Cultivating Votes in Rural Chile.

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Abstract

We extend the "swing voter" model to the context of the "binominal" electoral system used to elect members of Chile's Congress. The model predicts that targetable benefits will be directed toward two member districts in which the ruling coalition is on the cusp of winning either the first or the second seat. Using data on the allocation of discretionary agricultural loans distributed by the Agriculture Ministry the prediction that subsidies will be channeled towards districts in which a Deputies seat is in play receives strong support, while we cannot reject the hypothesis of no political targeting of loans to communities that are pivotal for the Senate. We find that communities that are pivotal for the first seat in a district receive more loans than those that are comparably 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 US electoral college in presidential elections looks at the allocation of resources and attention 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[2]. Here we adapt the swing voter model to legislative elections in Chile that employ low magnitude proportional representation.

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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 to 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 cutpoint 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 cutpoints, 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 cutpoints means that all parties are always at the cusp of electing another member. By contrast, the Chilean system has but two cutpoints, 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 in which a seat in the Chamber of Deputies is in play, with a larger impact when it is the first rather than the second seat that is in close contention. We cannot reject the null hypothesis that loans are not targeted to communities that are pivotal to the outcomes of Senate contests. 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[3] a greater priority that the capture of a second.

In the next 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 section 2 we discuss our data from the 1997 Congressional elections, and describe our empirical methodology. We present our results in section 3, while a brief final section summarizes our conclusions.

1 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 if 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) and Tullock (1983), and in 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 nearly 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 US 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[4].

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[5] 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) finds that *non-discretionary* 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 *non-discretionary* spending in the form of Conditional Cash Transfers (CCT) lead to more support for the government, even when if 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 to 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) and Groseclose and Snyder (2000). Perhaps the US Electoral College has received the most attention in this respect.[6] 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. Meyerson (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[7] 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 elections 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", it's interesting genesis in the military government that stepped down in 1990 is beyond the scope of this paper[8] 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 cutpoints, 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.

The 1997 Legislative Elections

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).

These four parties negotiated the division of the party lists, with two candidates running in every district. 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). In addition there were several smaller parties, the Chilean Communist Party, and the Humanist-Green Party, neither of which won any seats in the election we consider, the Union of the Center Center, which won two seats, and there were various independent candidates running off the two major lists. Of these two won election. Thus, the Concertación and UPC lists won all but four of the one hundred and twenty seats in the Chamber of Deputies. In the Senate the domination 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 choose to focus on the elections held in 1997 because these did not coincide with presidential elections, where we might expect benefits to be targeted toward voters who are pivotal in that national election, which chooses the winner in a "dual ballot" system with a runoff election held between the most popular pair of candidates in case no candidate earns an absolute majority at the first round. While the 1997 election did not coincide with balloting at either the municipal or presidential level, it did involve both chambers of the Congress. While the entire country elected Deputies in 1997, only ten of nineteen Senate districts did so. This is because terms of office in the Senate are staggered, every four years roughly half of the Senators are elected for eight year terms.

In contrast with the elections held in 1993 Angell and Pollack (1995), and in 1999 Angell and Pollack (2000), the 1997 legislative elections were relatively uneventful at the national level. In the Chamber of Deputies the 1997 vote was broadly similar to the 1993 ballot. Candidates for the government coalition earned 70 seats, whereas in 1993 they had won 69. Candidates running on the main opposition list won 47 seats, down from 51 in the 1993 election, however, many of those who ran as independents subsequently affiliated with the opposition. In terms of the overall vote the government's list won 2,927,702 votes nation wide, whereas the main opposition list garnered 2,101,392 votes. Within lists, the

Socialists lost four seats, whereas their government coalition partners each picked up one or two seats. On the opposition list the National Renovation party (RN) lost six seats, whereas the Union of Independent Democrats (UDI) picked up two. For our purposes this Chamber of Deputies election largely represented continuity–it was not overshadowed by a dramatic national shift in voter preferences.

In the Senate there were 20 seats up for election in 1997. These had last been in competition during the 1989 transitional election. Of the seats in play the government won 11, and the main opposition party came away with the remaining nine. The government's candidates received 2,114,653 votes, while 1,553,192 votes went to the opposition. At the same time the initial group of appointed Senators, chosen by the outgoing military government, were replaced with a new group including former president Eduardo Frei of the government coalition, former military ruler Augusto Pinochet, and a mixture of appointees friendly to the government and to the opposition. Combined with the Senate seats that were not involved in the election, and with the newly appointed unelected Senators, this left the government with 23 seats in the 48 member upper chamber. The opposition narrowly retained it's majority in the Senate, which it had enjoyed since 1990. Within lists there was a small increase in the relative strength of the two main parties on the right, RN and UDI, as increasingly many independent candidates on the right affiliated with one of the two parties[9], while the Christian Democrats held there own in this election, and the Socialists picked up yet another seat. As with the Chamber of Deputies, the 1997 Senate elections largely represented continuity of the *status quo*, no transcendental issue overshadowed the local contests.

There was one other legislative election under Chile's 1980 constitution that did not coincide with either a presidential election or with municipal contests. That election occurred in 2001, since then the presidential term has been shortened so that each subsequent legislative election has coincided with a presidential contest. But by 2001 INDAP had changed. As the result of various scandals involving the administration of the INDAP programs we study here, by 2001 the agency's autonomy to target redistributive benefits had been substantially curtailed. INDAP began to channel a significant portion of it's funds through the PRODESAL program, in which municipal governments exercised significant discretion[10], see Harris (2010) for more details.

For the election we study, and indeed for the entire twenty year period from 1990 until early 2010, when an opposition candidate was elected president, the chief executive of Chile was a member of the Concertación coalition. For the purposes of this paper, 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. INDAP's charter restricts it to offering assistance to farmers with relatively small landholdings (25 acres or less[11]) of modest value (no more than the equivalent of about $140,000 US dollars), where to be considered a farmer one must be primarily occupied in working the land. 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. INDAP's discretion in choosing which applications to grant is 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 cover 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 election, we would expect to observe this happening during legislative election years[12]

Because we observe so few Senate races, 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. 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 southern 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. 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 ten.

A Model of Electoral Transfers

Next we set forth a formal model of voting and targetable transfers in Senate elections. Our model presumes that transfers are "tactical", in the sense of not being ideologically motivated–in particular, we assume the public expects the same targeted transfers from the opposition. A different, and statistically more complicated model would arise if the INDAP transfers were part of the programmatic agenda of the government but not of the opposition.

Our model is presented in full in Appendix A. Here we outline it's crucial features. We model the contest between the government and opposition as a zero sum 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. Our approach in treating the government coalition as an actor in our model we are consistent with Carey (2002)[13]. The 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 de Mesquita and Stephenson (2002). We further assume that to retain credibility the government must vouchsafe its promises of post-electoral transfers by making similar transfers prior to the election.

The model implies an INDAP loan allocation process summarized by:

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

where κ_{d1} 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 $\vec{w}_c$ 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 that 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 section 2.

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)–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:

$$p_c = \vec{m}_c'\vec{\pi} - \xi_c \tag{2}$$

Here p_c is a latent variable that determines whether we observe an outcome. We observe $\$_c$ only if $0 < p_c$, while $\vec{m}_c$ is a vector of observable variables such as whether the community possesses any arable land, and $\vec{\pi}$ is a vector of coefficients. This model of censored observations was first put forth by Heckman (1979), and Amemiya (1984) pp31–33 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 $\vec{\zeta}$ 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 concretize formula (2) as equation (8) in section (2). We estimate (1) conditional on the community receiving at least some subsidy.

2 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 preelection transfers. This means that the voting part of the statistical model is exogenous with respect the grant allocation portion. This is an equilibrium phenomenon–if either side was 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, *ceteras 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 evaluation probability densities over joint voteshares in multi-community 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 seventy communes in our sample that do not receive any transfers. The key features that determine whether a district receives at least something *vs* getting nothing at all from INDAP center on whether there is any agricultural activity in the community. Communities with no such activities, the cores or large cities, desert wastelands, get nothing. Among the remaining districts the determinants of how much the district receives are somewhat distinct. With no rain[14] 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 nor 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[15] and region[16] 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"[17]. 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[18]. 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 1960's. 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, 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.

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 $v^d_{1997,c}$ denote the 1997 voteshare for the government's lower house candidates in commune c then our dependent variable is:

$$y^d_{1997,c} = \log(v^d_{1997,c}) - \log(1 - v^d_{1997,c})$$

We likewise transform the lagged voteshares 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[19]. 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[20] for the Deputies election in community c:

$$y^d_{1997,c} = \alpha_0 + \alpha_{1989s} y^s_{1989,c} + \alpha_{1993} y^d_{1993,c}$$
$$+ \alpha_{1989} y^d_{1989,c} + \alpha_{No} No_c + \alpha_{Aylwin} Aylwin_c$$
$$+ \alpha_{mayor} m_c + \alpha_{rural} r_c + \alpha_{tilled} f_c + \alpha_{h2o} w_c + \epsilon_c + \epsilon_{d(c)} \quad (3)$$

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:

$$y^s_{1997,c} = \beta_0 + \beta_{1989s} y^s_{1989,c} + \beta_{1993} y^d_{1993,c}$$
$$+ \beta_{1989} y^d_{1989,c} + \beta_{No} No_c + \beta_{Aylwin} Aylwin_c$$
$$+ \beta_{mayor} m_c + \beta_{rural} r_c + \beta_{tilled} f_c + \beta_{h2o} w_c + \nu_c + \epsilon_{s(c)} \quad (4)$$

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.

Identifying the Pivotal Communes

Next we calculate the pivotalness of the communes. Starting with our estimates for the Deputies elections we turn to κ_{d1} and κ_{d2} set forth in Appendix A, where we find that:

$$\kappa_{d1,c} = \int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty} f\big(\epsilon_d + \mu_c - \log(\Omega_c) + \log(1-\Omega_c)\big) f(\epsilon_{c'}) d\epsilon_{c'} \ldots g(\epsilon_d) d\epsilon_d \quad (5)$$

where $f(\epsilon_{c'})$ is the normal density function with mean 0 and variance σ^2, while $g(\epsilon_d)$ is the normal pdf with mean 0 and variance ω^2. The variable Ω_c is described in detail in 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 there are five Deputies districts that consist of a single commune[21] 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 $\frac{1}{3}$ needed to win the first seat to the chamber of Deputies.

The solution we adopt is a variant of importance sampling, see Liu (2001) pp. 32–4. Here we draw simulated $\epsilon_{c'}$ and ϵ_d values from the relevant normal pdfs, and then calculate the average value:

$$\kappa_{d1,c} = 10^{-6} \sum_{i=1}^{10^6} f\big(\epsilon_{di} + \mu_c - \log(\Omega_{ci}) + \log(1 - \Omega_{ci})\big) \tag{6}$$

While this procedure gives us workable results, we find that some communes continue to return zero values for the pivotalness parameters, even with 10^6 simulated draws. The communes in question have small populations as a fraction of their districts, districts that are dominated in most cases by a single large urban commune. Thus, we are confident that these communes are in fact not very likely to be pivotal[22]. We likewise use importance sampling to estimate κ_{d2} and for the corresponding Senate race parameters κ_{s1} and κ_{s2}.

The κ_{d1} variable gives us the average probability density among the set of voteshares at which an infinitesimal change in voteshare will make the difference between the Concertación winning or losing the first seat in a district. While the numerical values are very small, districts with larger values for κ are more likely to be pivotal.

The estimates for the Deputies pivots require about 8 hours on a fast laptop machine to calculate, the results for the Senate pivots consume in the neighborhood of five hours. In each case we simulated 10^6 random draws for each community that participated in the election, along with 10^6 shocks for each district or constituency.

A 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. Moreover, INDAP's *de facto* discretion was even more ample than authorized by the law. Spectacular abuses of the loan program during the $1990's$ 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 discretionary power was shared with municipal governments, see Harris (2010).

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:

$$\begin{aligned} loan_c = \delta_0 + \delta_a arable_c + \delta_r^* \Delta(rural_c > 0) + \delta_r rural_c \\ + \delta_o office_c + a_1 \kappa_{d1} + b_1 \kappa_{d2} + c_1 \kappa_{s1} + d_1 \kappa_{s2} + \tilde{\epsilon}_c \end{aligned} \quad (7)$$

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 districts land that is arable, $rural$ corresponds to the share of the population classified as rural, while $\Delta(rural_c > 0)$ is an indicator for communes that have at least some rural population. The $offices$ variable is an indicator for whether community c is one of the 57 communes with at least one INDAP office[23].

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 base line models we encounter a substantial number of cases (about a 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:

$$z_c^* = \theta_0 + \theta_a \mathtt{arable}_c + \theta_r^* \Delta(\mathtt{rural}_c > 0) + \theta_f^* \Delta(\mathtt{arable}_c > 0) - \xi_c \quad (8)$$

Here z_c^* is a latent variable, we observe $\mathtt{grant}_c$ 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, $\mathtt{Mills}_c$, and substitute it into equation (7). Then, using the subsample of communes that receive grants, we estimate the "reduced form" model:

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

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 $\tilde{\epsilon}_c$ is normal. Amemiya (1984) advocates taking advantage of this flexibility to apply 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 to even 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.

3 Results

Summary statistics for the variables we use in our analysis appear in table 1. The first group of electoral variables are expressed as log-odds. These are the log odds of voting for the government *vs* the opposition (the Aylwin vote calculates the odds of voting for Patricio Aylwin in the 1989 election *vs* both Büchi and Errazurriz. The log odds for the "No" vote reports the log odds of voting "No" instead of "Yes" in the 1988 plebiscite on whether Augosto Pinochet would continue as president in 1990.

Table 1 About Here

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 $\log(1 + [\text{INDAPLoans}])$ 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[24].

Turning to our electoral model[25] our estimates for the parameters of 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 $\frac{5}{8}$ for the 1993 Deputies vote, while the "No." vote earns a coefficient of about $\frac{2}{9}$. The $\frac{1}{9}$ coefficient for a government mayor implies that a one standard deviation change in that indicator variable translates into an extra tenth of a standard deviation for the dependent 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 $\frac{1}{5}$ 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 an tenth of a standard deviation increase in the log odds for the Deputies. Offsetting this agrarian advantage, we note that the large, $-\frac{2}{3}$, and negative coefficient for irrigation means that an extra standard deviation of irrigated land implies a reduction of about a fifth 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 pro-government, while *ceteras 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 commune specific innovation, suggesting that the random shocks embody district-wide effects such as campaigns, with only smaller level commune-specific shocks.

Table 2 About Here

Our estimates for the subset of communes that were in Senate constituencies that held elections appear in column 2 of Table 2. The dependent variable for equation (4) is the log odds of voting for the government *vs* voting for the opposition. Our estimates award a significant coefficient to the 1989 Senate voteshare, with an estimated coefficient of about $\frac{2}{7}$. 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 $-\frac{1}{2}$.

It should be born 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 6 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 pivotalness measure for the second Senate seat is over thirty thousand times larger than for the first. The corresponding ratio for the Chamber of Deputies elections is about 12, 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 Senate races are, on average, about three times as competitive as Deputies 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 negligibly small.

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 have coefficients equal to 0. Calculating a Wald test[26] for the null our test statistic is asymptotically distributed as χ^2_4. The realized value of 6.51 corresponds to a p-value of 0.6253. 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 Mills ratio for each of the unobserved residuals from the censoring equation, and we report summary statistics in Table 1.

Table 3 About Here

At this stage one might ask whether it would make sense to apply a standard Tobit model, see Tobin (1958), that forces the coefficients for the eligibility model of equation 8), reported in Table 3 to equal those for the loan allocation model of equation (9) displayed in Table 4. If the restriction is a valid one the standard Tobit model will be more efficient than the type two variant, but of the restriction is false then the standard Tobit coefficients will be inconsistent. To address this we compare our estimates for a standard Tobit model with the probit estimates displayed in Table 3 using a Hausman test Hausman (1978). This requires us to divide the coefficients of from the Tobit model by the estimated standard deviation to make them comparable with the probit coefficients[27]. We test for equality between the models' estimates of the seven coefficients reported in column 1 of Table 3. The realized value for Hausman's test statistic is 15.21, which corresponds to a p-value of 0.03 relative to the asymptotic χ^2_7 distribution for this statistic. Given this comparison we opt for the more robust type 2 Tobit model developed by Heckman (1979), and discussed in Amemiya (1984).

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 "base line" model without pivotalness considerations. 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 $1960's$, well before the current electoral system had even been imagined.

Table 4 About Here

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.

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[28] of 2.58 earns a p-value of 0.0378. However, this outcome is a composite of the significant impact of the Deputies pivots and the lack of an impact from the Senate pivots. A test of the null hypothesis that the Deputies pivots both equal zero, the test statistic is $f(2, 260)$ with a realized value of 5.15 leads to a p-value of 0.0064, whereas the comparable test statistic for the Senate generates a p-value of 0.8417.

We note that the coefficient for the first Deputies pivot is more clearly significant than the coefficient for the second seat. We also note that the coefficient for the first seat is about eight times as large as that for the second (recall that we rescaled the pivotalness measures to avoid a table full of zeros). Testing the null hypothesis that the two coefficients are in fact equal gives rise to an $f(1, 260)$ statistic of 8.55, corresponding to a p-value of 0.0038, leaving us highly confident that the first pivot attracts more loans than the second.

Our model predicted that the pivots for the first and second seats would be equal, and moreover that the Senate pivots would also attract loans. We note that while the Senate pivot coefficients are much smaller than the Deputies coefficients, and we handily reject the hypothesis that the coefficients are of the same magnitude, the p-value for this test[29] is a mere 0.0022. While we cannot reject equality for the second pivots, this is largely a result of the low precision of our estimated coefficients for the second pivot.

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[30]. The Wald test statistic for joint significance[31] of the ancillary controls is equal to 0.54, corresponding to a p-value of 0.6560. Notice that the coefficients for the pivotalness measures (and for our other variables as well) are little affected by including our additional controls.

Could Senators be "free riding" on the efforts of the Deputies whose districts lie within their constituencies? Perhaps the pivotal Deputies communes are also pivotal for the Senate? Looking at rural communes that cast ballots in both the Deputies and Senate races in 1997 we find that the densities at the first pivot for the two chambers are only slightly positively correlated[32]. Among Senate constituencies, the 19^{th} has the highest density at the first pivot–yet the associated Deputies districts are not particularly competitive. The communes of the 17^{th} Senate constituency have relatively high values for the fist pivot density for the Senate, and for the Chamber of Deputies[33]. The correlation between the densities at the second pivot is higher[34] raising the possibility that the low estimated coefficient for the Senate is the result of free riding behavior by Senators, however, as we have already discussed, the second Deputies pivot earns much lower coefficient than the first. Finally we should note that the correlation between the first and second pivot densities for the Deputies is negative[35].

Discussion

Our salient finding is that INDAP loans do seem to be given out more freely in communes that are pivotal in Deputies elections, but not in Senate contests. Moreover, we find that the pivot for the first seat in a Deputies district attracts more loans than the second, and this despite the fact that the pivotalness measures for the second seat tend to be higher.

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 *ceteras paribus* to encounter less reliance on INDAP when there are more pro-government 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 Deputies districts and Senate constituencies is similar to the finding that members of the US House in close elections receive more targeted "pork" than their counterparts in safe districts, whereas the same regularity does not appear in the US Senate Lazarus and Steigerwalt (2009). One possible explanation for the difference in chambers is that Senators free ride on the efforts of the Deputies in their constituencies, although Snyder and Ueda (2009) find that US 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 possibility 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 in fact INDAP loans tend to bolster the pro-government vote. This would be consistent with 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 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 it's pivotalness for the second seat does not. For that we would 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[36]. Non-matching 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. We view this as an interesting subject for future research.

Conclusion

In this paper we adapt the swing voter model to Chilean legislative elections. The electoral rule used in these elections creates two cut points at which the number of deputies elected from a district changes, rather than a single cutpoint as in the well known case of simple plurality rule elections. We use a model of Congressional voting to identify districts near these cutpoints. We then examine whether more competitive districts, as measured by the risk of their electing two deputies from the same list, were the recipients of targetable agricultural subsidies during the 1997 Congressional elections in Chile. We find that government loans were given out more generously in communes that were located in competitive Deputies districts, with the cash flowing more freely when the government was on the margin of losing both seats. In contrast, we cannot reject the null hypothesis that funds were not directed towards districts that were pivotal for the Senate.

Of course, one possible explanation for the mixed success of our theory is that it is simply wrong. An alternative 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.

Future directions for research include searching for other conduits for transfers, an examining the alternative hypothesis that the transfer game is really asymmetrical, and 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.

References

Alesina, Alberto, John B. Londregan and Howard Rosenthal. 1993. "A Model of the Political Economy of the United States." American Political Science Review 87:12–33.

Amemiya, Takeshi. 1984. "Tobit Models: A Survey." Journal of Econometrics 24:3–61.

Angell, Alan and Benny Pollack. 1995. "The Chilean Elections of 1993: from Polarisation to Consensus." Bulletin of Latin American Research. 14:105–125.

Angell, Alan and Benny Pollack. 2000. "The Chilean presidential elections of 1999–2000 and democratic consolidation." Bulletin of Latin American Research. 19:357–378.

Ansolabehere, Stephen and James M. Snyder. 2006. "Party Control of State Government and the Distribution of Public Expenditures." Scandanavian Journal of Economics 108:547–69.

Austen-Smith, David. 2000. "Redistributing Inome Under Proportional Representation." Journal of Political Economy 108:1235–1269.

Berry, Christopher and Jacob Gerson. 2011. "Agency Design and Distributive Politics.". Working Paper.

Bianco, William T. 1999. "Party Campaign Committees and the Distribution of Tally Program Funds." Legislative Studies Quarterly 24:451–69.

Bickers, Kenneth N. and Robert M. Stein. 1996. "The Electoral Dynamics of the Federal Pork Barrel." American Journal of Political Science 40:1300–1326.

Brams, Stephen and Morton Davis. 1974. "The 3/2ths rule in presidential campaigning." American Political Science Review 68:113–34.

Brescia, Maura. 2001. Manos Limpias. Santiago, Chile: Editorial Mare Nostrum.

Buchanan, James and Gordon Tullock. 1962. The Calculus of Consent: Logical Foundations of Constitutional Democracy. Ann Arbor: University of Michigan Press.

Carey, John. 2002. "Parties, Colaitions, and the Chilean Congress in the 1990's." In Legislative Politics in Latin America., ed. Scott Morgenstern and Benito Nacif. New York: Cambridge University Press.

Case, Anne. 2001. "Election goals and income redistributon: Recent evidence from Albania." European Economic Review 45:405–23.

Cerda, Rodrigo and Rodrigo Vergara. 2008. "Government Subsidies and Presidential Election Outcomes: Evidence for a Developing Country." World Development 36:2470–2488.

Colantoni, Claude, Terrence Levesque and Peter Ordeshook. 1975. "Campaign resource allocation under the electoral college." American Political Science Review 69:141–154.

Coram, Alex. 2010. "The Red Queen and the Dynamics of Resource Spending in Party Competition." British Journal of Political Science 40:469–475.

Coughlin, Peter. 1986. "Elections and Income Redistribution." Public Choice 50:27–91.

Cox, Gary D. and Matthew D. McCubbins. 1986. "Electoral Politics as a Redistributive Game." Journal of Politics 48:370–389.

Dahlberg, Matz and Eva Johansson. 2002. "On the Vote-Purchasing Behavior of Incumbent Governments." American Political Science Review 96:27–40.

de Mesquita, Ethan Beuno and Matthew Stephenson. 2002. "'Informative Precedent and Intra-Judicial Communication." American Political Science Review 96:755–66.

Dixit, Avinash and John B. Londregan. 1995. "Redistributive Politics and Economic Efficiency." American Political Science Review 89:856–66.

Dixit, Avinash and John B. Londregan. 1996. "The Determinants of Success of Special Interests in Redistributive Politics." Journal of Politics 58:1132–55.

Dixit, Avinash and John B. Londregan. 1998. "Ideology, Tactics, and Efficiency in Redistributive Politics." Quarterly Journal of Economics 113:497–529.

Dropp, Kyle and Zachary Peskowitz. 2011. Electoral Security and the Provision of Constituency Service. Working Paper.

El Mercurio. April 11, 2001. "Contraloría: Ex Director de Indap Es Culpable.".

Epanechnikov, V. A. 1969. "Non-parameteric Estimation of a Multivatriate Probability Density." Theory of Probability and its Applications 14:153–58.

Gelman, Andrew, Jonathan Katz and Joseph Bafumi. 2004. "Standard voting power indices do not work: An emprical analysis." British Journal of Political Science 34:657–74.

Golden, Mariam and Lucio Picci. 2008. "Pork Barrel Politics in Postwar Italy, 1953-1994." American Journal of Political Science 52:268–89.

Gordon, Sanford C. 2010. "Executive Control vs. Bureaucratic Insulation: Evidence from Federal Contracting .".

Grofman, Barnard and Scott Feld. 2005. "Thinking about the Political Impacts of the Electoral College." Public Choice 123:1–18.

Groseclose, Timothy and James Snyder. 2000. "Buying Supermajorities in Finite Legislatures." American Political Science Review 94:677–681.

Harris, Guillermo Donoso. 2010. Informe Final: Evaluacion de Impacto de los Programas de INDAP: Programa de Desarollo Local, Programa de Desarollo de Comunas Pobres. Santiago: Departamento de Economa Agraria, Pontificia Universidad Catlica de Chile. Coauthors: José Cancino Vicente, Jimena López de Lérida Milicic, Huho Contreras Gómez, and Walter Rivas Villela.

Hausman, Jerry A. 1978. "Specification Tests in Econometrics." Econometrica 46:1251–71.

Heckman, James J. 1979. "Sample Selection Bias as a Specification Error." Econometrica 47:931–62.

Herron, Micahel C. and Brett A. Theodos. 2004. "Government Redistribution in the Shadow of Legislative Elections: A Study of the Illinois Member Initiative Grants Program." Legislative Studies Quarterly 29:287–311.

Johansson, Eva. 2003. "Intergovernmental grants as a tactical instrument: empirical evidence from Swedish municipalities." Journal of Public Economics 87:883–915.

Lazarus, Jeffrey and Amy Steigerwalt. 2009. "Different Houses: The Distribution of Earmarks in the U.S. House and Senate." Legislative Studies Quarterly 34:347–73.

Lenz, Gabe. 2011. Understanding and Curing Myopic Voting. Working Paper.

Lindbeck, Assar and Jorgen Weibull. 1987. "Balanced Budget Redistribution as the Outcome of Political Competition." Public Choice 52:273–297.

Liu, Jun S. 2001. Monte Carlo Strategies in Scientific Computing. New York: Springer.

Londregan, John B. 2000. Legislative Institutions and Ideology in Chile's Democratic Transition. New York: Cambridge University Press.

Luna, Juan Pablo and Rodrigo Mardones. 2011. Selective Distributive Politics: The Political Use of Targeted Social Funds in Chile, 2000-2008. Working Paper.

Meltzer, Alan H. and Scott F. Richard. 1981. "A Rational Theory of the Size of Government." Journal of Political Economy 89:914–927.

Meyerson, Roger D. 1993. "Incentives to Cultivate Favored Minorities Under Alternative Electoral Systems." American Political Science Review 87:856–869.

Olsen, Randall J. 1980. "A Least Square Correction for Selectivity Bias." Econometrica 48:1815–20.

Owen, Guillermo. 1975. "Evaluation of a presidential election game." American Political Science Review 69:947–53.

Schady, Norbert R. 2000. "The Political Economy of Expenditures bu te Peruvian Social Fund (FONDCOCES). 1991-95." American Political Science Review 94:289–304.

Shaw, Daron. 2006. The Race to 270: The Electoral College and the Campaign Strageties of 2000 and 2004. Chicago: Univeristy of Chicago Press.

Snyder, James M. 1991. "On buying legislatures." Economics and Politics 3:93–109.

Snyder, James M. and Gerald H. Kramer. 1988. "Fairness, Self-Interest, and the Politics of the Progressive Income Tax." Journal of Public Economics 36:197–230.

Snyder, "James M." and Michiko Ueda. 2009. "Do Multimember Districts Lead to Free-Riding?" Legislative Studies Quarterly 32:649–79.

Stein, Robert M. and Kenneth N. Bickers. 1994. "Congressional Elections and the Pork Barrel." Journal of Politics 56:377–399.

Stratmann, Thomas and Martin Baur. 2002. "Plurality Rule, Proportional Representation, and the German Bundestag: How Incentives to Pork-Barrel Differ across Electoral Systems." American Journal of Political Science 46:506–514.

Tobin, James. 1958. "Estimation of relationships for limited dependent variables." Econometrica 26:24–36.

Tullock, Gordon. 1983. Economics of Income Redistribution. Boston: Kluwer-Nijhoff.

Weingast, Barry R., Kenneth A. Shepsle and Christopher Johnsen. 1981. "The Political Economy of Benefits and Costs: A Neoclassical Approach to Distributive Politics." Journal of Political Economy 89:642–664.

White, Halbert. 1980. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." Econometrica 48:817–38.

Zucco, Cesar. 2011. Conditional Cash Transfers and Voting Behavior: Redistribution and Clientelism in Developing Democracies. Working Paper.

Notes

[1]Authors names are in alphabetical order.

[2]This assumption only approximates the reality of the US electoral college, Maine and Nebraska choose their electors using a less disproportionate selection rule.

[3]During the election in question the opposition coalition only won both seats in the urban 23$^{\mathrm{rd}}$ district.

[4]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).

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

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

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

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

[9]In 1989 both the left and the right coalitions included large numbers of independent candidates. The process of consolidation into parties took place more rapidly on the left (though it was less complete, leaving the left with four parties while the right converged to two) and by 1997 it was largely over.

[10]The impact of municipal politics on the allocation of INDAP funds is a subject of ongoing research by the authors.

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

[12]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.

[13]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.

[14]There has never been recorded rainfall in parts if the Atacama desert since systematic records began being kept.

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

[16]During 1997 the country was divided into thirteen regions.

[17]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 likely that the grant was dispensed to a recipient in the province of Chacabuco, in the northern part of the Metropolitan region.

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

[19]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.

[20]Incumbency is not a very useful measure for this elections because a large fraction of what were presumably the strongest Deputies ran, unsuccessful, for the Senate in 1997.

[21]None of these single commune districts was rural, and none received INDAP funds.

[22]We have also experimented with kernel density estimates, see Epanechnikov (1969). However, with as few as 10^6 draws, and using Epanechnikov's recommendations for the scaling parameters, kernel estimators return even more "empty cells" with no observations. Thus we are, somewhat to our surprise, driven back to importance sampling as our preferred method for calculating the κ parameters.

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

[24]For reference, one peso is equivalent to about a fifth of a US penny.

[25]Recall that in the equilibrium of the political transfers model voteshares 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.

[26]The likelihood ratio test for the same hypothesis gives rise to very similar results: the likelihood ratio test statistic is asymptotically χ^2_4, and the realized value for our sample of 2.61 again corresponds to a very high p-value, in this case 0.4263.

[27]See Appendix B for details.

[28]The asymptotic distribution of the test statistic is f with 4 and 260 degrees of freedom.

[29]The Wald statistic is distributed as $f(1, 260)$ under the null with a realized value of 9.54.

[30]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.
[31]This statistic is asymptotically distributed as $f(3, 257)$.
[32]The Pearsonian correlation coefficient is $r = 0.0930$ with a sample of 189 rural communes.
[33]The relevant districts are 56, 57, and 58.
[34]For the 189 rural communes with Senate contests $r = 0.4473$.
[35]For the entire sample of 340 communes we have $r = -0.3563$, nor does the existence of a Senate contest change this, for the 189 rural districts also holding Senate races we have $r = -0.3373$.
[36]We are grateful to James Alt for this suggestion.

Table 1: Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
log-odds Senate 1997	0.26	0.51	−2.35	1.61
log-odds Senate 1989	0.42	0.56	−1.23	2.45
log-odds Deputies 1997	0.36	0.63	−1.48	2.22
log-odds Deputies 1993	0.34	0.11	−1.29	2.05
log-odds Deputies 1989	0.21	0.13	−2.55	1.42
log-odds Aylwin	0.05	0.11	−2.64	1.24
log-odds “No” vote	−0.13	0.13	−3.39	1.20
$\delta(RuralPopulation > 0)$	0.92	0.28	0.00	1.00
$\delta(Farms > 0)$	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
$\delta(INDAP\ Loans)$	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	0.09	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
$log(1 + [INDAPLoans])$	6.43	3.69	0.00	11.81
$\kappa_{d1} \times 10^5$	0.08	0.14	0.00	0.95
$\kappa_{d2} \times 10^4$	0.10	0.06	0.00	0.29
$\kappa_{s1} \times 10^7$	0.01	0.03	0.00	0.21
$\kappa_{s2} \times 10^3$	0.03	0.04	0.00	0.22
Mills	1.55	0.53	0.11	2.12

Table 2: Legislative Elections

Explanator	Col. 1	Col. 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

Table 3: 1997 Censoring Equation for Agricultural Loans

Explanator	Col. 1	Col. 2
Farm Density $\times 10^2$	1.41	1.51
	(0.37)	(0.31)
δ(Rural Population > 0)	1.00	0.94
	(0.40)	(0.38)
δ(Farms > 0)	0.93	0.92
	(0.46)	(0.46)
Irrigation Intensity	0.12	
	(0.79)	
Rural Population Share	−0.36	
	(0.32)	
INDAP Office	−0.00	
	(0.26)	
Estimated Poverty Percentage (1996)	1.48	
	(1.06)	
log(Lik)	−120.81	−122.11
N	340	340

Standard errors appear in parentheses.

Table 4: 1997 Agricultural Loans

Explanator	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 7
$\kappa_{d1} \times 10^5$		2.55	2.45	2.55	2.54	2.42
		(0.82)	(0.82)	(0.82)	(0.81)	(0.82)
$\kappa_{d2} \times 10^4$		3.11	2.80	3.12	3.11	2.78
		(1.65)	(1.64)	(1.65)	(1.65)	(1.65)
$\kappa_{s1} \times 10^7$		4.31	3.61	4.28	4.02	2.90
		(7.62)	(7.67)	(7.62)	(7.60)	(7.72)
$\kappa_{s2} \times 10^3$		−0.92	−0.72	−0.92	−0.83	−0.61
		(3.40)	(3.43)	(3.40)	(3.40)	(3.41)
Rural Population Share	4.36	4.02	4.02	4.02	4.00	4.05
	(0.40)	(0.38)	(0.39)	(0.40)	(0.39)	(0.41)
δ(Rural Population > 0)	10.67	13.01	12.94	13.03	12.92	12.94
	(4.23)	(4.54)	(4.58)	(4.54)	(4.55)	(4.58)
Farm Density	14.43	19.79	19.68	19.83	19.68	19.72
	(8.26)	(8.81)	(8.86)	(8.81)	(8.83)	(8.87)
INDAP Office	0.43	0.51	0.50	0.51	0.50	0.50
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
Irrigation Intensity			−0.58			−0.64
			(0.56)			(0.57)
Estimated Poverty Percentage (1996)				−0.10		−0.36
				(0.89)		(0.90)
Government Coalition Mayor					−0.10	−0.11
					(0.18)	(0.18)
Mills	−11.21	−15.22	−15.08	−15.25	−15.13	−15.10
	(6.80)	(7.24)	(7.29)	(7.24)	(7.26)	(7.30)
σ	1.37	1.35	1.35	1.35	1.35	1.36
N	270	270	270	270	270	270

Robust standard errors appear in parentheses.

Appendix A: A Formal Model of Electoral Transfers

We suppose voters have attachments to the parties. We represent these attachments as stemming from spatial preferences over policy, with the programmatic policy locations of the government and the opposition fixed. We assume that neither the government nor the opposition can easily change these positions during the time frame of a single election, so for the purposes of setting transfers the underlying affinities of the voters for the parties are taken as given. Let's suppose that the citizens living in community c have heterogeneous ideological preferences that are distributed along a continuum, where x_v is the preferred spatial outcome for voter v. Voter v compares a party offering an issue position which we normalize as $z_g = -\frac{1}{2}$ and a cash transfer of $\$_g$ with another that credibly promises to implement a position $(z_o, \$_o)$ were we adopt the normalization $z_o = \frac{1}{2}$. If the voter's preferences are given by:

$$u(z, \$|x_v) = -\frac{1}{2}(x_v - z)^2 + \lambda\$$$

then voter v in commune c will prefer party g whenever:

$$x_v < \lambda(\$_{g,c} - \$_{o,c})$$

For some districts, notably in urban areas, both the government and the opposition are constrained to offer no agricultural transfers–for example in the entirely urban community of Providencia where there is no farming activity even the flexibility of the targetable INDAP transfers is not sufficient to permit infusions of cash from this program, likewise, promised agricultural transfers to the frozen Chilean community in Antarctica or the arid moonscape of the northern community of Putre will not translate into votes.

Now let $F_c(x)$ denote the cumulative density function of voters in community c measured from left to right. Thus $F_c\big(\lambda(\$_{g,c} - \$_{o,c})\big)$ is the fraction of individuals in commune c who will support the government, while the remainder vote for the opposition. For concreteness, and to operationalize our model, we assume that F is the cdf for the logit distribution[37]:

$$F_c\big(\lambda(\$_{g,c} - \$_{o,c})\big) = \frac{1}{1 + e^{-\mu_c^* - \epsilon_d - \epsilon_c - \lambda(\$_{g,c} - \$_{o,c})}} \tag{10}$$

where:

$$\epsilon_c \sim N(0, \sigma^2) \text{ and } \epsilon_d \sim N(0, \omega^2) \tag{11}$$

are normally distributed shocks to the distribution of voter preferences. The ϵ_c shock is peculiar to commune c, while the district shock ϵ_d reflects random district level effects, notably the conduct of the electoral campaign.

This immediately gives rise to the vote share V_d going to the government for the entire district as a voter weighted sum of the community shares:

$$\nu_d\left(\{\$_{g,c}, \$_{o,c}\}_{c\in d}\right) = \sum_{c\in d} s_{c,d} F_c(\{\lambda(\$_{g,c} - \$_{o,c})\}_{c\in d})$$

where we sum over the set of communities in the relevant district, and $s_{c,d}$ is the fraction of district d voters casting ballots in community c. During the period we study participation was mandatory for registered voters, and we will treat the decision of whether to vote as exogenous to the transfers promised by both parties, though of course the transfers will influence how voters cast their ballots once they arrive at the ballot box.

For reference, we define the Senate constituency vote shares in an entirely analogous manner:

$$\hat{V}_S\left(\{\$_{g,c}, \$_{o,c}\}_{c\in S}\right) = \sum_{c\in S} s_{c,S} \frac{1}{1 + e^{-\hat{\mu}_c - \nu_d - \nu_c - \hat{\lambda}(\$_{g,c} - \$_{o,c})}} \tag{12}$$

where $s_{c,s}$ is the fraction of constituency S voters casting ballots in community c, $\hat{\lambda}$ calibrates voters' willingness to make tradeoffs between ideological distance and targeted agricultural benefits in Senate elections, and the random error terms:

$$\nu_c \sim N(0, \sigma^2) \text{ and } \nu_S \sim N(0, \alpha^2) \tag{13}$$

are shocks to the distribution of voter preferences over Senate candidates at the commune and Senate constituency level respectively.

Using the d'Hondt election rule with two candidate lists, as is done in Chilean legislative elections, the government will win the first seat in a district if it garners at least half as many votes as the opposition (only the votes cast for the two most popular lists matter in this allocation rule), while it wins the second seat if it attracts twice as many votes as the opposition list.

Let us suppose that the government's utility from electoral victory is given by:

$$U_g = \sum_d \left(\delta_{1d} + \rho\delta_{2d}\right) + \psi \sum_s \left(\delta_{1s} + \rho_s\delta_{2s}\right)$$

where $\delta_{1d} = 1$ if the government wins at least one seat in Deputies' district d, and zero otherwise, $\delta_{2d} = 1$ if the government wins both seats, $\delta_{1s} = 1$ if the government candidate receives at least one seat in Senate constituency s, and 0 otherwise, while δ_{2s} is a dummy variable indicating whether the government earned both seats ($\delta_{2s} = 1$) or not ($\delta_{2s} = 0$). We start with the assumption that $\rho = 1$ so that the government seeks to maximize seats in both chambers, with perhaps a different weight ψ for the Senate than for the Deputies. We assume that the opposition wants to maximize it's electoral success, and that it uses the same values for ψ, ρ, and ρ_s as the government, making the election a zero-sum game for the government and opposition.

Let's suppose the government and opposition make implicit and binding promises of redistributive benefits in advance of the election–the government allocates benefits to signal its future behavior, the opposition makes an implicit promise about how it would allocate benefits.

Only after binding promises have been made do the government and opposition observe the realizations of the random variables in equations (11) and (13). We assume that the government's post election promises are believed only if they are consistent with the pre-election transfers it actually pays out, whereas the opposition cannot be held accountable for a budget they do not control.

If agricultural transfers are made apolitically, in the spirit of the law, community c will receive benefits of $\zeta_c + \eta_c$. The farther the actual spending level departs from $\zeta_c + \eta_c$ the greater the costs incurred by the election winner who implements the promise. This is because gross departures are more likely to be detected and punished, either by public opinion, or by the judiciary. The η_c term allows for our not being able to perfectly estimate the apolitical transfer–suppose that we observe ζ_c but not η_c.

We implement this using a quadratic functional form for the cost of deviations. The government's objective function is thus:

$$E\{U_g\} = \sum_d \big(\text{Prob}\{\frac{1}{3} \leq \nu_d\} + \rho \text{Prob}\{\frac{2}{3} \leq \nu_d\}\big)$$
$$+ \psi\big(\sum_s (\text{Prob}\{\frac{1}{3} \leq \hat{V}_s\} + \rho_s \text{Prob}\{\frac{2}{3} \leq \hat{V}_s\}\big) - \frac{\gamma}{2} \sum_c (\$_c - \zeta_c - \eta_c)^2$$

The government maximizes this function with respect to the transfers, in the form of concessionary loans, that it offers each commune. For some communes, notably in urban areas, both the government and the opposition are constrained to offer no agricultural transfers–for example in the entirely urban community of Providencia where there is no farming activity even the flexibility of the targetable INDAP transfers is not sufficient to permit infusions of cash from this program, likewise, promised agricultural transfers to the frozen Chilean community in Antarctica or the arid moonscape of the northern community of Putre will not translate into votes. Thus the government chooses a set of transfers $\{\$_{g,c}\}$ for the remaining communes.

It is straightforward to show that in this setting there is no pure strategy equilibrium in which the opposition and the government that dominates both making identical promises[38]. To see why this is the case, note first note that the opposition can always make the same binding promise to spending that the government makes. Could there be another equilibrium in which one of the players is strictly better off? If one player strictly prefers to deviate from matching promises it must be that, in the context of this zero sum game, the other side is left worse off. But the opponent could always match the deviation for a better payoff. So there can be no other equilibrium that offers either player a better payoff than they can get by making identical promises.

The first order condition with respect to $\$_{g,c}$ for an optimum for the government, holding the transfers offered by the opposition constant are:

$$\frac{\partial}{\partial \$_{g,c}} E\{U_g\} = \sum_d \Big(\frac{\partial}{\partial \$_{g,c}} \text{Prob}\{\frac{1}{3} \leq \nu_d\} + \rho \frac{\partial}{\partial \$_{g,c}} \text{Prob}\{\frac{2}{3} \leq \nu_d\}\Big)$$
$$+ \psi \sum_S \left(\frac{\partial}{\partial \$_{g,c}} \text{Prob}\{\frac{1}{3} \leq \hat{V}_S\} + \rho_s \frac{\partial}{\partial \$_{g,c}} \text{Prob}\{\frac{2}{3} \leq \hat{V}_S\}\right) + \gamma\big(\zeta_c + \eta_z - \$_c\big) = 0 \quad (14)$$

Solving for the government's transfer we have:

$$\$_c = \zeta_c + \hat{\kappa}_{d1} + \rho\hat{\kappa}_{d2} + \psi\hat{\kappa}_{s1} + \psi\rho_s\hat{\kappa}_{s2} + \eta_z \tag{15}$$

where:

$$\zeta_c = \vec{w}'_c\vec{\zeta}$$

is the deterministic portion of the apolitical level of spending in commune c if INDAP scrupulously pursued its statutory objectives, as in (1) of section 1.

The random terms from equation (14) satisfy:

$$\text{and } \hat{\kappa}_{d1} = \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\{\frac{1}{3} \le \nu_d\} \text{ and } \hat{\kappa}_{d2} = \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\{\frac{2}{3} \le \nu_d\} \tag{16}$$

and:

$$\hat{\kappa}_{s1} = \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\{\frac{1}{3} \le \hat{V}_S\} \text{ and } \hat{\kappa}_{s2} = \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\{\frac{2}{3} \le \hat{V}_S\} \tag{17}$$

Notice that there is no pure strategy Nash equilibrium in which (1) fails to hold for the opposition as well, so that $\theta_c(\$_g - \$_o) = 0$ in equilibrium.

To obtain the result in equation (5) we first substitute for F_c from equation (10). Noting from (11) that ϵ_c and ϵ_d are normally distributed we have:

$$\begin{aligned}
\hat{\kappa}_{d1} &= \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\{\frac{1}{3} \le \nu_d\} \\
&= \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\left\{\frac{1}{3} \le \sum_{c\in d} s_{c,d}F_c\left(\lambda(\$_{g,c} - \$_{o,c})\right)\right\} \\
&= \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\left\{\frac{1}{3} \le \sum_{c\in d} s_{c,d}\frac{1}{1+e^{-\mu_c-\epsilon_d-\epsilon_c-\lambda(\$_{g,c}-\$_{o,c})}}\right\} \\
&= \frac{1}{\gamma}\frac{\partial}{\partial\$_{g,c}}\mathsf{Prob}\left\{\Omega_c \le \frac{1}{1+e^{-\mu_c-\epsilon_d-\epsilon_c-\lambda(\$_{g,c}-\$_{o,c})}}\right\}
\end{aligned}$$

where:

$$\Omega_c = \frac{1}{3s_{c,d}} - \Big(\sum_{c' \neq c \bigcap c' \in d} \frac{s_{c',d}}{s_{c,d}} \frac{1}{1+e^{-\mu^*_{c'} - \epsilon_d - \epsilon_{c'} - \lambda(\$_{g,c} - \$_{o,c})}} \Big)$$

so:

$$\begin{aligned}
\hat{\kappa}_{d1} &= \frac{1}{\gamma} \frac{\partial}{\partial \$_{g,c}} \text{Prob}\left\{ \Omega_c \leq \frac{1}{1+e^{-\mu_c - \epsilon_d - \epsilon_c - \lambda(\$_{g,c} - \$_{o,c})}} \right\} \\
&= \frac{1}{\gamma} \frac{\partial}{\partial \$_{g,c}} \text{Prob}\left\{ \log(\Omega_c) - \log(1-\Omega_c) \leq \mu_c + \epsilon_d + \epsilon_c - \lambda(\$_{g,c} - \$_{o,c}) \right\} \\
&= \frac{1}{\gamma} \frac{\partial}{\partial \$_{g,c}} \text{Prob}\left\{ -\epsilon_c \leq \lambda(\$_{g,c} - \$_{o,c}) + \epsilon_d + \mu_c - \log(\Omega_c) + \log(1-\Omega_c) \right\} \\
&= \frac{1}{\gamma} \frac{\partial}{\partial \$_{g,c}} \int_{-\infty}^{\infty} \dots \int_{-\infty}^{\infty} \dots \int_{-\lambda(\$_{g,c} - \$_{o,c}) - \epsilon_d - \mu_c + \log(\Omega_c) - \log(1-\Omega_c)} f(\epsilon_c) d\epsilon_c \dots f(\epsilon_{c'}) d\epsilon_{c'} \dots g(\epsilon_d) d\epsilon_d \\
&= \frac{\lambda}{\gamma} \int_{-\infty}^{\infty} \dots \int_{-\infty}^{\infty} f\big(-\lambda(\$_{g,c} - \$_{o,c}) - \epsilon_d - \mu_c + \log(\Omega_c) - \log(1-\Omega_c)\big) f(\epsilon_{c'}) d\epsilon_{c'} \dots g(\epsilon_d) d\epsilon_d
\end{aligned}$$

where $f(\epsilon_{c'})$ is the normal density function with mean 0 and variance σ^2, by symmetry of the normal pdf about it's mean, and recalling that $\$_{g,c} = \$_{o,c}$, this simplifies to:

$$\hat{\kappa}_{d1} = \frac{\lambda}{\gamma} \int_{-\infty}^{\infty} \dots \int_{-\infty}^{\infty} f\big(\epsilon_d + \mu_c - \log(\Omega_c) + \log(1-\Omega_c)\big) f(\epsilon_{c'}) d\epsilon_{c'} \dots g(\epsilon_d) d\epsilon_d$$

For our purposes here $\frac{\lambda}{\gamma}$ is a "nuisance parameter"–it depends on γ, which calibrates the resistance to allocating loans in ways not foreseen by the INDAP charter, while λ tells us about voters' willingness to trade off ideological purity for loan benefits. It is more convenient to work with $\kappa_{d1} \equiv \frac{\gamma}{\lambda} \hat{\kappa}_{d1}$:

$$\kappa_{d1} = \int_{-\infty}^{\infty} \dots \int_{-\infty}^{\infty} f\big(\epsilon_d + \mu_c - \log(\Omega_c) + \log(1-\Omega_c)\big) f(\epsilon_{c'}) d\epsilon_{c'} \dots g(\epsilon_d) d\epsilon_d$$

We define κ_{d2}, κ_{s1}, and κ_{s2} in completely analogous ways. Remember that for the Senate elections the λ parameter is replaced by $\hat{\lambda}$, as in equation (12).

Starting with equation (15) we see that:

$$
\begin{aligned}
\$_c = \zeta_c + \hat{\kappa}_{d1} + \rho\hat{\kappa}_{d2} + \psi\hat{\kappa}_{s1} + \psi\rho_s\hat{\kappa}_{s2} + \eta_z \\
= \vec{w}_c'\vec{\zeta} + \left(\frac{\lambda}{\gamma}\frac{\gamma}{\lambda}\right)\hat{\kappa}_{d1,c} + \rho\left(\frac{\lambda}{\gamma}\frac{\gamma}{\lambda}\right)\hat{\kappa}_{d2,c} + \psi\left(\frac{\hat{\lambda}}{\gamma}\frac{\gamma}{\hat{\lambda}}\right)\hat{\kappa}_{s1,c} + \psi\rho_s\left(\frac{\hat{\lambda}}{\gamma}\frac{\gamma}{\hat{\lambda}}\right)\hat{\kappa}_{s2,c} + \eta_c \\
= \vec{w}_c'\vec{\zeta} + \left(\frac{\lambda}{\gamma}\right)\kappa_{d1,c} + \left(\rho\frac{\lambda}{\gamma}\right)\kappa_{d2,c} + \left(\psi\frac{\hat{\lambda}}{\gamma}\right)\kappa_{s1,c} + \left(\psi\rho_s\frac{\hat{\lambda}}{\gamma}\right)\kappa_{s2,c} + \eta_c \\
= \vec{w}_c'\vec{\zeta} + a_1\kappa_{d1,c} + b_1\kappa_{d2,c} + c_1\kappa_{s1,c} + d_1\kappa_{s2,c} + \eta_c \qquad (18)
\end{aligned}
$$

where $a_1 = \frac{\lambda}{\gamma}$, $b_1 = \rho\frac{\lambda}{\gamma}$, $c_1 = \psi\frac{\hat{\lambda}}{\gamma}$, and $d_1 = \psi\rho_s\frac{\hat{\lambda}}{\gamma}$. Notice that equation (18) is identical with equation (1) in the text.

Appendix B

To conduct the Hausman test Hausman (1978) comparing the probit coefficients in column 1 of Table 3 with the corresponding Tobit coefficients from a model that has the log of INDAP expenditures as the dependent variable we need to rescale the Tobit coefficient estimates in terms of the estimated standard error. We do this by applying the "delta method". Let's denote the Tobit coefficient for variable i by $\hat{\beta}_i$, while $\hat{\sigma}$ is the estimated standard deviation of the standard error from the Tobit model. Let $\omega_{i,i}$ indicate the estimated variance of $\hat{\beta}_i$, while $\omega_{i,\sigma}$ is the covariance of $\hat{\beta}_i$, with $\hat{\sigma}$, and $\omega_{\sigma\sigma}$ is the variance of $\hat{\sigma}$. If we define the rescaled coefficient for variable i as $\alpha_i \equiv \frac{\hat{\beta}_i}{\hat{\sigma}}$ then a first order approximation to the covariance between $\hat{\alpha}_i$ and $\hat{\alpha}_j$ is[39]:

$$
\mathrm{Cov}(\hat{\alpha}_i, \hat{\alpha}_j) = \begin{pmatrix} \frac{1}{\hat{\beta}_i} & -\frac{\hat{\alpha}_i}{\hat{\beta}_i} \end{pmatrix} \begin{pmatrix} \omega_{i,i} & \omega_{i,\sigma} \\ \omega_{i,\sigma} & \omega_{\sigma,\sigma} \end{pmatrix} \begin{pmatrix} \frac{1}{\hat{\beta}_i} \\ -\frac{\hat{\alpha}_i}{\hat{\beta}_i} \end{pmatrix}
$$

We use this formula to calculate the entries of the variance covariance matrix for the rescaled coefficients used to perform the Hausman test.