Online Appendix to "Political Screening: Theory and Evidence from the Argentine Public Sector"

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Abstract

This Appendix, not intended for publication, discusses extensions to our model of political screening, and presents the additional empirical results we refer to in the paper.

1 Extensions of the theory

1.1 Uncertainty

There are several ways that adding uncertainty to the model could increase its realism. First, we can allow the politician's values v^t and μ^t or the employee's outside option u^t to be random variables. If their realization is observed by everyone and long-term contracts can be conditioned on them, nothing changes in the basic model. Second, we can allow for asymmetric information. Unfortunately, little is known about the solution to these types of problems once contracting occurs in a stochastic environment.

1.1.1 Private information about the outside option

We are not aware of any studies allowing the agent's outside option to be private information. The following simple example shows that one effect of such an extension is often to remove the need for screening contracts.

Consider the static contracting problem. Assume there is full information on partisanship, but each applicant's outside option u is drawn from a uniform distribution on $[0,1]$. Let $c_{NP}(x) = \frac{x^2}{2}$ and $c_P = \alpha c_{NP}$ where $\alpha \in (0,1)$. For type i, the politician solves

$$\max_{s_i, x_i} (s_i - c_i(x_i))(x_i - s_i),$$

which reflects the fact that with probability $\Pr(u_i < s_i - c_i(x_i)) = s_i - c_i(x_i)$ the applicant's outside option will be low enough to satisfy the participation constraint, while with the complementary probability the applicant will not take the job.

This yields the solution $(x_P, s_P) = (\frac{1}{\alpha}, \frac{3}{4\alpha})$ and $(x_{NP}, s_{NP}) = (1, \frac{3}{4})$. Note that for $\alpha \leq 1/2$, we have $s_P - c_P(x_P) = \frac{1}{4\alpha} \geq \frac{3}{4} - \alpha\frac{1}{2} = s_{NP} - c_P(x_{NP})$. Therefore in this case the incentive constraints are automatically satisfied. It follows that incomplete information about partisanship would result in the same contracts. Intuitively, because the principal faces some probability that a given contract is not accepted, he is prompted even in the first best to offer rents to both types to increase the probability of acceptance. In some cases, the rent in the first best contracts is sufficient to guarantee self-selection, i.e., the first best contract solves the second best screening problem as well.

Since the first best contract is independent of p, in our case this would mean that the incentive effect disappears, and any effect of the vote share p on the average salary would be the monotonic composition effect. By contrast, our empirical work finds robust non-monotonicities.

1.1.2 Changing political preferences

Another possibility is that political preferences might change over time. If employees foresee that this might happen, this will change their incentives at the contracting stage. Battaglini (2005) is an important paper studying such a problem for the case of a buyer-seller relationship where consumers' tastes follow a Markov process.[1] Unfortunately, for our application, the Markovian assumption seems counterintuitive, as it would imply, for example, that the likelihood of an employee's preferences changing is independent of how often they have changed in the past. Since we are not aware of any other study with stochastic types, we

[1] He shows that under these assumptions, the first best contract will solve the screening problem for most histories. In our case this would again imply a monotonic relationship between p and the average salary.

simply assume that preferences do not change or, if they do, employees do not take this into account at the contracting stage.[2]

1.2 Productive employees

Suppose that, in addition to political services x, employees also provide a useful output y. Let the politician's payoff in period t be given by $v_t(x^t) - s^t + \mu_t(y^t)$, where μ_t is increasing and concave. Partisans and nonpartisans do not differ in their ability to perform on-the-job: the cost of providing output y is the same for everyone, $\kappa(y)$.[3] (The consequences of relaxing this assumption are discussed below.) A contract is now a triplet (s^t, x^t, y^t), and yields the instantaneous payoff $s^t - c_i(x^t) - \kappa(y^t)$ to a worker of type $i = P, NP$. In a first best contract, $\kappa'(\hat{y}_i^t) = \mu_t'(\hat{y}_i^t)$, $c_i'(\hat{x}_i^t) = v_t'(\hat{x}_i^t)$ and $\hat{s}_i^t = c_i(\hat{x}_i^t) + \kappa(\hat{y}_i^t) + u^t$.

In the second best, by modifying the politician's problem appropriately it is easy to verify that the optimal contracts become

$$
\begin{aligned}
x_P^t &= \hat{x}_P^t && (1)\\
c_{NP}'(x_{NP}^t) &= (1-p)v_t'(x_{NP}^t) + pc_P'(x_{NP}^t) && (2)\\
y_P^t &= y_{NP}^t = \hat{y}^t && (3)\\
s_{NP}^t &= c_{NP}(x_{NP}^t) + u^t + \kappa(\hat{y}^t) && (4)\\
s_P^t &= c_P(x_P^t) + u^t + \kappa(\hat{y}^t) + c_{NP}(x_{NP}^t) - c_P(x_{NP}^t) && (5)
\end{aligned}
$$

Since partisans and nonpartisans do not differ in their ability to perform on-the-job, they provide the same level of output (equation (3)). Yet, comparing equations (4) and (5), we see that partisans get a higher salary: $s_P^t - s_{NP}^t = c_P(x_P^t) - c_P(x_{NP}^t) > 0$. The prediction for the period-t salary of the average employee (Proposition 1) becomes

$$\tilde{s}^t(p) = p[c_P(x_P^t) - c_P(x_{NP}^t(p))] + c_{NP}(x_{NP}^t(p)) + u^t + \kappa(\hat{y}^t),$$

which does not change the same comparative statics as in the paper.

[2] A buyer may be able to estimate the probability that his preferences will change based on exogenous market processes (e.g., if his valuation for the good is dependent on its resale value or its value as an input into some production process, such changes can be forecasted). It is harder to see where an employee's prior on a future change in his political preferences would come from.

[3] One interpretation of this assumption is that exogenous professional requirements have already narrowed down the pool of applicants to individuals equally capable of performing the job, at least to the extent that the politician cares about performance. Within this group, the only relevant difference remaining between workers is partisanship.

1.2.1 Political screening and the level of public services

An important question regarding public service delivery concerns the various sources of potential inefficiency in government provision (e.g., Bandiera et al., 2009). It is therefore natural to ask how the type of political screening we study affects the level of services.

To address this issue, we consider the following extension of the model. Suppose that x and y represent the time allocated by an employee to providing political support and public services, respectively, out of a total of 1 unit of time available. Let an employee's payoff from a contract (s, x, y) be $s + b(1 - y - x) - h_i(x)$ for $i = P, NP$. Here, $b(.)$ is an increasing and concave function representing utility from leisure, and h_i is the utility cost (such as psychological cost) of providing political services. In line with our earlier assumptions, let $h_P < h_{NP}$, $0 < h'_P < h'_{NP}$, and $h''_i > 0$, guaranteeing that the single-crossing condition is satisfied.

As before, the politician chooses the optimal screening contracts to maximize his payoff subject to the participation and incentive constraints. For simplicity, assume that there is only 1 period. The first order conditions defining the optimal pair of contracts (s_i, x_i, y_i) are:

$$v'(x_P) - h'_P(x_P) = 0 \quad (6)$$

$$b'(1 - y_P - x_P) - \mu'(y_P) = 0 \quad (7)$$

$$ph'_P(x_{NP}) + (v'(x_{NP}) - \mu'(y_{NP}))(1 - p) - h'_{NP}(x_{NP}) = 0 \quad (8)$$

$$b'(1 - y_{NP} - x_{NP}) - \mu'(y_{NP}) = 0 \quad (9)$$

From (7) and (9) we see that all employees spend less time y_i providing public services than they would in a world with no political support ($x_i = 0$). This reflects the popular notion that political duties take time away from service delivery, and confirms that patronage is likely to lead to inefficiencies.

But is political *screening* responsible for the lower level of public services? The answer turns out to be no. Surprisingly, relative to a world with full information on political preferences, screening contracts result in a *higher* level of public services. The intuition is the following. Recall that relative to the full information case, the political support required in screening contracts is distorted downwards for nonpartisans. Because ceteris paribus this lowers the marginal utility of leisure, it becomes relatively cheap for the politician to require that more time y be spent on public services. Because the value of leisure is the same for partisans and nonpartisans, raising y is possible without giving rents to either type. In essence, the need to screen acts as a constraint on how much political support can be required from public employees, and this helps raise the level of public services. Environments where the

politician has better information on the political preference of employees result in less service provision.

The following proposition establishes this formally.

Proposition 1 *As p rises, y_{NP} increases above its full information level, while y_P remains unchanged.*

Proof. From the first-order conditions (6)-(9), the comparative statics w.r.t. p give

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \frac{\partial x_{NP}}{\partial p} \\ \frac{\partial y_{NP}}{\partial p} \end{bmatrix} = \begin{bmatrix} z \\ 0 \end{bmatrix},$$

where

$$\begin{aligned} a_{11} &= ph''_P(x_{NP}) + v''(x_{NP})(1-p) + (1-p)b''(1-x_{NP}-y_{NP}) - h''_{NP}(x_{NP}) \\ a_{12} &= a_{21} = (1-p)b''(1-x_{NP}-y_{NP}) \\ a_{22} &= (1-p)[b''(1-x_{NP}-y_{NP}) + \mu''(y_{NP})] \\ z &= v'(x_{NP}) - b'(1-x_{NP}-y_{NP}) - h'_P(x_{NP}) \end{aligned}$$

From the second-order conditions, we know that $a_{22} < 0$ and $a_{11}a_{22} - (a_{12})^2 > 0$, which are necessary for the Hessian to be negative semidefinite. From (8), we also know that $z > 0$. Using Cramer's rule, we therefore find $\frac{\partial x_{NP}}{\partial p} = \frac{z \cdot a_{22}}{a_{11}a_{22}-(a_{12})^2} < 0$ and $\frac{\partial y_{NP}}{\partial p} = \frac{-z \cdot a_{12}}{a_{11}a_{22}-(a_{12})^2} > 0$.

■

Next, we show that the negative incentive effect and the positive composition effect of the vote share p on public wages identified in our paper also survive in this environment.

Consider the average wage as a function of p. From the binding constraints we find, that

$$\tilde{s}(p) = p(-b(1-x_P-y_P)+h_P(x_P)+b(1-x_{NP}-y_{NP})-h_P(x_{NP}))-b(1-x_{NP}-y_{NP})+h_{NP}(x_{NP}).$$

Taking the derivative and simplifying gives

$$\frac{d\tilde{s}}{dp} = [-b(1-x_P-y_P)+h_P(x_P)+b(1-x_{NP}-y_{NP})-h_P(x_{NP})]+(1-p)[v'(x_{NP})\frac{\partial x_{NP}}{\partial p}+\mu'(y_{NP})\frac{\partial y_{NP}}{\partial p}].$$

The first term in brackets is the positive composition effect. The second term is the incentive effect, which now reflects both x_{NP} and y_{NP} changing as the vote share changes. Using the expressions above for the derivatives of x_{NP} and y_{NP}, we find that the incentive

effect is

$$v'(x_{NP})\frac{\partial x_{NP}}{\partial p}+\mu'(y_{NP})\frac{\partial y_{NP}}{\partial p} \sim b''(1-x_{NP}-y_{NP})(v'(x_{NP})-\mu'(y_{NP}))+\mu''(y_{NP})v'(x_{NP}) < 0,$$

where the inequality follows from $b'' < 0$, $\mu'' > 0$, and the first order condition (8).

This example illustrates that understanding the nature of patronage contracts may have interesting implications for thinking about the quality of public services. Together with our empirical results, which confirm the relevance of our model in explaining public wages, this suggests that estimating the impact of political screening on the level of public services would be interesting. Unfortunately, measuring output in the public sector is extremely difficult and requires innovative strategies that are outside the scope of this paper (see, e.g., Di Tella and Schargrodsky (2003), Bandiera et al. (2009)). We therefore leave this question for future research.

1.2.2 Different on-the-job productivity

Another interesting extension of the model arises when job applicants are allowed to vary by their on-the-job ability as well as partisanship. That is, given any qualifications and other formal requirements, some applicants may have a lower cost κ of producing output y (higher ability). It is interesting to ask how political screening contracts affect the equilibrium output produced. For example, a common concern regarding patronage is that political hiring leads to less productive employees.[4]

Suppose each type of employee $i = P, NP$ can have high ability (1) or low ability (2), with $\kappa_{i1}(y) < \kappa_{i2}(y)$ and $\kappa'_{i1}(y) < \kappa'_{i2}(y)$. Let q_i be the probability that type i has high ability, so, e.g., the probability of an applicant being a high ability partisan is pq_P. In this case, the politician may want to offer 4, rather than two different contracts. That is, he may want to screen on ability as well as political preferences.

As is typical in multidimensional screening models, the solution quickly becomes very complex. The general characterization of the optimal contracts in this model follows from Armstrong and Rochet (1999), who show that the optimum can take several forms depending on the correlation between the two screening dimensions (in our case, ability and partisanship) and the shape of the utility functions. In many cases, the presence of the political motive leads to a distortion in the output produced. For example, if partisanship is positively correlated with ability ($q_P - q_{NP} > 0$), in the optimal contracts, all high-ability

[4] We are not aware of previous studies directly addressing this question, but there are papers asking whether higher public sector wages lead to the selection of less corrupt bureaucrats (e.g., Besley and McLaren, 1993).

employees provide the efficient level of output but all low-ability employees provide too little output. Moreover, if $q_P - q_{NP}$ is sufficiently large, one can show that as the share of partisans p increases, the distortion in both the political support of nonpartisans *and* in the output of low-ability employees increases. Thus, relative to a situation with no partisans, output y is more distorted under patronage.

At the same time, there are also cases when the presence of the political motive may actually help efficiency. When $q_P < q_{NP}$, so that ability and partisanship are negatively correlated, there are cases when the optimal contract involves efficient output by both low and high-ability partisans. (By contrast, if ability was the only dimension of private information, low-ability employees would always provide too little output in the optimal screening contracts.) The intuition for this is that under negative correlation, the actions of low-ability partisans and high-ability nonpartisans are especially important to the politician, therefore it is optimal to raise the political support and output of these groups. When output is relatively less valuable, its efficient level is lower, and the politician might benefit from raising it all the way to the efficient level. Thus, interestingly, the efficiency gain in output requires that the politician's utility from political support relative to output be *high* enough, i.e. that the political motive be strong.

2 Additional empirical results

2.1 Turnover

This section provides background information describing turnover rates for the Argentine public sector. To this end, we take advantage of 33 very large surveys known by their acronym EPH (Household Income Survey or *Encuesta Permanente de Hogares*) conducted from 2003 through 2011 by the Argentine Bureau of Statistics (INDEC). Each survey includes approximately 50,000 individuals for a total sample of 1,838,828. Close to 25,000 respondents in each survey are economically active, for a total of 799,520 and approximately 4,500 are public sector employees, for a total of 161,373. Income surveys are conducted each trimester, four times a year, in urban conglomerates covering all Argentine Provinces, collecting a variety of income and social indicators.

An important feature of the EPH is that it surveys individuals multiple times over two year spans, providing panel information to measure turnover in the argentine public sector. In all, 136,913 (7.45%) individuals were measured only once; 362,368 (19.71%) were measured twice; 385,239 (20.95%) were measured three times; and 954,308 (51.9%) were measured four times. Table 1 provides descriptive information of overall turnover in the public sector for

all adults measured at least two times, without distinguishing economically active status.

As it is possible to observe, overall turnover in the public sector is relatively high, with close to 16% of new public sector employees replacing existing employees on any given panel measure. Because times in between measures vary between three months and one year, a better description of the yearly turnover is the sample of individuals in the panel measured exactly one year apart. For those individuals in the sample, the rate of new hires is 21.8% (5393/24673) and the attrition rate is 20.4%. Overall, every year there is a turnover of approximately 20% in the Argentine public sector.

Out of the 20% of public sector employees dropped from rolls every year, close to a third (6%) result from age related retirements or change in disability status. Consequently, the attrition of working age employees eliminated for reasons other than age or disability is about 14% a year while recruitment is close to 20%.

We now turn to analyzing how the electoral cycle explains recruiting individuals into de public sector. As the dependent variable for our analyses we consider a dummy variable taking the value of 1 if the individual is a public sector employee and 0 otherwise. We include the lag of the dependent variable as in Table 1, taking the value of 1 if the respondent was a public employee at time $t-1$ and zero otherwise.

We also created an electoral cycle variable, C, measuring the number of days (d) from the moment of the survey to the next governor's election in each province as a share of the total number of days in between each governor's election:

$$C = \frac{d_{election} - d_{survey}}{d_{election} - d_{prior\ election}}.$$

This variable takes the value of 1 if the survey was conducted immediately after the previous election and declines towards zero as the new election approaches. We also interact the lagged public employee variable and the electoral cycle, to distinguish at which point of the electoral cycle individuals are recruited into or eliminated from public sector rolls. Finally, we added a panel ticker that counts the number of trimester since the previous panel measure was taken, to control for differences in the time elapsed between interviews to the same individual in the panel.

Table 2 presents results of the logistic model, reporting log-odds ratios with standard errors in parentheses. Results describe the relationship between the governor's electoral cycle and recruitment into the public sector. As it is possible to observe, the estimate of the electoral cycle is positive, indicating that individuals are more likely to be incorporated into the public sector at the beginning of the electoral cycle (when the value of the variable cycle is closer to 1). Furthermore, the interaction of public employee[t-1] and the electoral cycle is

negative, indicating that existing employees are more likely to be dropped from rolls at the beginning of the electoral cycle. Coefficients are statistically and substantively significant, showing a 8.3% ($= e^{0.08} - 1$) higher probability of being recruited early in the electoral cycle and a 18% ($= e^{0.08-0.27} - 1$) decrease in the probability of remaining employed in the public sector early in the electoral cycle. These findings support the idea that politicians in Argentina face considerable flexibility in hiring and firing public employees.

2.2 Referrals

Table 3 shows that referral hires earn somewhat higher wages, but this is not statistically significant. Table 4 reports the regressions used to construct Figure 4 in the paper (Columns 1-3 correspond to Panels A-C, respectively). It also includes additional robustness checks. In every regression on public employees the *Votes* and $Votes^2$ variables confirm the U-shaped pattern, while their interactions with the *Referral* dummy has the opposite sign compared to the main effects. This results in a flatter relationship among referral hires: here, the only effect of the vote share on wages is the positive composition effect for large values of *Votes*.

2.3 Other

Table 5 repeats regression (1) in Table 4 in the paper, including an indicator for employees hired under the current governor (who are also part of the restricted sample of Table 3 in the paper). As can be seen, the effect of vote shares does not differ significantly between these two samples.

Figure 1 shows the number of observations in the sample for each election.

References

[1] Armstrong, M., and J.-C. Rochet (1999): "Multi-dimensional screening: A user's guide," *European Economic Review* 43, 959-79.

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[3] Battaglini, M. (2005): "Long-Term Contracting with Markovian Consumers," *American Economic Review* 95(3), 637-58.

[4] Besley, T., and J. McLaren (1993): "Taxes and Bribery: The Role of Wage Incentives," *The Economic Journal* 103, 119-141.

[5] Di Tella, R., and E. Schargrodsky (2003): "The Role of Wages and Auditing during a Crackdown on Corruption in the City of Buenos Aires," *Journal of Law and Economics* 46(1), 269-292.

Table 1: Employment Status at time *t* and *t*-1, All Adults

		Employees at t-1		
		Private sector, retired, or unemployed	Public sector	Total
Employees at time t	Private sector, retired, or unemployed	1,035,845	15,958	1,051,803
	Public sector	16,237	85,701	101,938
	Total	1,052,082	101,659	1,153,741

Note: EPH Income Survey (2003-2011), INDEC. Panel of individuals measured at least two times.

Table 2: Electoral Cycle and Public Sector Turnover

	(1)	(2)
Public Employee (t-1)	5.96***	5.96***
	(0.024)	(0.024)
Electoral Cycle	0.08***	0.08***
	(0.030)	(0.030)
Public Employee (t-1) * Electoral Cycle	-0.27***	-0.27***
	(0.044)	(0.044)
Panel Ticker		0.02***
		(0.006)
Constant	-4.2***	-4.23***
	(0.017)	(0.020)
N	1081742	1081742
LogLik	-119962	-119955
Adjusted R^2	0.628	0.628
AIC	239932.2	239921

Note: Logistic estimates explain changes in the dependent variable "public sector employee." Coefficients describe log-odds ratios, with standard errors in parentheses. National Household Survey (INDEC), 2003-2011

Table 3: Referrals

	(1)	(2)
Referral	0.027	0.027
	(0.027)	(0.027)
Votes		-2.710***
		(0.807)
$Votes^2$		2.797***
		(0.639)
R^2	0.50	0.50
N	4,691	4,691
Provinces	24	24

Notes: Dependent variable is ln*Wage*. All regressions include *Women, Age, Age*^{2}*, Experience, Experience*^{2}*, City, Oldsystem, Currentgovernor*, dummies for *Schooling* and *Occupation*, and a full set of province fixed effects. Robust standard errors clustered two-way by province and election year in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: Referrals, partisan shares, and public-sector wages (all hires)

	(1)	(2) without Federal Capital and Buenos Aires	(3) without La Rioja, Tierra del Fuego, and Tucuman	(4)	(5)	(6) with year-of-hiring FE	(6) with election-year FE	(8) private sector workers
Votes	-3.048***	-2.959***	-4.992***	-2.905***	-2.894***	-2.274***	-2.537***	-0.609
	(0.670)	(0.790)	(1.509)	(1.065)	(1.075)	(0.699)	(0.814)	(1.011)
Votes^2	3.088***	3.002***	5.001***	3.224***	3.192***	2.284***	2.386***	0.899
	(0.523)	(0.642)	(1.394)	(0.883)	(0.897)	(0.496)	(0.616)	(0.805)
Referral	-0.322	-0.274	-0.247	-0.294	-0.294	-0.337	-0.315	-0.041
	(0.308)	(0.345)	(0.280)	(0.331)	(0.328)	(0.295)	(0.318)	(0.101)
Referral x Votes	1.283	1.103	1.264*	1.252	1.248	1.310	1.252	0.184
	(0.945)	(1.093)	(0.703)	(1.039)	(1.034)	(0.872)	(0.977)	(0.403)
Referral x Votes^2	-1.127*	-0.959	-1.383***	-1.150	-1.143	-1.123*	-1.082	-0.220
	(0.669)	(0.802)	(0.497)	(0.774)	(0.784)	(0.577)	(0.689)	(0.385)
Unemployment				-0.009	-0.008			
				(0.007)	(0.008)			
GDP per capita				-0.517	-0.517			
				(0.322)	(0.348)			
Tax revenues					0.001			
					(0.001)			
IG transfers					-0.000			
					(0.000)			
R^2	0.50	0.50	0.48	0.51	0.51	0.50	0.51	0.43
N	4,691	4,012	4,003	4,008	4,008	4,691	4,691	14,323
Provinces	24	22	21	22	22	24	24	24

Notes: Dependent variable is ln*Wage*. All regressions include *Women, Age, Age*^{2}*, Experience, Experience*^{2}*, City, Old system hire, Current party hire*, dummies for *Schooling* and *Occupation*, and a full set of province fixed effects. Column (8) presents a falsification exercise on private sector employees. Robust standard errors clustered two-way by province and election year in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: The effect of partisan shares on public-sector wages: all hires vs. current governor hires

	(1)
Votes	-2.426***
	(0.613)
Votes^2	2.193***
	(0.529)
Votes x Current gov. hire	-0.062
	(1.690)
Votes^2 *x Current gov. hire*	0.583
	(1.239)
Current gov. hire	-0.259
	(0.575)
R^2	0.50
N	4,742
Provinces	24

Notes: Dependent variable is ln*Wage*. Controls include *Women, Age, Age*^{2}*, Experience, Experience*^{2}*, City, Old system hire, Current party hire*, dummies for *Schooling* and *Occupation*, and a full set of province fixed effects. Robust standard errors clustered two-way by province and election year in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

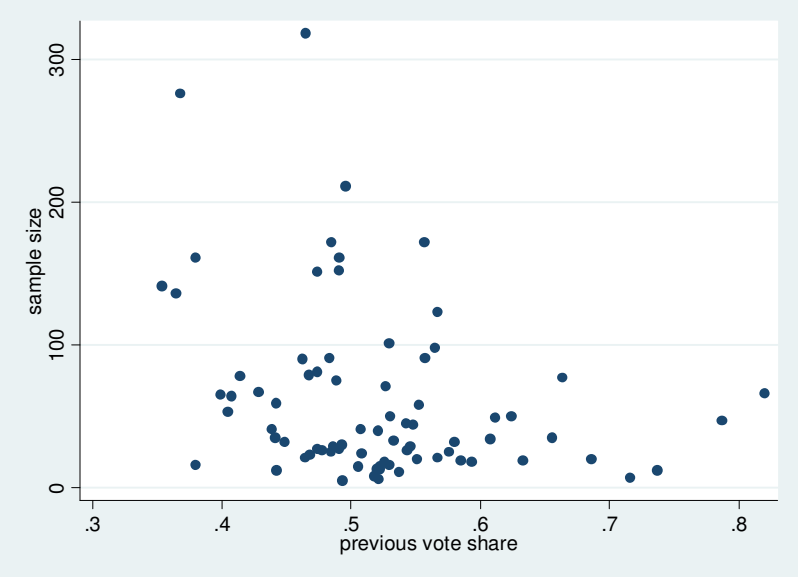

Figure 1: Number of observations in the sample for each province / election cell