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Cultivating Votes in Rural Chile

In Chile's two-member legislative districts we show there are two groups of swing voters, one group for the first seat won by the governing coalition, another for the second. We build a model that allows us to identify the relative prevalence of these voters across communities. Using data on the allocation of discretionary agricultural loans, we find that communities with relatively many voters pivotal for the first seat receive more loans than they otherwise would have, but we find no systematic advantage for districts that are pivotal for the second seat.

Introduction

Swing-voter models predict that pivotal voters will be the recipients of bipartisan largess as candidates vie for their support. Most models of swing voters in mass elections focus on two candidate contests operating under a simple plurality rule. A different literature, focused on the U.S. electoral college in presidential elections, looks at the allocation of resources to swing states in a setting in which each state is treated as allocating its electoral votes to the winner of a plurality of votes in the state.[1] Here we adapt the swing-voter model to legislative elections in Chile that employ low-magnitude proportional representation.

Our operationalization of the swing-voter model in this context generates the prediction that communes (e.g., townships) that are forecast to be close to the threshold of electing one additional legislator for the governing coalition will be targeted for discretionary transfers. We then test this model using data from the 1997 elections for Chile's Congress. We construct a model of voting in legislative elections that helps us identify the communes at the greatest "risk" of giving the government coalition an additional seat in Congress.

We note that the Chilean "binominal" system provides an interesting case of a low-magnitude system of proportional representation. If we were to attempt to identify the closeness to the critical cut point for electing another legislator in a high-magnitude system we would be hard

put. On one hand the larger number of legislators from a given district would leave us with fewer districts to work with, while the greater number of cut points, combined with the imperfect accuracy of most models of voting behavior would make it hard to predict which districts were at risk of electing another legislator. In the extreme consider legislative elections in the national districts used by Israel and the Netherlands—the plethora of cut points means that all parties are always at the cusp of electing another member. By contrast, the Chilean system has but two cut points, and this permits us to identify which districts are "in play" and which are all but certain to elect one deputy from each of the two major lists.

We find mixed support for the model. We show that discretionary agricultural subsidies are targeted disproportionately towards communities located in districts and constituencies in which the "first" seat is in play, while we cannot reject the null hypothesis that no extra resources are channeled toward districts in which the "second" seat is at risk. We speculate that in communities that are friendly enough for the ruling coalition to be competitive for the second seat, the government coalition can rely on many sympathetic local officials through whom to channel resources, whereas INDAP loans remain one of the few instruments that are still useful in less-friendly districts. Alternatively, we note that without at least one elected representative in the district to take credit for the targeted subsidies, the government's candidates may have difficulty claiming credit for government achievements, making the retention of at least one seat[2] a greater priority than the capture of a second.

In the first section, we briefly review some of the relevant literature, and we discuss the institutional context of the elections we study. We then present our operationalization of the swing-voter model in the context of elections to Chile's Congress. In the next section, we discuss our data from the 1997 Congressional elections and describe our empirical methodology. We then present our results, and in a brief final section we summarize our conclusions.

Swing Voters with Low-Magnitude PR

There are several strands of the literature on redistributive benefits and legislative competition that are relevant to the setting we consider. After briefly discussing some of the salient work, we turn to the case at hand: elections to the Chilean Chamber of Deputies in 1997.

Some Related Literature

The notion that politicians might allocate benefits in response to personal or careerist motives has important roots in Buchanan and Tullock (1962), Tullock (1983), Meltzer and Richard (1981), Weingast, Shepsle, and Johnsen (1981), and Snyder and Kramer (1988) which have become classic models of resource allocation by electorally motivated parties competing for office. When voters have attachments to parties, and the parties can offer targetable transfers to the voters, financed by net taxes on other voters, the parties are pressured by strategic considerations to target swing voters. Models in which the government targets swing voters include Coughlin (1986), Lindbeck and Weibull (1987), and Dixit and Londregan (1995). An alternative perspective on this problem is offered by Cox and McCubbins (1986) who argue that parties will target core constituents. Dixit and Londregan (1996) reconcile these competing perspectives by showing that if parties are more efficient at targeting their core constituents for transfers than they are at making transfers to swing voters then they will focus their largess on core supporters, while if they are more equally efficient at both sorts of transfers then electoral considerations will favor transfers to swing voters. Dixit and Londregan (1998) show that the swing-voter findings are robust to the possibility that parties have distinct programmatic agendas that directly affect income redistribution.

In most of the literature, the assumption is that parties make binding promises to redistribute after the election. Redistribution in advance of the election may then be viewed as a signal of good faith by the party in power, but it is the prospective transfer that weighs on voters' minds. Voters then cast ballots for the party or candidate offering the most attractive package of transfers and programmatic policies.

The swing-voter model receives some empirical support in the literature. Stein and Bickers (1994) and Bickers and Stein (1996) find that the flow of grant awards to U.S. Congressional districts accelerated in the wake of close district-level election results. Gordon (2010) finds that political appointees pressured the General Services Administration to allocate more procurement to districts represented by vulnerable incumbent party members, while Berry and Gerson (2011) also find that swing districts receive more political pork overall. Case (2001) estimates the impact of the political context on block grants from the central government of Albania to local jurisdictions and finds that constituencies in which the government faced closer elections received larger transfers. Likewise, analysis of a local transfer scheme known as the "ecological grant program" found that the Swedish government made

disproportionately generous discretionary transfers to communities with relatively many swing voters (Dahlberg and Johansson 2002; Johansson 2003). Herron and Theodos (2004) found that discretionary "member initiative" funds in the state legislature of Illinois were disproportionately targeted to competitive districts.[3]

Consistent with the provision of pork, party campaign funds also appear to be allocated to legislators in competitive races (Bianco 1999), while Dropp and Peskowitz (2011) find that members of the Texas state legislature who face stiff electoral competition devote more time to constituency services.

On the other side of the balance, Schady (2000) contends that the Peruvian FONCODES program he studied allocated targetable funds to core constituents of the election winners, while Golden and Picci (2008) conclude that in Italy,[4] party discipline is insufficient to keep legislators attentive to their parties' interests: instead of directing transfers to marginal electoral districts, party leaders and committee chairs direct funds to their own, relatively secure, districts.

Do funds actually affect voting? The swing-voter model of Dixit and Londregan (1998) indicates that voters will respond to programmatic transfers, but that in equilibrium the targeted transfers will cancel out, with voters anticipating the same treatment from both sides. Ansolabehere and Snyder (2006) find that Democrats allocate more of overall spending to districts that vote heavily for their candidates, but this measure is a combination of programmatic benefits, such as Aid for Families with Dependent Children, and targetable transfers, such as bridge and harbor construction. As such it does not cast light on the question of targetable funds. Cerda and Vergara (2008) find that *nondiscretionary* spending had an impact on voting in the Chilean presidential elections of 1989, 1993, and 2001: they conclude that voters who received more generous government subsidies were more inclined to vote for the left of center government's presidential candidate, a finding echoed by Zucco (2011), who shows that in Brazil higher levels of *nondiscretionary* spending in the form of Conditional Cash Transfers (CCT) lead to more support for the government, even when it faces opposition from the left.

When voters are segregated into electoral districts, tactical redistribution takes on another characteristic. Even under simple plurality rule, winning a majority of votes no longer suffices to win a majority of seats. One must also garner a majority of districts. Redistributive competition thus takes on some of the aspects of legislative bargaining with side payments, which has been modeled by Snyder (1991), Groseclose and Snyder (1996), and Banks (2000). Perhaps the U.S. Electoral College has

received the most attention in this respect,[5] with Brams and Davis (1974) noting that large states are more likely to be decisive in a presidential election and that they ought to receive more attention from competing candidates. Colantoni, Levesque, and Ordeshook (1975) take this analysis one step further and add the competitiveness of states to the mix, arguing that states whose voters are closer to dividing their votes should receive more attention—a claim echoed by Grofman and Feld (2005).

An additional layer of strategic complexity emerges when candidates compete under alternative electoral rules. Myerson (1993) analyses two candidate elections and finds that the choice of voting rule has an important impact on the nature of redistributive promises made by optimizing candidates, while Austen-Smith (2000) presents a model of redistribution with proportional representation. Stratmann and Baur (2002) find that legislators in the lower house of the German legislature who are elected under simple plurality rule are more likely to join legislative committees that make it easy for them to serve their geographically based constituencies, whereas legislators elected from party lists[6] are more likely to join committees that further their ideological agendas or permit them to serve geographically diffuse constituencies.

Legislative Elections in Chile

The two-member legislative contests that are the focus of our analysis use "open list PR": the d'Hondt rule allocates seats among lists, while within two-member lists that earn but one seat the candidate with the most votes is elected. Chileans now refer to this electoral system as the "binominal system," but its interesting genesis in the military government that stepped down in 1990 is beyond the scope of this article.[7] A key feature of this system is that in elections with two parties competing along a single left-to-right dimension of conflict, it engenders two cut points: to win the first requires a third of the votes cast for the top two lists; to win both seats calls for two-thirds of the votes for the top lists.

In the 1997 elections we consider, there were effectively six political parties organized into two competing lists. The center-left Concertación de Partidos por la Democracia (hereafter the Concertación) was an alliance of the Christian Democrats (PDC), the Party for Democracy (PPD), the Socialists (PS), and the Radical Social-Democrats (PRSD). Two center-right parties, the Union of Democratic Independents (UDI), and the National Renovation Party (RN), formed the second list in the legislative elections: in 1997 they competed along with the tiny Party of the South (Sur) on the Union for Chile list (the UPC). While there were several smaller parties, the Concertación and UPC lists won all but four

of the 120 seats in the Chamber of Deputies. In the Senate, the domina-
tion of the two primary lists was even more hermetic—all of the Senators
elected ran on one of the two lists. We focus on the competition between
two major party lists.

We focus on the 1997 election because it coincided with neither
presidential nor with municipal elections.[8] Because Senate elections are
staggered into two cohorts, reminiscent of the three Senate "classes" in
the United States, only 10 of 19 Senate districts held elections in 1997.

For the election we study, and indeed for the entire 20-year period
from 1990 until early 2010, when an opposition candidate was elected
president, the chief executive of Chile was a member of the left-of-center
Concertación coalition. For the purposes of this article, we will refer to
the Concertación as the "government" and to the center-right coalition as
the "opposition."

Agricultural Development Funds

The targetable benefits we consider are distributed by the Institute
for Agricultural Development (INDAP), created by law 15.020 on
November 27, 1962. INDAP is involved in many activities, but notably it
disposes of discretionary targetable funds. From its inception, INDAP
field representatives have been involved in disseminating political ideas
even as they allocated credit[9] (Fontaine Aldunate 2001, 96). Out of power
and campaigning for a new term, former president Jorge Alessandri
complained that INDAP had formulated its policies within "political and
demagogic frameworks"[10] (Anonymous 1970).

After the end of military rule, a new organic law[11] 19.213 governing
INDAP was promulgated on May 4, 1993, and spending levels and
INDAP activities both expanded (INDAP 1994). Subsequently the Frei
administration implemented a process of "modernization and institution-
alization of INDAP" that implied further expansion (INDAP 1998).
Moreover, INDAP's de facto discretion was even more ample than
authorized by the law. Spectacular abuses of the loan program during the
1990s embroiled former INDAP directors Maximiliano Cox, Hugo
Ortega, and Luis Marambio in scandal, including a scheme that funneled
millions of dollars to firms that little resembled the indigent population
that are the official charge of INDAP (see Brescia 2001; *El Mercurio*
April 11, 2001). These scandals led to significant changes in the way
INDAP operated. In the ensuing decade there was a marked shift of
emphasis toward the PRODESAL program in which INDAP's discre-
tionary power was shared with municipal governments (see Donoso et al.

2010). However, we focus on the 1997 election, before the postscandal reforms were implemented.

INDAP's charter restricts it to offering assistance to farmers with relatively small landholdings[12] of modest value,[13] while to be considered a farmer, working the land must be one's primary occupation. For 1997 we have data on "colocaciones," concessionary loans to poor farmers who would otherwise have great difficulty in qualifying for bank credit. These loans come with a low interest rate and favorable terms for repayment. INDAP administrators at the national and regional level are political appointees who serve at the pleasure of the government. As of 1997, INDAP's discretion in choosing which applications to grant was reminiscent of Sweden's "ecological grant program" (Dahlberg and Johansson 2002; Johansson 2003) and the member-initiative funds in Illinois (Herron and Theodos 2004).

Our spending data covers only 1997; however, we note the general finding that voters appear to react disproportionately to recent economic performance (Alesina, Londregan, and Rosenthal 1993; Lenz 2011), perhaps for the reasons highlighted in Coram (2010). If there is a tendency to channel spending to pivotal voters in legislative elections, we would expect to observe this happening during legislative election years.[14]

Because we observe so few Senate races, and while even for the Chamber of Deputies we are restricted to a mere five dozen districts per election, we build a model of legislative voting that is disaggregated below the district level. At the time of the 1997 legislative elections, Chile was partitioned into 340 local jurisdictions called "communes." The average population of these jurisdictions was about 44,281 people, though there was tremendous variation,[15] and the median community had a population of 16,689.

We have both voting data and data on loans disaggregated to the commune level. This allows us to build a model of targetable transfers at the commune level. This leaves us with 340 observations for the Chamber of Deputies elections and 212 observations for the Senate contest. In the case of the Senate, this provides us with a dramatic increase from the sample size we would have if we worked only with the data at the level of the senate constituency, of which we observe but 10.

A Model of Electoral Transfers

Next we set forth a model of voting and targetable transfers in legislative elections. We present the formal model in full in Appendix A. Here we outline its crucial features. Within each community, voters have

heterogeneous preferences over the programmatic platforms of the parties, with those on the left being most inclined to cast ballots for the Concertación, while voters on the right lean toward casting ballots for the opposition. As we move from left to right along the spectrum of voters, we start out with voters who are strongly attached to the government and move through voters with increasingly weak adhesion to the government, until we arrive at a point at which the voter is indifferent between the two parties—we'll refer to the ideology of this voter as the "cut point." Moving to the right of the cut point we encounter voters with increasingly strong attachments to the opposition. Voters make trade-offs between their attachments to parties' programs and the transfers offered to each voter. For voters at the cut point, even a small difference in the transfers offered by the two parties will be decisive in determining how to vote. As we move away from the cut point, it takes an increasingly large transfer to persuade a voter to shift her ballot.

Assuming, as is almost always the case, that the Concertación and Alliance are the first- and second-place lists, we see that under the rules of Chile's proportional system, the government wins no seats if it earns less than one-third of the vote going to the top two lists, while it wins both seats if its share of the vote for the top two lists exceeds two-thirds. Otherwise the government and opposition lists each win one seat. In a district with one commune, such as the 32d Deputies' district that consists of the commune of Rancagua, if the communal cut point is to the left of one-third, then the government vote share is also below one-third, and the right wins both seats. If the cut point is between one-third and two-thirds, the government and opposition each elect one deputy, while if the cut point (and so the vote share) is to the right of two-thirds, then it is the left who wins both seats.

In a multimember district the mapping between community-level voting and district-level vote shares is a bit more complicated. Consider a district with two communities, such as the 50th that consists of the communities of Temuco, with about four-fifths of the constituents in the district, and Padre las Casas, where the remainder reside. If we expect that each community gives an expected 0.6 of its vote to the government, with a standard deviation of about 0.32 and the correlation between the random shocks is about one-half, then we can map out the contours of the joint probability density of vote shares for the two communities as in Figure 1, with the vote share for the larger community, Temuco, shown on the horizontal scale, while the share for the less populous Padre Las Casas appears on the vertical scale. The contours are spaced exponentially.[16] The diagonal line on the left-hand side, labeled "1st Seat," represents combinations of vote shares for the two communities that result in

FIGURE 1
Joint Density of Community Level Votes
in the 15th Deputies' District
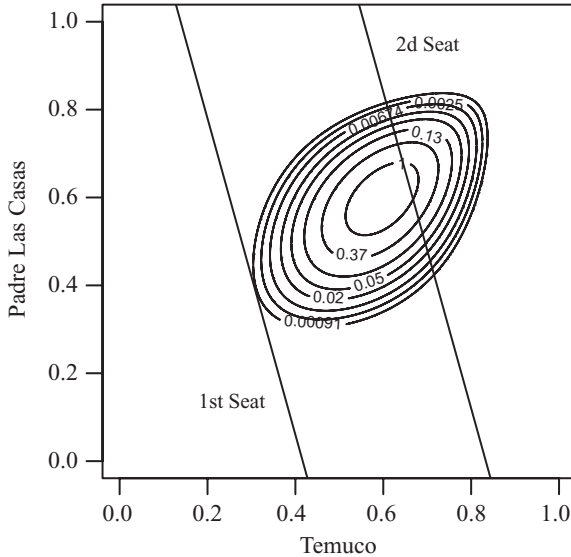
the government winning the one-third of district-wide votes needed to win the first seat. Points below and to the left of this line represent vote-share combinations that lead to the opposition winning both of the district's seats. The steepness of the slope reflects the asymmetry between the sizes of the communes. The right-hand diagonal line, which is tagged as "2d Seat," depicts the combinations of communal vote shares that lead to the government earning the necessary two-thirds of the district's votes to garner the second seat. The region above and to the right of this line consists of all the vote-share combinations leading to the government winning both seats. In the region between the diagonal lines each list wins one seat.

Reading along the left-hand diagonal, we see that the fraction of the vote in Padre Las Casas, the community corresponding to the vertical axis, that is needed to place the district at the threshold of giving the government one-third of the vote, and hence one seat in the Chamber of Deputies, depends on how well the government's list of candidates fares in Temuco, represented along the horizontal axis. Following the left-hand line to the top of the graph we see that if the government's list garners less than 5/36 of the vote in Temuco, then even if it wins all of the votes for Padre Las Casas, it will still fall short of the first seat.

Most legislative districts contain more than two communities, making a graphical depiction more difficult, but for all multicommunity districts, the community-level thresholds for winning another seat depend on the voting behavior of the rest of the district.[17] This dependency is detailed in the online appendix.

Political parties seek to maximize the number of seats they earn in the legislature, but the effort required to direct promised transfers rises the farther the promises depart from the mission of INDAP. In the appendix, we present a formal model of the contest between the government and opposition as a game in which the government seeks to maximize the number of seats it wins in the legislature, subject to quadratic costs of allocating extra funds to electorally sensitive districts, while the opposition seeks to minimize the government's seat share, subject to its own quadratic costs of allocating funds. Our approach in treating the government coalition as an actor in our model is consistent with Carey (2002).[18] The quadratic costs capture the notion that while the government and opposition have discretion in the allocation of funds, the farther they stray from the spirit of the INDAP charter of allocating loans to needy farmers who will nevertheless eventually repay their loans, the more effort they have to expend in rationalizing their choices. This echoes the model of judicial opinions in Bueno de Mesquita and Stephenson (2002). We further assume that to retain credibility the government must vouchsafe its promises of postelectoral transfers by making similar transfers prior to the election. In the online appendix we show that this leads parties to "tilt" the allocation of INDAP funds toward communities where the cut point is close to one of the thresholds for earning another seat. Because the district cut points depend on the details of the campaign and on other shifts of public opinion, the parties do not know the exact locations of the cut points. Instead, their beliefs are characterized by a probability distribution over possible locations of the cut points. The parties then allocate funds to communities on the basis of where extra funds are most likely to garner the party another legislative seat. This leads parties to allocate funds to communities in districts where the probability density for the cut points, and so for the vote shares, is large and near the thresholds needed to win an additional seat, and where there are relatively many voters near the threshold for another seat. Of course, both parties are engaged in the same activity, in equilibrium transfers match,[19] and vote shares are what they would have been absent any offered transfers.

We denote by $\kappa_{d1,c}$ the probability density of the log-odds of the vote share for the government candidate at the pivot. In online Appendix A, we show that this is proportional to the marginal change in the probability

of winning the first seat in the Deputies contest for that commune's district in response to a small additional increment of per capita transfers to commune c. While the model generates a pivotalness measure for total transfers to the district, we renormalize our pivotalness measure in per capita terms to harmonize it with our model of programmatic INDAP transfers, which is estimated in per capita terms. Likewise, $\kappa_{d2,c}$ is the corresponding change in the probability of winning the second Deputies seat as a result of a small increase in per capita funds to commune c. The variables $\kappa_{s1,c}$ and $\kappa_{s2,c}$ are similarly defined in terms of the impact on the outcomes for the first and second Senate contests in response to additional funds being allocated to community c.

We operationalize our model of INDAP loan allocation with the following linear model:[20]

$$\$_c = \overrightarrow{w}'_c\vec{\zeta} + a_1\kappa_{d1,c} + b_1\kappa_{d2,c} + c_1\kappa_{s1,c} + d_1\kappa_{s2,c} + \eta_c \qquad (1)$$

where $\kappa_{d1,c}$ is a measure of the "pivotalness" of the commune in terms of the first Deputies seat. The higher the value of $\kappa_{d1,c}$, the greater the probability that a small increment of extra transfers will change the outcome in the commune's Deputies' district from no government deputies to one. Likewise, $\kappa_{d2,c}$ measures the probability that a marginal increase in transfers to community c will result in the government winning both seats. The definitions of $\kappa_{s1,c}$ and $\kappa_{s2,c}$ tell us about the pivotalness of the community for the first and second Senate seats in the constituency containing the commune. Of course, these pivotalness measures will equal zero in communes that are not holding Senate elections. The $\overrightarrow{w}_c$ term captures other characteristics of the community, such as the fraction of land that is under the plough, or the presence of an INDAP office in the commune, we would expect to affect the INDAP allocation in the absence of political pressures. The vector $\vec{\zeta}$ is a vector of coefficients. We operationalize this formula as equation (7) in the second section.

Finally, we need to contend with the problem that some districts simply won't receive any agricultural transfers due to their characteristics. Here we refer, for example, to urban districts where there is no farming. These are not simply districts with negative residuals for equation (1), and transfers to these districts are governed by a different process. To capture the "no tractors on the subway" effect, we model the process that determines whether a community receives any agricultural subsidies at all using an equation of the form:

$$p_c = \overrightarrow{m}'_c\vec{\pi} - \xi_C \qquad (2)$$

Here p_c is a latent variable that determines whether we observe an outcome. We observe $\$_c$ only if $0 < p_c$, while $\overline{m_c}$ is a vector of observable variables such as whether the community possesses any arable land, and $\overline{\pi}$ is a vector of coefficients. This model of censored observations was first put forth by Heckman (1979), and Amemiya (1984, 31–33) refers to it as the "type 2 Tobit model." If we were to ignore the process captured by equation (2) and simply estimate equation (1), our estimates of ζ and of the κ parameters would be inconsistent unless the random error terms η_c and ξ_c were uncorrelated. Our empirical estimates reveal that they are not. We concretise formula (2) as equation (8) in the second section. We estimate (1) conditional on the community receiving at least some subsidy.

Our Data and Methodology

Our empirical strategy to identify politically motivated targeting of benefits has several key ingredients. Firstly, as in Dixit and Londregan (1996), our model of electoral transfers implies that the two major parties' transfers and transfer offers "cancel out," with the opposition's promised transfers credibly matching the government's promises, though the latter are vouchsafed by the government's actual pre-election transfers. This means that the voting part of the statistical model is exogenous with respect to the grant allocation portion. This is an equilibrium phenomenon—if either side were to depart from their equilibrium grant allocation strategy then the transfers would have consequences; however, in the equilibrium of our model they do not.

A second key feature of our strategy is to use the voting equations to estimate the pivotalness for each district. Our estimation equation treats each commune as having a unimodal "logit" distribution, with a mode at the predicted vote share for the government candidates. This means that within districts some communities have relatively more swing voters than others. Also, some districts are closer to the thresholds for electing another legislator for the government coalition, and these districts are, ceteris paribus more attractive targets for transfers. Our model builds both of these features into its calculation of the pivotalness of each district. The pivotalness parameters involve evaluating probability densities over joint vote shares in multicommunity districts (which account for all of our senate constituencies and all but five of the lower house districts). To operationalize this calculation we apply importance sampling, a Monte Carlo technique. Because the probabilities we estimate are small, we take a large number of draws.

A third statistical feature of the model emerges from the common sense observation that there are limits to the flexibility of even a discretionary agricultural transfer program. There are 70 communes in our sample that do not receive any transfers. The key features that determine whether a district receives at least something versus getting nothing at all from INDAP center on whether there is any agricultural activity in the community. Communities with no such activities, the cores of large cities, desert wastelands, get nothing. Among the remaining districts, the determinants of how much the district receives are somewhat distinct. With no rain[21] at all, a commune receives nothing, but agricultural communities that are irrigated are neither more nor less likely to receive INDAP grants. Accordingly, we use a consistent estimator for the "type 2 Tobit" model to estimate the grant equation, with a censorship model that allows the impact of the explanators to affect censorship differently than they do spending among districts that are subsidized.

Our key test for the impact of the subsidy program hinges on the coefficients for the electoral pivotalness measures. We add these to the grant-making model. If the coefficients were all indistinguishable from zero, then our findings would be consistent with the view that INDAP grants were unresponsive to the electoral pivotalness of the communes to which they were directed. Our pivotal voter model implies positive coefficients for these swing coefficients, and we would expect the coefficients on both pivots for the same chamber to be equal—we began our analysis with no *ex ante* expectation that first seats were either more or less valuable to the political parties than second seats.

The Data

We apply our model to targetable agricultural benefits allocated by INDAP during 1997. As we have noted above, this was an election year in which there were neither presidential nor municipal elections to distract either the public or INDAP from the parliamentary contests for the Senate and the Chamber of Deputies. In about half of the districts in each election there was a simultaneous Senate race, while in the remaining districts the sole race in the election was the competition for the Chamber of Deputies.

Our data, which come in the form of electronic files compiled by INDAP, provide information about every loan made by INDAP in 1997. For each loan INDAP made, there is a field listing the commune[22] and region[23] of the recipient. There are some problematic codings: in a few cases grants were attributed to a commune and region that were incompatible, in a few others the commune appears to have been confused with

the region, as in "Santiago north."[24] As the data INDAP shared with us does not include identifying information about the individual recipients, we cannot further check these locations, and so we simply omit these grants from the total.

For 1997 our INDAP data register loans totaling 35,530 million pesos (worth about 70 million dollars) distributed across 270 of the then existing 340 townships. These loans were made to cover the expense of productivity enhancements, from fertilizer and barbed wire to tractors and irrigation pipes. In addition to loan disbursements by INDAP, we have some basic agricultural data. For each township we observe the total population and the fraction of the population who are rural. We also see the land area of each township, the fraction of that land that is arable, and on the fraction of arable land that is irrigated.

Additional data include the total population from the 2002 census and the fraction of the population classified as rural in the 2002 census.[25] We also catalog the number of INDAP field offices in each commune as of 2007. These offices are of long standing—many have been in place since the 1960s. We suspect that proximity to an INDAP office increases the likelihood someone will receive a transfer. In addition, we have poverty measures from the CASEN surveys taken in 1996, 1998, and 2006. The CASEN data provide only partial coverage for the country, especially in 1996 and 1998; but by 2006 coverage was extensive. We are able to use the 2006 values to infer the 1996 poverty levels for the missing districts. While we are mindful of the limitation of this variable estimating poverty in 1996, we include it in some of our specifications to check the robustness of our results.

We combine these agricultural data with electoral data. We have voting returns at the precinct level, though we eventually aggregate these to the level of the commune. We have data on voting in Deputies and Senatorial elections held in 1989, 1993, and 1997, as well as presidential election data from 1989 and 1993. We have also compiled data on the 1988 plebiscite on Pinochet's continuation in power and on the municipal elections of 1996.

Similarly to Lindbeck and Weibull (1987) and to Dixit and Londregan (1996), our analytical model predicts that the electoral effects of promised transfers cancel out, so that voting is as it would have been absent transfers, while transfers are directed disproportionately to swing districts. Yet before we plunge into the details of our empirical model, it behooves us to take a first look for evidence of strategic electioneering. One might imagine that if the government was asymmetrically able to manipulate votes in its direction that it would focus its efforts on districts close to the cusp of giving the government an additional legislative seat.

If districts had been drawn in an ideologically neutral way, successful government electioneering would result in relatively more districts in which the government was just above the threshold for another seat, and disproportionately few districts in which its vote share fell just below the cusp for electing another legislator; that is, we might expect to see more districts with Concertación vote shares on the intervals (0, 1/6), (1/3, 1/2), and (2/3, 5/6), call the union of these intervals S, than on the remainder of (0, 1).[26] In fact, only 23 of 60 districts are on these intervals. This allows us to reject the null hypothesis[27] that the underlying probability of a given district being in S is 1/2 at $\alpha = 0.05$. Likewise, there are but two of the ten Senate constituencies voting in 1997 that belong to S, allowing us to reject the null hypothesis[28] that the probability a Senate constituency being in S is equal to 1/2 at $\alpha = 0.10$, but not at $\alpha = 0.05$. However, there are too few cases rather than too many. The data suggest strategic manipulation in favor of the opposition! While it is unlikely that the government has been targeting transfers to assist the opposition, the boundaries for Chile's legislative districts were drawn during the final months of the military government, and one might expect that their shape favors candidates of the center-right opposition.[29] We suspect that this is the reason for there being so many districts in the complement to the set S. If we want to test our theory of targeted transfers, we will need to look directly at the transfers themselves, and to separate the incentives to pursue pivotal communities from the spending that is called for by the charter of INDAP.

An Empirical Model of Voting in Legislative Elections

Let's turn first to our legislative voting models. For the Chamber of Deputies elections we have data from 340 communes. Given our operationalization of the commune-level heterogeneity of voters, we estimate the voting model in terms of the "log-odds ratio" of government votes as a fraction of votes cast for the two top lists. If we let $v_{1997,c}^{d}$ denote the 1997 vote share for the government's lower house candidates in commune c, then our dependent variable is:

$$y_{1997,c}^{d} = \log(v_{1997,c}^{d}) - \log(1 - v_{1997,c}^{d})$$

We likewise transform the lagged vote shares for the 1993 and 1989 Deputies elections into log odds ratios. We also include the Aylwin vote (expressed as the log odds of voting in 1989 for Aylwin relative to the two opposition candidates) and the log odds of voting against keeping Augusto Pinochet as president in the October 1988 plebiscite. In addition, we include the 1989 Senate vote in the commune.[30] We also include a

dichotomous indicator variable for the presence in the commune of a government coalition mayor, m_c. In addition, our specification includes some characteristics of the commune, such as the fraction of the population classified as rural, r_c, the fraction of land that is cultivated, f_c, and the fraction of land in the community that is irrigated, w_c. This leaves us with the following specification[31] for the Deputies election in community c:

$$
\begin{aligned}
y^d_{1997,c} = {} & \alpha_0 + \alpha_{1989s}y^s_{1989,c} + \alpha_{1993}y^d_{1993,c} \\
& + \alpha_{1989}y^d_{1989,c} + \alpha_{No}No_c + \alpha_{Aylwin}Aylwin_c \\
& + \alpha_{mayor}m_c + \alpha_{rural}r_c + \alpha_{tilled}f_c + \alpha_{h2o}w_c + \varepsilon_c + \varepsilon_{d(c)}
\end{aligned}
\tag{3}
$$

where d(c) pertains to the Deputies district that contains commune c. We estimate equation (3) by Generalized Least Squares.

For the 212 communes in which there was a Senate race in 1997, our Senate voting equation is:

$$
\begin{aligned}
y^s_{1997,c} = {} & \beta_0 + \beta_{1989s}y^s_{1989,c} + \beta_{1993}y^d_{1993,c} \\
& + \beta_{1989}y^d_{1989,c} + \beta_{No}No_c + \beta_{Aylwin}Aylwin_c \\
& + \beta_{mayor}m_c + \beta_{rural}r_c + \beta_{tilled}f_c + \beta_{h2o}w_c + \theta_c + \varepsilon_{s(c)}
\end{aligned}
\tag{4}
$$

where s(c) pertains to the Senatorial constituency that contains commune c.

Notice that in 1997 the last Senate election to have taken place in these districts transpired in 1989. The Deputies elections, particularly those in 1993, tell us something about how the commune's preferences evolved during the interim.

Measuring the Pivotalness of Communes

Next we calculate the pivotalness of the communes. Starting with our estimates for the Deputies elections, we turn to our pivotalness measure $\kappa_{d1,c}$ referred to in subsection 1 and set forth in detail in online Appendix A, where we see that:

$$
\kappa_{d1,c} = \int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty} f(\varepsilon_d + \zeta_c - \log(\Omega_c) + \log(1 - \Omega_c))f(\varepsilon_{c'})d\varepsilon_{c'} \ldots g(\varepsilon_d)d\varepsilon_d
\tag{5}
$$

Here $f(\varepsilon_{c'})$ is the normal density function with mean 0 and variance σ^2, while $g(\varepsilon_d)$ is the normal pdf with mean 0 and variance ω^2. The variable Ω_c is described in detail in online Appendix A; it tells us about the voting of the rest of the district containing commune c.

This is a high-dimensional multivariate normal integral. While some Deputies districts consist of a single commune,[32] there are others with over a dozen communes. We need to find for each community the probability that an infinitesimal increase in grants to farmers in the commune will push the district over the threshold of the one-third needed to win the first seat to the Chamber of Deputies.

The solution we adopt is a variant of importance sampling (see Liu 2001, 32–34). First, we use our voting equations to estimate ζ_c and Ω_c. Then we draw simulated $\varepsilon_{c'}$ and ε_d values from the relevant normal pdfs and calculate the average value for the probability density function conditional on $\varepsilon_{c'}$ and ε_d:

$$\kappa_{d1,c} = 10^{-6} \sum_{i=1}^{10^6} f\left(\varepsilon_{di} + \hat{\zeta}_c - \log\left(\hat{\Omega}_{ci}\right) + \log\left(1 - \hat{\Omega}_{ci}\right)\right) \qquad (6)$$

This procedure gives us workable results; see online Appendix C for more details. We likewise use importance sampling to estimate $\kappa_{d2,c}$ and for the corresponding Senate race parameters $\kappa_{s1,c}$ and $\kappa_{s2,c}$.

The $\kappa_{d1,c}$ variable gives us the responsiveness of the probability the Concertación wins or loses the first seat in a district to an infinitesimal change in spending in the district; districts with larger values for $\kappa_{d1,c}$ are more likely to be pivotal for the first seat.

An Empirical Model of INDAP Allocations

We now turn our attention to equation (1) from our model of legislative elections. We observe INDAP loans disbursed in 1997. These concessionary loans must be paid back, at least in theory. As a practical matter, INDAP loans targeted farmers on the economic margin, most of whom would not have been able to obtain commercial credit. As we have already noted, considerable discretion was afforded to INDAP administrators. Eventually abuses of that discretion led to significant decentralization in the control of INDAP funds, reforms that made municipal governments much more important in allocating funds (see Donoso et al. 2010). But in 1997, control was still highly centralized, and INDAP authorities had ample discretion.

While the public scandals involved converting INDAP funds into personal lucre, they indicate that as a practical matter, INDAP authorities enjoyed ample discretion to redirect loans to politically attractive borrowers. The extent to which the INDAP authorities actually used their evident discretion to channel funds to politically pivotal communes is the object of our analysis here.

Our baseline model for INDAP loans is given by:

$$
\begin{aligned}
\text{loan}_c = {} & \delta_0 + \delta_a \text{arable}_c + \delta_r^* \Delta(\text{rural}_c > 0) + \delta_r \text{rural}_c \\
& + \delta_o \text{office}_c + a_1 \kappa_{d1,c} + b_1 \kappa_{d2,c} + c_1 \kappa_{s1,c} + d_1 \kappa_{s2,c} + \tilde{\varepsilon}_c
\end{aligned} \tag{7}
$$

Our dependent variable, loan_c, equals the log of the "colocaciones," concessionary loans provided by INDAP to recipients in commune c. The variable arable reports the fraction of the district's land that is arable, rural corresponds to the share of the population classified as rural, while $\Delta(\text{rural}_c > 0)$ is an indicator for communes that have at least some rural population. The office variable is an indicator for whether community c is one of the 57 communes with at least one INDAP office.[33]

We also experiment with adding our estimate of the poverty rate based on the partial CASEN estimates we discussed earlier, with a measure of the fraction of the land that is irrigated, and an indicator variable for communes with a mayor from the government coalition.

For each of these baseline models, we encounter a substantial number of cases (about one-fifth of our sample) for which no grants were made. This brings us to the censorship equation (2) in our model. The resulting model of censorship is:

$$
z_c^* = \omega_0 + \omega_a \text{arable}_c + \omega_r^* \Delta(\text{rural}_c > 0) + \omega_f^* \Delta(\text{arable}_c > 0) - \xi_c \tag{8}
$$

Here z_c^* is a latent variable; we observe loan_c when $0 < z_c^*$ and not otherwise.

Using the procedure laid out in Amemiya (1984), we estimate the parameters in (8) by probit maximum likelihood. We then calculate the inverse Mills ratio, Mills_c, and substitute it into equation (7). Then, using the subsample of communes that receive loans, we estimate the "reduced form" model:

$$
\begin{aligned}
\text{loan}_c = {} & \delta_0 + \delta_a \text{arable}_c + \delta_r^* \Delta(\text{rural}_c > 0) + \delta_r \text{rural}_c + \delta_o \text{office}_c \\
& + a_1 \kappa_{d1,c} + b_1 \kappa_{d2,c} + c_1 \kappa_{s1,c} + d_1 \kappa_{s2,c} + \rho_M \text{Mills}_c + \tilde{\varepsilon}_c
\end{aligned} \tag{9}
$$

This yields consistent estimates of the δ coefficients, while information about the variance of ξ_c and the covariance between ξ_c and ε_c can be recovered from the estimated value of ρ and from the estimated residual error from the regression. However, for our purposes the latter are nuisance parameters, and we do not pursue them. Olsen (1980) showed that the second-stage equation for this procedure, in our case this is (9), continues to be a valid specification even when one relaxes the assumption that $\tilde{\varepsilon}_c$ is normal. Amemiya (1984) advocates taking

advantage of this flexibility to apply the formulation of White (1980) in calculating the standard errors for the estimated parameters of (9), and this is the procedure we use here.

To summarize, our empirical strategy is first to estimate the voting equations (3) and (4). We then use these estimates to calculate the pivotalness measures given by equation (6). We also estimate the censoring equation (8) that tells us whether a district is sufficiently agricultural even to qualify for an INDAP subsidy. Finally we use the pivotalness measures from (6), and the inverse Mills ratio from the censorship equation (8), along with our agricultural covariates to estimate the INDAP loan making equation (9). Recall that in the equilibrium for our model the electoral impact of the transfers offered by each party cancel out, so there is no feedback from the errors in the loan allocation equation to the voting equations.

Results

Summary statistics for the variables we use in our analysis appear in Table 1. The first group of electoral variables is expressed as log odds. These are the log odds of voting for the government versus the opposition.[34] The log odds for the "No" vote reports the log odds of voting "No" instead of "Yes" in the 1988 plebiscite on whether Augusto Pinochet would continue as president in 1990.

The next variables on the table are dichotomous (0, 1); these are indicators for whether at least some of the population are rural, at least some of the land is tilled, whether there is an INDAP field office, or a government coalition mayor. A final dummy variable indicates whether a commune receives at least some INDAP funds.

The farm density and poverty variables are percentages, while irrigation intensity (the fraction of arable land that is irrigated) and the rural population share are fractions between 0 and 1. The $\log(1 + [INDAPLoans])$ variable is the natural log of the amount of money (in Chilean pesos) loaned out in each commune. The one-peso adjustment is a standard response to the problem that for communes with no loans at all, the logarithm becomes infinitely negative.[35]

Turning to our electoral model,[36] our estimates for the parameters of the Deputies' election equation (3) appear in the first column of Table 2. The dependent variable is the government vote, calibrated as the log odds of voting for the government instead of the opposition.

Notably we estimate a coefficient of approximately 5/8 for the 1993 Deputies vote, while the "No" vote earns a coefficient of about 2/11. The 1/9 coefficient for a government mayor implies that the presence of a

TABLE 1
Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
log-odds Senate 1997	0.42	0.56	−1.23	2.45
log-odds Senate 1989	0.26	0.51	−2.35	1.61
log-odds Deputies 1997	0.36	0.63	−1.48	2.22
log-odds Deputies 1993	0.34	0.48	−1.29	2.05
log-odds Deputies 1989	0.21	0.59	−2.55	1.42
log-odds Aylwin	0.06	0.48	−2.64	1.24
log-odds "No" vote	−0.13	0.62	−3.39	1.20
δ(Rural Population > 0)	0.92	0.28	0.00	1.00
δ(Farms > 0)	0.93	0.26	0.00	1.00
INDAP Office	0.17	0.37	0.00	1.00
Government Coalition Mayor	0.67	0.47	0.00	1.00
δ(INDAP Loans)	0.79	0.40	0.00	1.00
Farm Density (as a percentage)	0.60	0.32	0.00	1.00
Estimated Poverty Percentage (1996)	0.24	0.10	0.00	0.51
Irrigation Intensity	0.11	0.20	0.00	0.94
Rural Population Share	0.39	0.30	0.00	1.00
$\log(1 + [\text{INDAPLoans}])$	6.43	3.69	0.00	11.81
$\kappa_{d1,c} \times 10^{-3}$	1.80	12.80	0.29	226.00
$\kappa_{d2,c} \times 10^{-2}$	2.70	4.66	1.78	37.90
$\kappa_{s1,c} \times 10^{-7}$	5.88	13.88	0.00	75.13
$\kappa_{s2,c} \times 10^{-3}$	7.07	19.40	0.00	229.00
Mills	1.55	0.53	0.11	2.12

Concertación mayor in the community translates into an extra sixth of a standard deviation for the 1997 Deputies vote. This significant variable suggests the importance of mayors for organizing electoral support in Deputies elections. The estimated coefficient for the rural population share of about 1/5 indicates that in districts with a larger share of the population in agriculture the government has an advantage—an extra standard deviation for this variable translates to about a tenth of a standard deviation increase in the log odds for the Deputies. Offsetting this agrarian advantage, we note that the large, −2/3, and negative coefficient for irrigation means that an extra standard deviation of irrigated land implies a reduction of about −2/9 of a standard deviation in the log odds of the government's Deputies vote. The irrigated farms of the northern part of the Central Valley of Chile appear to be less progovernment, while ceteris paribus the farmers of southern Chile appear to give their votes more generously to government candidates. The variance of the district-level shock is over three times the magnitude of that for the

TABLE 2
Legislative Elections
(standard errors in parentheses)

Explanator	Column 1	Column 2
log-odds Senate 1989	−0.02	0.28
	(0.11)	(0.12)
log-odds Deputies 1993	0.62	0.61
	(0.06)	(0.07)
log-odds Deputies 1989	0.07	−0.10
	(0.08)	(0.06)
log-odds "No" vote	0.18	0.03
	(0.08)	(0.12)
Government Coalition Mayor	0.11	0.08
	(0.04)	(0.05)
Rural Population Share	0.21	0.21
	(0.08)	(0.10)
Farm Density	0.11	0.16
	(0.08)	(0.09)
Irrigation Intensity	−0.68	−0.48
	(0.16)	(0.18)
σ^2	0.05	0.07
ω^2	0.18	0.05

commune-specific innovation, suggesting that the random shocks embody district-wide effects such as campaigns, while commune-specific shocks tend to be smaller.

Our estimates for the subset of communes that were in Senate constituencies that held elections in 1997 appear in column 2 of Table 2. The dependent variable for equation (4) is the log odds of voting for the government versus voting for the opposition. Our estimates award a significant coefficient to the 1989 Senate vote share, with an estimated coefficient of about 2/7. Also significant are the Deputies vote in the 1993 election, and the fraction of the population who are classified as rural. In both cases the coefficients are virtually identical with their values in the Deputies voting equation. Also significant, but with an estimated magnitude that is somewhat smaller than for the Deputies vote, is the coefficient for irrigation, which is estimated to equal about −1/2.

It should be borne in mind that the Senate constituencies are substantially larger than the Deputies districts, with an average of about 21 communes per Senate constituency, whereas the average for the Chamber of Deputies is just under six communes per district. Notably, the constituency-wide shock is no larger than the community-specific shock, in marked contrast with the finding for the Chamber of Deputies where

the district-level shock was over three times the magnitude of the commune-level shock. The larger size of Senate constituencies may also help to explain why the presence of a government mayor does not earn a significant coefficient in our Senate voting equation—perhaps mayors form closer relationships with the political careers of the Deputies than they do with their more remote Senators.

Using our estimates for the voting equations, we calculate our pivotalness measures. These are reported in Table 1. Because the magnitudes differ dramatically, and in order to avoid cluttering our tables with large strings of empty decimals, we rescale the pivotalness measures as indicated in the table. Notice that the average value of the pivotalness measure for the second Senate seat is over ten thousand times larger than for the first. The corresponding ratio for the Chamber of Deputies elections is about 15, while this is a substantially smaller disparity, it is still the case that elections for the second seat tend to be more competitive. Indeed, in most districts the government was all but certain of winning at least one seat. Notice that while Deputies races are, on average, about four times as competitive as Senate contests in terms of the second seat, there are some Deputies races for which the first seat is in contention, whereas for the Senate races the average pivotalness measures for the first seat is miniscule.

Next let's identify the communes that were plausible recipients of agricultural loans. We include a panoply of variables in our estimation of equation (8) (see column 1 of Table 3). However, we easily accept the null hypothesis that four of them, irrigation intensity, the rural population share, the presence of an INDAP office in the community, and the poverty rate, have coefficients equal to 0. Calculating the likelihood ratio test for the null, the test statistic is asymptotically χ_4^2 and the realized value for our sample of 2.72 again corresponds to a very high p-value, in this case 0.3943. Parameter estimates for the model with only the remaining variables, namely the fraction of land under the plough, and indicators for the existence of at least some farmers, and at least some farms, can be found in the second column of Table 3.

In order to calculate the Mills ratio for the grant-amounts equation (9), we use the sparser specification of (8) found in column 2 of Table 3. The variable Mills is equal to the inverse Mills ratio for each of the unobserved residuals from the censoring equation,[37] and we report summary statistics in Table 1.

We now come to the loan-making equation. In 1997, of the 340 townships then in existence, 70 received no loans. These are treated as censored according to our model. Our estimates in column 1 of Table 4 pertain to our "baseline" model without pivotalness considerations.[38]

TABLE 3
1997 Censoring Equation for Agricultural Loans
(standard errors in parentheses)

Explanator	Column 1	Column 2
Farm Density $\times 10^2$	1.45	1.51
	(0.33)	(0.31)
δ(Rural Population > 0)	0.95	0.94
	(0.42)	(0.38)
δ(Farms > 0)	0.98	0.92
	(0.48)	(0.46)
Irrigation Intensity	−0.19	
	(0.49)	
Rural Population Share	−0.38	
	(0.31)	
INDAP Office	−0.01	
	(0.26)	
Estimated Poverty Percentage (1996)	1.41	
	(1.06)	
log(Lik)	−120.75	−122.11
N	340	340

Perhaps the single most powerful predictor of grants is the fraction of the population who are rural. Moreover, an indicator variable for townships that have some rural population earns a positive coefficient. Having an INDAP field office in the community increases the expected value of grants. We note in passing that many of these offices were established in the 1960s, well before the current electoral system had even been imagined.

In striking contrast with the censoring equation, in which farm density was a highly significant predictor whereas the rural population percentage was not, here we find that farm density is of marginal significance, while the percentage of the population who are rural is a key predictor of the level of INDAP loan activity. The large but only marginally significant negative coefficient for the Mills ratio suggests a negative correlation between the shocks for the censoring and loan equations.[39]

In particular, we see that a one standard deviation increase in the fraction of the community who are rural is associated with about a one-third standard deviation increase in the log of INDAP loans. A one standard deviation increase in our farm density variable, which measures the fraction of land under the plough, is associated with an increase of about 5/4 of a standard deviation in the log of INDAP loans,[40] while the

TABLE 4
1997 Agricultural Loans (robust standard errors in parentheses)

Explanator	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6
Rural Population Share	4.36	4.28	4.25	4.27	4.27	4.26
	(0.40)	(0.43)	(0.43)	(0.45)	(0.43)	(0.45)
δ(Rural Population > 0)	10.67	9.58	9.31	9.55	9.52	9.30
	(4.23)	(4.33)	(4.46)	(4.35)	(4.35)	(4.48)
Farm Density	14.43	13.18	12.78	13.14	13.13	12.82
	(8.26)	(8.52)	(8.66)	(8.55)	(8.55)	(8.71)
INDAP Office	0.44	0.53	0.52	0.53	0.52	0.52
	(0.17)	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)
$\kappa_{d1,c} \times 10^2$		1.41	1.43	1.41	1.39	1.40
		(0.52)	(0.52)	(0.52)	(0.53)	(0.52)
$\kappa_{d2,c}$		0.23	0.30	0.21	0.34	0.45
		(2.56)	(2.60)	(2.58)	(2.59)	(2.65)
$\kappa_{s1,c} \times 10^5$		1.99	1.84	2.00	2.00	1.83
		(0.52)	(0.54)	(0.53)	(0.53)	(0.54)
$\kappa_{s2,c}$		−3.73	−3.71	−3.70	−3.78	−3.85
		(6.37)	(6.27)	(6.43)	(6.44)	(6.40)
Irrigation Intensity			−0.57			−0.59
			(0.48)			(0.49)
Estimated Poverty Percentage (1996)				0.08		−0.20
				(0.93)		(0.94)
Government Coalition Mayor					−0.10	−0.10
					(0.19)	(0.19)
Mills	−11.21	−10.06	−9.69	−10.03	−10.02	−9.71
	(6.80)	(7.01)	(7.13)	(7.04)	(7.04)	(7.18)
σ	1.37	1.34	1.33	1.34	1.34	1.34
N	270	270	270	270	270	270

presence of an INDAP field office in the community results in increase of about 1/8 of a standard deviation in our INDAP loans variable.

In column 2 we add our pivotalness parameters to the specification. The pivotalness variables are jointly significant—the realized value of the Wald test statistic joint significance[41] of 23.4 earns a p-value of 0.0001. However, this outcome is a composite of the significant impact of the pivots for the first seats and the lack of an impact from the pivots for the second seats. Although they are more precisely estimated, the second pivots are individually insignificantly different from zero, whereas each of the first pivots is positive and significant. In a test of the null hypothesis that the first pivots both equal zero, the test statistic, with a realized value of 21.24, leads to a p-value of 0.00002, whereas the comparable test statistic for the second pivots is equal to 0.5, corresponding to a p-value of 0.7788.

Given that the second pivots are jointly and individually insignificantly different from zero, while the first pivots are not, it is hardly a surprise that a formal test of our model's prediction of equality between the first and second pivots rejects the hypothesis $\kappa_{d1,c} = \kappa_{d2,c}$. The relevant test statistic is asymptotically distributed as χ_1^2 with a realized value of 7.38, corresponding to a p-value of 0.007; likewise we can reject the hypothesis that $\kappa_{s1,c} = \kappa_{s2,c}$, for which the relevant test statistic of 14.42 has a p-value of 0.0001.

Notice that the vastly different magnitudes of the coefficients, and of the underlying variables largely "cancel out." Average pivotalness for the "first" Deputies' seat is over 3×10^3 times higher than is pivotalness for the first Senate race, with a standard deviation that is over 9×10^3 higher. In contrast, the estimated coefficient for the first Senate pivot is over 1,400 times larger than for the first Deputies pivot. Putting this together we see that a one standard deviation increase in the pivotalness of a community for the "first" Deputies' seat, that is for the government winning one seat, corresponds to about a half a standard deviation increase in our INDAP loan variable, while a similar increase of one standard deviation in the pivotalness for the first Senate seat corresponds to an increase of only about 1/14 of a standard deviation in our measure of INDAP loans.

Including additional variables, singly or in tandem, does not substantially affect our estimates for the coefficients of the pivotalness parameters. Table 4 reports the results for including our irrigation measure, the estimated poverty percentage for 1996, and controlling for the presence of a government coalition mayor. Each of these variables is individually insignificant, as can be seen by comparing them with their estimated standard errors.[42] The Wald test statistic for joint significance[43] of the ancillary controls is equal to 1.71, corresponding to a p-value of 0.6347. Notice that the coefficients for the pivotalness measures (and for our other variables as well) are little affected by including our additional controls.

Discussion

Our salient finding is that INDAP loans are given out more freely in communes that are pivotal for the first seat won by the government in their Deputies district or Senate constituency, whereas we find no evidence that pivotalness for the second seat allocated to the government is systematically related to loan allocations by INDAP. The result for the first seats is consistent with our theory of politically strategic behavior, but the result for the second seat is not. Moreover, we can decisively

reject the hypothesis, sustained by swing-voter theory, that the impact of pivotalness should be the same for the first and second seats. While our theory makes no predictions about the relative magnitudes of the coefficients for the Chamber of Deputies and the Senate, our empirical results indicate that INDAP loans are more responsive to changes in pivotalness for the first Senate seat than they are to changes in a district's pivotalness for the first Deputies contest, though the importance of the Deputies' races in explaining variation in loan allocations is enhanced by the greater variation in pivotalness for these elections.

The explanation that has the gentlest implications for our theory is that the disparity between districts where the first and second seats are at risk is caused by the existence of other conduits for "pork" to districts that are friendlier to the government. If this is true, then a full test of the theory awaits a more comprehensive data base that includes all government transfers, favors, regulatory relief, etc.—a position advocated by Luna and Mardones (2011). If in fact electoral largess is funneled into INDAP loans for want of other conduits in districts that are less friendly to the government, then we might expect ceteris paribus to encounter less reliance on INDAP when there are more progovernment local politicians to facilitate the targeting of local block grants. While we do not find a direct impact of government mayors on INDAP loans, we do note that the presence of a mayor from the government coalition affects the election outcomes for the Chamber of Deputies, but not the Senate, as indicated by our estimates reported in Table 2.

The asymmetry between responsiveness to Deputies and Senate pivotalness in our results is somewhat similar to the finding that members of the U.S. House in close elections receive more targeted "pork" than their counterparts in safe districts, whereas the same regularity does not appear in elections for the U.S. Senate (Lazarus and Steigerwalt 2009). One possible source of difficulty in calibrating the difference we measure between chambers of the Chilean Congress is that Senators free ride on the efforts of the Deputies, although Snyder and Ueda (2007) find that U.S. municipalities represented by at-large delegations actually receive more aid than those represented by single-member districts, suggesting that free riding may be offset by other pressures on legislators who share constituents.

Another possible explanation for the asymmetry between the impacts of pivotalness for the first seat and second seats is that the government and opposition in fact pursue asymmetrical strategies, counter to our game theoretic model. If in fact the opposition are not able to promise transfers as credibly as the government, then our model of matching transfers would not necessarily apply. Of course, this would

break our identifying condition that equilibrium transfers have no impact on the election. Instead we would expect to see that INDAP loans bolster the progovernment vote. This would be consistent with Zucco (2011), who finds that recipients of conditional cash transfers in Brazil, transfers that are much less discretionary than the INDAP loans we study here, are more likely to vote for the government than they otherwise would have been, and with Cerda and Vergara (2008) who reach a similar conclusion about social spending, but not geographically targeted INDAP loans, and presidential voting in Chile.

While this is an interesting theoretical possibility, it does not by itself explain why a community's pivotalness for the first seat would make it attractive for transfers, though its pivotalness for the second seat does not. For that we would still need an ancillary hypothesis. One such conjecture is that the government places more weight on the first seat to facilitate credit taking for the transfers.[44] Nonmatching transfers would mean that we would be able to measure the impact of transfers on voting behavior, but it would also complicate the estimation strategy, as these transfers would themselves be jointly endogenous with the closeness of the election.

Conclusion

In this article we adapt the swing-voter model to Chilean legislative elections. The electoral rule used in these elections creates two electoral pivots at which the number of deputies elected from a district changes, rather than a single cut point as in the well-known case of simple plurality rule elections. We use a model of Congressional voting to identify districts that are "at risk" of being decisive for a legislative seat. We then examine whether more competitive districts during the 1997 Congressional elections, as measured by the risk of their electing an additional progovernment deputy, received a disproportionate share of targetable agricultural loans from Chile's INDAP program. We find an asymmetry in the allocation of loans. INDAP loans were given out more generously in communes that were located in competitive Deputies districts and Senate constituencies, with the cash flowing more freely when the government was on the margin of losing both seats. Yet we find no evidence that communities that were at the cusp of helping the government to win both seats received more generous treatment.

One possible explanation for the mixed success of our theory is that it is simply wrong, though this leaves open the question of why pivotalness for a district's first government seat has a statistically significant impact on loan allocations. An alternative possibility is that the

government focused INDAP resources on pivotal communities that it could not reach in other ways, while in communities that were more friendly to government candidates, and where the contest was thus for the second rather than the first legislative seat, the government could resort to other conduits for funneling transfers. Another hypothesis is that the government needs at least one legislator in the relevant chamber to facilitate credit taking for transfers brought to the district by the government. These hypotheses are interesting subjects for future research.

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NOTES

1. This assumption only approximates the reality of the U.S. electoral college, Maine and Nebraska choose their electors using a less disproportionate selection rule.

2. During the election in question the opposition coalition only won both seats in the urban 23d district.

3. Both the Swedish environmental funds and the "member initiative" funds in Illinois were eventually discontinued, perhaps in part because of the attention that came in the wake of the research findings of Dahlberg and Johansson (2002), Johansson (2003), and Herron and Theodos (2004).

4. Legislative party lists in Italy are "open," allowing voters to reward individual candidates for the targetable benefits they receive.

5. For more on this important application of strategic campaigning, see Owen (1975), Gelman, Katz, and Bafumi (2004), and Shaw (2006).

6. In the Bundestag there are "compensatory" seats for parties that win disproportionately few seats under the plurality rule.

7. For more on the genesis of the electoral system and on the workings of legislative politics in Chile, see Londregan (2000).

8. One other election, that of 2001, shared this characteristic, but by then the discretion over loan allocations accorded to INDAP had been severely curtailed; see online Appendix D for more details.

9. Fontaine Aldunate (2001) quotes a former INDAP field representative: "Yo trabajé allí en los últimos años de Alessandri y en los primeros de Frei. Ahí se crearon los promotores, gente que fue a hacer política y a agitar el campo: llegaban con el asunto de dar crédito a los campesinos, de darles un gran estándar de vida, y empezaron a predicar el odio y la desigualdad, lo cual llevó a la agitación."

10. Literally "marcos politiqueros y demagógicos" (Anonymous 1970).

11. Organic laws require supermajorities to repeal.

12. The limit is 12 hectares of "basic tillage," standardized relative to land in the fertile central valley—cattle herders and farmers of poor quality soil can still qualify with larger holdings.

13. The recipient's landholdings cannot exceed the equivalent of about US$140,000 in value.

14. Serendipitously for our purposes, Chilean legislative elections take place in December, so that spending for the calendar year of an election corresponds almost exactly with the year prior to the ballot.

15. The community of Antarctica, which sprawls across 1.25 million square kilometers, had but 130 inhabitants in the 2002 census, whereas Puente Alto, a commune in the outskirts of metropolitan Santiago, was home to 492,195 individuals, crammed onto 88.2 square kilometers, with a density of 5,580 people per square kilometer.

16. The lowest contour corresponds to a probability of $e^{-7} \approx 0.00091$, while the highest of the eight contours corresponds to a probability density of $e^0 = 1$.

17. We note in passing that if all legislative districts had but a single community, then the pivotalness parameters, the κ, would be highly collinear with the community-level vote margins. However, in districts with multiple communes, which constitute almost our entire sample, the relationship between community-level vote margins and district-level pivotalness is more complicated, justifying our direct calculation of the κ values.

18. Carey's assertion that the government and opposition coalitions are so close knit that they can be viewed as political parties has interesting implications well beyond our model.

19. In the online appendix, we see that there is no equilibrium in which the parties' payoffs differ from the ones they receive when their transfers match.

20. See the online appendix for a derivation.

21. There has never been recorded rainfall in parts of the Atacama desert since systematic records began being kept.

22. In the years we study, Chile was divided into 340 "comunas," literally translated as "communes."

23. During 1997, the country was divided into 13 regions.

24. We doubt very much that INDAP made a grant to someone tilling the earth in the commune of Santiago, located at the center of a sprawling metropolis, where the most extensive cultivation is likely a basil plant growing in someone's kitchen windowsill. It is far more probable that the grant was dispensed to a recipient in the province of Chacabuco, in the northern part of the Metropolitan region.

25. Censuses are taken roughly every decade and, at least in rural communities, population change between 1997 and the 2002 census was likely fairly small.

26. We are grateful to an anonymous referee for this suggestion.

27. Under the null hypothesis that the probability any given district is in S is Bernoulli with $p = 0.5$, the overall count of elements of S out of 60 trials is distributed as binomial with n = 60 and $p = \frac{1}{2}$. Under this null hypothesis the probability of observing 23 or fewer observations in S is only 0.0462.

28. The p-value for this test statistic is 0.0547.

29. See Londregan (2000) for more details.

30. A subset of 128 communes in our sample also participated in the 1993 Senate elections, but we do not incorporate the 1993 Senate voting variable in our estimation of the Deputies' voting model.

31. Incumbency is not a very useful measure for this election because a large fraction of what were presumably the strongest Deputies ran, unsuccessfully, for the Senate in 1997.

32. For example, the community of Rancagua corresponds to the 32d district, while the 37th district consists entirely of the community of Talca. Both communities are predominantly urban, but each has a significant agricultural population as well.

33. Only two communes, Saavedra and Teodoro Schmidt, in the southern province of Cautín, have more than one office. Each has two.

34. The Aylwin vote calculates the odds of voting for Patricio Aylwin in the 1989 election versus both Büchi and Errázurriz.

35. For reference, one peso is equivalent to about a fifth of a U.S. penny.

36. Recall that in the equilibrium of the political transfers model, vote shares are the same as they would have been if neither the government nor the opposition could offer transfers so our voting equations do not suffer from not including the loan amounts as an explanatory variable.

37. The reader will recall that the inverse Mills ratio corresponds to the conditional mean of the latent random shock from the INDAP loans probit, *conditional* on the community receiving a subsidy, except for communities that are predicted by the model as being *certain* to receive loans, receiving an agricultural loan indicates that the expectation of the random shock term was at least somewhat positive.

38. While Olsen (1980) extended the results of Heckman (1979) showing that the inverse Mills ratio needs to be included in the specification, as we have done here, we note that if the inverse Mills ratio is excluded from the specification, the qualitative results of Table 4 remain unchanged: the pivotalness of a community for the first seat affects INDAP loan making, while pivotalness for the second seat does not. In contrast, our result is not robust to the inclusion of the 70 nonrural communities that received no INDAP allocations. This appears to be the result of urban districts having higher pivotalness measures, as epitomized by the urban 23d district, the only one in Chile in which the right customarily wins both seats. For example, the mean for $\kappa_{d1,c} \times 10^3$ among the nonagricultural communities was 5.49, while among the agricultural communes the average value was 0.84; likewise, for $\kappa_{s1,c} \times 10^7$ the mean among the nonagricultural communities was 11.27, compared with 3.58 for the farm communities.

39. We use a Hausman test (Hausman 1978) to check whether we would be justified in using the more tractable but restrictive type 1 Tobit model (Tobin 1958). The test statistic is asymptotically distributed as χ^2_7 with a realized value of 15.21

corresponding to a *p*-value of 0.03. This leads us to reject the type 1 model in favor of the more robust type 2 model we report here. See online Appendix B for more details.

40. Switching the indicator variable for communities with at least some rural population from zero to one implies an increase of almost three standard deviations in the log of INDAP loans, hardly a surprise given this variable is one of our predictors for receiving any INDAP loans at all.

41. The asymptotic distribution of the test statistic is χ^2 with four degrees of freedom.

42. As noted earlier, we follow the advice of Amemiya (1984) in using the standard error calculation of White (1980). As it turns out, our substantive conclusions are unaffected by our using the robust calculation for the standard errors.

43. This statistic is asymptotically distributed as χ^2_3.

44. We are grateful to James Alt for this suggestion.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix A. A Formal Model of Electoral Transfers
Appendix B. A Hausman Test for the Tobit Model
Appendix C. Importance Sampling
Appendix D. The 1997 Legislative Elections