Inequality, Uncertainty and Redistribution.

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Inequality, Uncertainty and Redistribution.[*]

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Abstract

For centuries it has been believed that the extension of the franchise in unequal societies would lead to relatively high levels of redistribution. According to international rankings, however, among the fourteen most unequal countries in the world, nine have been democratic for at least the past fourteen years. A prerequisite for the adoption of redistributive policies is that there be elected representatives who are either committed to or who have an incentive to advocate for such policies. The prospects of such an outcome depend not only on candidates personal policy preferences and motivations, but also how they are perceived by voters. One important feature shared by highly unequal democracies is that they tend to be relatively young, with many new parties and candidates in the political scene. This means elections occur under a high degree of uncertainty about critical information voters need to chose their delegates. Thus, in this paper we develop a model of elections as a game of incomplete information to explore how uncertainty, candidates' motivation (policy vs. office), and beliefs about their ideological inclinations affect what policy interests are likely to be represented in the political process. I explore the model's assumptions and outcomes empirically using individual level data for each presidential election in Brazil since democratization.

1 Introduction

For centuries it has been believed that the extension of the franchise in unequal societies would lead to high levels of redistribution. Benjamin Constant (1767-1830), for example, wrote:

> *Notice that the necessary aim of those without property is to obtain some: all the means which you grant them are sure to be used for this purpose. If, to the freedom to use their talents and industry, which you owe them, you add political rights, which you do not owe them, these rights, in the hands of the greatest number, will inevitably serve to encroach upon property.* (Constant, 1988, pg. 215).

Marx expresses similar expectations in *Surveys from Exile* (Marx, 1973), and, more recently, a number of authors have formalized the idea. Among the most famous studies is the work by Meltzer and Richard that shows how majority rule would lead to high levels of redistribution in societies where the income of the median voter lies well below that of the average voter. Under high inequality, a uniform tax schedule with equal distribution of the proceeds among individuals would benefit all those earning less than the average income. Thus redistribution would be a winning policy platform.

In reality, however, the extension of political rights in unequal societies does not necessarily lead to high levels of redistribution. If we consider the latest ranking of countries by the United Nations, we find that among the most unequal ones, a considerable share has been considered democratic for more than a decade[1].

Democracies are representative forms of government. This means citizens need to choose individuals to represent their interests and to whom policy decisions will be delegated. Thus, elections are a fundamental stage in the democratic political process and the main instruments for citizens to affect political decisions (Powell, 2000). So the crucial question is: under what conditions would we expect candidates who are either committed to or who have an incentive to advocate for redistribution to be elected?

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[1]Namibia, Lesotho, Botswana, Bolivia, Colombia, Brazil, Paraguay, South Africa and Chile are among the top fourteen most unequal countries in the world and have received a polity score of 6 or higher for at least the past fifteen years. The polity score varies from -10 (very undemocratic) to 10(very democratic).

There are a number of factors that can prevent such an outcome. First, the simple fact that a majority of voters favor certain policies, does not mean a majority of politicians do too. The pool of candidates in an election does not necessarily mirror that of voters. In most countries being a viable candidate is a very expensive enterprise. Given that redistributive policies take away from the rich and give out to the poor, these costs can restrict the entry of candidates who are committed to the cause of the poor.

Hence candidates may announce the "median voter" platform to win votes, but lack credible commitment to implement it. Once in office, candidates need to weight the benefits of remaining in office against the costs of implementing policies they might dislike. This leads to a second relevant factor: candidate motivation. If candidates care solely about holding office, they would be inclined to implement policies favored by a majority, even if, based on their personal convictions, they actually oppose them. For other candidates, however, one of the biggest benefits of holding office is indeed the opportunity to implement policies they favor, and get rid of those they oppose. Thus, in order to assess candidates's incentives, voters need to consider their motivations and ideological inclinations.

Lastly, one important shared characteristic among the most unequal democracies today, is that they are relatively new democracies. This means new political parties and candidates emerge with some frequency in the political scene, making it difficult for voters to know their particular policy inclinations. Thus voters make their choices during elections under a great deal of uncertainty about crucial information.

In this paper we develop a model of elections as a game of incomplete information to explore how uncertainty, candidates' motivation (policy vs. office), and voters' beliefs about candidate's ideological inclinations affect what policy interests are likely to be represented in the political process. We characterize all pure strategy equilibria to gain insight into the conditions leading to both high and low redistribution.

To preview the main results, we find that low levels of redistribution under high inequality are supported by the belief that candidates who care about the welfare of the poor are rare. In other words, the more poor voters are skeptical about having candidates truly representing their

interests, the more likely is low redistribution to persist. As pointed by Robinson (2009) one important obstacle to lowering inequality in developing countries is the lack of political contenders who actually favor redistribution.

We also find that the often observed pattern of poor voters reelecting non-redistributive incumbents is not necessarily a sign that the poor do not care about policy or that they are being irrational or ignorant in assessing candidates' policy positions. Even under the assumption that they are as capable as any other voter to evaluate policy and update beliefs about politicians preferences, such an outcome can occur.

The paper is divided into four parts. In the next section we introduce and solve the model. We then explore the empirical plausibility of the conditions found to support an equilibrium of low redistribution under high inequality. We base this analysis on individual level data on voting intention during every presidential election in Brazil since democratization. We conclude with a summary of results and a brief discussion.

2   The Model

We model a polity with three groups of voters, $i = \{p, m, r\}$, where p stands for poor, m for middle and r for rich, and three types of candidates, $t = \{L, C, R\}$, where L stands for left, C for center, and R for right. We consider a unidimensional policy space where policies, denoted by x, can take the following values: $x \in \{0, \frac{1}{2}, 1\}$. Each member of a group of voters share the same ideal policy denoted by $\tilde{x}_i$. Each type of candidate is associated with an ideal policy that we identify by $\tilde{x}_t$. These are given by:

- $\tilde{x}_L = \tilde{x}_p = 0$

- $\tilde{x}_C = \tilde{x}_m = \frac{1}{2}$

- $\tilde{x}_R = \tilde{x}_r = 1$

We model a two-period game of incomplete information where voters know their own types, but do not know the candidates' types. All players share a common prior distribution of these types. This is given by $p_L > 0$, $p_C > 0$ and $p_R > 0$, denoting the probabilities of a candidate being at the

left, the center or the right of the ideological space, and where $\sum p_t = 1$. Candidates are assumed to have full information. They know their own type and those of the voters. The distribution of voters in the population is known to all players and is given by p_p, p_m and p_r, where $\sum p_i = 1$.

It is assumed the group of poor voters form a majority in the population, that is $p_p > \frac{1}{2}$, as is the case in most unequal countries. Furthermore, we assume that they all vote in each election.

The utility of candidates is as a function of their preferred policies $(\tilde{x}_t)$ and the extent to which they are office oriented (Calvert, 1985; Duggan and Fey, 2005). This is captured by the term $w \geq 0$. When $w = 0$ candidates are said to be purely policy oriented. As w increases the value of office grows relative to that of policy and candidates become increasingly office oriented. Candidates' utilities are given by:

$$U_t^e(x) = -(x - \tilde{x}_t)^2 + w,$$

$$U_t^{ne}(x) = -(x - \tilde{x}_t)^2.$$

where e stands for "elected" and ne stands for "non-elected". In the model, candidates and voters have Euclidean preferences for policy. Voters' utilities are simply a function of policy, and can be written as:

$$U_i(x) = -(x - \tilde{x}_i)^2.$$

Candidates can be reelected once, that is, they do not serve more than two terms. The game sequence can be described as follows.

(1) Nature draws the first incumbent[2];

(2) Incumbent implements policy x^1, where the superscript 1 denotes the first period;

(3) Voters observe x^1 and, whenever possible, update their beliefs about the incumbent's type via Bayes' Rule.

(4) Nature draws a challenger;

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[2]Since in the first period voters have no information about candidates' types, it is assumed they "flip a coin" in deciding who to vote for.

(5) Voters cast their votes;

(6) Winner becomes the incumbent in the second period and implements x^2. Game ends.

Candidates strategies consist of a pair of policies denoted $s_t = (x_t^1, x_t^2)$ chosen to maximize their expected utilities as incumbents in the first and second periods, given the strategies of the other players. Let $S = (s_L, s_C, s_R)$.

Candidates' expected utility can be written as follows:

$$EU_t(s_t, s_{-t}) = U_t^e(x_t^1) + \Gamma(\gamma_i)[U_t^e(x_t^2)] + (1 - \Gamma(\gamma_i)) \sum p_t \left[U_t^{ne}(x_t^2) \right]$$

where Γ is a function that maps voters' strategies denoted by $\gamma_i(x^1)$ (defined below) to a probability of the incumbent being reelected. Let $\sigma = (\gamma_p, \gamma_m, \gamma_r)$, then $\Gamma : \sigma \to [0, 1]$.

Voters' strategies consist of deciding whether to vote for the incumbent, $\gamma_i(x^1) = 1$, or the challenger, $\gamma_i(x^1) = 0$. If indifferent, a voter votes for the incumbent with probability $\frac{1}{2}$.

In deciding who to vote for, voters compare their expected utility from reelecting the incumbent (I) with that of electing the challenger (Ch) instead. These expected utilities are given by:

$$\begin{aligned} EU_i(I) &= \sum \mu_{(t|x^1,S)} \left[U_i(x_t^2) \right], and \\ EU_i(Ch) &= \sum p_t \left[U_i(x_t^2) \right]. \end{aligned}$$

where $\mu_{(t|x^1,S)}$ is the updated probability that the incumbent is of type t given the policy she implemented in her first term. This probability is updated whenever possible following Bayes' Rule.

Given the features of the model, we use the Perfect Bayesian Equilibrium concept. A complete characterization of such equilibria includes a full description of beliefs, that is, not only those updated beliefs following equilibrium strategies but also those following off-the-equilibrium-path actions. Given the latter can take numerous forms generating a multiplicity of equilibria, we apply the divinity refinement.

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$\gamma_i(x^1)$ is a step function, defined as follows:

$$\gamma_i(x^1) = 1 \quad if \quad EU_i(I) > EU_i(Ch)$$

$$\gamma_i(x^1) = 0 \quad if \quad EU_i(I) < EU_i(Ch)$$

$$\gamma_i(x^1) = \frac{1}{2} \quad if \quad EU_i(I) = EU_i(Ch)$$

$\Gamma(\gamma_i)$ is simply a function that weights each of the groups' strategies by the groups' sizes to determine whether the incumbent gets reelected or not.

Clearly, voters should consider how the other players vote in making their final decisions. Given the assumption that the poor form a majority of the electorate and always turn out to vote, unless they are indifferent between the two contenders, their vote is decisive and strategic voting does not play a role.

Results

The model yields three different pure strategy equilibria. In the first equilibrium, candidates value office to a relatively high extent. They find it thus profitable to choose the policy that pleases the majority of poor voters in the first period to secure a chance at reelection. As a result voters are indifferent between the incumbent and the challenger.

In the second equilibrium, the value of office is low enough to make the right-wing candidate choose her ideal policy in the first period even if that means no reelection. It is, however, still profitable for the moderate type to mimic the left candidate and implement the ideal policy of the poor. Voters, in turn, reelect only incumbents who implement their preferred policy in their first term.

Finally, for relatively low values of office we get an equilibrium where each candidate implements their ideal policy, revealing their exact type. Both the left and the moderate types get reelected. That is, even with full information about the incumbent's type, poor voters reelect a non-left representative.

Proposition 1: *If $w > 2 - p_L - \frac{p_C}{4}$, and $p_R < \frac{1}{4}(1 - p_C)$ there exists a unique Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = \frac{1}{2}), (x_R^1 = 0, x_R^2 = 1) \right);$$

- *voters' beliefs are:*

$$\mu_{L|0,S^*} = p_L, \mu_{C|0,S^*} = p_C, \mu_{R|0,S^*} = p_R, \mu_{R|\{\frac{1}{2},1\},S^*} = 1;$$

- *voters choose:* $\gamma_i(0) = \frac{1}{2}$ *for all i, and $\gamma_p(\frac{1}{2}) = \gamma_p(1) = 0$.*

The first equilibrium is described in Proposition 1. Because every incumbent decides to implement the same policy, voters cannot learn about their ideological inclinations, making them indifferent between the incumbent and the challenger during elections. This equilibrium is supported by two conditions. First, candidates are sufficiently office oriented, as opposed to caring mainly about policy. That makes it profitable for both the right and moderate type to concede on policy – by implementing a leftist policy in the first period – for a chance to remain in office for a second term.

The second condition is the shared belief that a right type is relatively rare. This means the expected utility from an unknown challenger is higher than that expected from the moderate type. Thus poor voters do not reelect incumbents implementing $x^1 = \frac{1}{2}$, guaranteeing C has no incentive to deviate.

Another possible equilibrium (stated in Proposition 2) is one where only the left and the moderate candidates choose the preferred policy of the poor in the first period and get reelected. The Right candidate plays her ideal policy in both periods, but does not remain in power for a second term.

Proposition 2: *If $\frac{1}{4}(\frac{p_C}{p_C + p_L} - p_C) < p_R < \frac{1}{4}(1 - p_C)$ and $\frac{p_C}{4} < w < 1 - p_L - \frac{p_C}{4}$, there exists a unique separating Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = \frac{1}{2}), (x_R^1 = 1, x_R^2 = 1) \right);$$

- *voters' beliefs are':*

$$\mu_{L|0,S^*} = \frac{p_L}{p_C + p_L}, \mu_{C|0,S^*} = \frac{p_C}{p_C + p_L}, \mu_{R|\{\frac{1}{2},1\},S^*} = 1;$$

- *voters choose:* $\gamma_p(0) = 1$ *and* $\gamma_p(\frac{1}{2}) = \gamma_p(1) = 0.$

Two conditions need to be satisfied to support this equilibrium. First, the probability of a right type needs to be relatively low, but not too low. The upper bound on p_R guarantees that poor voters would not reelect an incumbent who implements $x^1 = \frac{1}{2}$, which would encourage C to deviate. The lower bound guarantees that poor voters reelect the incumbent after observing the leftist policy, since they know there is a chance the incumbent is a moderate and will thus implement $x^2 = \frac{1}{2}$.

The second condition specifies a range on the value candidates place on holding office. The intuition for the upper bound is that the Right candidate needs to care enough about policy relative to office in order to prefer her ideal point as opposed to deviating to get votes. The lower bound plays the opposite role with respect to C. Since C is not implementing her ideal policy, she needs to care enough about office not to have an incentive to deviate to her preferred policy outcome.

Finally, in a third possible equilibrium (stated in Proposition 3) each type implements her own ideal policy in both periods. Thus after observing an incumbent in office, voters know her ideological preferences for certain. Even then, both left and moderates get reelected.

Proposition 3: *If $w < \frac{1}{4}(1 - p_C) - p_L$, there exists a unique separating Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = \frac{1}{2}, x_C^2 = \frac{1}{2}), (x_R^1 = 1, x_R^2 = 1) \right);$$

- *voters' beliefs are:*

$$\mu_{L|0,S^*} = 1, \mu_{C|\frac{1}{2},S^*} = 1, \mu_{R|1,S^*} = 1;$$

- *voters choose* $\gamma_p(0) = \gamma_p(\frac{1}{2}) = 1,$ *and* $\gamma_p(1) = 0.$

The condition supporting this equilibrium is that candidates be sufficiently policy oriented. This guarantees that the right type has no incentive to deviate to a moderate policy in the first period to get reelected. A corollary of this condition is that the prior probability of a left type be relatively small. This leads voters to expect policies closer to the right from an unknown challenger, thus leading the poor to reelect a moderate. These expectations also play a role in the utility of the right type. Not getting reelected is not too bad if the chances that another right candidate will come to power and implement her preferred policy are high.

Figure 1 displays the values of the parameters supporting the equilibria described in Propositions 1 and 3. Note that the equilibrium described in proposition 2 – not displayed in the Figure – holds for the same probability distribution of types in equilibrium 1, except that the values of office lie between those of proposition 1 and 3.

In general, Proposition 3 is the one that most closely reflect the reality in many unequal democracies. Politicians who are genuinely interested in the welfare of the worse-off and able to implement redistributive policies are relatively rare. As a consequence, poor voters are likely to settle for policies further away from their ideal with the overall result being possibly long spells of low redistribution. Interestingly, however, even in the presence of uncertainty, the lack of redistribution in unequal societies is not necessarily a consequence of parties being office oriented and caring thus little about policy (this would actually lead to more rather than less redistribution).

Extensions

How far to the right?

Given that it can be rational for the poor to reelect non-leftist incumbents even under full information about their policy preferences, a natural question that arises is how far to the right an

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incumbent can be and still get reelected. The answer is stated in Proposition 4.

Let $\tilde{x}_C = a$, where $a \in (0, 1)$. We can restate Proposition 3 as follows:

Proposition 4: *If $w < (1 - a)^2(1 - p_C) - p_L$, there exists a separating Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = a, x_C^2 = a), (x_R^1 = 1, x_R^2 = 1)\right);$$

- *voters' beliefs are:*

$$\mu_{L|0,S^*} = \mu_{C|a,S^*} = \mu_{R|1,S^*} = 1;$$

- *voters choose $\gamma_p(0) = \gamma_p(a) = 1$, and $\gamma_p(1) = 0$.*

The conditions supporting an equilibrium where poor voters reelect a "moderate" incumbent becomes increasingly restrictive as her ideal policy becomes closer to the rightmost policy. As $a \to 1$, $p_L \to 0$ and $w \to 0$. That is, the more players perceive a redistributive type as a rare type, and the more candidates care about policy relative to office, the more poor voters would be willing to reelect an incumbent who does not redistribute much. Again, this holds with full knowledge of the incumbent's policy preferences.

Risk neutrality

So far we have assumed concave utilities over policies. That is, players are risk averse. It is indeed common to attribute risk aversion to individuals, in particular poor ones[3]. Thus it is interesting to understand what role this assumption plays in the equilibria discussed so far. In order to do it we characterize similar equilibria under the assumption of risk neutrality drawing attention to differences between them. Under this alternative assumption, candidates' utilities are given by[4]:

$$U_t^e(x) = -|x - \tilde{x}_t| + w,$$

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[3]Interesting experiments were run in Canada and Peru to capture the degree to which the poor are risk averse and have short term horizons. For results see Engle-Warnick et al. (2006) and Eckel et al. (2004)

[4]Notice that while both the poor and rich are risk neutral in this case, moderates are not. Given their central position their utility function is tent-shaped

$$U_t^{ne}(x) = -|x - \tilde{x}_t|;$$

and voters' utilities by:

$$U_i(x) = -|x - \tilde{x}_i|.$$

We begin by examining the semi-pooling equilibrium, where all candidates choose the leftmost policy in their first term and their ideal policies in the second term. The conditions assuming the poor are risk neutral are stated in Proposition 5. We notice that the equilibrium holds with less restrictive conditions than when risk aversion is assumed. In particular, we see that the value of office can be smaller than that stated in Proposition 1, while the shared probability of a right type can be higher.

Proposition 5: *If $w > 2 - p_L - \frac{p_C}{2}$, and $p_R < \frac{1}{2}(1 - p_C)$ there exists a Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = \frac{1}{2}), (x_R^1 = 0, x_R^2 = 1) \right);$$

- *voters' beliefs are:*

$$\mu_{L|0,S^*} = p_L, \mu_{C|0,S^*} = p_C, \mu_{R|0,S^*} = p_R, \mu_{C|\frac{1}{2},S^*} = \mu_{R|1,S^*} = 1;$$

- *voters choose: $\gamma_i(0) = \frac{1}{2}$ for all i, and $\gamma_p(\frac{1}{2}) = \gamma_p(1) = 0$.*

Consider now the equilibrium where the moderate pools with L in the first period – choosing $x^1 = 0$ – and R plays her ideal policy in both periods. As stated in Proposition 6, under risk neutrality this equilibrium still holds. Compared to the conditions in Proposition 2, however, the range of values of office supporting the equilibrium is now smaller and the values of p_R are higher.

Proposition 6: *If $\frac{1}{2}(\frac{p_C}{p_C + p_L} - p_C) < p_R < \frac{1}{2}(1 - p_C)$ and $\frac{p_C}{2} < w < 1 - p_L - \frac{p_C}{2}$, there exists a separating Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = \frac{1}{2}), (x_R^1 = 1, x_R^2 = 1) \right);$$

- *voters' beliefs are :*

$$\mu_{L|0,S^*} = \frac{p_L}{p_C + p_L}, \mu_{C|0,S^*} = \frac{p_C}{p_C + p_L}, \mu_{C|\frac{1}{2},S^*} = \mu_{R|1,S^*} = 1;$$

- *voters choose:* $\gamma_p(0) = 1$ *and* $\gamma_p(\frac{1}{2}) = \gamma_p(1) = 0$.

In the most interesting case, the separating equilibrium where both leftist and moderate candidates are reelected, risk neutrality also leads to less restrictive conditions on the value of office and, as a consequence on the shared prior probability of leftist candidates. As stated in Proposition 4.7 the equilibrium holds for higher values of p_L and of w when compared to Proposition 4.3.

Proposition 7: *If $w < \frac{1}{2}(1 - p_C) - p_L$, there exists a separating Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = \frac{1}{2}, x_C^2 = \frac{1}{2}), (x_R^1 = 1, x_R^2 = 1) \right);$$

- *voters' beliefs are:*

$$\mu_{L|0,S^*} = \mu_{C|\frac{1}{2},S^*} = \mu_{R|1,S^*} = 1;$$

- *voters choose* $\gamma_p(0) = \gamma_p(\frac{1}{2}) = 1,$ *and* $\gamma_p(1) = 0$.

Thus two of the equilibria found under risk neutrality – one where all candidates choose the same policy and another where they all pool on the policy preferred by the poor – hold for a higher range of parameter values than the corresponding equilibria found under risk aversion. This difference is clear when we compare Figures 1 and 2. This suggests that, given the assumptions made, risk aversion leads poorer voters to reelect incumbents that are relatively more redistributive than

they would were they risk neutral.

Proposition 8: *If* $w < |1 - a|(1 - p_C) - p_L$, *there exists a separating Perfect Bayesian Equilibrium where:*

- *candidates play:*

$$S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = a, x_C^2 = a), (x_R^1 = 1, x_R^2 = 1) \right);$$

- *voters' beliefs are:*

$$\mu_{L|0,S^*} = \mu_{C|\frac{1}{2},S^*} = \mu_{R|1,S^*} = 1;$$

- *voters choose* $\gamma_p(0) = \gamma_p(a) = 1$, *and* $\gamma_p(1) = 0$.
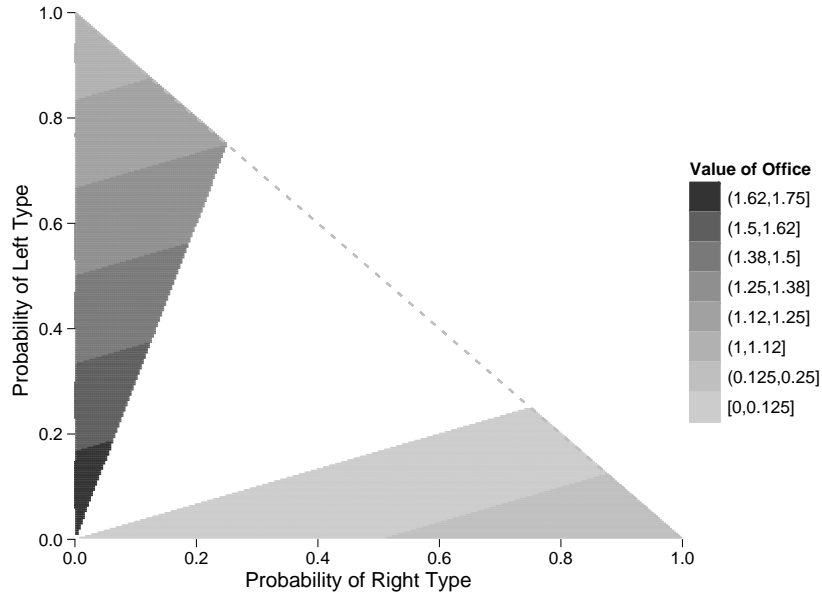
As stated in Proposition 8, the lower the value of office and, as a corollary, the lower the shared probability of a left candidate, the less redistributive an incumbent can be and still get reelected. Compared to the results under the assumption of risk aversion stated in Proposition 4, under risk neutrality candidates might care more about office and left candidates can be perceived as relatively more common and the equilibrium still holds. Thus under this set up, and as noted earlier, risk aversion can work to the advantage of poor voters.

3 Empirical Analysis

In this section we analyze individual level data to explore some of the observable implications of the model, in particular three factors. First, the model relies on the assumption that voters face uncertainty about the actual policy position of candidates when making a decision at elections. While this is an intuitive assumption, we still present evidence suggesting this is indeed the case.
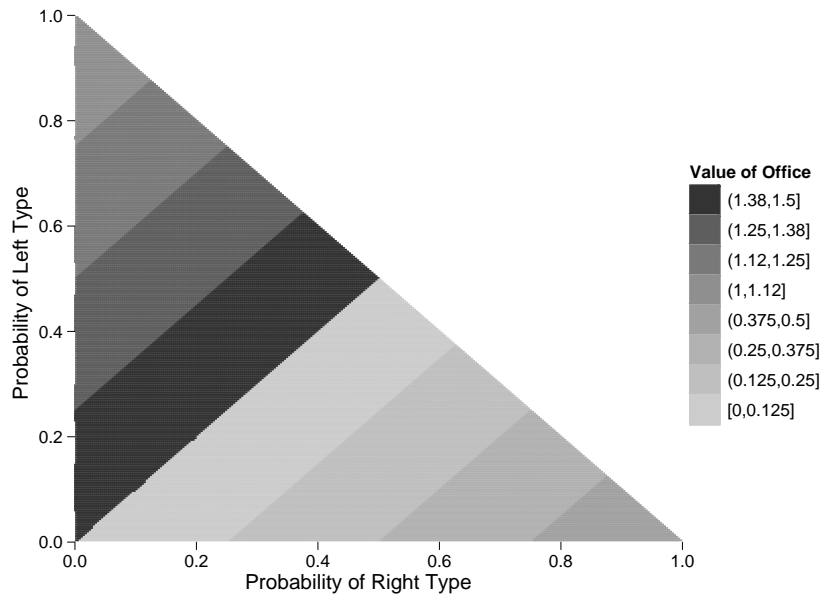
Second, based on the model results, we look for evidence that the separating equilibrium characterized in the previous section (Proposition 3) holds. To recap, the condition supporting this equilibrium was that candidates be relatively policy oriented, as opposed to only caring about winning the elections. The corollary condition was that poor voters perceive candidates who share their preferences to be rare. While no data is available to test the main condition, we are able to explore the plausibility of its corollary.

Figure 1: Equilibrium conditions: Proposition 4.1 (left) and 4.3 (right)

Value of Office
- (1.62,1.75]
- (1.5,1.62]
- (1.38,1.5]
- (1.25,1.38]
- (1.12,1.25]
- (1,1.12]
- (0.125,0.25]
- [0,0.125]

Notes: The values of office displayed correspond to the lower bound in the case of Proposition 4.1 – condition supporting equilibrium is $w > 2 - p_L - \frac{p_C}{4}$ – and the upper bound in the case of Proposition 4.3 – condition supporting equilibrium is $w < \frac{1}{4}(1 - p_C) - p_L$. For illustration purposes I categorized the values of office.

Figure 2: Equilibrium conditions: Proposition 5 and 7

Value of Office
- (1.38,1.5]
- (1.25,1.38]
- (1.12,1.25]
- (1,1.12]
- (0.375,0.5]
- (0.25,0.375]
- (0.125,0.25]
- [0,0.125]

For illustration purposes we categorized the values of office. They are actually continuous, but given the jump from 0.5 to 1 that occurs from one equilibrium to the next, a continuous shading would not be very informative

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Finally, if that separating equilibrium holds, incumbents would seek to implement their own ideal policy. This means after observing an incumbent in office, voters should be able to update their beliefs about this representative's actual policy inclinations. This yields two observable implications. First, uncertainty about the ideological location of an incumbent running for reelection would be lower relative to "unknown challengers".

Second, in elections where none of the contenders are former incumbents, due to uncertainty, voters' would be unable to distinguish between them on ideological grounds. As a consequence, the choice of representatives would be more random with no significant socioeconomic cleavages in voting patterns. Conversely, if one of the candidates is an incumbent, voters should have more information on his or her ideological inclinations and use this information to make their decisions. That is, if different socioeconomic groups have different tastes for redistribution, once they are able to distinguish candidates ideologically they would choose the one they believe is closer to their preferences. As a result, significant differences should arise in voting patterns across groups.

In sum, if the separating equilibrium provides an accurate description of the situation in unequal new democracies we should observe: a) no significant differences among groups of voters backing different candidates when they resemble "unknown challengers", b) significant differences when more information is available, that is, when at least one of the candidates is an incumbent.

The section is divided into two parts. The first part deals with the issue of uncertainty in individuals' evaluations of candidates policy positions and the extent to which individuals perceive pro-poor candidates as rare. On the former, we cover both the basic assumption that uncertainty is an issue, and also the observable implication arising from the separating equilibrium that levels of uncertainty should differ between evaluations about an incumbent and those regarding "unknown challengers". The second part deals with voting patterns. That is, the extent to which we observe significant differences between the voting choices of different socioeconomic groups.

The analysis conducted in this chapter is based on individual level data from a number of different sources. For the sake of clarity I discuss the different sources and the variables employed in each exercise in the corresponding section.

3.1 How Much do Respondents Know About Candidates Policy Positions?

The basic assumption in the model developed in the previous chapter is that individuals are uncertain about the actual ideological orientation of candidates during elections. In some of the equilibria found, because candidates favoring different policies might implement similar policies once in office, not a lot of learning takes place once voters observe a candidate serve as an incumbent. In the equilibrium that most closely reflect the patterns we are interested in explaining, however, incumbents choose their own ideal policies and updating takes place. That is, after observing an incumbent in office voters gain more information about her or his ideological stance.

In the analysis that follows we use individual placements of candidates to the presidency on an ideological scale ranging from pro-poor inclinations to pro-rich ones. The presidency is the most salient post in Brazil, and one where incumbents' views should be more easily conveyed to the public. The scale defined in terms of interests of the poor versus those of the rich is particularly close to the subject of this study and less susceptible to misinterpretations by survey respondents compared to the commonly used left-right scale. This measure is available for two election years.

The data utilized in this section comes from three sources. Data for the first presidential election after democratization comes from a survey conducted in October of 1989 by Datafolha, a private polling firm. Both urban and rural dwellers were interviewed in a sample of 4893 respondents drawn to be representative of the Brazilian population aged 16 or older (16 years old is the age where Brazilian citizens acquire the right to vote). The 1998 survey was conducted in September of that year by Vox Populi, another private polling firm[5]. The sample (3266 respondents) was drawn to be representative of the voting age Brazilian population. Finally data for 2006 – the latest presidential election in Brazil – comes from the LAPOP survey conducted in 2006 with a representative sample of citizens 18 years old or older (1214 respondents).

In 1989, when asked about the policies their preferred candidate favored that they thought was important, one third of respondents answered they didn't know. The survey was conducted less than one month before the elections. This figure changed somewhat depending on the respondents' level of education. Among those with primary or less – around 70% of the sample – 39% answered "don't

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[5]The data is available online at the Consórcio de Informações Sociais.

know". Among those with college only 16% did so, and among those with secondary education about one fourth admitted not knowing. Since respondents were only asked to rate their own chosen candidate, no comparisons can be made across candidates based on this data.

In 1998 – the third presidential election, where Fernando Henrique Cardoso (FHC) was the incumbent running for re-election – when asked whether each of three contenders – FHC, Lula and Ciro – had will to improve the lot of the poor answers varied. When the question referred to the incumbent, FHC, only 13% answered "don't know" and about half said "yes". With regards to Ciro Gomes, answers were very close to a random draw: one-third answered "don't know", another third said "yes" and the remaining third "no". Evaluations of Lula lied in between with 46% of respondents answering "yes" and 17% "don't know".

On this particular topic – how pro-poor candidates were – the differences in educational attainment were not very pronounced in terms of incidence of "don't knows" by candidate. Considering only those respondents with primary education or less, the rates of "don't know" were 36% for Ciro, 22% for Lula and 16% for FHC.

In 2006 – the fifth and latest presidential election, where Lula was the incumbent running for re-election – the LAPOP survey asked respondents to place the four main contenders on a scale going from pro-rich (1) to pro-poor (10) – this scale was reversed for the purposes of this analysis. Inspection of the individual placements show an interesting pattern of "don't know" answers. In evaluations of the incumbent, Lula, 98% of respondents ventured an answer, even among the least educated. The challengers had much higher rates of "don't know" answers that went from around one fourth to one third of respondents.

Figure 3 displays the incidence of "don't know" in both years where respondents were asked to rank the main contenders. While we cannot test for the significance of these differences we observe a pattern compatible with the model developed in the previous chapter. The rates of uncertainty are higher for challengers who never served as incumbents before and lower for the incumbent running for reelection. In particular if we compare the rates of "don't know" for Lula, who was a challenger in 1998 and the incumbent in 2006, the differences suggest an increase in the number of respondents who believed they were able to provide an estimate of his policy stance.

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Figure 3: Incidence of "don't know" answers to candidate placement question
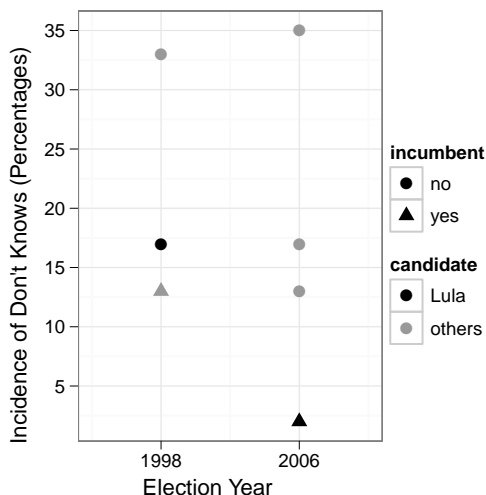
Looking solely at self-reported "don't knows", however, is a very crude way of capturing uncertainty. Those providing an answer might still be guessing the candidates' positions. While there exists methods to capture the degree of uncertainty in respondents' answers, both in terms of "don't know" and actual ratings (see for example Bartels (1986) and Alvarez (1997)), we lack the data necessary to identify the proposed models. In particular data on individual placement of candidates on different policy issues and individuals self-placement on these same ideological scales.

An additional way of evaluating uncertainty is by comparing the individual ratings to more informed estimates of candidates' or their parties' placement. Given the data limitations, such comparisons are, again, very exploratory, but insightful nonetheless. They can, in fact, shed light on both uncertainty and the extent to which respondents believe some types to be more common than others.

First, where the individual assessments diverge from other accepted estimations of the positions of candidates, there is, at least to some extent, sign of uncertainty[6]. That is, respondents might

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[6]Ideally this should be evaluated based on individuals self-placement or some other reference point so that ratings from different individuals are in fact comparable. Roughly speaking, however, the higher the disagreement between more informed estimates of candidates placement and individuals' placement the more likely it is that uncertainty played a role. The other reason can be that individuals make mistakes, that they don't know how to infer candidates' policy positions based on what they observe. If mistakes by the individual were the main reason, however, we would probably not find a higher congruence of assessments with respect to incumbents. Individuals would likely be wrong about them too, but that is not what the data suggests.

just be taking their best guess at placing candidates on the scale. Second, if this is the case, then the natural question is how likely are these guesses the result of a particular belief about the distribution of candidates as opposed to a simple random estimate? In other words, are the answers, or "guesses" we observe likely to come from a prior belief that candidates sharing the preferences of the poor are rare relative to moderate and rightist types?

The discussion that follows tries to bring insights to all these questions, including the expectation of more uncertainty regarding candidates who never served as incumbent compared to those who have. As pointed out earlier, if the separating equilibrium found in the previous section provides a good characterization of the situation in unequal new democracies, individuals should be able to update their beliefs about the actual ideological inclination of the incumbent, because incumbents always try to implement their own ideal policies. Thus if we find evidence that there is less uncertainty regarding the incumbent, we find evidence in favor of the separating equilibrium and against the other two pure strategy equilibria found.

Beginning with 1998, where FHC was the incumbent running for reelection, about 50% of respondents answered that FHC was committed to the cause of the poor. This number was slightly lower for Lula (46%) and even less for Ciro (34%). Those with primary education or less were slightly less likely to see Lula as pro-poor (42%) than the average and less likely to see him as pro-poor compared to FHC (53% thought FHC had the resolve to improve the situation of the poor).

Lula, however, is considerably more to the left than FHC. Estimates of the ideological positions of parties based on legislators' assessment place the PSDB (FHC's party) around the center and both the PT (Lula's party) and the PPS (Ciro's party) towards the left of the ideological spectrum in 1997(Power and Zucco Jr, 2009). These estimates are plotted in Figure 4 together with the proportion of respondents in 1998 who rated each of the candidates as being pro-rich[7].

The individual ratings of FHC are relatively close to those obtained from legislators (closer to the 45 degree line in the graph). The evaluations of both Lula and Ciro, however, seem considerably off-mark relative to the legislators' party ratings. The fact that both Ciro and Lula were ranked

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[7]These proportions were calculated coding the "don't knows" as missing. If instead we use the whole sample, the discrepancies between Lula's and Ciro's rating relative to their parties' placement is even starker.

Figure 4: Placement of candidates and parties on ideological scale (1997-1998)
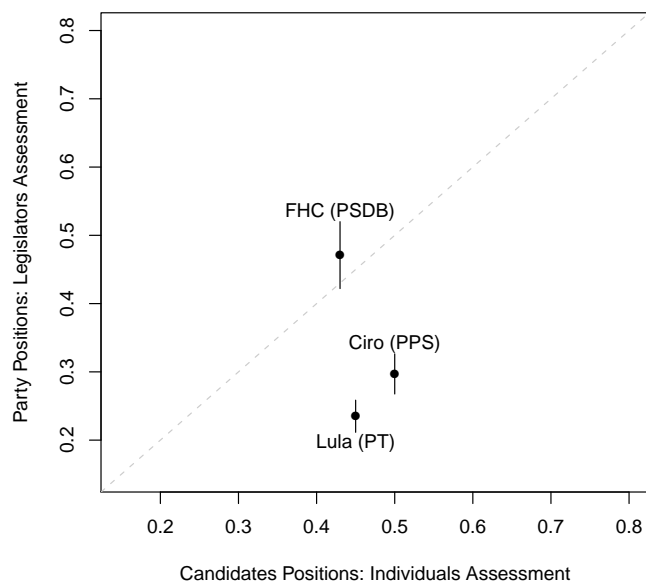
Source: Data on legislators' assessment of party positions were taken from Power and Zucco Jr (2009). Vertical bars represent the 95% confidence intervals around the estimates. Candidates positions correspond to the proportion of respondents to the Vox Populi survey in 1998 saying that the candidate was pro-rich.

by respondents as more rightist than they actually were, suggests the conditions supporting the separating equilibrium might in fact hold. That is, when asked to assess the policy position of an "unknown challenger", voters believing left types are rare would tend to place that candidate towards the right.

As we will see, the view of FHC as more leftist than Lula is also in line with the results we obtain in the next section on vote intentions. In 1998 the poor were more likely to vote for FHC. The reason might be exactly the one proposed in the separating equilibrium. Although poor voters saw him as a moderate, they reelected him because they expected the challengers to be further to the right.

Thus based on the 1998 data, figures suggest that there was more uncertainty about the placement of the challengers than that of the incumbent. Moreover, the challengers tended to receive ratings placing them further to the right of the policy spectrum. If respondents believed that left types were more common, we would expect the opposite to hold. That is, challengers being more

likely to be placed towards the left of the scale. In addition, the fact that FHC was seen as a moderate, lends plausibility to the results obtained from the separating equilibrium. In particular the part saying that moderates would be reelected even if poor voters were fully aware of her or his position.

Moving now to 2006, based on the LAPOP data, respondents were more likely to rate the challengers – Gerald Alckmin, Heloísa Helena, and Cristovam Buarque – as either moderate or pro-rich. Lula, the incumbent, was placed rightly towards the left. More respondents were likely to rank him as "pro-poor" in 2006 than in 1998, when he was a challenger.

In fact, for the placement of Lula in 2006 to be similar to those in 1998 we would have to assume that anyone placing him around the third position or higher on the ideological scale from 1 (pro-poor) to 10 (pro-rich), believed he was not committed to the cause of the poor. Considering only those respondents with primary education or less, we would need to assume anyone placing Lula somewhat after the second position or higher believed he had no will to improve the lot of the poor. Another way to see that is by simply splitting the 2006 scale in two. Then 64% of respondents rated Lula as pro-poor in 2006 compared to 46% in 1998. This figure goes to 69% among the least educated in 2006 compared to 42% in 1998.

In order to test for the observed differences in candidates' ranking we run a simple Bayesian analysis. First we rescale the answers to the 0 to 1 interval. Assuming the ratings have a beta distribution we estimate the scale and shape parameters in each case – one set of parameters per candidate. We can then compare differences in the estimated distributions likely to have yielded the answers we obtained from the survey for each candidate. The model is given in the appendix. We follow the parameterization in Branscum et al. (2007).

Figure 5 displays the posterior density of the estimated mean of the beta distribution likely to have yielded the responses in the LAPOP survey by candidate. As we can see, the estimated mean in the case of Lula is significantly to the left of his main challengers. The challengers tend to be clustered towards the right side of the spectrum. An interesting question that arises is how closely these placements based on individual assessments are to other estimates of candidates position?

Helosa Helena belongs to the PSOL, an extreme left faction of the PT that decided to split in

Figure 5: Posterior distribution of estimated mean ideological placement
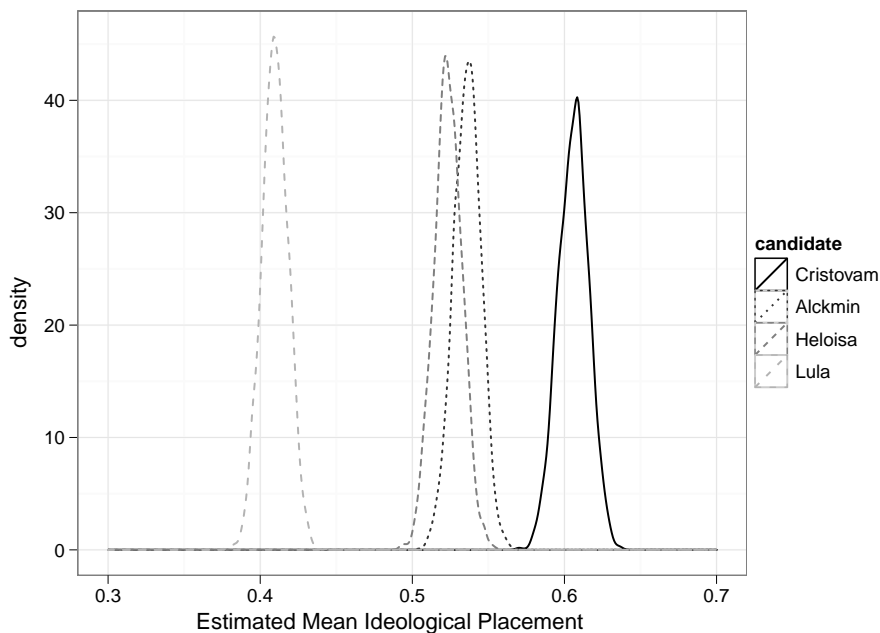
response to the party's moderation in the past couple of years. Thus the fact that Helosa Helena is considerably to the right of Lula is quite interesting. It is highly suggestive of the tendency of voters to believe challengers are not likely to be pro-poor.

Cristovam Buarque ran as the candidate for the PDT, another left party. His campaign in 2006 was heavily based on increasing the quality of public provision of education. He was the head of the think thank that designed the *Bolsa Escola* program, a conditional-cash-transfer program requiring recipients to attend school on a regular basis. He was the first to implement the program in the Federal District during his term as a governor (1995 - 1998) for the PT. During Lula's first term in the presidency, *Bolsa Escola* was incorporated into *Bolsa Famlia*, a more encompassing transfer program that now benefits millions of poor families in the country. In sum, a member of a left party and co-creator of the most popular conditional-cash-transfer program in the country was rated as the most rightist candidate by respondents. This suggests individuals ideological assessments of Cristovam are very likely the result of a prior belief that "unknown challengers" are more likely to be rightists.

Geraldo Alckmin, in turn, ran under the PSDB, the party of the former president FHC. Respondents placed him somewhat towards the right, which seems compatible with the position of his party. Unfortunately it is impossible to assess how much of this consistency is due to lucky guesses as opposed to informed responses.

Finally Lula was the candidate for the Workers Party (PT) a relatively cohesive left party. In order to discuss his placement it is worth considering both the time trends and his position relative to his main contenders (both from the PSDB) in 1998 and 2006. Based on legislators' assessment[8] of party positions, Power and Zucco Jr find that during the period 1990 to 1993 the PT and the PSDB tended to converge to positions at the left of the median legislator. From 1993 to 2001, however, they begin to diverge with both the PT moving to the left and the PSDB moving to the right past the median legislator.

Going back to the individual assessments of candidates, the year where respondents rated FHC as more "pro-poor" than Lula – 1998 – was the year where their parties diverged the most on ideological leanings. Lula's ratings were then considerably more to the right than that of his party. This suggests a right bias in his evaluations at a year where respondents had not yet had the opportunity to observe him in action.

When we move to 2006, where some ideological convergence between the PT and the PSDB takes place, Lula receives mostly pro-poor ratings, even more than he had in 1998. Thus taking these party positions into account, the shift in perception regarding Lula was considerable. Were his rating in 1998 to reflect his party position then, they should have been even more to the left than those in 2006.

To summarize, the data suggests that voters face uncertainty about the policy positions of candidates during elections. This uncertainty is visible both in terms of incidence of respondents admitting they do not know about the ideological inclinations of candidates, and also among those who provided answers. Compared to ideological placements based on legislators assessments, re-

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[8]While the scale presented to legislators was the same that was presented to respondents in the LAPOP survey (1 - 10), the wordings were different. Legislators were asked about left (1) and right (10) ideological placement, while respondents were asked about pro-poor (10) and pro-rich (1). This last scale was reversed for the analysis. These differences make precise comparisons difficult. Moreover, the methodology employed by Power and Zucco Jr differs from the one employed here, since they have data on legislators self-placement on the same scale available for computations. For details on the methodology the reader is referred to the authors' paper.

spondents' ratings in the two surveys analyzed not only differed to a greater extent when it came to rating challengers as opposed to incumbents, but also suggested that answers could have resulted from a prior belief that left leaning candidates tend to be rare.

Regarding the ratings of incumbents – FHC in 1998 and Lula in 2006 – individuals' assessments seemed more consistent with legislators rankings of their parties, thus suggesting that some learning about the policy positions of incumbents does indeed take place. In the next section we explore differences in voting patterns between elections with an incumbent and those without one.

3.2 Socioeconomic Characteristics and Vote Intention in Presidential Elections

In the analysis that follows we switch focus to two particular implications of the model. First, assuming redistribution is a salient issue and that preferences for it differ among voters from different socioeconomic groups, we look for evidence that voting choices in elections where no incumbent is running for reelection are less predictable – based on voters socioeconomic characteristics – than the ones with incumbents. Second, in elections with incumbents we look for evidence that respondents make their voting choices based on information about the incumbent's policy position acquired during the incumbent's first term.

To answer these questions we build a baseline econometric model specified to assess how socioe-conomic characteristics affect voting decisions[9].

To address the first question we compare the predicted probabilities of vote intention of three different profiles of voters (poor, median and rich) based on the econometric specification. The goal is first to estimate the extent to which respondents belonging to different groups intended to vote for different candidates. Second, we want to know whether results differ depending on who the candidates were: former incumbents or "unknown challengers".

Given that the surveys analyzed do not contain questions on vote intention and respondents' preferred levels of redistribution, the second question needs to be evaluated in light of the policy decisions of incumbent candidates during their first term. The kinds of policies an incumbent

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[9]The focus on socioeconomic characteristics is a function of the object of study. Redistribution is one issue where a person's income, age and educational level should be particularly relevant in determining preferences.

implements in her or his first term can affect voting decisions at two levels. One more visible level refers to the actual observable outcomes of these policies. They can be gauged through pragmatic questions such as: Has poverty declined, increased or remained the same as a result?

The other, less directly observable level, thus requiring a higher degree of sophistication and information on the part of voters, refer to the actual contents of the policies or the chosen approach to fighting poverty and inequality. These refer to questions such as: What kind of social policies were supported? Which ones were reversed from the previous period and which new ones were created? For practical reasons, and not to impose too much on the level of sophistication of voters we chose to focus on the more pragmatic approach.

The data gathered for this section come from various sources and mainly from private polling firms. The 1989 data comes from IBOPE (Brazilian Institute of Public Opinion and Statistics) and was conducted between the first and the second round of the presidential elections. The data for 1994 comes from the CBPA (Brazilian Company of Research and Analysis) and was conducted in August 1994 (about a moth before the actual election). These two were obtained through the Roper Center. For 1998 we have data from Vox Populi, another private pooling firm. The survey was conducted in October 1998, a couple of days before the elections. For the remaining two elections data was collected by CESOP at Unicamp and FGV/Opinião in 2002 and CESOP and Ipsos in 2006. Both are part of the ESEB (Brazilian Electoral Study) and were collected a couple of months before the elections. The last three data sets were obtained through the Consortium of Social Information (CIS)[10]. They were all designed to be representative of the Brazilian population. Except in the case of 1994, they all include multiple cities and cover all states. In 1994 only residents of five major capitals were interviewed.

The analysis presented focus on voters choice between two candidates. The actual number of candidates in each election varied from 6 up to 20 contestants. Usually though, no more than 3 were considered "viable", that is, receiving at least 10% of the votes. In the 1989 election we use the question on vote intention for the second round, where the choices were Collor and Lula. In the 1994 election we selected only those respondents who intended to voter either for Fernando

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[10]Available at http://www.nadd.prp.usp.br/cis/index.aspx

Henrique Cardoso (FHC) or Lula. The third most voted candidate was Eneas receiving only 7% of the votes. In 1998 we run the analysis on a question prompting respondents to chose between Lula and FHC. In this election, where FHC won in the first round, the third most voted candidate was Ciro Gomes, receiving about 11% of the votes. In 2002 and 2006 we focus on the question prompting respondents to choose between the two contestants who made it to the second round, they were Lula and José Serra and Lula and Alckmin, respectively.

This analysis is thus based on the IIA (independence of irrelevant alternatives) property of multinomial logit models. This means that throughout the analysis results should be interpreted in relative rather than absolute terms[11].

To make the analysis comparable across the five election years, we recoded the independent variables so that every year was measured using the same scale. This, however, entailed identifying the "minimum common denominator" for each variable, that is, the most condensed categorization of answers. Below we present a brief description of how each of these variables was measured along with some associated qualifications.

Income The self-reported income of the household, that is, of all incomes of all household members combined[12]. Three of the surveys categorize income in terms of corresponding number of minimum wages, while the remaining two provide the actual amount in Reais as a continuous variable. The preliminary approach adopted was to transform the minimum wage categories into current Reais amounts (at 2008 values) and replace the value of each category with the mean log value of that category range.

Education This indicator is composed of four categories of educational attainment: 0 - from illiterate/no education to 4th grade; 1 - from 5th to 8th grade; 2 - high school (9th to 11th grade); and 3 - some or complete college and beyond.

Age The age categories are coded as follows: 1 - 16 to 17 years old; 2 - 18 to 25 years old; 3 - 26 to 30 years old; 4 - 31 to 40 years old; 5 - 41 to 50 years; 6 - more than 51 years old.

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[11] The sample size for each election year and the actual number of observations used in the analysis are as follows: 1989 - 3650,3109; 1994 - 1400,802; 1998 - 3168, 2802; 2002 - 2514,1931; and 2006 - 1000,785

[12] Since only two of the surveys ask how many people live in the household, we could not work with per capita values.

Gender Females are coded as 1 and males as zero.

We take advantage of the fact that Lula was a candidate in all five elections and set the intention to vote for him to 1 and the intention to vote for his opponent to zero. Figure 6 shows the estimated coefficients along with the 95% confidence intervals. There are two specifications being compared in this graph. One containing an interaction term of income and education and one without it.

While these coefficients give us some idea of what mattered in the decision of who to vote for, it is difficult to assess the model's results based solely on them. We thus compare predicted probabilities of meaningful profiles of voters to discuss the results. While the theoretical model in the previous section was based on three types of voters going from a majority of poor to a minority of middle and upper classes, empirically it is difficult to distinguish between the last two. The number of respondents to the surveys would need to be considerably higher so that we could have a representative sample of the two smaller groups. Thus when generating the profiles for comparison we aggregate them under the label "rich". Given that poorer and less educated respondents form a majority we break down this group into two, simply to explore possible differences. We divide this group into the very poor and the median, this last one still poor relative to the middle class.

The very poor voter profile was created to represent the about one-third to one-fourth of the population in Brazil considered to be living below the poverty line. Their average income during the course of these years were always around $R\$60$ per capita in Reais of 2008[13]. Thus we set the income of the poor profile to $R\$240$, corresponding to a poor household with 4 members (with all the caveats mentioned above). In terms of in sample household income this figure corresponds roughly to the bottom 20%. The education level of the poor profile was set to 0, meaning 4th grade or less, the gender was set to male and the age to the mean, represented by the group of 31 to 40 year olds[14].

The median voter, while better off than the very poor, is still poor with a household income

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[13]All income values in this exercise were decided based on per capita income estimates for each category based on household surveys. The data is available at IPEADATA.

[14]We also compared predicted probabilities setting the age to the other categories and did not observe a significant difference in results on first differences. We did though observe differences in the predicted probability of the poor voting for Lula instead of his opponent. Younger poor voters (18 to 25) were more likely to vote for Lula in 1989, while older voters (30 to 40, and 40 to 50) were significantly more likely to vote for Collor. The other significant difference occurred in 1994, where both median and richer older voters (30 to 50) were significantly more likely to vote for FHC.

Figure 6: Logit regression results: votes for Lula vs. opponent
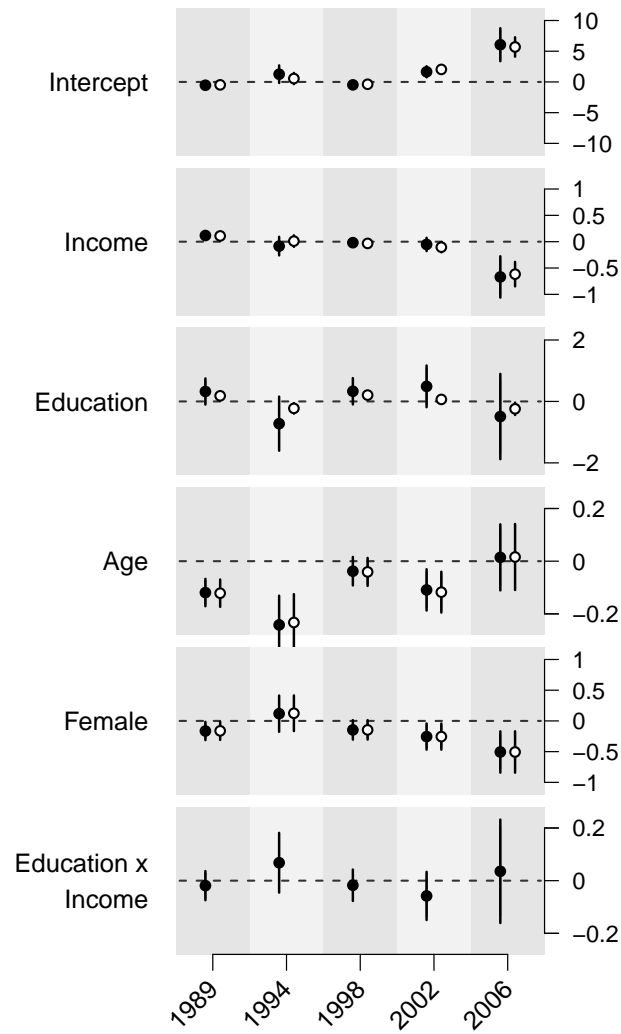
Lines correspond to 95% confidence intervals. This graph was built based on code developed by Kastellec and Leoni (2007).

set at $R\$800$ per month (which corresponds to about $US350$). The level of education was set to 1, corresponding to the category 4th to 8th grade, and the age and gender as specified for the poor. Finally we set the rich voter profile to a household monthly income at around $R\$6600$ (corresponding to the top quintile in the sample), college education and mean age.

### 3.2.1 Do Voters from Different Socioeconomic Groups Vote Alike?

Going back to the first question, are elections without an incumbent less predictable than the ones where an incumbent was running for reelection? That is, can we forecast respondents voting decisions based on their socioeconomic characteristics once they had the opportunity to observe the policies implemented by an incumbent?

To answer this question we calculate predicted probabilities of intention to vote for Lula for each profile generated. If specific constituencies based on income and education formed around an incumbent we should observe significant differences in vote intention between the profiles. Conversely, if citizens do not have information on the policy position of candidates, we expect to observe a relatively random pattern of voting. In the absence of information about policy, voters may rely on other cues. Unless these cues happen to be correlated with socio-economic characteristics, we would expect to be unable to differentiate between the profiles in their intention to vote when both candidates are challengers.

In Figure 7 we plot the estimated first differences along with the corresponding 95% confidence intervals. Starting with the very first election we actually observe significant differences between voters with different socioeconomic backgrounds. With no previous experience enabling voters to determine the ideological inclinations of candidates we see a clear pattern of the poor being significantly more likely to vote for Collor (a governor from the poor Northeast) than the rich and the median voter. We also observe the rich being significantly more likely to vote for Lula (a blue collar worker in the state of São Paulo) than both the poor and the median.

Different reasons might be behind this result. This was the very first presidential election after democratization, and possibly the election were the least amount of information about candidates' policy positions was available to voters. This could have led to two possibilities. First, under

Figure 7: First differences: probability of voting for Lula vs. opponent
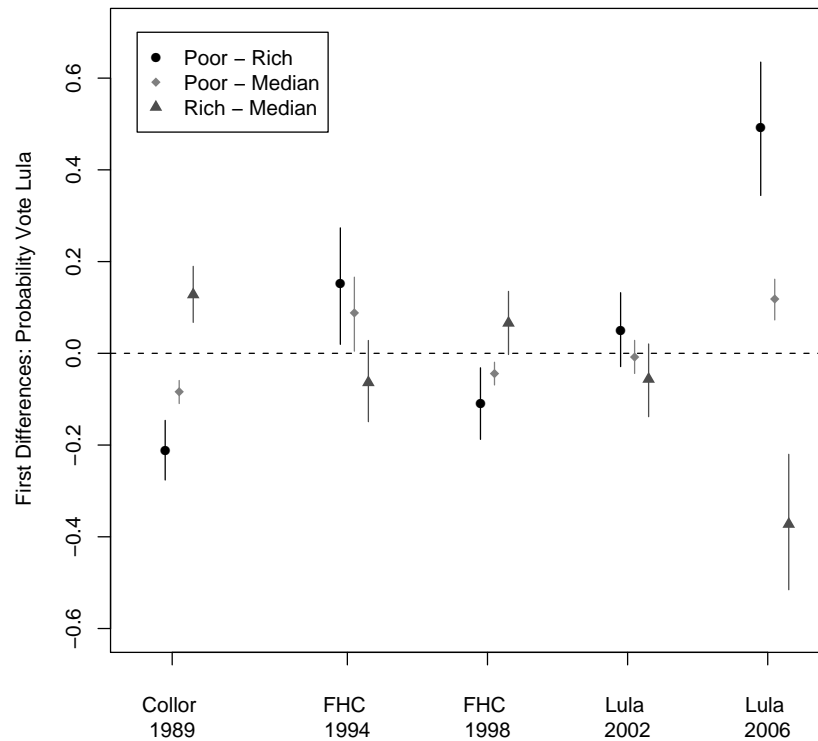
Lines correspond to 95% confidence intervals

such circumstances it would be natural for voters to rely on other features of candidates in making their decisions. Indeed Collor ran on an anti-corruption platform that reflected the popularity he acquired during his term as a governor of Alagoas – a poor state in the Northeast of the country – of being tough on civil servants receiving public salaries and benefits without actually working. His great clout over the media, specially in the poorer regions of the country, contributed to building a strong reputation, specially among the poor.

Another view is that poor voters being more risk averse would be more likely to favor a candidate with ties to previous governments and on which they had more information. No one really knew what kinds of policies to expect from Lula at that time, in particular whether his policies would benefit the poor or not.

It is interesting to note, however, that Collor's tenure as a president was short lived, mainly because of his policy choices and, ironically, corruption. He only governed for about half of his term, as corruption scandals and disastrous economic policy led to a motion for his impeachment and subsequent resignation in 1992.

In the following "non-incumbent" election (1994) the distinction between voters earning different incomes and of distinct educational levels was much less stark. On the one hand, we observe a statistically significant difference between the very poor and the rich and median respondents. According to the estimation, the very poor were more likely to intend to cast their votes for Lula than the other two groups. On the other hand, there was no statistically significant difference between the median and the rich respondents. Given that the median voter in this case is relatively poor, there is some consistency with the model results.

Like Collor, while FHC was not an incumbent to most voters, he had built a reputation of being highly skilled at dealing with the most important issue of the day: inflation. FHC served as a finance minister during the previous government and was the mastermind behind the "Plan Real". This was the economic stabilization plan that put an end to years of hyperinflation, bringing the four-digit annual inflation rate of 1993 (2490%) down to one digit in subsequent years. The plan was not implemented during FHC's tenure as finance-minister as he was running for office at the time (the plan was implemented in June of 1994). Clearly the triumph of the plan was used during his campaign to signal his competence (apparently with a high degree of success as FHC started the race behind Lula gaining increasing ground after the implementation of the Plan Real). Whether or not this conveyed information on FHC's ideological inclinations is however debatable. As with the case of corruption, we would expect the success of the Real plan to favor every citizen in the country. Indeed individuals of every socioeconomic strata were more likely to vote for him than for Lula.

In the next elections, when FHC ran for reelection, we observe a higher degree of differentiation between the three groups of respondents, consistent with the model expectations. Interestingly we observe a complete reversal from the 1994 tendencies. In this election the poor were significantly more likely to intend to vote for FHC than both the rich and the median. Also the rich were

significantly more likely than the median to intend to vote for Lula instead of FHC. According to the model, richer respondents would be expected to vote for the challenger if the incumbent is a moderate. As mentioned earlier, according to the Vox Populi poll one month before the election FHC was perceived to be more pro-poor than Lula. His moderate position according to the survey results also seem consistent with the overall impact of his policies on poverty and inequality – explored in more detail below – specially if compared to his predecessor Collor.

In 2002, when no incumbent was running for office, we move to a state of imperceptible differences, as suggested by the theoretical model. Finally at the last contest (2006), where Lula ran for reelection, we observe marked differences in the predicted intentions to vote for Lula as opposed to Alckmin. Again matching the expectations derived from the theoretical model. The clear pattern is the poor being most likely to intend to vote for Lula, followed by the median. The rich are at the opposite end, being significantly more likely to choose the challenger over the incumbent. As the results in the previous section suggested, Lula was perceived as significantly more pro-poor than Alckmin and all the other main contenders.

3.2.2   Linking Respondents Voting Intentions to Incumbents' Performance

One thing is assessing the degree to which we are able to distinguish between voting intentions of different socioeconomic groups. Another is evaluating whether the direction of the observed differences follow the expected patterns.In order to place candidates on a unidimensional ideological scale of redistributive inclinations we rely on changes in indicators measuring levels of poverty and inequality over the course of a candidate's term. The crucial implicit assumption in this exercise is that redistribution is a relevant policy issue that we expect voters to respond to first and foremost.

During Collor's short tenure, poverty and inequality remained high. Around 40% of the population was estimated to be living below the poverty line, the income of the poor declined somewhat and inequality levels reached a peak value of the Gini coefficient of .64.

Table 1 reports some changes in selected indicators of poverty, using data available at SEDLAC (Socioeconomic Database for Latin America and the Caribbean). These data are based on the annual household surveys conducted by the IBGE (Brazilian Institute of Geography and Statistics).

Many different indicators are available. Given that they are highly correlated, we report a selection of them.

Table 1: Changes in indicators of poverty and inequality during presidential terms

Measure	1989-1993	1994-1998	2002-2005
Poverty as basic needs[15]	- 1.5%	- 1.5%	- 7%
Gini	.64	.6	.59 to .56
Share below US2/day	6.5%	- 2%	- 14%
Child labor	3%	- 28%	- 26%
Child labor bottom quintile	33%	- 16%	- 6%

Source: SEDLAC (Socioeconomic Database for Latin America and the Caribbean)

What we observe is that FHC's first term was marked by no drastic change in the condition of the poor. In relative terms, however, compared to what happened during the government of Collor, the situation of the poor has started to reverse course. It was not until the government of Lula, however, that considerable improvements were obtained, both in absolute and relative terms.

These figures exclude the biggest poverty alleviation program the "Bolsa Família", which conditions cash transfers on school attendance and health check-ups. FHC was the first president to adopt the program nationally, focusing on municipalities with selected development indicators below the country average. Thus only families living in very poor municipalities were eligible. Lula extended the program to cover the whole national territory, with eligibility based solely on household characteristics. The growth in the number of families enrolled in the program was considerable during the government of Lula. The number of beneficiaries from governmental transfers almost tripled, going from 4,824,542 individuals by the end of FHC's last term to 12,013,372 by the end of

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[15]Computed using an indicator of basic needs. This indicator includes the following conditions:

1. more than 4 persons per room

2. the household lives in poor places (e.g. street, shanty towns)

3. the dwelling is made of low-quality materials (see section 7)

4. the dwelling does not have access to water

5. the dwelling does not have an hygienic restroom (see section 7)

6. there are children aged 7 to 11 not attending school

7. the household head does not have a primary school degree

8. the household head does not have a high-school degree, and there are more than 4 household members for each income earner.

Lula's first term (IPEA, 2005). As noted by Clements et al., in Brazil, "the expansion of the Bolsa Famlia during 2003 and 2005 contributed to a narrowing of income gaps between the rich and poor and a reduction in poverty rates" (2007, 27).

Consistent with the figures just presented, social spending has seen a steady increase over the past years as shown in Figures 8 and 9 based on data from ECLAC.

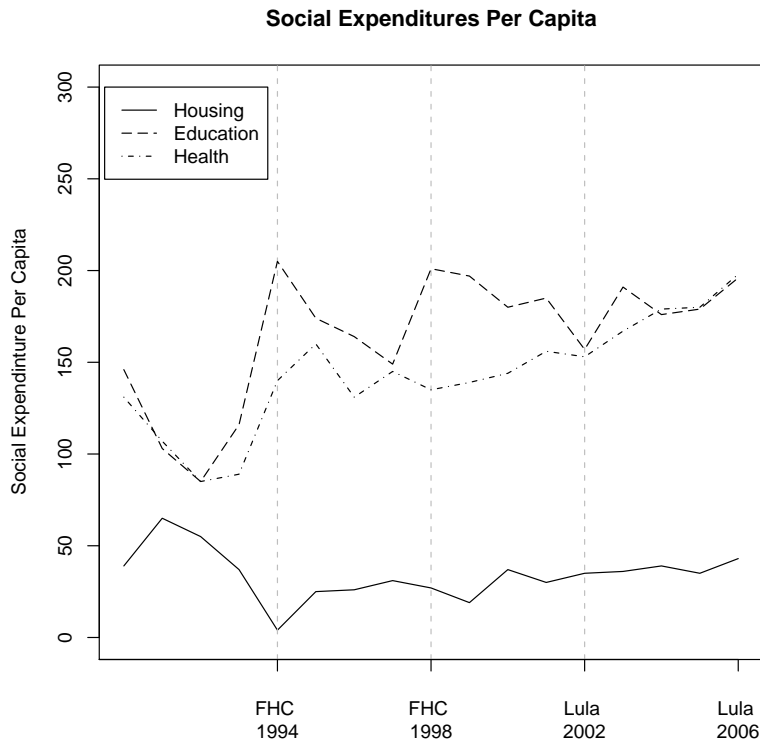**Social Expenditures Per Capita**

Figure 8: Trends in social expenditure in current US of 2000 (health, education and housing)

According to these figures there was a pattern of increased amelioration in the situation of the poor. While they were timid during FHC's first term, they were markedly better than under his predecessor. With Lula, the improvements are remarkable, especially if we take into account the fact that less scope for improvement would lead to lower advancements in percentage terms.

According to the separating equilibrium found in the previous chapter, if a candidate displays relatively moderate rather than rightist inclinations she would be receiving the votes of the poor, but not those of the rich. While we do not observe this stark result we do observe patterns consistent

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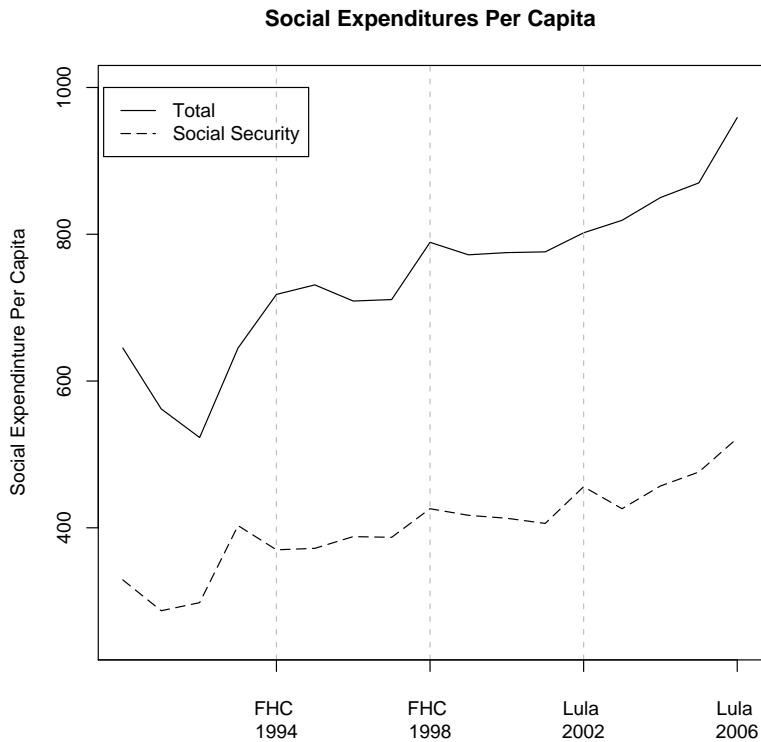**Social Expenditures Per Capita**

Figure 9: Trends in social expenditure in current US of 2000 (social security and total)

with it (see Figure 10). Most respondents reported the intention to vote for FHC when he ran for reelection in 1998, which is reflected in predicted probabilities for Lula that are below 50% for all groups. Thus the model prediction that the rich would vote for the challenger is not observed.

One of the reasons – that deserves further exploration – can be that the better educated are better able to evaluate the policy position of candidates. As pointed out by Power and Zucco Jr, during the government of FHC the PSDB shifted considerably to the right. For the average voter, however, Lula was located even more to the right, which, as pointed out earlier, could have resulted from a shared prior belief that "unknown challengers" are rarely leftist. Better educated voters, with access to more and higher quality information might have been able to assess the candidates' ideological positions with more accuracy.

In line with the results obtained in the previous section, we do observe that the poor were more likely to intend to vote for FHC if compared both to the rich and the median. The median, in turn,

Figure 10: Predicted probabilities of voting for Lula vs. opponent
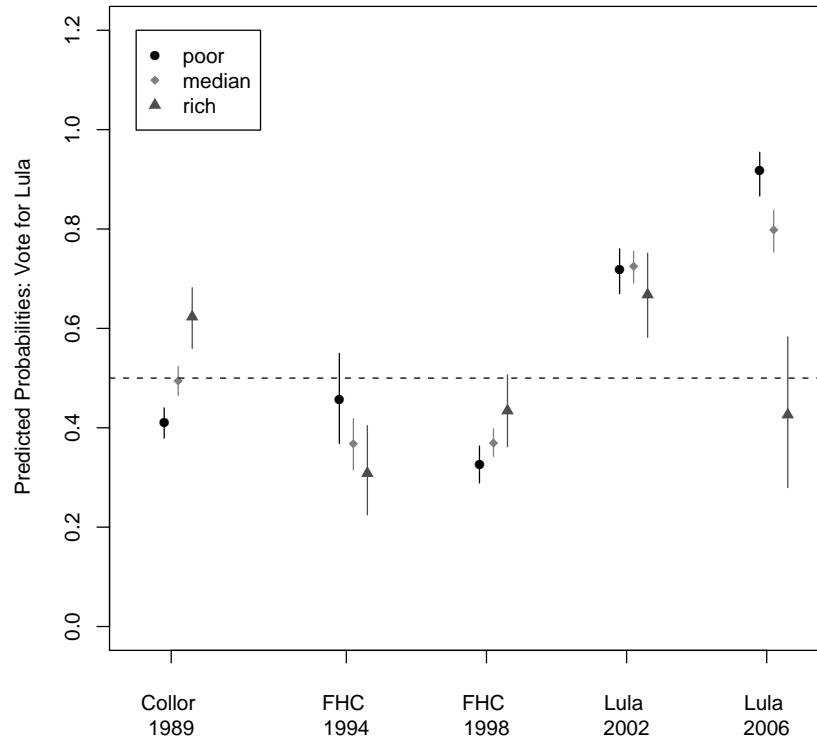
was also more likely to vote for FHC if compared to the rich.

Now turning to the 2006 elections the observed predictions follow much more closely the model results. The poor and the median were considerably more likely to have voted for Lula, the incumbent, after observing his redistributive policies and experiencing considerable improvements. The rich, however, were split between Lula and his opponent Geraldo Alckmin.

4   Conclusion

Despite long held expectations that the extension of the suffrage in unequal societies would lead to high redistribution, many new democracies remain remarkably unequal. In this paper we address this puzzle with a focus on the electoral process. We develop a model of elections as a game of

incomplete information to explore how uncertainty (pervasive in new democracies), candidates' motivation (policy vs. office), and beliefs about their ideological inclinations affect what policy interests are likely to be represented in the political process.

Three important insights arise from the model. First, regarding the role of candidates' motivations, low redistribution in unequal democracies can be a sign that candidates are relatively policy, as opposed to office, oriented. Policy orientation leads candidates to choose their own ideal policies once in office. That is, both moderates and right types would not try to "mimic" a left type in order to garner votes. If candidates were purely office seekers, they would have an incentive to implement the policy favored by a majority to win the election. If that were the case, however, we would likely observe more rather than less redistribution.

The second point refers to the importance of voters perceptions of the ideological locations of candidates. The particular equilibrium addressing the central question of this study suggests that voters believe candidates sharing the preferences of the poor majority to be relatively rare. This can lead poor voters to reelect center or center-right incumbents, even if they are aware of these preferences. This is because they expect a random challenger to be relatively more to the right. Hence the feeling of distance from and disillusionment with most politicians – common in many new democracies – can serve to perpetuate outcomes that are disadvantageous for the majority.

Finally, the model provides an account of voters' behavior that does not rely on suppositions of irrationality, ignorance, and disregard for policy. Even under the assumption that they are as capable as any other voter to evaluate policy and update beliefs about incumbents' policy positions, it can be optimal for them to reelect incumbents who favor less redistribution than they do.

We analyzed individual level data gathered closed to presidential elections in Brazil to evaluate the theoretical model's results. We found that individuals responses to candidates' ideological placements on a pro-poor to pro-rich scale both in 1998 and 2006 indicates they do indeed face uncertainty. Moreover, in line with the theoretical model, this uncertainty seemed higher with respect to first time challengers than incumbents. There were thus clear signs that voters update their beliefs about the policy positions of incumbents. The individual assessments of incumbents ideological placement tended to lie closer than the individual assessments of challengers to the

ideological placements of candidates' parties according to the opinion of legislators.

Furthermore, comparisons between legislators' evaluations of challengers' parties positions and the individual assessments of challengers revealed a bias towards the right in individuals' evaluations. That is, respondents' placements of challengers on a policy scale seem to have resulted from the belief that left types are rare. In terms of voting patterns, some of the results were more consistent with the theoretical model's than others. While in the first two elections after democratization results differed somewhat from the model expectations, those regarding the following three elections conformed fairly well.

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5 Appendix

5.1 Proof of Propositions 1 to 3

Starting by backwards inductions, at her second and last term a candidate maximizes her utility by implementing her ideal policy. This is because no reelection is allowed at this point, thus office motivations do not play a role.

We need to show that in the first period, given the equilibrium strategies and conditions no player has an incentive to deviate. First we consider voters' responses to each possible policy. Then we establish the conditions that make it not profitable for candidates to unilaterally deviate from their equilibrium strategies given voters responses to them. Since the poor form a majority, as long as they are not indifferent between candidates their vote is decisive. Indifference only happens for one specific value of the prior distribution of candidates types out of a continuum of possible values. Therefore I focus on cases where the poor are decisive.

Proof of Proposition 1:

After observing $x^1 = 0$ given that all types of incumbents choose 0 in equilibrium, no updating occurs. This yields

$EU_p(I) = EU_p(Ch)$, and

$\gamma_i(0) = \frac{1}{2}$ for all i.

After observing off-the-equilibrium-path policies, voters cannot update their beliefs via Bayes' Rule. In such cases, I apply the divinity refinement (D1) to set these beliefs. Following D1, the deviation is believed to come from the type for whom it would be profitable for the most inclusive range of reelection probabilities. Starting with C the range of reelection probabilities that would make a deviation to x profitable is given by:

$$EU_C(s'_C, (s^*_L, s^*_R)) \quad > \quad EU_C(S^*)$$

$$-x^2 + w + \gamma^C w + (1 - \gamma^C)(-\frac{p_C}{4} - \frac{p_R}{4}) \quad > \quad -\frac{1}{4} + w + \frac{1}{2}w + \frac{1}{2}(-\frac{p_C}{4} - \frac{p_R}{4})$$

$$\gamma^C \quad > \quad \underbrace{\frac{x^2 - x}{w + \frac{p_c}{4} + \frac{p_R}{4}} + \frac{1}{2}}_{a(x)}$$

Replicating the same calculations to the other two types yields:

$$EU_R(s'_R, (s^*_L, s^*_C)) \quad > \quad EU_R(S^*)$$

$$\gamma^R \quad > \quad \underbrace{\frac{x^2 - 2x}{w + \frac{p_c}{4} + p_L} + \frac{1}{2}}_{b(x)}$$

and

$$EU_L(s'_L, (s^*_R, s^*_C)) \quad > \quad EU_L(S^*)$$

$$\gamma^L \quad > \quad \underbrace{\frac{x^2}{w + \frac{p_c}{4} + p_R} + \frac{1}{2}}_{c(x)}$$

Comparing these values we get that for all x, $b(x) < a(x)$ and $(x)b < c(x)$. This means deviations are believed to come from the R type. That is, $\mu_{R|\{\frac{1}{2},1\},S^*} = 1$, leading to

$$EU_p(I) = -1.$$

This is the lowest utility possible for poor voters, thus leading to

$$\gamma_p(\frac{1}{2}) = \gamma_p(1) = 0.$$

Now we need to consider profitable deviations on the part of candidates. Given the conditions stipulated so far, any deviation by L means loss of utility, since L would not be reelected for sure and would be further away from $\tilde{x}_L$. Thus L will not deviate. Both C and R, however, may deviate.

Consider R first. Given voters beliefs any deviation by R results in no-reelection. Of all possible deviations the one bringing highest utility to R is $x^1 = 1$ since utility from office is constant and $x^1 = 1$ maximizes her utility from policy. R's expected utility from this unilateral deviation, denote it by s'_R, is

$$EU_R(s'_R, (s^*_L, s^*_C)) = w - \frac{p_C}{4} - p_L,$$

while

$$EU_R(S^*) = \frac{3}{2}w - 1 - \frac{p_C}{8} - \frac{p_L}{2}.$$

The necessary and sufficient conditions for R not to deviate are given by $EU_R(S^*) > EU_R(s'_R, (s^*_L, s^*_C))$. This yields

$$w > 2 - p_L - \frac{p_C}{4}. \tag{1}$$

Now consider C. By the same logic above, the most profitable deviation by C is to $x^1 = \frac{1}{2}$. C's expected utility from this unilateral deviation, denote it by s'_C, is

$$EU_C(s'_C, (s^*_L, s^*_R)) = w - \frac{p_L}{4} - \frac{p_R}{4},$$

while

$$EU_C(S^*) = \frac{3}{2}w - \frac{1}{4} - \frac{p_L}{8} - \frac{p_R}{8}.$$

The necessary and sufficient conditions for C not to deviate are given by $EU_C(S^*) > EU_C(s'_C, (s^*_L, s^*_R))$. This yields $w > \frac{1}{2} - \frac{p_L}{4} - \frac{p_R}{4}$ which is satisfied by (1). $\square$

Proof of Proposition 2: After observing $x^1 = 0$ voters updated beliefs according to Bayes'

Rule are $\mu_{L|0,S^*} = \frac{p_L}{p_C + p_L}$ and $\mu_{C|0,S^*} = \frac{p_C}{p_C + p_L}$. Thus

$$EU_p(I) = \frac{p_C}{4(p_C + p_L)}, \quad and$$

$$EU_p(Ch) = -\frac{p_C}{4} - p_R.$$

This yields $\gamma_p(0) = 1$ iff

$$p_R > \frac{1}{4}\left(\frac{p_C}{p_C + p_L} - p_C\right) \tag{2}$$

When $x^1 = 1$ is implemented $\mu_{R|1,S^*} = 1$,

$$EU_p(I) = -1,$$

and $\gamma_p(1) = 0$.

After observing $x^1 = \frac{1}{2}$, voters again cannot update their beliefs following Bayes' Rule and I aplly D1. Thus C would find it profitable to deviate to $x^1 = \frac{1}{2}$ when

$$\gamma^C > \frac{x^2 - x}{w + \frac{p_L}{4} + + \frac{p_R}{4}} + 1$$

and R would find it profitable to deviate when

$$\gamma^R > \frac{(x-1)^2}{w + p_L + \frac{p_C}{4}}$$

Whether the deviation is expected to come from C or R depends on the parameter values. Whenever $\mu_{C|\frac{1}{2},S^*} = 1$, after observing $x^1 = \frac{1}{2}$ poor voters compare:

$$EU_p(I) = -\frac{1}{4}.$$

to

$$EU_p(Ch) = -\frac{p_C}{4} - p_R.$$

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If poor voters reelect an incumbent who implements $x^1 = \frac{1}{2}$, then C would deviate. Thus we need $\gamma_p(\frac{1}{2}) = 0$ which requires

$$p_R < \frac{1}{4}(1 - p_C). \tag{3}$$

Now, when the deviation is expected to come from R, then

$$EU_p(I) = -1,$$

and $\gamma_p(\frac{1}{2}) = 0$.

Now we need to consider profitable deviations on the part of candidates. Since under the conditions stipulated so far, L is obtaining her highest possible utility by playing her equilibrium strategies, L will not deviate. Both C and R, however, may deviate.

Consider R first. Given voters beliefs any deviation by R results in no-reelection. Of all possible deviations the one bringing highest utility to R is $x^1 = 1$ since utility from office is constant and $x^1 = 1$ maximizes her utility from policy. R's expected utility from this unilateral deviation, denote it by s'_R, is

$$EU_R(s'_R, (s^*_L, s^*_C)) = w - \frac{p_C}{4} - p_L,$$

while

$$EU_R(S^*) = 2w - 1.$$

The necessary and sufficient conditions for R not to deviate are given by $EU_R(S^*) > EU_R(s'_R, (s^*_L, s^*_C))$. This yields

$$w < 1 - p_L - \frac{p_C}{4}. \tag{4}$$

Now consider C. By the same logic above, the most profitable deviation by C is to $x^1 = \frac{1}{2}$. C's

expected utility from this unilateral deviation, denote it by s'_C, is

$$EU_C(s'_C, (s^*_L, s^*_R)) = w - \frac{p_L}{4} - \frac{p_R}{4},$$

while

$$EU_C(S^*) = 2w - \frac{1}{4}.$$

The necessary and sufficient conditions for C not to deviate are given by $EU_C(S^*) > EU_C(s'_C, (s^*_L, s^*_R))$. This yields

$$w > \frac{p_C}{4}. \tag{5}$$

□

Proof of Proposition 3: After observing $x^1 = 0$ voters updated belief according to Bayes' Rule is $\mu_{L|0,S^*} = 1$. This yields

$$EU_p(I) = 0,$$

which poor voters compare to their expected utility from electing the challenger,

$$EU_p(Ch) = \frac{3}{4}p_C + p_L - 1.$$

Since $EU_p(I) > EU(Ch|S^*)$, $\gamma_p(0) = 1$. After observing $x^1 = 1$, voters believe the candidate's type is R, that is $\mu_{R|1,S^*} = 1$. This leads to

$$EU_p(I) = -1,$$

and $\gamma_p(1) = 0$.

After observing $x^1 = \frac{1}{2}$ voters updated belief according to Bayes' Rule is $\mu_{C|\frac{1}{2},S^*} = 1$ and

$$EU_p(I) = -\frac{1}{4}.$$

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The poor reelects C iff

$$p_L < \frac{3}{4}(1 - p_C), \tag{6}$$

which is satisfied by $p_L < \frac{1-p_c}{4}$.

While not relevant for the equilibrium characterized, I discuss other voters equilibrium voting strategies. After observing $x^1 = \frac{1}{2}$, m voters get their maximum utility and choose $\gamma_m(\frac{1}{2}) = 1$ since $p_c < 1$. Rich voters choose $\gamma_r(\frac{1}{2}) = 1$ if and only if $EU_r(I) > EU_r(Ch)$. This holds only if $p_L > \frac{1-p_c}{4}$. Since from $w < \frac{1}{4} - (p_L + \frac{p_C}{4})$ it follows that $p_L < \frac{1-p_c}{4}$, $\gamma_r(\frac{1}{2}) = 0$. After observing $x^1 = 1$ rich voters get their maximum utility and choose $\gamma_r(1) = 1$ given $p_R < 1$. m voters are indifferent between s_L^* and s_R^*. Given that there is a positive probability of the challenger being a centrist candidate, that is $p_C > 0$, then $EU_m(I) < EU_m(Ch)$, leading to $\gamma_m(1) = 0$. A similar logic applies to m after she observes $x^1 = 0$, which leads again to $\gamma_m(0) = 0$.

Now we need to consider profitable deviations on the part of candidates. Since under the conditions stipulated so far both L and C are getting their highest possible utility by playing their equilibrium strategies, they will not deviate. R, however, may deviate. A deviation by R to $x_R^1 = 0$ yields a strictly lower payoff than a deviation to $x_R^1 = \frac{1}{2}$, since in both cases R gets reelected and the further she moves from her ideal point the lower her payoff. Thus if we show the latter is not profitable, then the former deviation is not profitable either. R's expected utility from this unilateral deviation, denote it by s_R', is

$$EU_R(s_R', (s_L^*, s_C^*)) = -\frac{1}{4} + 2w,$$

while

$$EU_R(S^*) = w - p_L - \frac{p_C}{4}.$$

The necessary and sufficient condition for R not deviating is given by $EU_R(S^*) > EU_R(s_R', (s_L^*, s_C^*))$.

This yields

$$
\begin{aligned}
w &< \frac{1}{4} - (p_L + \frac{p_C}{4}) \quad or \\
p_L &< \frac{1 - p_c}{4}
\end{aligned}
$$

when $w = 0$. $\square$

Proof of Uniqueness: Let $\underline{w}^1 = 2 - p_L - \frac{p_C}{4}$ denote the lower bound value of office supporting the equilibrium in Proposition 1, $\bar{w}^2 = 1 - p_L - \frac{p_C}{4}$ denote the upper bound value of office supporting the equilibrium in Proposition 2, and $\bar{w}^3 = \frac{1}{4} - \frac{p_C}{4}$ denote the upper bound value of office supporting the equilibrium in Proposition 3. Then $\underline{w}^1 > \bar{w}^2$ and $\underline{w}^1 > \bar{w}^3$. Hence the equilibrium in Proposition 1 is unique.

Now let $\underline{p_R}^3 = \frac{3}{4}(1 - p_C) + w$ denote the lower bound probability of a right type supporting the equilibrium in Proposition 3, $\bar{p}_R^1 = \frac{1}{4}(1 - p_C)$ denote the upper bound probability of a right type supporting the equilibrium in Proposition 1 and 2. Given $\underline{p_R}^3 > \bar{p}_R^1$ the equilibrium in Proposition 3 is unique, and consequently the equilibrium in Proposition 2.

Proof of non-existence of additional pure strategy equilibria:

First I show that no pure strategy equilibrium exists where $x_L^1 \neq 0$. Second I show that no pure strategy equilibrium exists where $x_C^1 = 1$. And finally I show the remaining three possible sets of pure strategies are not a Perfect Bayesian Equilibrium.

I show that $x_L^1 = 0$ by contradiction. Suppose first that $x_L^1 = 1$. Then either:

a) $x_L^1 = x_C^1 = x_R^1 = 1 \Rightarrow \Gamma(1) = \frac{1}{2}$. By D1 $\mu_{L|0} = 1 \Rightarrow \gamma_p(0) = 1$. Thus L deviates.

b) $x_L^1 \neq x_C^1$ and $x_L^1 \neq x_R^1 \Rightarrow \mu_{L|1} = 1 \Rightarrow \gamma_p(1) = 1$. Thus R deviates

c) $x_L^1 = x_R^1 \neq x_C^1$. In this case $\mu_{L|1} = \frac{p_L}{p_L + p_R}$ and $\mu_{R|1} = \frac{p_R}{p_L + p_R}$. If $\gamma_p(1) = 0$ then L deviates. If $\gamma_p(1) = \frac{1}{2}$, then $p_R = \frac{1}{4} - \frac{p_C}{4}$, leading to $\gamma_r(1) = 0$. Since $\gamma_m(1) = 0$, $\Gamma(1) = 0$, and L deviates.

Finally, If $\gamma_p(1) = 1$ then $p_R < \frac{1}{4}(1 - p_C)$ and $\gamma_p(x_C^1) = 0$. If $x_C^1 = 0$ then C deviates to $x_C^1 = \tilde{x}_C = \frac{1}{2}$. If $x_C^1 = \frac{1}{2}$ then the condition for C not deviating to $x \in \{0, 1\}$ is $w < 1 - \frac{p_C}{2}$. Given $\gamma_p(\frac{1}{2}) = 0$, the most profitable deviation for L is to $x = 0$ and the condition for that not to happen is $w > 1 - \frac{p_C}{4} - p_R$. The only way both these conditions can be met is when $p_R > 1 - \frac{p_C}{2}$ which contradicts $p_R < \frac{1}{4}(1 - p_C)$.

d) $x_L^1 = x_C^1 \neq x_R^1$. Let $x_R^1 = x'$, where $x' \in \{0, \frac{1}{2}\}$. Then $\mu_{R|x'} = 1$ and $\gamma_p(x') = 0$. Thus R deviates.

Now suppose $x_L^1 = \frac{1}{2}$. Then either:

a) $x_L^1 = x_C^1 = x_R^1 = \frac{1}{2} \Rightarrow \Gamma(\frac{1}{2}) = \frac{1}{2}$. By D1 $\mu_{L|0} = 1 \Rightarrow \gamma_p(0) = 1$. Thus L deviates.

b) $x_L^1 \neq x_C^1$ and $x_L^1 \neq x_R^1 \Rightarrow \mu_{L|\frac{1}{2}} = 1 \Rightarrow \gamma_p(\frac{1}{2}) = 1$. Thus C deviates

c) $x_L^1 = x_R^1 \neq x_C^1$. If $\gamma_p(\frac{1}{2}) = 1$ then C deviates. If $\gamma_p(\frac{1}{2}) = 0$, then both L and R deviate. If $\gamma_p(\frac{1}{2}) = \frac{1}{2}$, then $p_R = \frac{1}{4}(1 - p_C) \Rightarrow \gamma_r(\frac{1}{2}) = 0$. Given $\gamma_m(\frac{1}{2}) = 0$ we have $\Gamma(\frac{1}{2}) = 0$, thus both L and R deviate.

d) $x_L^1 = x_C^1 \neq x_R^1$. By D1, L would deviate to $x^1 = 0$ for any $\gamma > \frac{1}{2} - \frac{1}{4(w + \frac{p_C}{4} + p_R)}$ while C for any $\gamma > \frac{1}{2} + \frac{1}{4(w + \frac{p_C}{4} + \frac{p_R}{4})}$. Thus $\mu_{L|0} = 1 \Rightarrow \gamma_p(0) = 1$ and L deviates.

Next I show that $x_C^1 \neq 1$ by contradiction. Suppose that $x_C^1 = 1$. Then either:

a) $x_C^1 = x_R^1 = 1$. Then $\mu_{C|1} = \frac{p_C}{p_C + p_R}$ and $\mu_{R|1} = \frac{p_R}{p_C + p_R}$ leading to $\gamma_p(1) = 0$. Hence C deviates.

b) $x_C^1 \neq x_R^1 = 1$. Then $\mu_{C|1} = 1$. If $\gamma_p(1) = 1$, then R deviates. If $\gamma_p(1) = 0$, then C deviates. If $\gamma_p(1) = \frac{1}{2}$, then $p_R = \frac{1}{4}(1 - p_C)$ which leads to $\gamma_R(1) = 1$. Since $\gamma_m(1) = 1$, then $\Gamma(1) = 1$ and R deviates.

Finally I need to show the remaining three possible combinations of pure strategies are not an equilibrium.

If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = \frac{1}{2}), (x_R^1 = \frac{1}{2}, x_R^2 = 1)\right)$, $\gamma_p(\frac{1}{2}) = 0$, since $\mu_{R|\frac{1}{2}, S^*} = 1$, and $EU_R((1, 1), (s_L^*, s_C^*)) > EU_R(S^*)$. Thus R deviates.

If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = \frac{1}{2}, x_C^2 = \frac{1}{2}), (x_R^1 = \frac{1}{2}, x_R^2 = 1)\right)$, then $\mu_{C|\frac{1}{2}, S^*} = \frac{p_C}{p_C + p_R}$, $\mu_{R|\frac{1}{2}, S^*} = \frac{p_R}{p_C + p_R}$ and $EU_p(I|x^1 = \frac{1}{2}) < EU_p(Ch)$, yielding $\gamma_p(\frac{1}{2}) = 0$. This means $EU_R((1, 1), (s_L^*, s_C^*)) >$

$EU_R(S^*)$, thus R deviates.

If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = \frac{1}{2}, x_C^2 = \frac{1}{2}), (x_R^1 = 0, x_R^2 = 1)\right)$, then $\mu_{C|\frac{1}{2},S^*} = 1$, $\mu_{L|0,S^*} = \frac{p_L}{p_L + p_R}$, $\mu_{R|0,S^*} = \frac{p_R}{p_L + p_R}$. Thus $\gamma_p(0) = 1$ iff $p_C > 4\frac{p_R}{p_L + p_R} - 4p_R$ and $\gamma_p(\frac{1}{2}) = 0$ iff $p_C < 1 - 4p_R$. That is, either $\gamma_p(0) = \gamma_p(\frac{1}{2}) = 1$ or $\gamma_p(0) = \gamma_p(\frac{1}{2}) = 0$. In the first case $EU_R((1,1), S^*_{-R}) > EU_R(S^*)$ and in the second $EU_R((\frac{1}{2}, 1), S^*_{-R}) > EU_R(S^*)$. Hence in both cases R deviates. $\square$

The proofs of Propositions 5 to 9 follow closely from the proofs just shown. In Proposition 5 a substitutes $\frac{1}{2}$ and in propositions 6 to 9 utilities are not quadratic, but expressed in terms of absolute values instead.

Proof of Proposition 9: Since all types choose the same policy in the first period, no updating occurs and $\gamma_p(0) = \gamma_m(0) = \gamma_r(0) = \frac{1}{2}$. The condition for $\mu_{R|\{b,0\}} = 1$ is derived from application of the divinity refinement as follows:

$$EU_R(s'_R, (s_L^*, s_C^*)) > EU_R(S^*)$$
$$\gamma^R > \underbrace{\frac{b^2 - 1}{w + (1-b)^2 p_C + p_L} + \frac{1}{2}}_{a(x)}$$

$$EU_C(s'_C, (s_R^*, s_L^*)) > EU_C(S^*)$$
$$\gamma^L > \underbrace{\frac{-b^2}{w + b^2 p_L + (1-b)^2 p_R} + \frac{1}{2}}_{c(x)}$$

$\mu_{R|\{b,0\}} = 1$ iff $a < c$, which yields

$$p_C < \frac{w(1 - 2b^2) - b^4 + p_R(1 + 2b^3 - 2b)}{b^2 - 2b^3}$$

The condition for R not deviating is $p_C > \frac{2-w-p_L}{(1-b)^2}$ which also guarantees C does not deviate.

$\square$

Proof of Proposition 10: After observing $x^1 = 0$, $\mu_{L|0} = 1$ and $\gamma_p(0) = 1$ iff $p_L > 1 - \frac{(1-b)^2}{b^2}$.

Given that $b < \frac{1}{2}$, $\gamma_p(1) = 0$. The condition for R not deviating is given by $EU_R(S^*) > EU_R((b,1), S^*_{-R})$, which is $p_L < (1-b)^2(1-p_C) - w$. $\square$

Proof of non-existence of additional equilibria where $s_L = (0,0)$ and $\gamma_P(0) = 1$ when $\tilde{x}_p = \tilde{x}_m = \tilde{x}_C = b$: Four possible cases need to be considered:

a) If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = b), (x_R^1 = b, x_R^2 = 1)\right)$, then $\mu_{R|b} = 1 \Rightarrow \gamma_p(b) = 0$ and R deviates.

b) If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = b, x_C^2 = b), (x_R^1 = 0, x_R^2 = 1)\right)$, then $\mu_{C|b} = 1 \Rightarrow \gamma_p(b) = 1$ and R deviates.

c) If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 1, x_C^2 = b), (x_R^1 = 0, x_R^2 = 1)\right)$, then $\mu_{C|1} = 1 \Rightarrow \gamma_p(1) = 1$ and R deviates.

d) If $S^* = \left((x_L^1 = 0, x_L^2 = 0), (x_C^1 = 0, x_C^2 = b), (x_R^1 = 1, x_R^2 = 1)\right)$ then $\gamma_p(0) = 1$ iff $p_L > \frac{(1-b)^2}{b^2}(1-p_R)$. If $\mu_{C|b} = 1$, then C deviates. If $\mu_{R|b} = 1$ then, following the divinity refinement, it must be the case that $a < c$, where a and c are as follows:

$$
\begin{aligned}
EU_R(s'_R, (s^*_L, s^*_C)) &> EU_R(S^*) \\
\gamma^R &> \underbrace{\frac{(1-b)^2}{w + (1-b)^2 p_C + p_L} + \frac{1}{2}}_{a(x)}
\end{aligned}
$$

$$EU_C(s'_C, (s^*_R, s^*_L)) > EU_C(S^*)$$

$$\gamma^L > \underbrace{1 - \frac{-b^2}{w + b^2 p_L + (1-b)^2 p_R} + \frac{1}{2}}_{c(x)}$$

When $p_L > \frac{(1-b)^2}{b^2}(1 - p_R)$, however, $a(x) > c(x)$, thus $\mu_{C|b} = 1$ and C deviates.

5.2 Beta Distribution Model

```
model {
    for (i in 1:n) {
        y[i] ~ dbeta(mu*gamma, gamma*(1-mu))
    }
    logit(mu) <- beta[1]
    beta[1] ~ dnorm(0, .001)
    gamma ~ dgamma(.01,.01)
}
```