



# Incumbency as a source of spillover effects in mixed electoral systems: Evidence from a regression-discontinuity design<sup>☆</sup>

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## Abstract

In this paper we demonstrate empirically that incumbency is a source of spillover effects in Germany's mixed electoral system. Using a quasi-experimental research design that allows for causal inferences under a weaker set of assumptions than the regression models commonly used in the electoral systems literature, we find that incumbency causes a gain of 1.4–1.7 percentage points in PR vote shares. We also present simulations of Bundestag seat distributions to show that spillover effects caused by incumbency are sufficiently large to trigger significant shifts in parliamentary majorities.

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## 1. Introduction

Since the early 1990s, more than 30 countries have adopted mixed electoral systems that combine single-member districts (SMD) in one tier with proportional representation (PR) in a second tier. Once regarded as an oddity among the ideal types of proportional and Westminster-type (first-past-the-post) electoral systems, mixed systems have begun to attract serious scholarly attention (Gschwend, 2006; Massicotte and Blais, 1999; Shugart and Wattenberg, 2001; Ferrara

et al., 2005). Recent work investigates how such systems arise (Bawn, 1993; Shugart, 2001), affect incentives for strategic voting and entry (Bawn, 1999; Gschwend, 2006; Gschwend et al., 2003; Moser and Scheiner, 2005), influence the behavior of legislators (Lancaster and Patterson, 1990; Stratmann and Baur, 2002; Bawn and Thies, 2003), and shape national party systems (Shugart and Wattenberg, 2001; Ferrara et al., 2005).

One reason for the increased attention devoted to mixed electoral systems is the apparent opportunity they offer for “a controlled comparison of voting patterns under different electoral rules” (Moser and Scheiner, 2005: 260). Mixed electoral systems seemingly allow scholars to use the outcomes generated in the SMD and PR tiers to compare the effects of different types of electoral rules while at the same time holding constant confounding variables (Lancaster and Patterson, 1990; Bawn, 1993; Stratmann and Baur,

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2002; Moser, 1999; Moser and Scheiner, 2005). Yet as Ferrara et al. (2005) point out, this line of reasoning is only correct to the extent that the two tiers are truly independent from each other; the operation of each tier must be unaffected by the presence of a second tier characterized by a different set of electoral rules. Recent empirical evidence for the existence of “contamination” or spillover effects between the two tiers in mixed electoral systems (Herron and Nishikawa, 2001; Cox and Schoppa, 2002; Ferrara et al., 2005) makes this a doubtful assumption.

Our paper builds on this literature by identifying incumbency as another source of spillover. Prior research has examined spillover effects on PR vote shares caused by the mere presence of district candidates. But an extensive literature in American politics (and to a lesser extent comparative politics) has demonstrated that incumbency status has a significant impact on district vote shares. Relating this well-established fact to the spillover literature leads us to our main theoretical argument: if the mere presence of a district candidate has a positive effect on her party’s PR vote share in her district, it seems plausible to expect incumbency to have an even bigger effect. After all, winning a district gives a party and its incumbent legislator 4 years to convince voters of their merits, a much longer time span than the relatively brief election campaigns highlighted as the source of spillover by the existing literature. Thus, incumbent legislators should not only enjoy an electoral advantage in terms of SMD votes, but also be able to attract additional PR votes in their districts.

We test this prediction against data from German federal elections, using a quasi-experimental regression-discontinuity (RD) design to estimate the causal effects of incumbency.<sup>1</sup> The RD design allows for causal inferences under a weaker set of assumptions than the regression models commonly used in the electoral systems literature. We find that incumbency causes a gain of about 1.4–1.7 percentage points in PR vote shares, a result that is robust to the use of different measures of incumbency. We also find that most of the votes that incumbents are able to attract for their

parties come from the other major party. To the best of our knowledge, our paper is also the first to analyze the substantive impact of spillover on the distribution of legislative seats. Our simulations show that spillover caused by incumbency leads to net shifts of 10–15 legislative seats and is thus sufficiently large to potentially trigger decisive shifts in Bundestag majorities.

The paper is structured as follows. In Section 2, we review prior work on spillover effects. Section 3 spells out our theoretical argument. Sections 4 and 5 discuss the statistical model and the data. In Section 6, we present the results. Section 7 concludes.

## 2. Spillover effects

Spillover effects can operate in two directions.<sup>2</sup> First, the presence of single-member districts could affect the electoral competition in the PR tier. Based on Germany’s experience with a mixed electoral system, Duverger (1986: 72), for example, argues that the two-party competition typical of SMDs spills over to the PR tier, leading to overall “pressure toward a two-party system” despite the existence of a more permissive proportional tier.

Second, the direction of causality also could be the reverse, from the proportional tier to single-member districts. Cox and Schoppa (2002: 1031) note that the Duvergerian tendency toward two-party competition in SMDs (Duverger, 1954; Cox, 1997) appears to be muted in the SMD tier of Germany’s, Japan’s, and Italy’s mixed systems. They attribute this fact to small parties’ incentives to run district candidates in many districts, even if they have no chance of winning, “in order to give their party a human face that they can use to boost the party’s [PR] vote totals.” Herron and Nishikawa (2001) find that in Russia and Japan the number of parties in the SMD tier is larger than in “pure” SMD systems. They too attribute this finding to the strategy pursued by small parties to run district candidates, even hopeless ones, in as many districts as possible in order to increase voter awareness of their programs and vote shares in the PR tier. Ferrara et al. (2005: chapter 3) present similar results for a larger number of mixed electoral

<sup>1</sup> In Germany’s “mixed-member-proportional” system (Shugart and Wattenberg, 2001), voters cast two ballots, one for district candidates and one for party lists. Seat allocation is compensatory; a party’s total number of seats in the Bundestag is proportional to its list vote share (conditional on reaching a 5% threshold or winning at least three district seats). Seats won in the plurality-rule SMDs are subtracted from the total number of seats allocated to each party according to its PR vote share in each state. For overviews of Germany’s electoral and party system see Falter et al. (2000) and von Alemann (2003).

<sup>2</sup> We adopt Ferrara et al.’s (2005: 8–9) definition of spillover (which they call contamination): “Contamination is present, at the micro-level, when the behavior of a voter, a party, a candidate, or a legislator in one tier of the election is demonstrably affected by the institutional rules employed in the other tier. At the aggregate level, contamination is observed when a particular outcome produced in one tier (like the number of parties) is affected by the institutional features of the other tier.”

systems, showing that parties' PR vote shares are positively associated with the presence of district candidates.

While these results are quite intriguing, their interpretation remains ambiguous. Parties might place candidates in districts in which they expect to be more popular than average or where they have the organizational resources to run a campaign. If this were the case, the positive association between the presence of district candidates and PR vote shares would be (at least partially) spurious. Of course, scholars working on spillover effects are aware of the possibility of such selection effects and attempt to address them by adding control variables to their models. Cox and Schoppa (2002: 1034), for example, use past vote shares as a measure of party popularity in each district. Herron and Nishikawa (2001) add a dummy variable for incumbency as a proxy for popularity, and for the Japanese case also include past vote shares from upper house elections for some parties. For some countries, Ferrara et al. (2005) add incumbency as a proxy for popularity in addition to demographic or regional controls.

However, given the limited set of control variables available to these authors, it seems likely that there remains a fair amount of selection bias due to the existence of unobserved confounders, i.e., variables that are correlated with both the independent variables and the dependent variable. For example, a party's expectation to do particularly well in a district might increase the probability that it runs a candidate in this district. If parties' expectations are also correlated with final vote shares, which seems rather likely, this would induce omitted variable bias. In order to yield unbiased causal estimates, previously used models had to make the assumption that treatment assignment is unconfounded conditional on the included control variables (Rubin, 1974; Rosenbaum, 2002). This implies that for each party, conditional on past vote shares or some other regional or demographic control variable, the probability of running a district candidate is the same in districts in which a candidate actually runs or does not run. This seems to be an overly restrictive assumption. As we will show below, the RD design in contrast helps us to avoid any selection bias from unobserved confounders.

There exists another equally thorny problem. Estimating spillover effects caused by the presence of district candidates is only possible if parties run candidates in some but not all districts. In many countries, however, most small parties regularly run candidates in all or almost all districts. Some scholars

have argued that this provides strong evidence that parties are aware of the existence of spillover effects and take advantage of it (Cox and Schoppa, 2002). However, the identification of treatment effects becomes impossible without variation in the treatment variable.<sup>3</sup> Since incumbency varies both across districts and over time, this does not pose a problem for us. We can estimate spillover effects even for Bundestag elections in which small parties ran candidates in every district.

### 3. Incumbency advantage and spillover

Why do we predict incumbency to have an effect on PR vote shares? A large body of work in American politics (and to a much lesser extent comparative politics) has examined the advantages that incumbent legislators enjoy when running in the next election. The causes of incumbency advantage identified in this literature include redistricting, strategic entry and exit, the increased visibility and name recognition of incumbents, and electoral payoffs from securing pork-barrel projects for their districts and helping constituents deal with the bureaucracy (Cox and Katz, 2002; Ansolabehere et al., 2000; Ansolabehere and Snyder, 2004; Levitt and Wolfram, 1997; King and Gelman, 1991; Cain et al., 1984; Gaines, 1998).

With rare exceptions (Bawn, 1999; Moser and Scheiner, 2005), explanations of SMD voting behavior in Germany have stressed national factors such as parliamentary coalitions or party platforms while downplaying district and candidate characteristics (Jesse, 1988; Porter, 1995). According to Pappi and Mnich (1992), Jesse (1988), and Cox (1997: 160), ticket-splitting voters will generally cast their two ballots for the parliamentary coalition they hope to see elected. Smaller parties such as the Liberals or the Greens cannot form a parliamentary coalition with one of the major parties unless they reach the 5% threshold set by election law. Since parties always make their coalition preferences known well before the election, CDU voters, for example, might therefore choose to cast their first votes for the CDU but their second votes for the Liberals.

With one exception (Lancaster, 1998), the question of whether candidate characteristics have an

<sup>3</sup> Cox and Schoppa (2002) therefore only present estimates for Japanese elections, and Ferrara et al. (2005) restrict their discussion of Germany to the 1953 Bundestag election, noting that in later elections even small parties such as the Liberals (FDP) or Greens ran candidates in virtually every district.

independent effect on PR vote shares has not been raised in the literature on voting behavior in Germany. That we should not simply discount this possibility is evident from the spillover effects literature, which has consistently found that the presence of district candidates is positively associated with PR vote shares (Cox and Schoppa, 2002; Herron and Nishikawa, 2001; Ferrara et al., 2005). However, if the mere presence of a district candidate is sufficient to boost her party's PR vote share, it seems quite plausible to expect candidate characteristics such as incumbent status to have an even bigger effect. After all, winning a district gives a party and its incumbent legislator 4 years to convince voters of their merits, a much longer time span than the relatively brief election campaigns that the existing literature on spillover effects stresses as a source of spillover. We therefore predict that incumbent legislators do not only enjoy an electoral advantage in terms of SMD votes, as previously shown by Bawn (1999) and Moser and Scheiner (2005), but that they are also able to attract additional PR votes for their parties.

Which causal mechanisms might lead incumbency to affect PR vote shares? We know from surveys of members of the Bundestag that they spend a significant amount of time in their districts, helping their constituents deal with local, state, and federal bureaucracies, securing pork-barrel projects, and maintaining close contacts to their local party organizations and constituents (Herzog et al., 1990; Patzelt, 1993; Lancaster and Patterson, 1990). Many legislators themselves consider ombudsman-type services and success in securing pork as important determinants of their re-election prospects (Lancaster and Patterson, 1990; Patzelt, 1993; Porter, 1995). Stratmann and Baur (2002) find that legislators who enter the Bundestag through the SMD tier instead of party lists systematically seek out committee assignments that help them better represent the interests of their districts. A recent study by Klingemann and Wessels (2001) shows that voters' perception of the performance of their district representative was strongly associated with SMD vote choice in the 1998 Bundestag election. If voters reward incumbents for good district service, which seems likely, it might also be possible for popular incumbents to attract additional PR votes for their parties.

A related body of evidence suggests that parties do take district service into account when nominating district candidates, and that incumbents who fail to represent the interests of their districts are sometimes denied renomination (Zeuner, 1970: 144–146; Patzelt, 1993: 366–382; Porter, 1995: 77–105). If the performance of incumbents has an effect on parties' PR

votes, it is of course not very surprising to see parties take a strong interest in the quality of the district service provided by their incumbent legislators.

Unfortunately, time-series data on district service are not available and we will have to leave an investigation of this potential causal mechanism to future work. One causal mechanism that we can examine, however, is challenger quality (Cox and Katz, 2002; Jacobson, 1987). To test whether any effect that incumbency might have on SMD and PR vote shares is due to incumbents' ability to deter high-quality opponents, we will perform separate estimations for sub-samples of districts in which the other major party did not run a "shadow" incumbent. Shadow incumbents are members of the legislature elected through party lists. Since many of them run in district races, many districts actually see two or more Bundestag members run against each other, only one of them being the district incumbent. The presence of such shadow incumbents thus gives us an excellent measure of candidate quality. Shadow incumbents, after all, already made it into the Bundestag. It would be hard to imagine more experienced and formidable challengers.

### 3.1. Measures of incumbency

We rely on two distinct measures of incumbency: *legislator incumbency* and *party incumbency*. Following Gelman and King (1990), the legislator incumbency advantage is defined as the difference between the district vote share received by an incumbent legislator in her district and the district vote share received by the incumbent party in that district, if the incumbent legislator does not run. Following Lee (2008), party incumbency advantage in contrast measures the electoral advantage to being the incumbent party in a district, relative to not being the incumbent party. Party incumbency thus subsumes legislator incumbency, but in contrast to legislator incumbency, it is not conditional on the incumbent legislator running.<sup>4</sup>

There are two reasons, one theoretical and the other methodological, for why we employ two different definitions of incumbency. Our theoretical expectation is that spillover effects arise primarily from incumbent legislators' success in representing the interests of their constituents. This suggests that legislator incumbency is the appropriate measure of incumbency. However, if

<sup>4</sup> Strictly speaking, party incumbency only subsumes legislator incumbency if incumbent legislators do not switch parties. We ignore this complication here since party switches are extremely rare in Germany.

a popular incumbent's reputation "rubs off" on the next candidate her party puts forward after she decides to retire (especially if she explicitly endorses the candidate), a focus on legislator incumbency would lead us to underestimate the size of spillover effects. Since we are interested in estimating the overall magnitude of spillover, this suggests that party incumbency might be a more appropriate measure. Moreover, from a methodological perspective, party incumbency is the preferred measure, since estimates of the causal effects of legislator incumbency are potentially biased due to strategic exit. If incumbent legislators choose not to run when the prospects for winning their districts are poor, estimates of legislator incumbency advantage will be biased (Gelman and King, 1990; Jacobson and Dimock, 1994). This is probably not a serious concern in German elections since most district incumbents also run on party lists and therefore have a good chance of retaining their legislative seats even if they lose their district race. Tables 1 and 2 present empirical evidence that also suggests that strategic exit is an unlikely source of bias. As we can see in Table 1, about 80% of incumbent legislators run. The median age of running incumbents is 52 years, whereas retiring incumbents are almost a full decade older. This is consistent with the notion that incumbents' decision to retire is not primarily strategic in nature. Table 2 reports marginal effect coefficients (partial derivatives) of simple probit response functions of incumbents' decision to run on age and closeness of the election. As one would expect, age has a negative, statistically significant effect on the probability of running. Margins of victory in the last as well as the upcoming election (which measure the closeness of the last race and serve as a proxy for the perceived closeness of the upcoming race) are generally statistically insignificant and have the wrong sign in three out of four models.

Table 1  
Incumbents that run or exit

| Election year | % Of incumbents that run |     |     | Median age of incumbents that run |     |     | Median age of incumbents that exit |     |     |
|---------------|--------------------------|-----|-----|-----------------------------------|-----|-----|------------------------------------|-----|-----|
|               | All                      | CDU | SPD | All                               | CDU | SPD | All                                | CDU | SPD |
| 1961          | 79                       | 80  | 72  | 55                                | 56  | 54  | 62                                 | 62  | 61  |
| 1969          | 69                       | 68  | 69  | 50                                | 50  | 48  | 63                                 | 63  | 63  |
| 1972          | 70                       | 68  | 72  | 48                                | 49  | 48  | 62                                 | 62  | 61  |
| 1983          | 88                       | 90  | 87  | 50                                | 50  | 49  | 53                                 | 53  | 54  |
| 1987          | 83                       | 87  | 71  | 53                                | 53  | 52  | 58                                 | 57  | 60  |
| 1990          | 75                       | 73  | 80  | 52                                | 52  | 52  | 61                                 | 61  | 61  |
| 1994          | 77                       | 77  | 78  | 53                                | 53  | 53  | 62                                 | 63  | 60  |
| 1998          | 79                       | 80  | 76  | 55                                | 55  | 55  | 59                                 | 59  | 59  |
| Average       | 77                       | 78  | 76  | 52                                | 53  | 51  | 61                                 | 61  | 60  |

Their inclusion adds virtually nothing to the predictive power of the models. These results suggest that strategic exit is not an important feature of German federal elections. Still, we will present estimates for the causal effects of legislator as well as party incumbency to deal with this potential source of bias.

#### 4. Regression-discontinuity designs

We rely on an RD design to obtain estimates of the causal effects of party and legislator incumbency. The RD design is a quasi-experimental technique that allows for the identification of treatment effects in settings in which assignment to treatment changes discontinuously as a function of one or more underlying variables. Its key advantage over conventional regression models is that it is not sensitive to omitted variables; it mimics a randomized experiment in this respect. Since the RD design has rarely been used in the political science literature we explain it here in detail.

The earliest published use of an RD design dates back to Thistlethwaite and Campbell (1960). In their seminal work, they examine the effect of scholarships on career outcomes by comparing students just above and below a threshold in test scores that determines whether students receive an award or not. The underlying idea is that in the close neighborhood of the threshold, assignment to treatment is "as good as random." Unlucky students who just miss the threshold are assumed to be virtually identical to lucky ones who score just above the cutoff value. The only difference between them is that the latter receive the scholarship while the former do not, thus providing Thistlethwaite and Campbell with a suitable counterfactual for causal inference.

Whenever the data-generating process is characterized by a treatment assignment mechanism that is solely based on exceeding a threshold on a predetermined covariate, a randomized experiment is "hiding" in the data. In a sense, the RD design allows us to separate this experiment from the rest of the data, which is tainted by selection effects. Such situations arise surprisingly often in empirical settings. Since the early work by Thistlethwaite and Campbell, RD designs have been frequently used in various disciplines such as medicine and public health, education, economics, and sociology (Shadish et al., 2002 provide a review). Recent work in econometrics and program evaluation also demonstrates a growing interest in their use. Most relevant for the purpose of this paper, economist David Lee (2008) has for the first time applied the RD design to the study of electoral behavior. Butler and Butler (2007) use it to study split-party delegations in

Table 2  
Incumbents' age and the probability of exit

|                               | CDU                                 |                | SPD            |                |
|-------------------------------|-------------------------------------|----------------|----------------|----------------|
| DV:                           | Running (1 if running, 0 otherwise) |                |                |                |
| Mean:                         | 0.78                                |                | 0.76           |                |
| SD:                           | 0.02                                |                | 0.02           |                |
|                               | 1                                   | 2              | 3              | 4              |
| Age                           | –0.018 (0.001)                      | –0.017 (0.001) | –0.020 (0.002) | –0.020 (0.002) |
| Margin of victory             |                                     | 0.004 (0.002)  |                | 0.000 (0.002)  |
| Margin of victory ( $t - 1$ ) |                                     | –0.004 (0.002) |                | 0.000 (0.003)  |
| $N$                           | 1254                                | 1254           | 699            | 699            |
| log Likelihood                | –570.33                             | –567.54        | –328.74        | –328.73        |
| Pseudo $R$ -squared           | 0.14                                | 0.14           | 0.14           | 0.14           |

Probit estimations: coefficients are estimated marginal effects ( $\delta F/\delta x_k$ ), i.e., the marginal effect on  $\Pr(y = 1)$ , given a unit increase in the value of the relevant regressor ( $x_k$ ), holding all other regressors at their sample means. Heteroskedasticity and serial correlation consistent standard errors are in parentheses. Margin of victory is computed separately for each party but coefficients are shown in the same row.

the Senate. Apart from this work, political scientists have so far ignored its potential as a tool for causal inferences.

The RD design is best formulated in the framework of the Rubin Causal Model, which conceptualizes causal inference in terms of potential outcomes under treatment and control (Rubin, 1974, 1978, 1990; Holland, 1986; Angrist and Krueger, 1999; Rosenbaum, 2002).

First, we need to introduce some notation. Let  $Y_{1ijt}$  denote the potential outcome for party  $j$  in district  $i$  in an election at time  $t$  if exposed to the treatment  $D_{ijt}$  (defined more formally below) and let  $Y_{0ijt}$  denote the potential outcome for the same party if not exposed to the treatment. Our two outcomes of interest are SMD vote shares and PR vote shares.<sup>5</sup>

For each unit, we never observe both potential outcomes  $Y_1$  and  $Y_0$  but only the realized outcome  $Y = DY_1 + (1 - D)Y_0$ . Holland (1986) has characterized this as the “fundamental problem of causal inference.” For example, given that a party is the incumbent in a district, in the next election we never get to observe the SMD and PR vote shares that it would attain if it was not the incumbent. It is thus impossible to estimate causal effects for individual units ( $Y_1 - Y_0$ ). However, we can, under certain assumptions, estimate the average treatment effect  $ATE = E[Y_1 - Y_0]$  or the average treatment effect for the treated  $ATT = E[Y_1 - Y_0 | D = 1]$  for a given population.

<sup>5</sup> To simplify notation we do not add yet another subscript to distinguish between SMD and PR vote shares. The formulas are identical for both outcomes. We will also suppress subscripts when the context is unambiguous.

We also need a model of the data-generating process. Let  $LVS_{ijt}$  denote a party's latent vote share. We assume that a party's observed vote share is represented by  $OVS_{ijt}$ , which is the sum of two components:

$$OVS_{ijt} = LVS_{ijt} + \eta_{ijt} \quad (1)$$

LVS reflects a systematic or predictable component that is a function of the party's attributes or actions (such as the party program, the quality of its district candidate, campaigning efforts), and  $\eta$  is an exogenous, random chance component (such as the weather on election day) with mean zero and a continuous density. For tractability we also assume that party  $j$  competes in elections at time  $t$  and  $t - 1$ .<sup>6</sup>

Our treatment is incumbency. As already discussed, there exist two different versions of this treatment: party incumbency and the more traditional legislator incumbency. Following Lee (2008), we define the effect of party incumbency as the causal effect of being the incumbent party in a district on the SMD or PR vote share obtained in the next election. Thus, let  $D_{ijt}$  be a binary indicator of treatment status that takes the value 1 if party  $j$  is the incumbent in district  $i$  at time  $t$ , and 0 otherwise. Note that all that matters here is that the party's candidate won the district in the last election. Such districts are considered treated units, regardless of whether the incumbent legislator herself runs in the next election

<sup>6</sup> This assumption is innocuous as both SPD and CDU/CSU compete in all districts in every election. They also divide virtually all district seats among themselves. Smaller parties such as the Greens and Liberals also compete in virtually every district but normally win all of their Bundestag seats in the PR tier.

or not. The causal effect of legislator incumbency is defined analogously, but here the treated group only consists of those districts in which the incumbent legislator runs. Thus, if an incumbent decides to exit, the district will be discarded from the sample.

Both measures of incumbency are characterized by somewhat different treatment assignment mechanisms. For party incumbency, assignment to treatment is determined by whether the party won the plurality of SMD votes in district  $i$  in the election at  $t - 1$ . For legislator incumbency, assignment to treatment is also determined by whether the party won the plurality of SMD votes in district  $i$  in the election at  $t - 1$ . But in addition, the party's candidate that won at time  $t - 1$  (the incumbent) needs to run in the next election (at time  $t$ ).

To compute the *margin of victory* ( $MV_{ijt}$ ), we rank parties in each district by their observed SMD vote shares in the election at  $t - 1$ . For the winning party,  $MV_{ijt}$  is the difference between its vote share and the vote share of the party that came second. For all other parties in the district,  $MV_{ijt}$  is the difference between the winning party's vote share and their own vote shares. Note that by construction,  $MV$  will be positive for winning and negative for losing parties. The threshold, labeled  $\bar{MV}$ , is zero. Once we define  $MV$  in this way it is easy to see that the causal effect of incumbency can be estimated with an RD design, because assignment to treatment is a deterministic function of whether a party's *margin of victory* in the previous election ( $MV_{t-1}$ ) exceeds 0.

The strength of the RD design stems from the fact that we know this treatment assignment mechanism. Under fairly weak smoothness assumptions (see Rubin, 1977; Hahn et al., 2000 for a rigorous discussion), the RD design allows us to estimate the average treatment effect (ATE) at the discontinuity of the covariate that determines treatment assignment. Even under non-random selection into treatment, the RD design yields an unbiased estimate of the treatment effect. Why is this the case? Recall that the *margin of victory* is a function of observed vote shares. Observed vote shares in turn consist of a latent systematic component  $LVS$  that parties can influence, but also a random component  $\eta$  over which parties cannot exert control. It can be proven that as long as the covariate that determines assignment to treatment includes such a random component with a continuous density, treatment status is randomized at the threshold (Lee, 2008). Therefore, at the threshold, all observed and unobserved covariates will be independent of treatment assignment.

In other words, just as in a randomized experiment, treatment effects will not be confounded by omitted variables. This provides an important advantage over commonly used regression models which are by construction vulnerable to omitted variable bias.<sup>7</sup>

It is important to at least briefly consider the conditions under which the assumption of local random assignment at the threshold could be wrong. Local random assignment critically hinges on the presence of the random component  $\eta$ . This does not imply that each district race has to be decided by this random component; in most races the random component will not be decisive. The key idea is that as races become closer and closer, confounders cease to systematically affect treatment assignment. In the limit, i.e., at the threshold, treatment assignment should be independent of all confounding variables. The plausibility of this assumption is a function of the degree to which parties are able to sort around the threshold. For example, if parties had perfect control over their observed vote shares or were able to perfectly predict them, they would never run if they knew that they would lose. Alternatively, they would just invest enough effort to get exactly one more vote than the strongest district opponent. Such behavior would violate our identifying assumption. However, given the randomness inherent in elections, such a scenario seems rather implausible (Matusaka and Palda, 1999). Just imagine the weather had been different on election day (Knack, 1994).

Note that in principle, all of the advantages of the RD design apply no matter whether we rely on party or legislator incumbency as our measure of incumbency. When estimating the causal effect of legislator incumbency, however, strategic exit creates one potential source of bias that even the RD design cannot fully avoid. If for incumbents that barely won in the last election, the decision to run is not independent of potential outcomes, our estimates of the causal effect of legislator incumbency will be biased. The same is true for specifications in which we restrict the sample to districts in which the other major party did not nominate a shadow incumbent. Both the incumbent legislator's decision to run and the other major party's decision to nominate a shadow incumbent are not locally randomized and thus a potential source of hidden bias. However, the results presented in Section 4 on incumbents' decision to

<sup>7</sup> For example, unobserved candidate characteristics will not bias our estimates because local random assignment in close districts ensures that they will be balanced between the treatment and control groups.

retire suggest that strategic exit is not a significant source of bias.

Before we proceed to estimation, a general limitation of the RD design needs to be mentioned. As noted above, our ATE estimates do not identify average treatment effects for the entire population, but only for districts with close races. Such marginal districts may not be representative of the whole population of districts. Unless we impose additional homogeneity assumptions, our causal estimates will not be applicable to the latter districts. The data are only informative about treatment effects for observations close to the threshold.

However, marginal districts are not uncommon in German elections. Over 20% of all races in an average German federal election are fairly close, with the winner in each district leading by less than 5 percentage points. That being said, we clearly face a trade-off here. The RD design helps us to derive credible causal estimates for the effects of incumbency, but only for close districts. The alternative is to attempt to estimate causal effects for the whole population by imposing assumptions about the treatment assignment mechanism (e.g., that parties choose districts in which they run candidates at random, or at least that treatment assignment is ignorable conditional on some control variable like past vote shares) that are almost certainly wrong. Doing so might appear to tell us something about the whole population, but we will have little reason to be confident that it gives us the right answer. We think that when faced with such trade-offs, internal validity is more important than generalizability (Shadish et al., 2002).

## 5. Estimation strategy

Our model suggests the following data-generating process for the observed outcomes:

$$Y_{i,j,t} = f(Z_{i,j,t-1}, \theta) + h(MV_{i,j,t-1}, \delta) + D_{i,j}\beta + \varepsilon_{i,j} \quad (2)$$

where  $f$  is some function according to which  $Z_{t-1}$ , a matrix of district-level covariates (e.g. candidate quality, campaign effort), may affect vote shares with coefficients  $\theta$ ;  $h$  is some function that relates the *margin of victory* in each district to votes in the next election. Finally,  $D$  is our treatment indicator and  $\beta$  is the central parameter of interest, identifying the causal effect of incumbency.

At first glance, Eq. (2) is just a conventional regression model. As already discussed earlier, the complication that makes the interpretation of prior results ambiguous is the possibility that there exists

some unobserved  $Z$  that we cannot control for. Since  $Z$  is likely to be correlated with  $MV$ , estimates of  $\beta$  tend to be biased. For the RD design, in contrast, local random assignment ensures that our estimate of  $\beta$  is unconfounded at the threshold, and we do not need to control for any covariates. Just as in randomized experiments, the inclusion of covariates should not appreciably affect our estimates of  $\beta$  (apart from increasing their precision). Under the assumption that there is no strategic exit, this will also be true for specifications in which we rely on legislator instead of party incumbency.

In order to draw causal inferences from an RD design we need to choose the correct functional form for  $h$ .  $D$  should only pick up the potential “jump” in the conditional expectation of  $E[Y|MV_{i,j,t-1}]$  at the threshold, and a miss-specification of the functional form of  $h$  would lead to bias.

The common solution (Lee, 2008; Butler and Butler, 2007), which we employ here as well, is to allow for a highly flexible functional form of  $E[Y|MV_{i,j,t-1}]$ . We therefore include a third-order polynomial in  $MV$  plus all interactions with the treatment indicator. We thus regress  $Y$  on  $MV + MV^2 + MV^3 + D + (D \times MV) + (D \times MV^2) + (D \times MV^3)$  using ordinary least squares. Since  $MV$  equals zero at the threshold, the coefficient of  $D$  identifies the ATE. The multiplicative third-order polynomial ensures a good fit of the functional form of the assignment variable on both sides of the threshold. All our results are substantively identical if we use fourth- or fifth-order polynomials instead.<sup>8</sup> We compute heteroskedasticity and serial correlation consistent (HAC) standard errors using Bartlett kernel weights as described in Newey and West (1987, 1994).

German federal election results were compiled by Caramani (2000). We added data on candidate characteristics (age, gender, and incumbency and shadow incumbency status) from Statistisches Bundesamt (various years). We originally had planned to examine all Bundestag elections. But due to several waves of redistricting we had to exclude the 1957, 1976, 1980, and 2002 elections, so that we are left with eight federal elections.<sup>9</sup> There are about 248 districts

<sup>8</sup> Results are available upon request. Higher order terms beyond the third polynomial are generally insignificant and are thus discarded to reduce multi-collinearity and maximize efficiency.

<sup>9</sup> Since our analysis requires lagged vote shares excluding one election effectively means excluding two elections.

per election up to 1990, and 328 districts after unification.<sup>10</sup>

In virtually all district races, the strongest two parties are the Social Democratic Party (SPD) and the Christian Democratic Union/Christian Social Union (CDU/CSU), although third parties do obtain some share of the vote. Accordingly, we only focus on the causal effects of incumbency for these two parties. We cannot estimate incumbency effects for small parties such as the Greens and Liberals because these parties never win district seats.<sup>11</sup>

For both the SPD and the CDU/CSU, we estimate the causal effects of incumbency by regressing either SMD or PR vote shares on a third-order polynomial in margin of victory in the previous election and all interactions with the treatment indicator. We only show the treatment effect estimates. In each model, the causal effect of incumbency is simply the “gap” in the conditional expectation of  $Y$  at the threshold, contrasting districts that were barely won with districts that were barely lost in the last election by the same party. We present specifications for three quantities of interest: the effect of party incumbency, the effect of legislator incumbency in general, and the effect of legislator incumbency in those districts in which the other major party did not nominate a shadow incumbent.

## 6. Results

### 6.1. Effect of incumbency on SMD vote shares

Tables 3 and 4 display the results. Concentrating on the top halves of the tables first, we see that for all three measures incumbency status has a substantial effect on a party’s SMD vote share. In magnitude and statistical significance, the effects are quite similar for the SPD and CDU/CSU. On average, party incumbency increases SMD vote shares in the next election by about 1.5–1.9 percentage points.<sup>12</sup> These effects are significant at the 0.05 level or better.

<sup>10</sup> Some scholars have argued that electoral dynamics in the Eastern Länder are distinct (Jeffery and Hough, 2001; Hough and Jeffery, 2003; Falter et al., 2000). Our findings are substantively identical if we include districts in Eastern Germany. Results are available upon request.

<sup>11</sup> As noted earlier, even smaller parties such as the Greens and Liberals compete in almost every district. Excluding the few partially contested districts does not affect our results.

<sup>12</sup> Please note that we can rule out reverse causality, from the PR tier to the SMD tier, due to the use of the RD design. Barely winning or losing the PR vote in a district has no noticeable consequences in this district; it is not associated with any district-level treatment as is the case with the SMD vote. To put this another way, nothing changes in a district when, say, the SPD barely wins the PR vote compared to when it barely loses it.

We find that effects on SMD vote shares are very similar or even slightly larger once we focus on legislator incumbency. The exact interpretation of this result depends on the assumptions we are willing to make about the effects of strategic exit. If strategic exit is not very important in Germany (as the results in Tables 1 and 2 suggest), then the similarity of our estimates suggests that party incumbency provides an excellent proxy for legislator incumbency. However, if one believes strategic exit to be an issue, our estimated legislator incumbency effect will be biased and we should rely on the estimates for party incumbency instead. Independent of what stance one takes on this issue, our results for the SMD tier are similar to what earlier studies of the incumbency effect in German elections have found (Bawn, 1999; Moser and Scheiner, 2005).

The third row of Tables 3 and 4 presents the legislator incumbency effect for districts in which the other major party did not run a shadow incumbent. Here, we see somewhat of a divergence between the results for the CDU and the SPD. For the CDU, the effect of incumbency remains about the same and challenger quality can thus be ruled out as an explanation for the existence of any incumbency advantage. For the SPD, in contrast, the size of the incumbency advantage seems to increase somewhat, suggesting that in districts in which the CDU does not run a strong district candidate (as measured by shadow incumbency), SPD incumbents enjoy a larger incumbency advantage. However, this difference is not pronounced enough to be significant at conventional levels of statistical significance.

### 6.2. Effect of incumbency on PR vote shares

Thus far, we have focused on the effect of incumbency on SMD vote shares. The lower halves of Tables 3 and 4 present tests of our core argument, displaying estimates for the average treatment effect of incumbency on PR vote shares, our measure of spillover. To the best of our knowledge, our paper is the first to estimate effects of incumbency on PR vote shares.

We find that for both parties, incumbency status has a positive and substantial effect on PR vote shares. This is true for all three measures of incumbency. On average, party incumbency increases PR vote shares by about 1.7 percentage points for the SPD and by about 1.4 percentage points for the CDU. These estimates are significant at the 0.05 level or better. For both parties, the legislator incumbency effect estimate is almost identical to the party incumbency effect

Table 3  
SPD: causal effect of incumbency on SMD and PR vote shares

|  | Incumbent    | Non-incumbent | ATE         | 0.90 CI |      | N    |
|--|--------------|---------------|-------------|---------|------|------|
|  |              |               |             | LB      | UB   |      |
| <i>Effect on SMD vote shares</i>               |              |               |             |         |      |      |
| Party incumbency                               | 46.45 (0.51) | 44.95 (0.49)  | 1.51 (0.59) | 0.54    | 2.47 | 1958 |
| Legislator incumbency                          | 46.03 (0.59) | 44.41 (0.50)  | 1.61 (0.66) | 0.52    | 2.7  | 1514 |
| Legislator incumbency<br>(no shadow incumbent) | 46.78 (0.81) | 44.41 (0.51)  | 2.36 (0.89) | 0.90    | 3.82 | 1236 |
| <i>Effect on PR vote shares</i>                |              |               |             |         |      |      |
| Party incumbency                               | 43.64 (0.54) | 41.97 (0.53)  | 1.67 (0.60) | 0.69    | 2.65 | 1958 |
| Legislator incumbency                          | 43.01 (0.60) | 41.49 (0.55)  | 1.52 (0.66) | 0.43    | 2.62 | 1514 |
| Legislator incumbency<br>(no shadow incumbent) | 43.63 (0.84) | 41.49 (0.56)  | 2.14 (0.90) | 0.66    | 3.62 | 1236 |

Regression coefficients with heteroskedasticity and serial correlation consistent standard errors are in parentheses. ATE represents the average treatment effect, i.e., the effect of incumbency on SMD and PR vote shares at the threshold. All estimates are based on a multiplicative third-order polynomial fit of the assignment variable and the treatment indicator to both sides of the threshold (only the treatment effect estimates are shown). LB and UB mark the endpoints of 0.90 confidence intervals.

estimate. When we focus on districts in which the other major party does not run a shadow incumbent, we again see somewhat of a divergence between the results for the CDU and the SPD. For the CDU, the effect size stays about the same, and challenger quality can thus be ruled out as an explanation for the existence of spillover. For the SPD, in contrast, the effect size increases somewhat, suggesting that in districts without a strong CDU challenger, SPD incumbents are particularly successful in boosting their party's PR vote share. As for SMD votes, this difference is noteworthy but not significant at conventional levels of statistical significance.

Fig. 1 provides a graphical representation of these results for the SPD. The upper (lower) graph displays the effect of party (legislator) incumbency.<sup>13</sup> In these graphs, the vertical axis displays the SPD's vote share in each district at time  $t$ , with the left (right) graph showing SMD (PR) vote shares. The horizontal axis displays the *margin of victory* at time  $t - 1$ , with the dashed vertical line at zero marking the threshold. All observations to the right (left) of the dashed line represent treated districts (control districts). The curves plot the fitted values from our polynomial fit on both sides of the threshold. Each data point represents a local average of the outcome variable (SMD or PR vote shares) for intervals of *margin of victory* with a width of 0.05.

Several features are apparent. First, note that there exists a positive relationship between *margin of victory*

and vote shares in both the SMD and PR tier. If a party wins (loses) by a larger margin in the last district race, it is more likely to receive a higher (lower) vote share in the next race. Second, and more importantly, we find a noticeable discontinuity at each of the four thresholds, graphically representing the average causal effect of party and legislator incumbencies on SMD and PR vote shares. If incumbency had no causal effect, there would be no such discontinuity. Also note that we do not see any discontinuous "jumps" in the conditional expectation functions except at the thresholds; the relationships between *margin of victory* and our outcome variables are generally smooth and well-approximated by a multiplicative polynomial fit.

Taken together, these findings lend strong support to our claim that incumbents not only enjoy an incumbency advantage, but also attract additional PR votes for their parties in their districts. Note that for party incumbency (and to a lesser extent for legislator incumbency), these treatment effect estimates are causal estimates based on very weak assumptions. It seems highly unlikely that these differences in vote shares are attributable to some unobserved confounder.

How do our estimates compare to earlier results on spillover effects in mixed electoral systems? Recall that so far the spillover literature has focused on the presence of district candidates, not incumbency. Ferrara et al. (2005: 44) find evidence for spillover effects for three small parties in the 1953 Bundestag election, but do not provide any point estimates. As noted earlier, Cox and Schoppa cannot estimate the effect of running SMD candidates in German elections because of lack of variation in their independent variable.

<sup>13</sup> Figures for shadow incumbency and the CDU look almost identical and are omitted here to economize on space. They are available upon request.

Table 4  
CDU: causal effect of incumbency on SMD and PR vote shares

|  | Incumbent    | Non-incumbent | ATE         | 0.90 CI |      | N    |
|--|--------------|---------------|-------------|---------|------|------|
|  |              |               |             | LB      | UB   |      |
| <i>Effect on SMD vote shares</i>               |              |               |             |         |      |      |
| Party incumbency                               | 43.09 (0.55) | 41.21 (0.55)  | 1.88 (0.66) | 0.79    | 2.97 | 1958 |
| Legislator incumbency                          | 43.35 (0.64) | 41.47 (0.67)  | 1.88 (0.74) | 0.66    | 3.11 | 1514 |
| Legislator incumbency<br>(no shadow incumbent) | 43.47 (0.68) | 41.48 (0.69)  | 1.99 (0.85) | 0.60    | 3.39 | 1021 |
| <i>Effect on PR vote shares</i>                |              |               |             |         |      |      |
| Party incumbency                               | 39.87 (0.57) | 38.51 (0.58)  | 1.36 (0.69) | 0.23    | 2.49 | 1958 |
| Legislator incumbency                          | 40.04 (0.63) | 38.70 (0.67)  | 1.33 (0.75) | 0.10    | 2.56 | 1514 |
| Legislator incumbency<br>(no shadow incumbent) | 40.12 (0.67) | 38.71 (0.69)  | 1.40 (0.85) | 0.01    | 2.8  | 1021 |

Regression coefficients with heteroskedasticity and serial correlation consistent standard errors are in parentheses. ATE represents the average treatment effect, i.e., the effect of incumbency on SMD and PR vote shares at the threshold. All estimates are based on a multiplicative third-order polynomial fit of the assignment variable and the treatment indicator to both sides of the threshold (only the treatment effect estimates are shown). LB and UB mark the endpoints of 0.90 confidence intervals.

Ferrara et al. (2005) also present estimates for the effect of running district candidates in other countries. Point estimates range from approximately 0 to 5 percentage points of vote share, depending on the party they look at. Herron and Nishkawa (2001) find even larger effects for several Japanese parties. The average treatment effects that we find here are considerably smaller. It might be the case, of course, that incumbency is just not as important a source of spillover as the presence of district candidates, or that its effect varies from country to country. While we cannot settle this question one way or the other in this paper, we think that it is quite possible that prior estimates are biased due to self-selection. If parties tend to run district candidates in districts in which they expect to do better than average, the spillover effects found in earlier work will be biased upwards.

### 6.3. Effect of incumbency on PR vote shares of other parties

So far, our results demonstrate that incumbents do indeed attract additional PR votes in their districts. It would be interesting, of course, to see who loses these votes. In order to examine this question, we re-ran our models, replacing the outcome variable by the PR vote share of each of the other parties. Results are shown in Table 5.

We find that most of the PR votes that incumbents are able to attract for their parties come from the other major party. On average, in their districts SPD incumbents reduce the PR vote share of the CDU by about 1.5 percentage points. CDU incumbents cause a comparable loss for the SPD of about 1.4 percentage points.

We cannot reject the null hypotheses that for both the CDU and the SPD, incumbency has no effect on the PR vote shares of the two smaller parties (Liberals and Greens). Incumbency predominantly leads to shifts in PR vote shares from one of the major parties to the other. The reason is probably quite straightforward: the other major party has many more voters to lose to begin with than the small parties. Even if all parties lost an equal percentage of their voters to the incumbent party, a switch of 2 or 3% of CDU voters to the SPD would be much more noticeable than the switch of 2 or 3% of Green or FDP voters. In our statistical model, switches due to spillover are large enough for the major parties to register as statistically significant, whereas for the FDP and Greens, the noise overwhelms the sparse information that is in the data.

### 6.4. Substantive magnitude of spillover: simulation results

One final question remains: are spillover effects large enough to actually trigger shifts in Bundestag majorities? In order to assess the substantive importance of spillover caused by incumbency, we wrote a numerical simulation of the distribution of Bundestag seats in the absence of spillover.<sup>14</sup>

We find that spillover generally leads to net shifts of 10–15 Bundestag seats. It tends to have the strongest impact on the Bundestag seat distribution whenever a disproportionate share of district seats was won by

<sup>14</sup> Details can be found in the supplementary material for this paper, available on the authors' websites, which also contains additional robustness and balance tests.

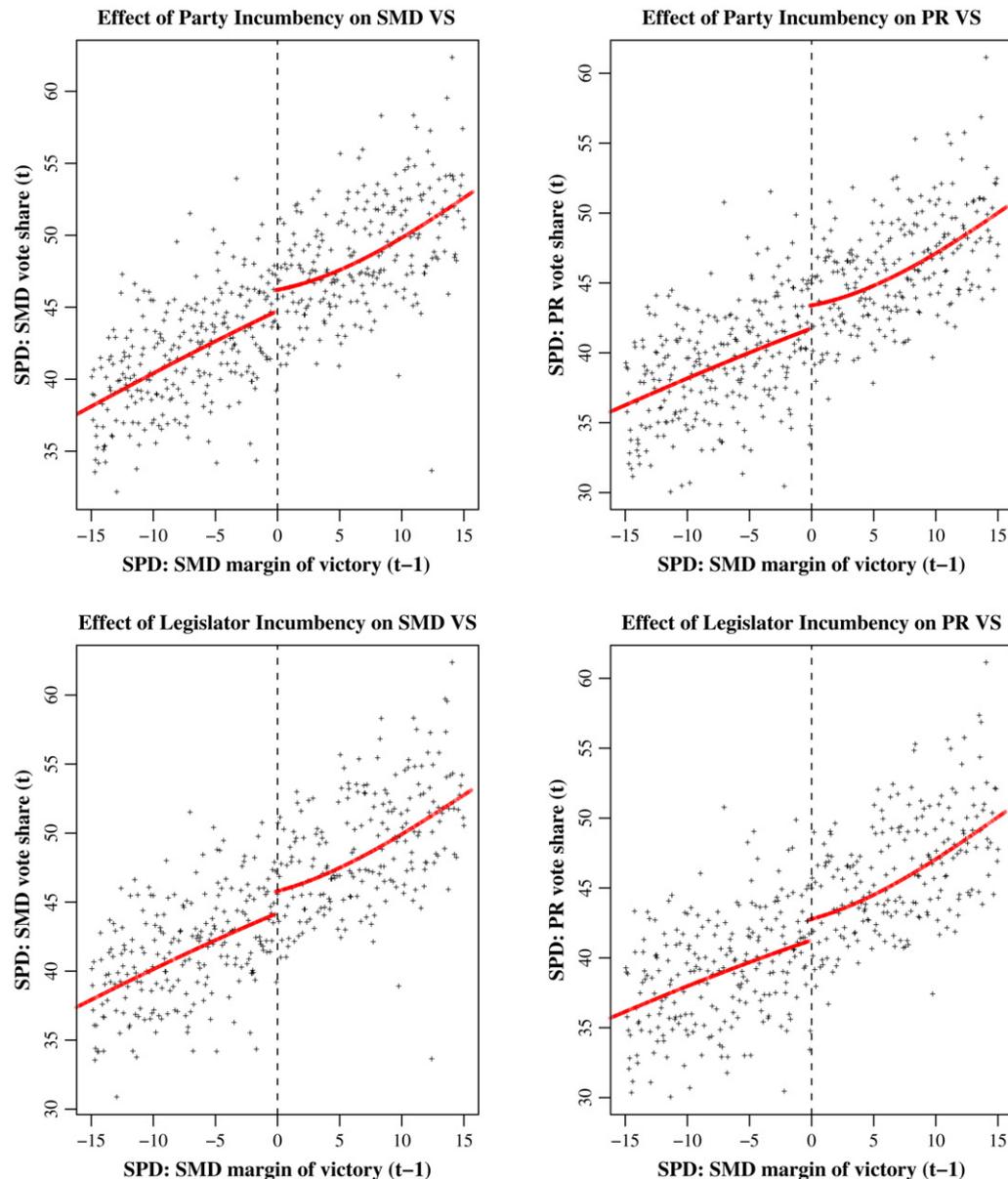


Fig. 1. SPD: causal effect of incumbency on SMD and PR vote shares.

one of the major parties in the previous election. The effects of such landslides are still felt in the next election when incumbents are able to attract additional PR votes for their parties. Overall, shifts in the Bundestag seat distribution caused by spillover are often large enough to alter the composition of the Bundestag in important ways. As expected, smaller parties are largely unaffected by spillover since they are never district incumbents; the SPD gains somewhat more from the existence of spillover than the CDU/CSU.

As an illustration, we show simulation results for the 2002 Bundestag election, which pitted Chancellor Gerhard Schröder (SPD) and the SPD/Greens coalition against challenger Edmund Stoiber, who was the candidate of a potential CDU/CSU/Liberals coalition. The original election results are displayed in the first row of Table 6. The SPD/Greens coalition won the election by a narrow margin, gaining 306 out of 603 seats. CDU/CSU and Liberals captured 295 seats, missing a Bundestag majority by only seven seats.

Table 5  
Causal effect of SPD and CDU incumbency on PR vote shares of other parties

|                      | Effect of SPD incumbency |                   |              |       |       |
|----------------------|--------------------------|-------------------|--------------|-------|-------|
|                      | SPD incumbent            | SPD not incumbent | ATE          | UB    | LB    |
| CDU PR vote share    | 38.71 (0.7)              | 40.24 (0.66)      | -1.53 (0.84) | -2.91 | -0.15 |
| Greens PR vote share | 7.5 (0.5)                | 6.96 (0.49)       | 0.54 (0.59)  | -0.43 | 1.51  |
| FDP PR vote share    | 9.21 (0.43)              | 9.01 (0.44)       | 0.20 (0.53)  | -0.67 | 1.07  |
|                      | Effect of CDU incumbency |                   |              |       |       |
|                      | CDU incumbent            | CDU not incumbent | ATE          | UB    | LB    |
| SPD PR vote share    | 41.66 (0.57)             | 43.08 (0.63)      | -1.42 (0.74) | -2.64 | -0.19 |
| Greens PR vote share | 6.96 (0.49)              | 7.50 (0.50)       | -0.54 (0.59) | -1.51 | 0.43  |
| FDP PR vote share    | 9.17 (0.47)              | 9.17 (0.43)       | 0.01 (0.57)  | -0.93 | 0.94  |

Regression coefficients with heteroskedasticity and serial correlation consistent standard errors are in parentheses. ATE represents the average treatment effect, i.e., the effect of incumbency on SPD and PR vote shares at the threshold. All estimates are based on multiplicative third-order polynomial fit of the assignment variable and the treatment indicator to both sides of the threshold (only the treatment effect estimates are shown). LB and UB mark the endpoints of 0.90 confidence interval.

The second and third rows of Table 6 display the counterfactual Bundestag seat distribution without spillover. If there had been no spillover due to incumbency, either of the coalitions could have won the 2002 election. If we assume that spillover effects were relatively large (the upper bound of the 0.90 confidence interval for our treatment effect estimate), the CDU/CSU together with the Liberals would have gained a stable majority of 304 seats, enabling them to form a coalition government. Fig. 2 displays the distribution of simulated Bundestag seats for the CDU/CSU/FDP coalition. Overall, we find that in 20% of our simulations of the 2002 Bundestag election, a CDU/CSU/FDP coalition would have won the majority of seats in the absence of spillover effects caused by incumbency.

## 7. Conclusion

In this paper, we have identified incumbency as another source of spillover in mixed electoral systems. Using two different measures of incumbency, we found that incumbency has a sizeable, positive effect on PR vote shares in Germany's mixed electoral system. We have also shown that such spillover effects are potent enough to alter election outcomes. According to our

simulation results, for example, spillover effects possibly lead to the close victory of the SPD/Green coalition in the 2002 Bundestag election. In contrast to the prior literature on spillover, the causal inferences we have drawn using a quasi-experimental regression-discontinuity design are not vulnerable to omitted variable bias.

Research on voting behavior in mixed electoral systems has almost exclusively focused on the PR tier so far. The existence of substantial spillover effects strongly suggests that district-level factors are more important for national election outcomes than has previously been thought. Regarding the causal mechanisms underlying spillover, our paper shows that spillover is not caused by strategic exit. The evidence is more ambiguous regarding challenger quality. For the SPD, we presented some preliminary evidence that weaker challengers cause incumbents to perform better. We were not able to find any such effect for the CDU, however. This difference in the impact of challenger quality merits further research, as do other potential causal mechanisms such as district service. It is also worth asking to what extent our findings are generalizable. While we have only looked at German federal elections in this paper, we expect incumbency to also be a source of spillover in

Table 6  
The effect of spillover on the seat distribution in the 2002 Bundestag

| Party   | CDU/CSU | FDP | SPD | Greens | PDS | Total | Majority | CDU/FDP | SPD/Greens |
|---|---------|-----|-----|--------|-----|-------|----------|---------|------------|
| <i>Seats with spillover (original results)</i>  |         |     |     |        |     |       |          |         |            |
|   | 248     | 47  | 251 | 55     | 2   | 603   | 302      | 295     | 306        |
| <i>Seats without spillover (counterfactual)</i> |         |     |     |        |     |       |          |         |            |
| 0.90 LB   | 245     | 49  | 254 | 57     | 2   | 605   | 303      | 294     | 311        |
| 0.90 UB   | 254     | 50  | 244 | 57     | 2   | 604   | 303      | 304     | 300        |

Total denotes the total number of seats including *Überhangmandate*. Majority denotes the minimum number of seats necessary for majority control of the Bundestag.

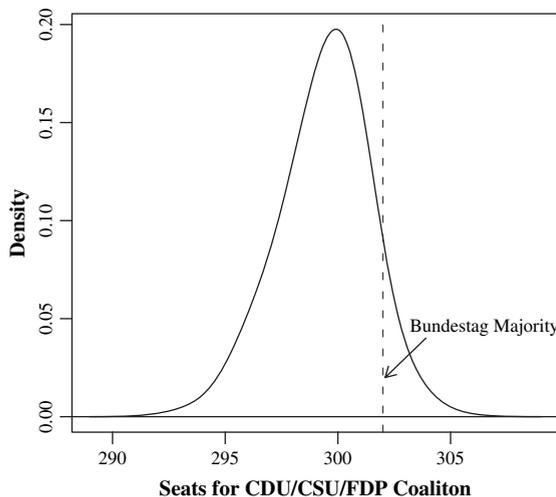


Fig. 2. Seat allocation in the 2002 Bundestag in a simulated counterfactual world without spillover. The curve represents the probability density of the estimated number of seats for the CDU/CSU/FDP coalition (based on 1000 simulated sets of parameters drawn from their sampling distribution in the baseline model presented in Table 3. See supplementary material for details).

other electoral systems. Extending the scope of inquiry to other countries is a logical next step.

Finally, the regression-discontinuity design we have used here has much wider applicability. It is a powerful tool for causal inference that should be used more frequently in research on comparative political behavior.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [10.1016/j.electstud.2007.10.006](https://doi.org/10.1016/j.electstud.2007.10.006).

## References

- Angrist, J., Krueger, A., 1999. *Handbook of Labour Economics*, vol. 3. Elsevier Science, Amsterdam (Chapter Empirical Strategies in Labor Economics).
- Ansolabehere, S., Snyder, J.M., 2004. Using term limits to estimate incumbency advantages when officeholders retire strategically. *Legislative Studies Quarterly* 29 (4), 487–515.
- Ansolabehere, S., Snyder, J.M., Stewart, C., 2000. Old voters, new voters, and the personal vote: using redistricting to measure the incumbency advantage. *American Journal of Political Science* 44 (1), 17–34.
- von Alemann, U., 2003. *Das Parteiensystem der Bundesrepublik Deutschland*, third ed. Leske + Budrich, Opladen.
- Bawn, K., 1993. The logic of institutional preferences: German electoral law as a social choice outcome. *American Journal of Political Science* 37 (4), 965–989.
- Bawn, K., 1999. Voter responses to electoral complexity: ticket splitting, rational voters and representation in the federal republic of Germany. *British Journal of Political Science* 28, 487–505.
- Bawn, K., Thies, M., 2003. A comparative theory of electoral incentives: representing the unorganized under PR, plurality, and mixed-member electoral systems. *Journal of Theoretical Politics* 15 (1), 5–32.
- Butler, D.M., Butler, M.J., 2007. Splitting the difference? Causal inference and theories of split-party delegations. *Political Analysis* 14 (4), 439–455.
- Cain, B.E., Ferejohn, J.A., Fiorina, M.P., 1984. The constituency service basis of the personal vote for U.S. representatives and British members of parliament. *American Political Science Review* 78 (1), 110–125.
- Caramani, D., 2000. *Elections in Western Europe since 1815: Electoral Results by Constituencies*. Macmillan, London.
- Cox, G.W., 1997. *Making Votes Count: Strategic Coordination in the Worlds Electoral Systems*. Cambridge University Press, Cambridge.
- Cox, G.W., Katz, J.N., 2002. *Elbridge Gerry's Salamander*. Cambridge University Press.
- Cox, K.E., Schoppa, L.J., 2002. Interaction effects in mixed-member electoral systems. *Comparative Political Studies* 35 (9), 1027–1053.
- Duverger, M., 1954. *Political Parties, their Organization and Activity in the Modern State*. Wiley, New York.
- Duverger, M., 1986. *Electoral Laws and their Political Consequences*. Agathon, New York (Chapter Duverger's Law: Forty Years Later), pp. 69–84.
- Falter, J., Gabriel, O.W., Rattinger, H., 2000. *Wirklich ein Volk?: Die Politischen Orientierungen von Ost- und Westdeutschen im Vergleich*. Leske + Budrich, Opladen.
- Ferrara, F., Herron, E.S., Nishikawa, M., 2005. *Mixed Electoral Systems: Contamination and its Consequences*. Palgrave Macmillan, New York.
- Gaines, B.J., 1998. The impersonal vote? Constituency service and incumbency advantage in British elections, 1950–92. *Legislative Studies Quarterly* 23 (2), 167–195.
- Gelman, A., King, G., 1990. Estimating incumbency advantage without bias. *American Journal of Political Science* 34 (4), 1142–1164.
- Gschwend, T., 2006. Ticket-splitting and strategic voting under mixed electoral rules: evidence from Germany. *European Journal of Political Research* 46 (1), 1–23.
- Gschwend, T., Johnston, R., Pattie, C., 2003. 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 (1), 109–127.
- Hahn, J., Todd, P., van der Klaauw, W., 2000. Identification and estimation of treatment effects with a regression-discontinuity design. *Econometrica* 69 (1), 201–209.
- Herron, E.S., Nishikawa, M., 2001. Contamination effects and the number of parties in mixed-superposition electoral systems. *Electoral Studies* 20 (1), 63–86.
- Herzog, D., Rebensdorf, H., Werner, C., Wessels, B., 1990. *Abgeordnete und Buerger*. Westdeutscher Verlag.
- Holland, P.W., 1986. Statistics and causal inference. *Journal of the American Statistical Association* 81 (396), 945–960.
- Hough, D., Jeffery, C., 2003. Landtagswahlen: Bundestestwahlen oder Regionalwahlen? *Zeitschrift fuer Parlamentsfragen* 34 (1), 79–94.
- Jacobson, G.C., 1987. The marginals never vanished: incumbency and competition in elections to the U.S. house of representatives, 1952–82. *American Journal of Political Science* 31 (1), 126–141.

- Jacobson, G.C., Dimock, M.A., 1994. Checking out: the effects of bank overdrafts on the 1992 house elections. *American Journal of Political Science* 38 (3), 601–624.
- Jeffery, C., Hough, D., 2001. The electoral cycle and multi-level voting in Germany. *German Politics* 10 (1), 73–98.
- Jesse, E., 1988. Split-voting in the federal republic of Germany: an analysis of the federal elections from 1953 to 1987. *Electoral Studies* 8 (2), 109–124.
- King, G., Gelman, A., 1991. Systemic consequences of incumbency advantage in U.S. house elections. *American Journal of Political Science* 35 (1), 110–138.
- Klingemann, H.-D., Wessels, B., 2001. Mixed-Member Electoral Systems: the Best of Both Worlds? Oxford University Press (Chapter The Political Consequences of Germany's Mixed-Member System: Personalization at the Grass Roots?), pp. 279–297.
- Knack, S., 1994. Does rain help the republicans? Theory and evidence on turnout and the vote. *Public Choice* 79 (1–2), 187–209.
- Lancaster, T.D., 1998. Stability and Change in German Elections: How Electorates Merge, Converge, or Collide. Praeger (Chapter Candidate Characteristics and Electoral Performance: A Long-Term Analysis of the German Bundestag), pp. 281–300.
- Lancaster, T., Patterson, W.D., 1990. Comparative pork barrel politics: perceptions from the West German Bundestag. *Comparative Political Studies* 22 (4), 458–477.
- Lee, D.S., 2008. Randomized experiments from non-random selection in U.S. house elections. *Journal of Econometrics* 142 (2), 675–697.
- Levitt, S.D., Wolfram, C.D., 1997. Decomposing the sources of incumbency advantage in the U.S. house. *Legislative Studies Quarterly* 22 (1), 45–60.
- Massicotte, L., Blais, A., 1999. Mixed electoral systems: a conceptual and empirical survey. *Electoral Studies* 18 (3), 341–366.
- Matusaka, J.G., Palda, F., 1999. Voter turnout: how much can we explain? *Public Choice* 98 (3–4), 431–446.
- Moser, R.G., 1999. Electoral systems and the number of parties in post-communist states. *World Politics* 51 (3), 359–384.
- Moser, R.G., Scheiner, E., 2005. Strategic ticket splitting and the personal vote in mixed-member electoral systems. *Journal of Legislative Studies* 30 (2), 259–276.
- Newey, W.K., West, K.D., 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica* 55 (3), 703–708.
- Newey, W.K., West, K.D., 1994. Automatic lag selection in covariance matrix estimation. *Review of Economic Studies* 61 (4), 631–653.
- Pappi, F.U., Mnich, P., 1992. *Electoral Change: Responses to Evolving Social and Attitudinal Structures in Western Countries*. Cambridge University Press, New York (Chapter Germany), pp. 179–204.
- Patzelt, W.J., 1993. *Abgeordnete und Repraesentation: Amtsverstaendnis und Wahlkreisarbeit*. Wissenschaftsverlag Rothe, Passau.
- Porter, S.R., 1995. *Political Representation in Germany: the Effects of the Candidate Selection Committees*, PhD thesis, University of Rochester.
- Rosenbaum, P.R., 2002. *Observational Studies*, second ed. Springer-Verlag, New York.
- Rubin, D.B., 1974. Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology* 66, 688–701.
- Rubin, D.B., 1977. Assignment to treatment group on the basis of a covariate. *Journal of Educational Statistics* 2 (1), 1–26.
- Rubin, D.B., 1978. Bayesian inference for causal effects: the role of randomization. *Annals of Statistics* 6 (1), 34–58.
- Rubin, D.B., 1990. Comment: Neyman (1923) and causal inference in experiments and observational studies. *Statistical Science* 5 (4), 472–480.
- Shadish, W.R., Cook, T.D., Campbell, D.T., 2002. *Experimental and Quasi-experimental Designs for Generalized Causal Inference*. Houghton-Mifflin, Boston.
- Shugart, M.S., 2001. Electoral efficiency and the move to mixed-member systems. *Electoral Studies* 20 (2), 173–193.
- Shugart, M.S., Wattenberg, M.P., 2001. *Mixed-member Electoral Systems: the Best of Both Worlds?* Oxford University Press, Oxford.
- Statistisches Bundesamt (various years). *Die Wahlbewerber fuer die Wahl zum Deutschen Bundestag*. Stuttgart: Verlag W. Kohlhammer.
- Stratmann, T., Baur, M., 2002. Plurality rule, proportional representation, and the German Bundestag: how incentives to pork-barrel differ across electoral systems. *American Journal of Political Science* 46 (3), 506–514.
- Thistlethwaite, D., Campbell, D., 1960. Regression-discontinuity analysis: an alternative to the ex post facto experiment. *Journal of Educational Psychology* 51 (6), 309–317.
- Zeuner, B., 1970. *Kandidatenaufstellung zur Bundestagswahl 1965*. Martinus Nijhoff, Den Haag.