prefers candidate 1 to any other candidate (i.e.,  $u_1 > u_j$  for  $j \neq 1$ ), the change of her expected utility caused by this PR outcome is strictly negative. Unless the value of  $\partial p_1 / \partial n_1$  changes dramatically relative to the case of no use of dual candidacy, therefore, the utility increment obtained by voting for candidate 1 becomes smaller than the one obtained under no use of dual candidacy. Moreover, it can be negative when the PR effect is greater than the SMD effect. This is an instrumental-voting interpretation of the intuition that voters feel little need to cast their SMD votes for dual candidates who are expected to win PR seats.

Voting for candidate 5 generates the exactly opposite effect to voting for candidate 1, and the PR effect is strictly positive (i.e.,  $\partial p_1 / \partial n_5 < 0$ ). Hence, if the PR effect is greater than the SMD effect, she votes for candidate 5, instead of candidate 1 whom she prefers most, so that 5 wins the SMD seat, while 1 wins a PR seat.

A necessary condition for the PR effect to exceed the SMD effect is  $u_5 > \min\{u_2, u_3, u_4\}$ . That is, locality must be sufficiently important relative to ideology if voters cast their SMD votes for the candidate of the opposite party. Japan had a tradition of the single nontransferable vote, under which candidates tended to compete with each other by providing voters with personal services rather than by insisting on their policy platforms. In addition, people in provincial areas recognize strongly that they are sending to the Diet their local representatives who bring them economic benefits.<sup>15</sup> Therefore, the necessary condition seems to hold for not a small number of voters in Japan.

If the voter casts her PR vote for party  $j$  ( $j = L, R$ ), her utility increment is written as

$$p_1 \left\{ \frac{\partial p_L}{\partial n_j} [p_2(u_4 - u_7) + p_6(u_3 - u_7)] + \frac{\partial p_R}{\partial n_j} [p_2(u_8 - u_3) + p_6(u_8 - u_2)] \right\} + p_5 \left\{ \frac{\partial p_L}{\partial n_j} [p_2(u_3 - u_7) + p_6(u_2 - u_7)] + \frac{\partial p_R}{\partial n_j} (u_8 - u_1) \right\}.$$

<sup>15</sup> Akarui Senkyo Suishin Kyokai [The Association for Promoting Fair Elections], *Senkyo ni Kansuru Zenkoku Ishiki Chosa (Dai 2 Kai): Genshiryo* [The Attitude Survey on Elections (2nd): Primary Data] (1991) reports that 20.5 per cent, 27.6 per cent, 41.9 per cent, and 39.0 per cent of respondents in the largest 12 cities, cities of more than 100,000 people, cities of less than 100,000 people, and towns and villages respectively answered whether to make efforts for the local benefits to the question about what is important in selecting for whom to vote.

Hence, the voter votes for the left party only if

$$\begin{aligned} & \left( \frac{\partial p_L}{\partial n_L} - \frac{\partial p_L}{\partial n_R} \right) \{p_1[p_2(u_4 - u_7) + p_6(u_3 - u_7)] + p_5[p_2(u_3 - u_7) + p_6(u_2 - u_7)]\} \\ & + \left( \frac{\partial p_R}{\partial n_R} - \frac{\partial p_R}{\partial n_L} \right) \{p_1[p_2(u_3 - u_8) + p_6(u_2 - u_8)] + p_5p(u_1 - u_8)\} \geq 0. \end{aligned}$$

This condition implies that how to cast a PR vote is determined by the relative relationship between the weighted sum of  $u_1$ ,  $u_2$ ,  $u_3$ , and  $u_4$  and that of  $u_7$  and  $u_8$ . Hence, unless the voter dislikes candidate 2 extremely (whose policy platform is the same as the voter's, but who runs in the other SMD), she votes for the left party.

In the above analyses of SMD and PR votes under individual ranking, we can see the possibility of split ticketing: the leftist voter casts her SMD vote for candidate 5, while she casts her PR vote for the left party. One explanation of split ticketing is that, when more than two candidates are running in the SMD, voters cast their SMD votes for one of the top two promising candidates to avoid wasting their votes, while they do not need to fear the waste in the PR tier.<sup>16</sup> Our model suggests that split ticketing can occur even with two SMD candidates if dual candidacy is allowed. Other things being equal, therefore, split ticketing is expected to occur more frequently under mixed systems which allow dual candidacy than ones which do not allow it. However, we must notice that our split ticketing requires the condition  $u_5 > \min\{u_2, u_3, u_4\}$  so that purely ideological voters, who do not care about locality, cannot split their votes.

The above logic holds even when the left party ranks dual candidates individually in other ways. Therefore, we obtain:

**Proposition 2:** *Suppose that the left party uses dual candidacy and ranks dual candidates individually, while the right party does not use dual candidacy:*

- (i) *Unless subjective probabilities of each candidate winning change dramatically, the utility increment obtained by casting an SMD vote for a left-party (right-party, respectively) candidate decreases (increases) relative to the case of no use of dual candidacy. Moreover, the utility increment can be negative (positive), and so leftist voters can cast their SMD votes for right-party candidates.*
- (ii) *How to cast PR votes is determined by the relative relationship between the weighted sum of utilities obtained by left-party candidates and that of right-party pure PR candidates. The weights are determined by voters' subjective probabilities of each candidate winning.*

<sup>16</sup> For example, see Gary W. Cox, *Making Votes Count* (New York, NY: Cambridge University Press, 1997), pp. 82–3; Steven R. Reed, 'Strategic Voting in the 1996 Japanese General Election', *Comparative Political Studies*, 32(1999): 257–70; Jeffrey A. Karp, Jack Vowles, Susan A. Banducci, and Todd Donovan, 'Strategic Voting, Party Activity, and Candidate Effects: Testing Explanations for Split Voting in New Zealand's New Mixed System', *Electoral Studies*, 21(2002): 1–22 and Thomas Gschwend, Ron Johnston, and Charles Pattie 'Split-Ticket Patterns in Mixed-Member Proportional Election Systems: Estimates and Analyses of Their Spatial Variation at the German Federal Election, 1998', *British Journal of Political Science*, 33(2003): 109–27.

*Equally ranked dual candidates*

Now we consider the effect of ranking dual candidates equally on voting decisions. As described in Table 1, this case was observed most frequently in the previous three elections held under the mixed system in Japan.

Suppose that the left party ranks dual candidates equally, selecting  $1 = 2 > 3 > 4$ , while the right party keeps not using dual candidacy staying with  $7 > 8$ , where  $x = y$  means that candidates  $x$  and  $y$  are ranked equally. Then the representative voter’s expected utility is written as

$$\begin{aligned}
 & p_1 u_1 + p_5 u_5 + p_2 u_2 + p_6 u_6 + p_1 \{ p_L [ p_2 (u_3 + u_4) + p_6 (u_2 + u_3) ] \\
 & + p_{LR} [ p_2 (u_3 + u_7) + p_6 (u_2 + u_7) ] + p_R (u_7 + u_8) \} + p_5 \{ p_L [ p_2 (u_1 + u_3) \\
 & + p_6 (u_1 + u_2) ] + p_{LR} [ p_2 (u_1 + u_7) + p_6 (q_1 u_1 + q_2 u_2 + u_7) ] + p_R (u_7 + u_8) \}.
 \end{aligned}$$

If the voter casts her SMD vote for candidate  $j$  ( $j = 1, 5$ ), the expected utility changes by

$$\begin{aligned}
 & \frac{\partial p_1}{\partial n_j} (u_1 - u_5) + \frac{\partial p_1}{\partial n_j} \{ p_L [ p_2 (u_4 - u_1) + p_6 (u_3 - u_1) ] + p_{LR} [ p_2 (u_3 - u_1) \\
 & + p_6 (u_2 - q_1 u_1 - q_2 u_2) ] \} + \frac{\partial q_1}{\partial n_j} p_5 p_6 p_{LR} (u_1 - u_2). \tag{4}
 \end{aligned}$$

The first two terms are the SMD effect and the PR effect as we saw in the case of individual ranking (equation (3)). Note that unless the subjective probabilities change dramatically, the absolute value of the second term (i.e., the utility gain or loss caused by the PR effect) is smaller in equation (4) than in equation (3) because candidate 1 is less likely to win a PR seat under  $1 = 2 > 3 > 4$  than under  $1 > 2 > 3 > 4$  (i.e.,  $q_1 u_1 + q_2 u_2 < u_1$ ). This is accompanied by a greater PR effect for voters in SMD 2 who cast their SMD votes for candidates 2 and 6.

In addition, equal ranking creates the third term, which we call *ER effect*: when both candidates 1 and 2 lose in their SMDs (with probability  $p_5 p_6$ ) and when only one PR seat is available between them (with probability  $p_{LR}$ ), an SMD vote for candidate 1 (5, respectively) increases (decreases) the probability of 1 winning a PR seat against 2 by  $\partial q_1 / \partial n_1$  ( $\partial q_1 / \partial n_5$ ), which gives a utility gain (loss)  $u_1 - u_2$ . That is, the ER effect is strictly positive (negative) if the voter casts her SMD vote for candidate 1 (5).

Unless the subjective probabilities change dramatically, the utility increment obtained by voting for candidate 1 under equal ranking (equation (4)) is greater than the one obtained under individual ranking (equation (3)). Moreover, the utility increment can be also greater than the one obtained under no use of dual candidacy (equation (1)) if the ER effect is greater than the PR effect. Hence, even when the SMD effect is weak, the voter votes for candidate 1 if the ER effect is sufficiently large. Note that the ability of equal ranking to attract more SMD votes is limited because the third term becomes smaller as candidates 1 and 2 become more likely to win in their SMDs (i.e., as probabilities  $p_5$  and  $p_6$  become smaller).

The utility increment obtained by casting a PR vote for each party is similar to the one obtained under individual ranking: the representative voter votes for the left party if the weighted sum of  $u_1$ ,  $u_2$ ,  $u_3$ , and  $u_4$  is greater than that of  $u_7$  and  $u_8$ . The only difference is that, when both candidates 1 and 2 lose in their SMDs and when only one PR seat is available between them, candidate 1 is less likely to win the PR seat under  $1 = 2 > 3 > 4$  (with probability  $q_1$ ) than under  $1 > 2 > 3 > 4$  (with certainty). This fact creates the following two effects under  $1 = 2 > 3 > 4$  relative to  $1 > 2 > 3 > 4$  if the voter votes for the left party: (i) the utility increment obtained by increasing  $p_L$  becomes greater; (ii) the utility increment obtained by decreasing  $p_R$  becomes smaller. Other subjective probabilities being equal, their net effect is determined by to what extent votes for the left and right parties change  $p_L$  and  $p_R$ , that is, the relative relationship between  $\partial p_L / \partial n_L + \partial p_R / \partial n_L$  and  $\partial p_L / \partial n_R + \partial p_R / \partial n_R$ . We obtain:

**Proposition 3:** *Suppose that the left party uses dual candidacy and ranks dual candidates equally, while the right party does not use dual candidacy. Unless subjective probabilities of each candidate winning change dramatically,*

- (i) *the utility increment obtained by casting an SMD vote for a left-party (right-party, respectively) candidate is greater (smaller) than the one obtained under individual ranking. Moreover, it can be greater (smaller) than the one obtained under no use of dual candidacy if the ER effect is greater than the PR effect;*
- (ii) *how to cast a PR vote depends on the relative relationship between the weighted sum of  $u_1$ ,  $u_2$ ,  $u_3$ , and  $u_4$  and that of  $u_7$  and  $u_8$ . Whether the representative voter is more or less likely to vote for the left party than under individual ranking depends on to what extent votes for the left and right parties respectively change the probabilities of each party winning PR seats.*

Propositions 2 and 3 provide one of the reasons why no parties except the JCP use individual ranking. For the purpose of attracting SMD votes, individual ranking is inferior to equal ranking and no use of dual candidacy.

#### *Dual candidates ranked in the middle of the list*

The PR effect is increasing in the probability of dual candidates winning PR seats. Hence, other probabilities being equal, ranking dual candidates in the middle of the PR list, instead of at the top of the list, might be helpful to parties that use dual candidacy in attracting SMD votes.

Suppose that now the left party chooses  $3 > 1 = 2 > 4$ , while the right party keeps not using dual candidacy (i.e.,  $7 > 8$ ). Then the utility increment obtained by casting an SMD vote for candidate  $j$  ( $j = 1, 5$ ) is written as

$$\begin{aligned} \frac{\partial p_1}{\partial n_j} (u_1 - u_5) + \frac{\partial p_1}{\partial n_j} p_L [p_2(u_4 - u_1) + p_6(u_2 - q_1 u_1 - q_2 u_2)] \\ + \frac{\partial q_1}{\partial n_j} p_5 p_6 p_L (u_1 - u_2). \end{aligned}$$

Now whether candidates 1 and 2 win SMD seats has an influence on the PR outcome only when the left party wins two PR seats (with probability  $p_L$ ). Hence, unless subjective probabilities change dramatically, the PR effect is smaller than the above two cases (equations (3) and (4)). At the same time, however, the ER effect here also depends on  $p_L$  instead of  $p_{LR}$ . So if  $p_L$  is small, not only the PR effect but also the ER effect becomes small.

Parties which try to attract SMD votes through the ER effect must rank dual candidates at the top of the list if  $p_{LR}$  is large, but they must rank dual candidates in the middle of the list if  $p_L$  is large. In the real elections, we do not know the *ex-ante* values of  $p_{LR}$ ,  $p_L$  and others accurately,<sup>17</sup> but the previous three elections in Japan observed that SMD votes in fact affected which dual candidate filled the final PR seat in 74 of the 96 PR lists (77.1 per cent) that ranked at least two dual candidates equally and won at least one PR seat. That is, in the *ex-post* sense, parties ranked dual candidates equally in their PR lists where the ER effect became sufficiently large.

*Mutual use of equal ranking*

So far we have considered the cases in which one party does not use dual candidacy. Now suppose that the right party, as well as the left party, makes use of dual candidacy and ranks dual candidates equally. Then the PR and ER effects observed in the previous cases work also in the opposite direction. That is, if the voter prefers candidate 5 to the other right-party candidates (i.e.,  $u_5 > \max\{u_6, u_7, u_8\}$ ), it adds a positive PR effect and a negative ER effect to the utility increment obtained by casting an SMD vote for candidate 1. For example, under  $1 = 2 > 3 > 4$  and  $5 = 6 > 7 > 8$ , the utility increment obtained by casting an SMD vote for candidate  $j$  ( $j = 1, 5$ ) is written as

$$\begin{aligned} \frac{\partial p_1}{\partial n_j}(u_1 - u_5) + \frac{\partial p_1}{\partial n_j}\{p_L [p_2(u_4 - u_1) + p_6(u_3 - u_1)] + p_{LR}[p_2(u_3 - u_1) \\ + p_6(u_2 - q_1 u_1 - q_2 u_2)]\} + \frac{\partial q_1}{\partial n_j} p_5 p_6 p_{LR}(u_1 - u_2) \\ + \frac{\partial p_1}{\partial n_j}\{p_{LR}[p_2(q_5 u_5 + q_6 u_6 - u_6) + p_6(u_5 - u_7)] + p_R [p_2(u_5 - u_7) \\ + p_6(u_5 - u_8)]\} + \frac{\partial q_5}{\partial n_j} p_1 p_2 p_{LR}(u_5 - u_6). \end{aligned} \tag{5}$$

The fourth term is the PR effect generated by the right party’s use of dual candidacy, and the final term is the ER effect generated by the right party’s use of equal

<sup>17</sup> For the 1996 Japanese House of Representatives election, Steven R. Reed, ‘Strategic Voting’, estimates *ex-ante* winning probabilities of candidates, which measure subjective probabilities perceived by voters, using their votes in the previous election, votes for their parties and candidates allied to them in the previous election, their campaign expenditures, and those of their main opponents. Karp *et al.* also employ the similar procedure for New Zealand’s 1996 election.

ranking. The net effect depends on the subjective probabilities and the utility parameters.

In the decision regarding a PR vote, the only difference from the previous cases is that now  $u_5$  and  $u_6$  are also included in the weighted sum of utilities obtained from right-party PR winners.

#### 4. Application

Let us apply our model to the 2003 election. We focus on the Hokkaido block which had the smallest number of serious parties and candidates.

This block is assigned eight PR seats and contains 12 SMDs. Five parties, LDP, DPJ, Komeito, JCP, and SDP, submitted PR lists. The LDP and the JCP ran one candidate in every SMD. The DPJ also ran one candidate in each SMD except SMD 11 where the DPJ recommended the SDP's candidate. All the SMD candidates of LDP and DPJ are included in their PR lists as equally ranked dual candidates, while the JCP had both pure SMD candidates and individually ranked dual candidates. The SDP had one dual candidate in SMD 11 and one pure PR candidate. Komeito had two pure PR candidates only.

The formula of expected utility for each type of voter can be written, but it is complicated if the voter places positive probabilities on all the theoretically possible electoral outcomes. For simplicity, therefore, let us consider the case of rational expectation. That is, we regard the *ex-post* probability of each event realized in the election as the subjective probability voters perceived *ex ante* for that event in their voting decisions.

In the Hokkaido block of the 2003 election, the JCP and the SDP got no seats in either the PR block or SMDs. So we can regard voters to ignore them rationally. We assume that non-Komeito voters ignore Komeito because it is a religious party and because it got one PR seat only. Independent pure SMD candidates ran in three SMDs, but they finished in third place or lower. So voters also ignore them. The serious actors therefore are only the DPJ and LDP candidates.

Table 4 describes the PR lists of DPJ and LDP in the 2003 Hokkaido block with the outcomes. Let us consider the decision made by a voter in SMD 10 where Yamashita Takafumi from the LDP and Kodaira Tadamasu from the DPJ were serious dual candidates. According to the rational expectation, the actual winner's *ex-ante* winning probability is perceived to be one in each SMD, and the probability of the LDP and the DPJ winning three and four PR seats respectively is also perceived to be one. Then, the voter's utility increment obtained by casting her SMD vote for Yamashita, which corresponds to equation (5), is written as

$$\begin{aligned} & \frac{\partial p_{Yamashita}}{\partial n_{Yamashita}}(u_{Yamashita} - u_{Kodaira}) + \frac{\partial p_{Yamashita}}{\partial n_{Yamashita}}(u_{Iwakura} - u_{Yamashita}) \\ & + \frac{\partial q_{Yamashita}}{\partial n_{Yamashita}}(u_{Yamashita} - u_{Iwakura}) + \frac{\partial p_{Yamashita}}{\partial n_{Yamashita}}(u_{Kodaira} - u_{Matsuki}). \end{aligned}$$

**Table 4.** *The PR lists of DPJ and LDP in the 2003 Hokkaido block with the outcomes*

Party		DPJ			LDP				
PR votes		1,153,471			876,653				
PR seats		4			3				
Rank	Name	SMD # if dual	Where to win	Ratio	Rank	Name	SMD # if dual	Where to win	Ratio
1	Mitsui Wakio	2	SMD	1.00	1	Kaneda Eiko	-	PR	-
1	Hachiro Yoshio	4	SMD	1.00	2	Machimura Nobutaka	5	SMD	1.00
3	Yokomichi Takahiro	1	SMD	1.00	2	Imadu Hiroshi	6	SMD	1.00
3	Arai Satoshi	3	SMD	1.00	2	Kitamura Naoto	7	SMD	1.00
3	Kaneta Seiichi	8	SMD	1.00	2	Nakagawa Shoichi	11	SMD	1.00
3	Hatoyama Yukio	9	SMD	1.00	2	Takebe Tsutomu	12	SMD	1.00
3	Kodaira Tadamasu	10	SMD	1.00	2	Ishizaki Gaku	3	PR	0.97
3	Sasaki Hidenori	6	PR	0.99	2	Yamashita Takafumi	10	PR	0.88
3	Kobayashi Chiyomi	5	PR	0.93	2	Iwakura Hirofumi	9	Lost	0.84
3	Nakano Hiroko	7	PR	0.85	2	Sato Shizuo	4	Lost	0.83
3	Matsuki Kenko	12	PR	0.70	2	Yoshikawa Takamori	2	Lost	0.77
12	Kimoto Yoshitaka	-	Lost	-	2	Sato Kenji	8	Lost	0.70
13	Hirota Mayumi	-	Lost	-	2	Mishina Takayuki	1	Lost	0.62
14	Nakamura Takeshi	-	Lost	-	14	Fujii Toshinori	-	Lost	-
15	Hayashi Kaduki	-	Lost	-	15	Yaegashi Noboru	-	Lost	-

Notes: 'Ratio' represents the ratio of the dual candidate's SMD votes to the winner's votes in his SMD.

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications, Self-Government Administration Bureau, Election Division, *Shugiin Giin Sosenkyo Saikosaibansho Saibankan Kokuminshinsa Kekka Shirabe* [Reports on the House of Representatives Election and the Popular Review of the Supreme Court Justices] (2003).

The first three terms (i.e., SMD, PR, and ER effects respectively) come from the LDP's use of dual candidacy with equal ranking. The final term expresses the PR effect created by the DPJ's use of dual candidacy. Under the vote distribution realized in the 2003 election (and usually in any large election), no votes are pivotal. Hence, the derivatives  $\frac{\partial p_{Yamashita}}{\partial n_{Yamashita}}$  and  $\frac{\partial q_{Yamashita}}{\partial n_{Yamashita}}$  are interpreted as the change of probabilities conditional on the event that the probabilities have actually changed.

The above equation is rewritten as

$$\frac{\partial p_{Yamashita}}{\partial n_{Yamashita}}(u_{Iwakura} - u_{Matsuki}) + \frac{\partial q_{Yamashita}}{\partial n_{Yamashita}}(u_{Yamashita} - u_{Iwakura}).$$

This implies that if voters expect the electoral outcomes rationally, or in the *ex-post* sense, SMD-10 voters made voting decisions between Iwakura Hirofumi (LDP candidate

in SMD 9) and Matsuki Kenko (DPJ candidate in SMD 12) (expressed by the first term) and between Yamashita and Iwakura (expressed by the second term). That is, a vote for Yamashita could have affected the electoral outcome in the following two ways. First, it could have changed the SMD-10 winner from Kodaira to Yamashita. If this happened, Iwakura, who was the LDP loser with the largest ratio of SMD votes to the winner's votes, could have won the final PR seat allocated to the LDP (see Table 4). At the same time, Kodaira would have won a PR seat replacing Matsuki who has got the final PR seat allocated to the DPJ in the actual outcome. Hence, Iwakura joins the set of winning candidates, while Matsuki leaves. Second, it could have changed a PR winner from Iwakura to Yamashita by increasing Yamashita's ratio when both of them lost in their SMDs. Note that Yamashita's SMD rival Kodaira disappears from the voter's decision making because he would have won any way: he won the SMD seat actually, and he would have won a PR seat even though he lost in SMD 10. In this way, dual candidacy differentiates actual voting decisions from what they looked like before the election.

### 5. Conclusion

We have constructed a decision theoretic model of a representative voter who tries to maximize her expected utility obtained from the set of winning candidates with respect to her votes in the Japanese mixed electoral system. The model shows that if an SMD candidate also runs in the PR block as a dual candidate, the voter's utility increment obtained by casting her SMD vote for him becomes smaller, and moreover she can vote away from him, which creates a possibility of split ticketing. However, if he is ranked equally in his party list with some other dual candidates, it creates a possibility of SMD votes helping him win a PR seat against other equally ranked dual candidates. This additional effect makes the utility increment greater and can attract more SMD votes although its ability is limited.

While our focus is on voters' decisions, candidates' decisions on the allocation of their election campaign efforts should be also affected by the order of candidates in each party list. Bawn and Thies analyze how a candidate allocates his efforts *ex ante* seeking a higher rank in the list under closed-list PR and mixed systems.<sup>18</sup> On the other hand, our framework can apply to candidates' *ex-post* incentives to campaign after their ranking in the list is determined.

<sup>18</sup> Bawn and Thies, 'A Comparative Theory of Electoral Incentives'.