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A Nested Multinomial logit Model Approach**

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Abstract

In democratic systems, elections are considered a mechanism to ensure that efficient policies seeking the wellbeing of the population are implemented by the government, although the reality often reflects the opposite. Governments usually act inefficiently due to problems of government performance such as capture and low accountability. In the African continent, the republic of Senegal is considered an example of a stable democracy. Electoral processes in the country have been considered relatively fair. However, the decline in the voter turnout over the past elections suggests that the party system is failing to engage voters. This study assesses influencing factors both in voting behavior in Senegal and in the decision to abstain. We estimated nested multinomial logit models including the alternative Abstention to determine the importance of the non-voters group in the policy making process. We found that even though people in general make their decision more non-policy oriented, abstainers, compared to those who cast a vote, tend to choose more retrospectively oriented and less policy and non-policy oriented. Furthermore, our findings show that this group of non-voters hold the government more accountable and have a higher political weight for the incumbent party. Thus, they could incentive the government to choose and implement more efficient policies. As regards the non-policy component, we observed that abstainers usually do not feel close to any party. Furthermore, a large share of people stating their intention to vote, do not have Party Identification (*PI*) and, in general, people tend to lie about their intended vote choice. Therefore, we might assume that most people with no *PI* who said that would vote for BBY, actually decided to abstain or vote for an opposition party. Thus, should the main opposition parties form a coalition, their probability of winning the elections is higher, as long as, abstainers decided to vote. Finally, after estimating the First Order Condition (FOC) and Second Order Condition (SOC), and finding a Local Nash Equilibrium (LNE), we noted that the main opposition parties are perceived to be closer to the optimal policy positions than the ruling party, which gives an incentive to the incumbent to change its policy positions as policy-oriented voters might choose an opposition party instead.

Keywords: probabilistic voter model, capture, accountability, agricultural policy, Senegal, Africa

JEL classification: Q18, C31, C35, C38

1 Introduction

Elections are considered a vital principle of democracy. An electoral process is commonly thought to be a mechanism to ensure that efficient policies seeking to reduce poverty and achieve prosperity are implemented by the government. However, in reality electoral competition does not necessarily guarantee the implementation of policies in favor of the whole society. In fact, governments usually apply inefficient policies due to problems of government performance such as capture and low accountability. Additionally, even though the political participation is a constitutional right, some people also consider the act of voting as a citizen's civic responsibility. However, it is clear that not all people take part in electoral processes. The purpose of this research study is to evaluate the importance of this group of people in the policy making process in Senegal. More specifically, we are looking to determine whether abstainers could motivate the Senegalese government to design and implement efficient policies.

Over the past decades serious scholarly attention has been given to the study of voter behavior, for example Downs [1957], Campbell et al. [1960], Lazarsfeld et al. [1968] and Lipset and Rokkan [1967] are among the main authors addressing this issue. Other important amount of research have been devoted to the analysis of government performance, for instance Bailey [1999] and Stevens [2005]. Furthermore, there is also a few amount of research studies combining both topics such as, Bardhan and Mookherjee [2002], Keefer and Khemani [2005], Henning et al. [2014] and Seide [2014]. However, in the body of theoretical and empirical literature little attention has been given to the role of non-voting on voter behavior analysis. In this regard, Thurner and Eymann [2000] drew the attention on this neglected topic and contributed with their study combining the spatial models of candidate/party choice and abstention/participation choice.

Other studies such as Owen and Grofman [1984] for instance, have referred to the paradox of non-voting. According to them, in a supposed scenario where all voters assign positive costs to voting, if all decide to vote, each will find their vote useless as it is highly unlikely to affect the outcome. On the other hand, if no one votes, then the vote becomes extremely valuable and thus, the paradox occurs. Another voting paradox was identified by Kooreman and Haan [2003]. They argued that in a binary election where potential voters can abstain and there is a cost of voting, the proposal with the lowest support may still be the most likely to win the election as members of the majority have an incentive to free ride on each other, giving the minority an advantage.

The implications of non-voting for democracy have been studied by authors like Bennett and Resnick [1990] who found that non-voting has an impact on some domestic policies in the United States, especially spending on welfare state programs. As pointed by Kirchgässner [1992], voting is an individual decision that is irrelevant for the individual himself/herself and for all other individuals, but the collective decision is relevant for

all individuals. Therefore, they are of high relevance for the society. Furthermore, as Feddersen and Pesendorfer [1999] mentioned, the level of information of the electorate is also determinant regarding the level of participation. In their research they showed that more informed voters are more likely to vote than their less informed counterparts.

According to Bannon [2003] another important factor to highlight is that having a political preference does not necessarily indicate someone's vote choice. He stated that in an election campaign, only small percentages of the electorate identify themselves as "non-voters" or voice their intention not to vote. However, even if all identified as "don't know" do not vote, this still does not represent the actual percentage of the electorate who actually abstain, because even voters with a political preference refrain from voting.

People decide to abstain for different motives. Authors such as Thurner and Eymann [2000], as well as, Plane and Gershtenson [2004] have studied, by means of spatial models of voting, indifference and alienation towards the candidate or party as reasons affecting the individual probability of voting.

As mentioned previously, we are looking to assess the importance of Senegalese abstainers in the policy making process. In this context, as pointed by Resnick [2013] voter turnout is an important aspect of the quality of the democracy for a country, and a massive participation means more responsiveness from the government towards a large share of the population. However, his examination of the first round of the 2012 presidential election revealed a low level of turnout and a high degree of electoral volatility.

This study proceeds as follows: First, we present the nested multinomial logit model that was developed, as well as, the econometric tools applied in the analysis. Second, we give an overview of the data and a description of the variables used. The following section shows the empirical estimations and results for the abstention/participation decision in the Senegalese multi-party system. In the last part of the paper we present our conclusion and summary of the research.

2 Methodology

2.1 Voter Behavior

It is well known that not all voters decide to participate in electoral processes. Thus, to analyze such decision, the alternative Abstention must be included in the choice set. In this sense, voter behavior can be modeled based on the rational choice approach, where the voter's decision depends on the alternative differential $V_{iA} - V_{iB}$. Furthermore, to include all unknown factors involved in the decision process, a probabilistic voter model is estimated. This allows the inclusion of an individual-specific stochastic component (μ_{ik}) in the utility function (U_{ik}) comprising these unknown factors.

$$P_{iA}(A, B) = Prob(U_{iA} \geq U_{iB}) \text{ where } U_{ik} = V_{ik} + \mu_{ik}, k = A, B \quad (1)$$

Discrete choice models are particularly appropriated to estimate probabilistic voter models, as they explain choices between two or more alternatives. More specifically, these models answer to the questions: Who?, what? and how?. Furthermore, the choice set fulfills three requirements: It must be *collectively exhaustive*, *mutually exclusive* and have a *finite number of alternatives*.

A Random Utility Maximization (RUM) model is usually applied to derive Discrete choice models. Here, the voter i chooses, from the choice set, the alternative k that provides him the highest utility U_{ik} . In other words, the greater the utility of an alternative, the more likely is that the voter will choose it.

The random unknown part μ_{ik} of the utility function U_{ik} is assumed to be independently, identically extreme value distributed (iid), and then a logit model was derived. Since the choice set includes several alternatives, the model was extended to a multi-alternative estimation, where voters can choose an alternative k from a set of alternatives K . The logit model was derived based on McFadden [1974, 1982] as:

$$P_{ik}(K) = \frac{e^{V_{ik}}}{\sum_{k=1}^K e^{V_{ik}}} \quad (2)$$

Like Thurner and Eymann [2000] we are proposing a model that simultaneously combines the choice among several parties and the alternative Abstention. To this end, a nested multinomial logit model based on Croissant [2012] and Greene [2008] was developed:

$$P_{ik}(K) = P_{ik|m}P_m \quad (3)$$

with

$$P_{ik|m} = \frac{e^{V_{ik}}}{\sum_k e^{V_{ik}}} \text{ where } V_{ik} = \alpha_k + \beta x_{ik} + \delta_k r_i \quad (4)$$

and

$$P_m = \frac{\left(\sum_k e^{V_{ik}}\right)^{\lambda_m}}{\sum_m^M \left(\sum_j e^{V_{ij}}\right)^{\lambda_m}} \quad (5)$$

where α_k is an alternative specific constant, x_{ik} is an alternative specific variable with a generic coefficient β , and r_i is an individual specific variable with an alternative specific coefficient δ_k . The alternative specific coefficients are estimated with one of them set

to zero and the remaining coefficients are interpreted with respect to the alternative whose coefficient was set to zero. On the contrary, generic coefficients are constant for all alternatives.

The conditional probability (equation 4) is the exponential expected utility of voter i from alternative k divided by the sum of the exponential expected utilities of all the alternatives within a nest m . In other words, it is the probability that voter i chooses alternative k that belongs to a nest m . The marginal probability (equation 5) is the sum of the exponential expected utilities of all the alternatives within a nest to the power of λ_m (elasticity of nest m), divided by the sum of the exponential expected utilities for all nests. Finally, the probability that voter i chooses alternative k (equation 3) is calculated by multiplying the conditional probability of choosing alternative k if the nest m is chosen times the marginal probability of choosing the nest m . For this model to be compatible with the RUM, all the nest elasticities have to be in the interval from 0 to 1.

The nested multinomial logit model estimated in this paper includes three components or voting motives: non-policy oriented (V_{ik}^{NP}), policy oriented (V_{ik}^P) and retrospective oriented (V_{ik}^R). The voter's utility function is now as follows:

$$V_{ik} = V_{ik}^{NP} + V_{ik}^P + V_{ik}^R \quad (6)$$

Not all voters are well informed and aware of policies, especially in developing countries. Therefore, voters might apply non-policy indicators to estimate their expected utility, such as their socio-demographic characteristics x_{ij} , as well as, their approval of the incumbent's work y_{ig} . Another variable included in the utility function is party identification PI_{ik} that works as an intensifier in the preferences of voters towards a candidate.

$$V_{ik}^{NP} = \sum_j^J \alpha_{kj} x_{ij} + \alpha_k y_{ig} + \alpha PI_{ik} \quad (7)$$

The policy oriented voter's utility function is calculated based on the spatial voting model [Davis et al., 1970, Enelow and Hinich, 1984], as the squared distance between a voter's position x_{id} on a specific issue d and the perceived position taken by the party or candidate y_{ikd} on the same issue:

$$V_{ik}^P = -\sum_d^D \beta_d (y_{ikd} - x_{id})^2 \text{ where } (y_{ikd} - x_{id}) = D_{ikd} \quad (8)$$

The coefficient β is always negative, because the greater the distance between the voter's position and the party/candidate's position, the less is the utility. We considered the minimal negative distance for the alternative Abstention. Then, the greater the distance, the greater is the benefit from abstaining, which agrees with the voting paradox.

As regards the retrospective voting motive [Fiorina, 1981], voters can express a general assessment of the past performance of a party/candidate or the government. They use observable welfare indicators Z_{ir} determined by governmental policies (γ_G).

$$V_{ik}^R = \sum_r^R \delta_{kr} Z_{ir}(\gamma_G) \quad (9)$$

2.2 Government Performance

The estimation of marginal effects (ME) is necessary to assess government performance, because they show how sensitive are the voters to changes in policy, non-policy and retrospective voting motives.

- For the variables with generic coefficients ME were estimated as follows:

$$\frac{\partial P_{ig}}{\partial D_{igd}} = \left| P_{ig} (1 - P_{ig}) \beta_d \left[\frac{(1 - P_{ig|m})}{(1 - P_{ig})} + \lambda_m \frac{(P_{ig|m} - P_{ig})}{(1 - P_{ig})} \right] \right| \quad (10)$$

- For the variables with alternative specific coefficients ME were estimated as follows::

$$\frac{\partial P_{ig}}{\partial Z_{ir}} = \left| P_{ig} \left(\delta_g - \sum_k^K \delta_k P_{ik} \right) \left[\frac{(P_m \delta_g - \sum_k^K \delta_k P_{ik})}{P_m (\delta_g - \sum_k^K \delta_k P_{ik})} + \lambda_m \frac{[1 - P_m] \sum_k^K (\delta_k P_{ik})}{P_m (\delta_g - \sum_k^K \delta_k P_{ik})} \right] \right| \quad (11)$$

where g refers to the government party.

These marginal effects point out the extent to which the probability P_{ig} changes when there is a one-unit change in the independent variables.

To evaluate the relative importance of the different motives, the relative marginal effects (RME) are calculated for each voter:

$$RME_i^{NP} = \frac{ME_i^{NP}}{ME_i^{NP} + ME_i^P + ME_i^R} \quad (12)$$

$$RME_i^P = \frac{ME_i^P}{ME_i^{NP} + ME_i^P + ME_i^R} \quad (13)$$

$$RME_i^R = \frac{ME_i^R}{ME_i^{NP} + ME_i^P + ME_i^R} \quad (14)$$

2.2.1 Government Accountability

Based on the RME , a government accountability index (GA) is estimated to verify whether electoral competition encourages governments to develop and implement efficient policies. The assumption is that, when voters choose more non-policy oriented, government accountability is low and vice versa.

$$RME^{NP} = \sum_{i=1}^n RME_i^{NP} \quad (15)$$

$$RME^P = \sum_{i=1}^n RME_i^P \quad (16)$$

$$RME^R = \sum_{i=1}^n RME_i^R \quad (17)$$

$$GA = \frac{RME^P + RME^R}{RME^{NP} + RME^P + RME^R} \quad (18)$$

where policy and retrospective RME can be added up in order to compare policy vs. non-policy motives.

2.2.2 Government Capture

Finally, another assumption is that the more policy oriented a voter chooses, the more importance he has for parties. Therefore, the next step is to calculate the individual relative political weights of voters, to then estimate the government capture index (GC).

$$g_i = \frac{ME_i^P}{\sum_{i=1}^n ME_i^P} \quad (19)$$

We analyze different groups from the electorate to identify those with a greater political weight.

$$GC_{1vs2} = \frac{\frac{\sum_{i \in 1} g_i}{a_1}}{\frac{\sum_{i \in 2} g_i}{a_2}} \quad (20)$$

where a_1 and a_2 are the share of voters in group 1 and 2 respectively.

2.3 Nash Equilibrium

We intended to identify the equilibrium policy positions where the party in power has no incentive to move away from. Since we were estimating a logit model where the error terms were assumed to be Type I extreme value distributed, a Local Nash Equilibrium (LNE) could be found [Schofield, 2007]. In this sense, based on the approach of Petri and Henning [forthcoming], to find the point where the probability P_{ig} is maximized, the following FOC was derived:

$$\frac{\partial P_{ig}}{\partial y_{igd}} = \frac{\partial P_{ig}}{\partial D_{igd}} \frac{\partial D_{igd}}{\partial y_{igd}} \quad (21)$$

$$\frac{\partial P_{ig}}{\partial y_{igd}} = P_{ig}(1 - P_{ig})\beta_d \left[\frac{(1 - P_{ig|m})}{(1 - P_{ig})} + \lambda_m \frac{(P_{ig|m} - P_{ig})}{(1 - P_{ig})} \right] 2(y_{igd} - x_{id}) \quad (22)$$

where the absolute political weight g_{igd} of voter i for the governmental party g for the issue d is:

$$g_{igd} = P_{ig}(1 - P_{ig})\beta_d \left[\frac{(1 - P_{ig|m})}{(1 - P_{ig})} + \lambda_m \frac{(P_{ig|m} - P_{ig})}{(1 - P_{ig})} \right] \quad (23)$$

FOC for all voters:

$$\sum_{i=1}^n \frac{\partial P_{ig}}{\partial y_{igd}} = 0 \quad (24)$$

$$\sum_{i=1}^n g_{igd} 2(y_{igd} - x_{id}) = 0 \quad (25)$$

$$\sum_{i=1}^n g_{igd}(y_{gd}^* - x_{id}) = 0 \quad (26)$$

$$\sum_{i=1}^n g_{igd} y_{gd}^* = \sum_{i=1}^n g_{igd} x_{id} \quad (27)$$

$$y_{gd}^* = \sum_{i=1}^n \left[x_{id} \left[\frac{g_{igd}}{\sum g_{igd}} \right] \right] \quad (28)$$

where y_{gd}^* is the optimal political position for the governmental party g for the issue d and $\frac{g_{igd}}{\sum g_{igd}}$ is the relative political weight of voter i for the governmental party g for the issue d .

The FOC $\frac{\partial P_{ig}}{\partial y_{igd}} = 0$ was satisfied, where the probability that the governmental party wins the election is maximized.

After finding a Nash-Equilibrium, we confirmed whether the SOC was fulfilled, i.e. the Hessian matrix was negative semi-definite. In our study, this was true, which means that

a LNE was estimated. The SOC was derived as follows:

if $d \neq p$, then

$$\frac{\partial P_{ig}^2}{\partial^2 y_{igd} y_{igp}} = \sum [4\beta_d \beta_p (y_{igd} - x_{id})(y_{igp} - x_{ip}) P_{ig} \quad (29)$$

$$[(\lambda_m - 1)(P_{ig|m})(1 - P_{ig|m}) + (\lambda_m(P_{ig|m} - 2P_{ig}) + (1 - P_{ig|m}))$$

$$((1 - P_{ig|m}) + \lambda_m(P_{ig|m} - P_{ig}))]]$$

if $d = p$, then

$$\frac{\partial P_{ig}^2}{\partial^2 y_{igd} y_{igd}} = \sum [4(y_{igd} - x_{id})^2 \beta_d^2 P_{ig} [(\lambda_m - 1)P_{ig|m}$$

$$(1 - P_{ig|m}) + (\lambda_m(P_{ig|m} - 2P_{ig}) + (1 - P_{ig|m}))$$

$$((1 - P_{ig|m}) + \lambda_m(P_{ig|m} - P_{ig}))] + P_{ig} \beta_d^2 \quad (30)$$

$$((1 - P_{ig|m}) + \lambda_m(P_{ig|m} - P_{ig}))]$$

3 Data

We designed a voter survey including questions on socio-demographic characteristics, voting behavior, policy positions and network characteristics. It was carried out in Senegal on January 2019 by the Senegalese Agricultural Research Institute. The interviews were conducted face-to-face in the respective dialect or language of the interviewees. The sample contains 1000 individuals from five different regions across the country. After data cleaning, 844 complete observations remained for the analysis of voters' behavior.

3.1 Dependent Variable

In a probabilistic voter model the dependent variable is usually the actual or intended vote choice. Nevertheless, given the approach of the nested multinomial logit model for this paper, the alternative Abstention was added. In the questionnaire, respondents were asked:

If a presidential election were held tomorrow, which party's candidate would you vote for?

The respondents showing an intended vote choice for the ruling party were considered to be part of the "Government" nest. On the other hand, the interviewees who did not show

support for the incumbent party were considered members of the “Non-Government” nest. Within the latter are the voters showing support for any of the opposition parties, as well as, those who decided not to participate in the electoral process. As pointed by Thurner and Eymann [2000], the number of people who revealed their intention of abstaining in an election is usually underestimated in surveys due to effects of social (un)desirability. Therefore, following the aforementioned approach we have considered the interviewees who answered “Don’t know” and “Will not vote” as part of the Abstention alternative.

Table 1 shows the results of the survey, as well as, the official presidential election outcome. Even though the survey results are not very close to the actual election outcome, the party in power BBY is a clear winner in both scenarios. For the analysis in the empirical section we consider all parties and Abstention. Then, the whole set of alternatives is: $K = \{BBY, Rewmi, Pastef, PUR, Niang \text{ and } Abstention\}$.

Table 1: Senegalese presidential election results

| | BBY | Rewmi | Pastef | PUR | Niang | Abstention |
|----------------------------|--------|--------|--------|-------|-------|------------|
| Presidential election 2019 | 38.48% | 13.55% | 10.35% | 2.69% | 0.98% | 33.95% |
| Own survey 2019 | 70.46% | 3.72% | 5.30% | 1.13% | 0.34% | 19.05% |

Source: [Constitutional Council of Senegal, 2019], own survey

3.2 Independent Variables

The variables with more than 10% of missing values were excluded from the analysis and the remaining were imputed with the mean value, except for the policy positions that were imputed via linear regressions. The independent variables were divided into policy, retrospective and non-policy variables.

Policy Variables: Nine different policy issues were considered. The policy positions on these issues were asked based on a five-point scale. The interviewees were asked about their own policy position, as well as, their perceived positions of the parties on the following issues:

- 1-Agree with liberal policies, 5-Disagree with liberal policies (Social)
- 1-Left (socialism), 5-Right (capitalism) (Ideology)
- 1-Tax revenues should be used to provide public services, 5-Tax revenues should be used to further improve economic growth (PSvsEG)

4. 1-Public services expenditures should be mainly invested in improving education and health services, 5-Public services expenditures should be rather used to reduce insecurity and violence (EHvsIV)
5. 1-Economic growth shall be achieved through the development of the agricultural sector, 5-Economic growth shall be achieved through the development of the industrial sector (AGRvsIND)
6. 1-Increase productivity of food crops to guarantee food security, 5-Increase productivity of cash crops to guarantee greater farm income (FoodvsCash)
7. 1-Benefit the agricultural sector through technological progress, 5-Benefit the agricultural sector through better access to markets (TPvsAM)
8. 1-Agricultural sector should be taxed, 5-Agricultural sector should be protected (TaxvsProtect)
9. 1-Decision-making process without population, 5-Decision-making process with population (Accountability)

These were used to calculate distances for parties as the difference between the voters' own policy position and the perceived policy position of the parties. For the alternative Abstention, the minimal negative distance was considered. Therefore, the utility of non-voting is greater than the utility of voting and hence the voting paradox is fulfilled.

Retrospective Variables: In the survey, questions of satisfaction with government performance were asked. More specifically, there were questions where the interviewees evaluated the economic situation of the country and their own personal living conditions. Additionally, there were questions addressing the level of satisfaction of the interviewees with the performance of the current president, as well as, the implementation of agricultural policies by the government.

Non-policy Variables: A whole set of sociodemographic variables was included, as well as, other variables measuring the level of trust of voters on different types of institutions. Furthermore, to measure party loyalty, the variable Party ID was created. More specifically, alternative specific dummies were created, where "1" indicates party affiliation for that specific party and "0" otherwise. In the case of the alternative Abstention, the variable was set to "0" since there is no such thing as party identification for abstention.

Based on Mattes [2008], a Lived Poverty Index (LPI) was estimated. The level of poverty is high if it is closer to 5 and low if it is closer to 1. Likewise, an Ownership Index (OI) was calculated, where the number of possessions increases when the index approximates 6 and it decreases the closer it is to 0. Additionally, we created the dummy

variable “informed” based on a Political Knowledge Index (PKI). The PKI was designed as the result of the sum of all correct answers of the voter to a number of exogenous questions about political knowledge. Then, we set its median as the frontier that defines if the voter is informed or uninformed.

4 Empirical Application and Results

4.1 Nested Multinomial Logit Model

We estimated probabilistic voter models, more specifically, nested multinomial logit models (NML) to observe the factors that influence voting behavior in Senegal, as well as, those factors that influence people’s decision of abstaining. With the data previously described, we performed different model specifications including only the independent variables that, according to a p-value test, were significant. The goodness of fit was defined by means of the Akaike Information Criterion (AIC) and the Log-likelihood function. Additionally, the ruling party was taken as the reference for interpretation purposes. Finally, we tested for multicollinearity among these variables through the estimation of condition indices and variance decomposition proportions. In our optimal NML models we did not observe multicollinearity.

Table 2: Nested Multinomial Logit Models

| AIC = | Model 1 | | | | Model 2 | | | |
|-----------------------------------|---|----------------|---------|------------|---|----------------|---------|------------|
| | 960.2 | | | | 962.76 | | | |
| VARIABLES | Coefficients | Standard Error | z-value | Pr(> z) | Coefficients | Standard Error | z-value | Pr(> z) |
| Abstention:(intercept) | 1.9693 | 1.1592 | 1.7000 | 0.0890 . | 0.6416 | 0.8787 | 0.7300 | 0.4653 |
| Niang:(intercept) | -25.5810 | 39.4397 | -0.6500 | 0.5170 | -3.5743 | 52.8391 | -0.0700 | 0.9461 |
| Pastef:(intercept) | -0.1235 | 1.7964 | -0.0700 | 0.9450 | 5.3259 | 1.7178 | 3.1000 | 0.0019 ** |
| PUR:(intercept) | -1.0056 | 5.8305 | -0.1700 | 0.8630 | -1.3454 | 5.1023 | -0.2600 | 0.7920 |
| Rewmi:(intercept) | -0.8436 | 2.2581 | -0.3700 | 0.7090 | 4.1262 | 2.0564 | 2.0100 | 0.0448 * |
| PSvsEG | -0.1296 | 0.0515 | -2.5200 | 0.0120 * | -0.1396 | 0.0474 | -2.9500 | 0.0032 ** |
| FoodvsCash | -0.1085 | 0.0593 | -1.8300 | 0.0670 . | -0.0995 | 0.0592 | -1.6800 | 0.0930 . |
| Party_id | 6.1441 | 1.0621 | 5.7800 | 0.0000 *** | 6.2231 | 0.9168 | 6.7900 | 0.0000 *** |
| Abstention:Trust_media | 0.2695 | 0.1553 | 1.7400 | 0.0830 . | 0.2515 | 0.1416 | 1.7800 | 0.0756 . |
| Niang:Trust_media | 2.9692 | 8.9953 | 0.3300 | 0.7410 | 1.7342 | 11.8977 | 0.1500 | 0.8841 |
| Pastef:Trust_media | -0.0222 | 0.4165 | -0.0500 | 0.9570 | -0.0137 | 0.3746 | -0.0400 | 0.9709 |
| PUR:Trust_media | 0.2613 | 1.5814 | 0.1700 | 0.8690 | 0.2530 | 1.5580 | 0.1600 | 0.8710 |
| Rewmi:Trust_media | -0.5033 | 0.4060 | -1.2400 | 0.2150 | -0.7315 | 0.3700 | -1.9800 | 0.0480 * |
| Abstention:Trust_president | -0.6097 | 0.3134 | -1.9500 | 0.0520 . | -0.5491 | 0.2777 | -1.9800 | 0.0480 * |
| Niang:Trust_president | -0.8694 | 5.3895 | -0.1600 | 0.8720 | -0.7668 | 4.9735 | -0.1500 | 0.8775 |
| Pastef:Trust_president | -0.8224 | 0.5416 | -1.5200 | 0.1290 | -0.8497 | 0.4699 | -1.8100 | 0.0706 . |
| PUR:Trust_president | -0.5753 | 2.6174 | -0.2200 | 0.8260 | -0.5421 | 1.2206 | -0.4400 | 0.6570 |
| Rewmi:Trust_president | -0.8752 | 0.4952 | -1.7700 | 0.0770 . | -0.8247 | 0.4409 | -1.8700 | 0.0614 . |
| Abstention:Satisfaction_president | -0.6083 | 0.3182 | -1.9100 | 0.0560 . | -0.5433 | 0.2680 | -2.0300 | 0.0426 * |
| Niang:Satisfaction_president | -0.6632 | 4.6399 | -0.1400 | 0.8860 | -0.8373 | 4.9864 | -0.1700 | 0.8667 |
| Pastef:Satisfaction_president | -1.2154 | 0.7070 | -1.7200 | 0.0860 . | -1.2173 | 0.5155 | -2.3600 | 0.0182 * |
| PUR:Satisfaction_president | -0.7240 | 2.4990 | -0.2900 | 0.7720 | -0.6380 | 1.5356 | -0.4200 | 0.6778 |
| Rewmi:Satisfaction_president | -0.9405 | 0.5111 | -1.8400 | 0.0660 . | -0.9102 | 0.3695 | -2.4600 | 0.0138 * |
| Abstention:OI | -0.3591 | 0.6035 | -0.6000 | 0.5520 | | | | |
| Niang:OI | 14.5604 | 36.6231 | 0.4000 | 0.6910 | | | | |
| Pastef:OI | 4.8101 | 2.1661 | 2.2200 | 0.0260 * | | | | |
| PUR:OI | 0.3775 | 3.8722 | 0.1000 | 0.9220 | | | | |
| Rewmi:OI | 3.3750 | 2.1350 | 1.5800 | 0.1140 | | | | |
| Abstention:PKI | -0.0652 | 0.0655 | -1.0000 | 0.3190 | | | | |
| Niang:PKI | 0.8931 | 5.3232 | 0.1700 | 0.8670 | | | | |
| Pastef:PKI | 0.0087 | 0.2216 | 0.0400 | 0.9690 | | | | |
| PUR:PKI | 0.0075 | 0.3368 | 0.0200 | 0.9820 | | | | |
| Rewmi:PKI | 0.4091 | 0.2236 | 1.8300 | 0.0670 . | | | | |
| Abstention:LPI | | | | | 0.2519 | 0.1578 | 1.6000 | 0.1103 |
| Niang:LPI | | | | | -1.0678 | 5.7567 | -0.1900 | 0.8528 |
| Pastef:LPI | | | | | -1.2080 | 0.3415 | -3.5400 | 0.0004 *** |
| PUR:LPI | | | | | 0.1089 | 0.7939 | 0.1400 | 0.8909 |
| Rewmi:LPI | | | | | -0.4436 | 0.4429 | -1.0000 | 0.3165 |
| iv:government | 0.2952 | 0.0662 | 4.4600 | 0.0000 *** | 0.2951 | 0.0610 | 4.8400 | 0.0000 *** |
| iv:non_government | 0.8311 | 0.3413 | 2.4400 | 0.0150 * | 0.8980 | 0.3401 | 2.6400 | 0.0083 ** |
| Log-Likelihood: | ***p<0.001, **p<0.01, *p<0.05, . p<0.10 | | | | ***p<0.001, **p<0.01, *p<0.05, . p<0.10 | | | |
| McFadden R ² : | -445 | | | | -451 | | | |
| Likelihood ratio test : | 0.405 | | | | 0.397 | | | |
| | $\chi^2 = 606$ (p.value $\leq 2e-16$) | | | | $\chi^2 = 594$ (p.value $\leq 2e-16$) | | | |

Source: Own estimation

The constants of our models absorb all the information not comprised on the rest of variables. The policy issues PSvsEG and FoodvsCash turned out to be significant for both models with negative coefficients. This means that the greater the distance, the lower is the utility that a voter receives from supporting one of the parties within the choice set and consequently, lower is the probability to choose one of such alternatives. On the other hand, concerning the alternative Abstention, the greater the distance, the greater is the benefit from not participating in the electoral process. Furthermore, the last significant attribute in our models was Party Identification (PI) with positive coefficients.

This implies that, when a voter has party affiliation for a specific party, he will be likely to support such party.

Our models suggest that the more the voters trust the media, the higher is the probability to abstain compared to the ruling party BBY. Furthermore, model 2 indicates that the more a voter trusts the media, the less is the probability that he chooses Rewmi and therefore, the higher is the probability to choose the government party. Likewise, the more the voters trust the president and the higher is their level of satisfaction with his performance, the less is the probability that voters will abstain or choose either Rewmi or Pastef, and higher the probability that they support the government party in the electoral process.

In the nested model 1, the results imply that voters with a better economic situation have a higher probability to decide in favor of Pastef compared to BBY. Also, those voters having a higher level of political knowledge, are likely to choose Rewmi rather than supporting the government party. The results of the nested model 2 in turn, suggest that the higher the LPI of voters, the less likely is that they will choose Pastef, and more likely is that they will support BBY in the elections.

The nests in the models were Government if the voter support the incumbent party and Non-Government if the voter decides to either abstain or choose an opposition party. Furthermore, the significant lambda values (λ) are the nest elasticities (iv:government and iv:non_government). The correlation values ($1 - \lambda$) within the iv:government nest were 0.7048 and 0.7049 for models 1 and 2 respectively, and for the iv:non_government nest were 0.1689 and 0.1020.

We then proceeded to calculate the utilities and probabilities. The results are displayed in table 3 and show the mean probabilities for each alternative. It is clear that the ruling party BBY has a substantial advantage compared to the other alternatives in both models.

Table 3: Mean probabilities

| Alternatives | Nested Model 1 | Nested Model 2 |
|---------------------|-----------------------|-----------------------|
| Abstention | 18.14% | 18.14% |
| BBY | 71.80% | 71.80% |
| Niang | 0.36% | 0.35% |
| Pastef | 4.99% | 4.97% |
| PUR | 1.05% | 1.06% |
| Rewmi | 3.66% | 3.68% |

Source: Own estimation

4.2 Government Performance Indicators

In order to evaluate the importance of each voting component, the next step was to obtain the relative marginal effects *RME*. The estimation of the *RME*, allows to see how sensitive are voters to changes in each voting motive. Unsurprisingly, as displayed in table 4, all voters choose, in general, more non-policy oriented. However, it is worth noting that non-voters tend to choose more retrospectively oriented and less policy and non-policy oriented than those who decided to take part in the electoral process.

Table 4: Relative Marginal Effects

| Components | Nested Model 1 | | | Nested Model 2 | | |
|----------------------|----------------|--------|---------|----------------|--------|---------|
| | Non-Voting | Voting | p-value | Non-Voting | Voting | p-value |
| Non-Policy | 77.71% | 80.03% | 0.0000 | 75.92% | 78.19% | 0.0000 |
| Policy | 1.39% | 1.55% | 0.0002 | 1.55% | 1.72% | 0.0000 |
| Retrospective | 20.91% | 18.42% | 0.0000 | 22.52% | 20.09% | 0.0000 |

Source: Own estimation

In this context, the more policy and retrospectively oriented voters choose, the more accountable the government is. An accountable government in turn, develops and applies efficient policies whose beneficiaries are the majority of voters instead of lobbying groups with a customized agenda. We estimated accountability indices for both models and the results in table 5 indicate that, although in general, the electorate in Senegal does not hold the government accountable, non-voters have a higher accountability index. Therefore, this group of people hold the government more accountable.

Table 5: Accountability indices

| | Nested Model 1 | Nested Model 2 |
|-------------------|----------------|----------------|
| Non-Voting | 22.29% | 24.08% |
| Voting | 19.97% | 21.81% |

Source: Own estimation

The government in its quest to be reelected might still have incentives to please the interests of special groups at the expense of the majority of voters. This problem of underrepresentation known as capture is common in electoral processes. To derive capture indices, we first had to calculate the political weight of groups within the electorate. The results in table 6 indicate, for example, that voters living in urban areas, women and young people capture the rural, men and old people respectively. Likewise, married people and farmers are captured by other marital status and non-farmers. Regarding ethnicities,

voters belonging to the Maures ethnic group capture other ethnicities, whereas the Serere ethnicity is captured by other tribes. Additionally, people with a low LPI and those with less political knowledge capture the poorer, as well as, those with higher political knowledge respectively. Finally, it is important to highlight that non-voters have a higher political weight and capture people who cast a vote. Therefore, they could incentive the government to choose and implement more efficient policies.

Table 6: Capture indices

| | Nested Model 1 | Nested Model 2 |
|-----------------------|-----------------------|-----------------------|
| Rural vs. Urban | 0.7646 | 0.7757 |
| Men vs. Women | 0.8451 | 0.8656 |
| Young vs. Old | 1.0573 | 1.0593 |
| Married vs. Other | 0.9016 | 0.8908 |
| Serere vs. Other | 0.8357 | 0.8109 |
| Maures vs. Other | 1.1762 | 1.2378 |
| Farmer vs. Non-Farmer | 0.9273 | 0.9317 |
| Low LPI vs. High LPI | 1.1578 | 1.0652 |
| Low PKI vs. High PKI | 1.2759 | 1.2053 |
| Non-voting vs. Voting | 1.5766 | 1.5817 |

Source: Own estimation

More in detail, as table 7 shows, the group of abstainers is comprised of more rural, younger and poorer voters than the group of people who cast a vote. Also, the non-voting group has more people belonging to the Maures ethnicity and with less political knowledge, compared to the group that takes part in the electoral process.

Table 7: Socio-demographic Characteristics

| | mean | mean | |
|-----------------|-------------------|---------------|----------------|
| | Non-Voting | Voting | p-value |
| Rural | 0.8758 | 0.8220 | 0.0784 |
| Age | 36.5098 | 39.0753 | 0.0833 |
| Kaffrine | 0.1503 | 0.2171 | 0.0439 |
| Serere | 0.0261 | 0.0695 | 0.0077 |
| Mandika_Bambara | 0.0131 | 0.0347 | 0.0616 |
| Maures | 0.0392 | 0.0043 | 0.0302 |
| LPI | 2.8392 | 2.6751 | 0.0215 |
| OI | 0.4161 | 0.4525 | 0.0529 |
| PKI | 3.6405 | 4.1664 | 0.0021 |

Source: Own estimation

The analysis of the policy component is very important in our research study. Nevertheless, our results have already demonstrated that voters in Senegal choose more non-policy oriented. In this sense, the most relevant non-policy variable in our models was Party Identification. People who abstain usually do not have any party affiliation. On the other hand, people who take part in the electoral process and have PI mostly choose the party towards they have PI. However, when looking at table 8 we can see that more than 50% of the people who said that would vote, do not have PI. In this context, it is worth noting that, in general, people tend to lie when they are asked about their intended vote choice. Many of them use to say that they will support the incumbent party, but in reality they will abstain or choose an opposition party. Therefore, based on the results of our survey compared to the official election outcome (displayed in table 1), we might assume that most people without party affiliation did not choose BBY, but instead they decided to abstain or vote for an opposition party.

Table 8: Analysis of the variable Party Identification

| Party ID | Choice | | | | | |
|-----------------|-------------------|------------|--------------|---------------|--------------|------------|
| | Abstention | BBY | Rewmi | Pastef | Niang | PUR |
| No | 128 | 335 | 9 | 15 | 1 | 4 |
| Yes | 25 | 271 | 22 | 27 | 2 | 5 |

Source: Own estimation

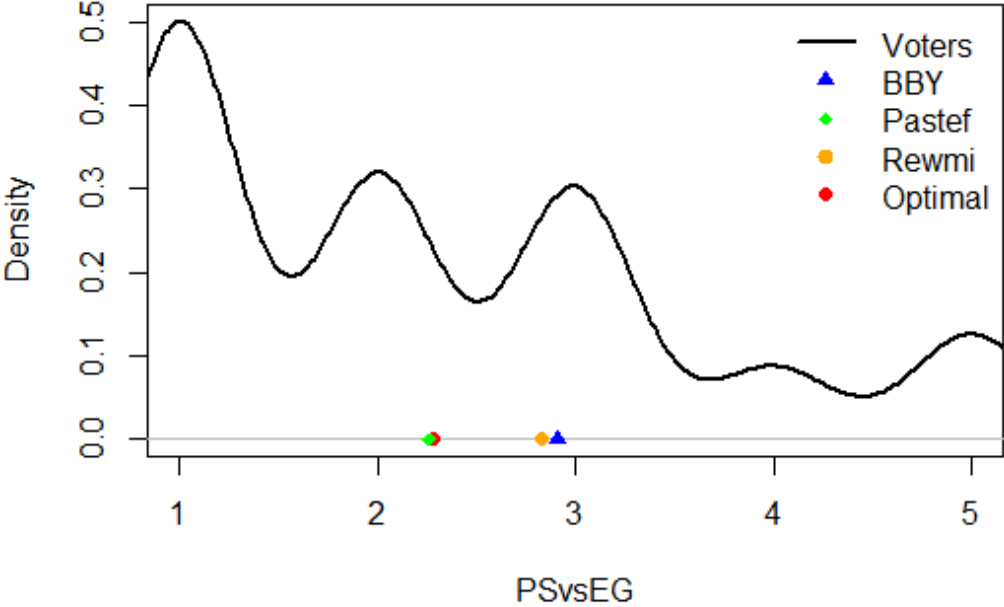
Additionally, according to the model people with higher OI and lower LPI, for simplicity named as rich people, choose Pastef. On the other hand, those with a higher PKI (informed people) are likely to choose Rewmi. In this sense, according to our data, almost

50% of the interviewees have no PI and are either rich or well informed. This suggests that if the two main opposition parties form a coalition they have a higher probability of winning the elections, as long as, abstainers decided to vote.

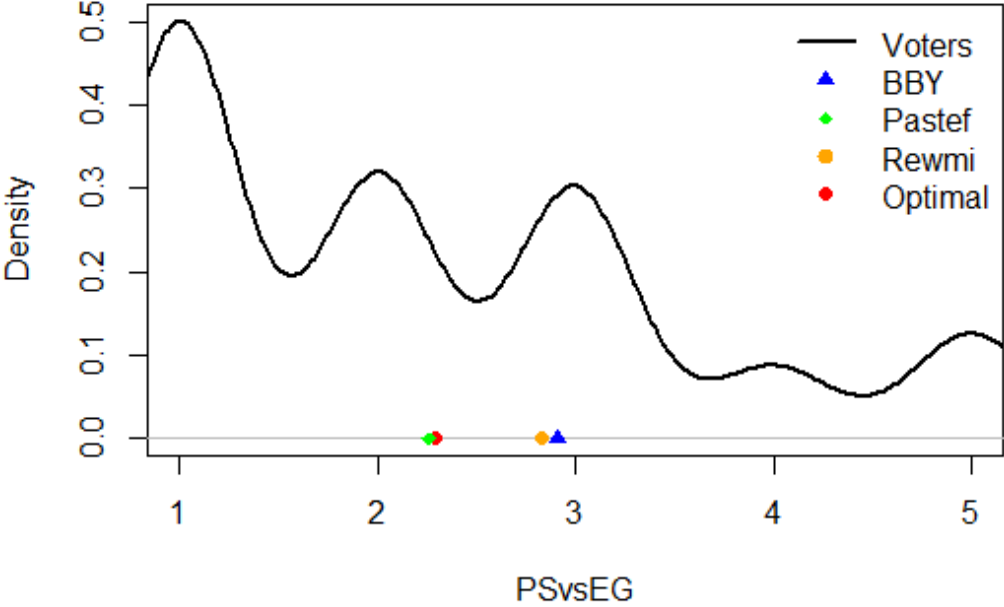
5 Nash Equilibrium

The last stage in our research study was to derive a FOC and a SOC to identify the optimal policy positions (Local Nash Equilibrium) for the issues PSvsEG and FoodvsCash. At these positions, the ruling party has no incentives to move away from because its probability of winning the elections is maximized. In the following figures 1 and 3 the optimal policy positions on each issue are displayed, along with the mean perceived policy positions of the main parties and the positions of all voters.

Figure 1: Policy Positions for PSvsEG



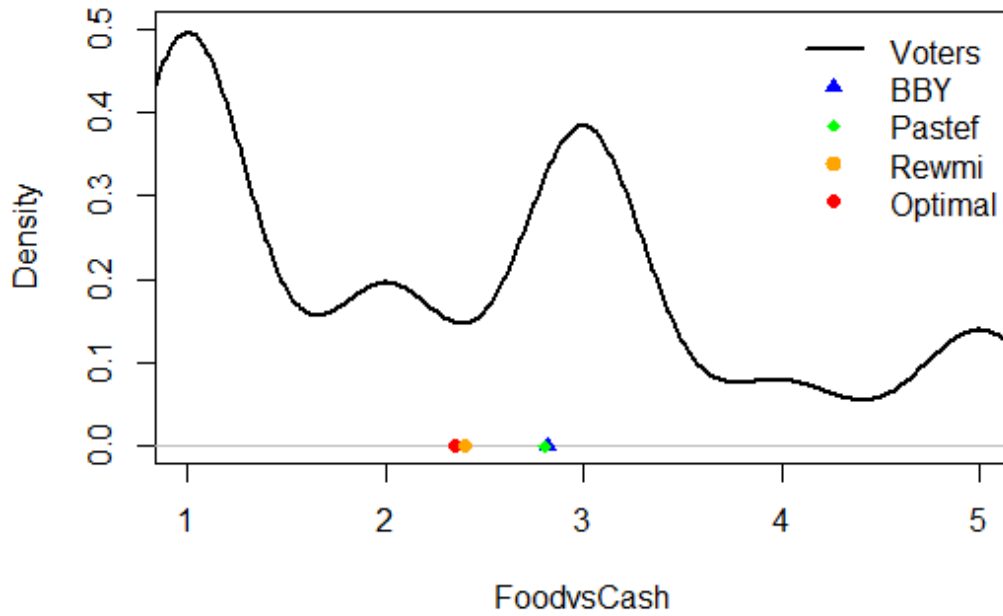
(a) Nested Model 1



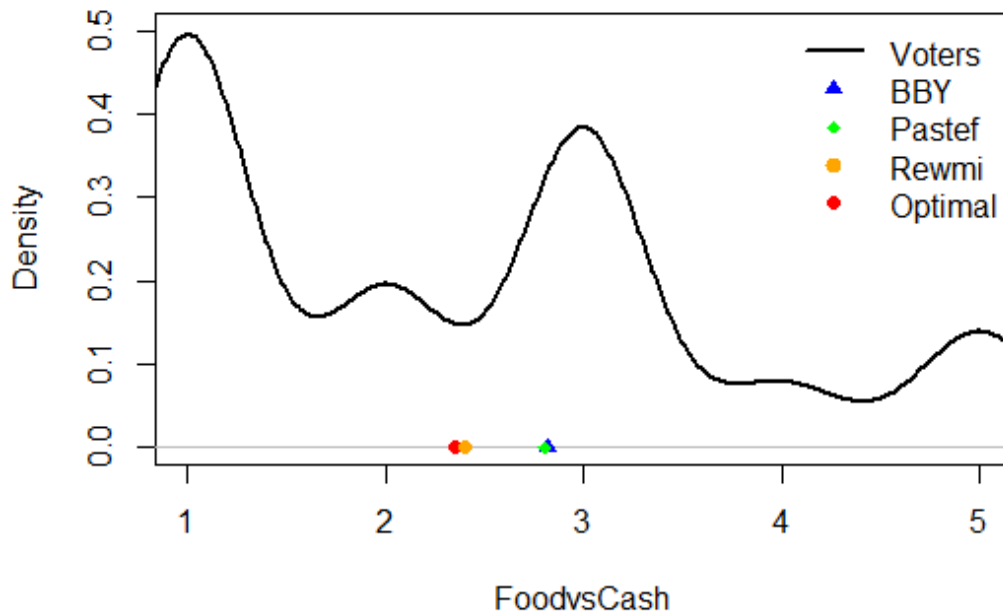
(b) Nested Model 2

Source: Own estimation

Figure 3: Policy Positions for FoodvsCash



(a) Nested Model 1



(b) Nested Model 2

Source: Own estimation

For the incumbent party BBY to be on its optimal policy position for each issue, it has to move to the left in both cases. In other words, regarding the issue PSvsEG, BBY should design and implement policies where tax revenues are mainly used to provide public services like health, education or security, rather than promoting economic growth. Likewise, concerning the issue FoodvsCash, the ruling party should promote more policies looking to guarantee food security, instead of securing a greater farm income. In this sense, the changes should be around 21% for the former issue and 16.5% for the latter. Should the party in power move to the aforementioned optimal positions, it would increase its probabilities of winning the elections by approximately one percentage point.

On the other hand, it is interesting to highlight the fact that the main opposition parties (Pastef and Rewmi) are perceived to be closer to the optimal policy position than BBY for both issues. Further in detail, for the issue PSvsEG, Pastef is perceived to have a policy position closer to the optimal, but Rewmi also has a closer position than BBY on the same issue. Regarding the issue FoodvsCash, Rewmi is the party perceived to be closer to the optimal position, and Pastef comes in second place, while the position of BBY is again the farthest.

6 Summary and Conclusions

The post-colonial history of Senegal has been considered a successful example of how to establish a stable democracy. Compared to its neighbor countries, that have experienced military takeovers or at least attempts at one and rigged electoral processes, the Senegalese elections have been considered relatively fair. However, there has been a decline in the voter turnout over the past elections, which means that the party system is somehow failing to engage voters in recent years.

In this study we evaluate the factors that influence voting behavior in Senegal, as well as, those factors that influence people's decision of abstaining. More specifically, we assess the importance of the non-voters group in the policy making process of the country, to determine if they could motivate the Senegalese government to implement efficient policies. For this purpose we estimated nested multinomial logit models including the alternative Abstention in the choice set.

Our results suggest that policy issues, party identification, variables related to the level of trust that voters have on the media and the incumbent, their level of satisfaction with the performance of the president, as well as, their Lived Poverty Index and political knowledge are important when making an electoral decision. The estimations also point at the ruling party BBY as the winner and show that most people have a tendency to make their decision more non-policy oriented. Nonetheless, the group of abstainers tend to choose more retrospectively oriented and less policy and non-policy oriented compared to

those who decided to participate in the elections. This implies that the group of non-voters have a higher accountability index and thus, hold the government more accountable.

As regards the capture indices, voters living in urban areas, women, non-married, non-farmers and young people, as well as, voters belonging to the Maures ethnic group and to other ethnicities different than Serere, and those with a low LPI and with less political knowledge, have a higher political weight for the incumbent party BBY. In this sense, abstainers are mainly comprised by young people, people with an ethnicity different than Serere, people from Maures and the less informed. This leads to the abstainers also having a higher political weight for the government party and therefore, capture people who cast a vote. This means, that from a perspective looking to the Senegalese society's welfare, they could incentive the government to choose and implement more efficient policies if they decided to participate in the elections.

The analysis of the policy component is very relevant in our research, but our results showed that Senegalese people choose more non-policy oriented. In this sense, we see that the most significant non-policy variable in our models was "Party Identification" and abstainers usually do not have party affiliation. Furthermore, more than 50% of the people who said that would vote, do not have PI and in general, people tend to lie when they are asked about their intended vote choice. Therefore, we might assume that most people without party affiliation did not choose BBY, but instead they decided to abstain or vote for an opposition party.

Additionally, our models suggest that rich people support Pastef. On the other hand, the informed voters are likely to choose Rewmi. According to our data, almost half of the interviewees have no PI and are either rich or well informed. This suggests that if the two main opposition parties form a coalition they have a higher probability of winning the elections, as long as, abstainers decided to vote.

The next stage in our study was to identify the optimal policy positions (Local Nash Equilibrium) for the policy issues, where the government maximizes its probability of winning and has no incentives to move away from. We observed that the main opposition parties are perceived to be closer to the optimal policy positions than the party in power for both issues. This in turn implies that policy oriented voters might decide to choose an opposition party, giving an incentive to the ruling party to change its policy positions on these issues.

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