universität wien

MASTERARBEIT / MASTER'S THESIS

Titel der Masterarbeit / Title of the Master's Thesis

Who would Bayes vote for?

verfasst von / submitted by

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angestrebter akademischer Grad / in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien, 2018 / Vienna , 2018

Studienkennzahl lt. Studienblatt / degree programme code as it appears on the student record sheet:	A 066 913
Studienrichtung lt. Studienblatt / degree programme as it appears on the student record sheet:	Master's Programme in Economics
Betreut von / Supervisor:	Univ.-Prof. Dr. Jean-Robert Tyran

Abstract

My master thesis aims to gain a deeper understanding why voters are failing to pick those politicians for office, which would serve their interests best. Previous research found that falsely updated information is an important factor in the misperception of abilities of politicians. Using a laboratory experiment it is feasible to control possible sources of biased voter perception in order identify the roots of biases in the process of voters' belief-forming. In the experiment voters are provided with all the information that is necessary, to form rational beliefs about the politicians' ability. To eliminate any further possible effect of Bayesian updating bias a so called Bayesian Calculator was implemented. The experiment shows that despite the help of this calculator voters are struggling to estimate the type of politicians correctly, for various reasons.
Since the treatment did not allow me to detect a direct connection between the estimation of politicians' strategies and elicitation of beliefs I suggest possible extensions of the treatment in order to explain the evaluated beliefs by voters' abilities to estimate politicians' strategies.

Zusammenfassung

Das Ziel meiner Masterarbeit ist es ein tieferes Verständnis dafür zu gewinnen, warum Menschen daran scheitern die fähigsten Politikerinnen zu wählen, obwohl es ihrem eigenen Interessen entsprechen würde. Bestehende Forschung konnte bereits darlegen, dass falsch verarbeitete Information dazu führen kann, dass die Fähigkeiten von Politikern in Folge falsch eingeschätzt werden. In dieser Arbeit möchte ich noch einen Schritt weiter gehen und in einem Laborexperiment einzelne Einflussfaktoren kontrollieren, welche die Einsichten der Wählerinnen verzerren können, um dadurch die Kernprobleme verzerrter Meinungsbildung zu identifizieren. Im Experiment haben die Wähler alle notwendigen Informationen, um rationale Einschätzungen über die Fähigkeiten der Politiker zu bilden. Um den sogenannten Aktualisierungsbias zu eliminieren wurde ein, Bayesianischer Rechner' implementiert. Selbst mit der Hilfe dieses Rechners haben die Wähler Probleme die Politiker richtig einzuschätzen. Dies hat mehrere mögliche Gründe.
Da das implementierte Treatment jedoch keine direkte Verbindung zwischen der subjektiven Einschätzung der Wahrscheinlichkeiten und der Einschätzung der Politiker zulässt, schließe ich mit Empfehlungen zu Erweiterungen für Folgestudien.

Acknowledgements

I would like to thank my supervisor Jean-Robert Tyran, who financed this study and guided me with his expert knowledge and experience through my master thesis. Parts of the experimental design and data presented in this master thesis are related to an ongoing research project by Florian Schuett, Jean -Robert Tyran, and Alexander K. Wagner (see also Schuett et al. 2018).

Contents

1 Introduction

Behavioural economics provides an extensive literature and evidence suggesting that many people are struggling to form probabilities in a statistically correct and rational way.[1]
The first experimental study from Kahneman and Tversky (1972) describes how participants assess probabilities under uncertainty. The experiment demonstrated that people's statistical evaluation of abilities is biased and therefore their estimations deviate from the Bayes Rule predicted probabilities. Further literatures[2] discuss how people are creating their beliefs and reveal that belief-formation is not in accordance with Bayes' rule, but rather it is deviating systematically from the predictions of Bayes rule.

Although this study provided subjects with all relevant probabilities (such as prior probability that a politician is of high ability) in an experimental environment subjects still failed to act entirely rational. If we take into account the complexity and uncertainty of events which determine decision-making and acts in everyday life, the probability of taking into consideration Bayes rules is even smaller as in an experimental setting. For example, deciding to take an umbrella with me when I leave home is determined by forming a belief about the chance that it is going to rain. To form a belief whether to trust the weather forecast or not I need to rely on my previous observations, i.e., my experience. After observing the cloudy sky I still need to judge the probability whether it is going to rain or not. This kind of belief forming determines our everyday decisions.

Previous experience and belief formation have also considerable impact on election decisions. To be able to decide whom to elect one has to form some beliefs over the politicians' abilities, by taking into consideration various factors observed in the past. The kind of bias, as emphasized by Kahneman and Tversky (1972), has a major role in electoral decision making as well. Before voters decide whom to elect they assess politicians' abilities. However, the evaluation of politicians' abilities is a more complex procedure as earlier judgement and decision making literature suggests.

Schuett et al. (2018) measured voters' beliefs about politicians and found that even providing full information for voters they are still more indulgent with politicians than the equilibrium beliefs predict. This leads voters to re-elect incompetent politicians too often. Voters tend to overestimate politicians' abilities even though they assess all the necessary information to be able to elicit their belief. These findings are in line with the study of Holt and Smith (2009), which provides evidence for representativeness bias using an urn model. This study[3] provides evidence that people always tend to calculate with a prior 50% even though the prior is only 20%, consistent with base-rate neglect. This could serve as an explanation that voters cannot incorporate the factor that it is less likely to deal with a skilled politician than with politicians who merely pretend they are skilled.

However, the question of how and why exactly voters fail to evaluate politicians is still not answered. The main deficiency of previous research on biased behaviour of

[1] Starting with the work of Kahneman and Tversky (1972) which was extended later with (Kahneman & Tversky, 1973), (Kahneman & Tversky, 1977) and (Tversky & Kahneman, 1983).

[2] Such as (Kahneman & Tversky, 1973) and (Kahneman & Tversky, 1977)

[3] Based on previous psychological studies such as (Grether, 1980) and (Gonzalez & Wu, 1999).

voters is that they detect several implications of different kinds of biases[4], but they do not discover the core of the problem; that is, how do voters form beliefs about politicians and at which points do they struggle to form these beliefs.

In my master thesis I follow the experimental design in Schuett, Wagner, and Tyran (2018), which ensures an environment for voters where they are faced with uncertainty about the type of politician (low or high ability), but they have all the information to be able to form beliefs, which corresponds to the equilibrium beliefs predicted by rational theory. In this game an asymmetric outcome is incorporated and only high ability politicians know the state of the world, that is, know with certainty with which action can they maximize their utility. Low ability politicians receives only a signal about the state of the world, which suggest them choosing an action with uncertainty[5]. The asymmetric outcome allows politicians to play the equilibrium strategies, which ensures them (with equilibrium probabilities) to get reelected after voters observed the signal, the action of the politicians, and the outcome. Since voters do not know the type of the politicians, they can only guess the probability with which the politician in office is a high type.

The aim of my master thesis is to gain an understanding about where voters in the evaluation process fail to estimate politicians' ability. Within this study, I extend the experimental design of Schuett et al. (2018) to understand in what part of the elicitation phase voters fail to estimate politicians' abilities. Because previous research of Schuett et al. (2018) detected significant deviations in the elicited beliefs from the fully rational benchmark, I assume that this arises from the problem, described by Kahneman and Tversky (1972), that voters fail to incorporate the correct priors to form beliefs over politicians' abilities. To exclude the possible failure of voters regarding the updating bias (also known as base-rate neglect) I implemented in the experiment a so called Bayesian Calculator.
The Bayesian Calculator calculates a belief for the subjects while incorporating the correct prior that voters seem to ignore. This Bayesian Calculator allows me to understand in more detail how voters think about the strategy of politicians. Additionally, this setup creates the possibility to learn whether voters understand how politicians act and whether they are able to learn about politicians' strategies over time. Furthermore, within this experimental setup I examine various possible aspects where voters fail to estimate politicians' strategies and how these influence the election decisions of voters. My master thesis illuminates all the possible cases when voters behave biased during their belief elicitation in more detail. The results also contribute to the literature on belief elicitation especially on election decisions by supplying a deeper understanding of where voters fail to understand the strategy of politicians.

After evaluating the results I found a more rational behaviour in politicians' decision making. This can be explained by the fact that the calculated beliefs are significantly closer to the equilibrium predicted beliefs, and therefore voters' decision electing low ability politicians significantly decreases. This development in voters' behaviour can be explained by the Bayesian Calculator, which correctly updates the voter's belief about

[4]Such as hindsight bias by Schuett and Wagner (2011) or correlation neglect bias by Levy and Razin (2015).

[5]It is 55% sure that the signal is correct.

the politician using correct priors. However, I found that voters seriously struggle to estimate low ability politicians' strategies, especially in the case when the forecast suggests them to choose the more risky option. Not being able to estimate low ability politicians' strategy has a significant impact on reelection decisions, namely, less high ability politicians get reelected. Last but not least, I found indirect evidence that if the calculator would calculate with a wrong prior, as voters did in the previous treatment, it would not correspond to the earlier treatments, in which voters did not possess the calculator. This can happen because the calculator corrects the prior and this implies the correction of surprise effect, but voters still fail estimating the equilibrium strategies of politicians. However, it has been clear that to gain a precise insight into voters' evaluation method of beliefs further extensions are needed.

The paper is structured as follows. First, I will recapitulate the literature behind my decisions. Then, in section 2, I will develop a variant of the game of Schuett et al. (2018) including the Bayesian Calculator. Additionally, in section 2.3, I will explain the Bayesian Calculator and its' advantages in more detail. Section 3 will present the change in the behaviour of politicians as a result of the Bayesian Calculator. In section 4 I will compare the main findings of my treatment to the previous one from the voters' point of view. Section 5 will summarize the results to show how voters estimated the strategies of politicians. In section 6 I will analyse the different aspects where voters' fail during the estimation of strategies and how this affects their election decisions. In Section 7 I will provide an indirect overview to what extend voters are struggling with updating priors. Finally, I will suggest some extensions to this research; in Section 8 and in Section 9 I will discuss my findings and conclude.

1.1 Literature Review

A large body of literature of behavioural political economics is committed to understand what kind of bias determines voters' irrational behaviour. Two major issues have been detected in voters' decision making. How voters recall information (e.g. Gennaioli and Shleifer (2010), Mullainathan (2002)) and how do they process the available information (e.g. Peterson and Beach (1967), Achen and Bartels (2004) and A. J. Healy, Malhotra, and Mo (2010)).

Gennaioli and Shleifer (2010) shows in theory that the "local thinkers" differs from rational voters, because they is not able to form the equilibrium beliefs, as they fails to recall all the necessary and accessible information. Mullainathan (2002) explains memory limitations with rehearsal and association of past experiences.

However, memory limitations are not the only obstacles what voters have to deal with. Voters tend to make systematic attribution errors when they are interpreting and processing the information, therefore Wolfers et al. (2002) characterized them as quasi-rational.

Different kinds of natural experiments (e.g. Achen and Bartels (2004), A. J. Healy et al. (2010) and Huber, Hill, and Lenz (2012)) found evidence that voters are not able to use correctly accessible information.

A. J. Healy et al. (2010) finds in their natural experiment that even a win in the local baseball team could affect voters' behaviour. This means that voters tend

to process unnecessary information as well, when they decide whom to elect. Achen and Bartels (2004) finds evidence in their natural experiment that human cognitive limitations form an obstacle for voters when voters should understand the connections between the action of the incumbent and their outcomes.

Since memory imperfections affect the decision making process (Wilson, 2014), recent theoretical research (e.g. Ashworth and De Mesquita (2014)) questions whether voters are "sufficiently rational". Some other recent works (e.g. A. Healy and Lenz (2014), Bisin, Lizzeri, and Yariv (2015), Levy and Razin (2015) and Schuett and Wagner (2011)) beyond asking the question whether voters' behaviour deviates from the equilibrium, investigate possible consequences of bonded rationality on equilibrium behaviour in theoretical models.

Previous research (A. Healy & Lenz, 2014) explored the intentions of voters. Through experimental research these authors found that voters weigh the importance of the election-year more than previous years. This finding is in line with the results of the natural experiment of Huber et al. (2012). These papers found that time-inconsistency explains why voters tend to elect manipulators instead of the most appropriate politicians, since manipulators take an advantage of biased voters. Bisin et al. (2015) also assumed that voters are time-inconsistent. They showed that the unattractive commitment of time inconsistent voters may lead to disadvantageous fiscal policies.

Besides time-inconsistency numerous other forms of biased behaviour of the voters have been found relying on information processing and weighting. Some studies found advantages of some of the biased behaviour of voters. The study of Levy and Razin (2015) showed theoretically that correlation neglect could actually help alleviate externalities. Besides correlation neglect, voters who are hindsight biased also tend to behave in a more rational way. Previous research (Schuett & Wagner, 2011) explains that since hindsight biased voters tend to reconstruct the memories in favour of interpreting the outcome of the event as obvious. However, its effect only serves as a tool to motivate politicians to gamble less, but does not help voters to elect the appropriate politician. Both studies focus on voters with different kind of memory distortions. This theory models that voters tend to forget about necessary information and reconstruct their memories focusing only to the outcome. This is in line with psychology literature on reconstructive memory of Kahana (2012).

Recent research (Schuett et al., 2018) presents the importance of memory in election decision making. Schuett et al. (2018) developed a model in which voters had to take several factors into consideration when making an election decision. As already Schuett and Wagner (2011) mentioned voters tend to reconstruct their memories using recent information. Therefore, to eliminate the possibility of missing information or incorrect information, Schuett et al. (2018) provides all the necessary information for voters to ensure full memory. The authors compare the outcomes with a treatment in which voters are not reminded about the necessary information when forming their beliefs about politicians. They find evidence that voters are more able to differentiate between gamblers and appropriate politicians if full information is provided for them. However, in both cases voters tend to be more indulgent to politicians than rational theory would predict. This finding inspired me to explore the reason behind the indulgence behaviour of voters. Forming beliefs needs, on the one hand, being able to use the given information

correctly, and on the other hand, being able to update the correct prior.

The above mentioned studies can serve as an explanation that voters in the game of Schuett et al. (2018) were not able to process the given information, even though full information was provided for them, and hence, they failed to form the equilibrium belief.

Forming beliefs over politicians' abilities is an intuitive statistical prediction of the voters. Gigerenzer and Hoffrage (1995) finds experimental evidence that people tend to perform better applying Bayes Rule if the question is represented visually or with frequencies, although people still seem to lack of understanding its' application. The study of Kahneman and Tversky (1972) finds (among others in further studies (Kahneman & Tversky, 1973) (Kahneman & Tversky, 1977) and (Holt & Anderson, 1996)) evidence that "man is apparently not a conservative Bayesian: he is not Bayesian at all" (Kahneman & Tversky, 1972). This statement is based on a simple experiment where subjects need to estimate probabilities. These examples contain basic Bayesian probabilities and it provides evidence that subjects deviate from Bayesian rule when they judge likelihoods of events.

The question arises, when people estimate the abilities of politicians, do they apply the Bayesian Rule? Do they think about that being faced with a gambler might have a higher probability than being faced with an appropriate politician?
The study of Holt and Smith (2009) is based on the game of the studies in (Grether, 1980) and (Grether, 1990). This game requires subjects to judge probabilities of unknown events. This experimental design allows investigating in which dimension subjects deviate in their estimation from the Bayes Rule predicted probabilities. They find that the deviation is the smallest if the prior of the event was 50%. As the prior deviates from 50% a tendency was observed that people deviate from the Bayesian Rule predicted values, as if they would incorporate the prior as 50%. This means that if the prior is lower than 50%, people's estimation is slightly higher than the Bayes Rule would predict. This is in contrast to the case when the prior is higher than 50% the estimations are slightly lower as the Bayes Rule would predict.

Based on this theory I assume that in the game of Schuett et al. (2018) voters are not able to correctly incorporate the prior, and particularly that there are less appropriate politicians as gamblers, even though they are informed about it. However, estimating politicians' abilities in the game (Schuett et al., 2018) voters have to deal with more complex tasks than the examples in the experiment of Kahneman and Tversky (1972) or Holt and Smith (2009)suggest. To eliminate at least one of the possible sources of voters' estimation bias a Bayesian Calculator will be implemented for voters in my master thesis. It rules out the possibility that voters miss to update some factors and allows me to observe where else voters can fail to estimate politicians' abilities.

2 Experimental setup

Subjects participated in a two and a half hours economic experiment, which replicates the experiment of Schuett et al. (2018). The experiment was fully computerized and was run by z-Tree (Fischbacher, 2007) to program the experiment and ORSEE (Greiner, 2015) to recruit participants. After 20 periods of the election game, subjects completed several tasks where we were able to collect some data about some individual characteristics of the subjects. These tasks were included after the twentieth period, such as a beauty contest game, a lottery from Holt and Laury and a handedness test. Furthermore, we tried to test their long-term memory with questions about the last game and their working memory with a backwards working-memory test.[6]

2.1 Experimental design

Figure 1: Time line of the experiment in CALC treatment

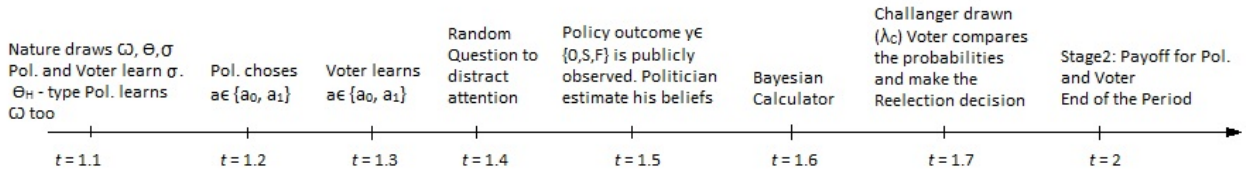


Figure 1 describes the time line of one period of the election game. During the first period participants were assigned a role (voter or politician). Role assignments were not change over the 20 periods. In each period participants were matched with someone else randomly. The politician's ability($\theta \in L, H$) could change after each period. Either they could be a low ability politician ($(1-\lambda) = Pr(\theta_L) = 80\%$), who only learns σ , which predicted the state of the world only with $\rho = 55\%$[7], or he could be assigned as a high ability politician with 20% chance ($\lambda = Pr(\theta_H) = 20\%$), who besides σ also learned the true state of the world ω which reported the state of the world with certainty).

In the beginning in each round the politician and the voter learned the signal (high ability politicians also learned ω), then the politician needed to choose an action in $t = 1.2$ (in Figure 1). Afterwards, the chosen action ($a \in [0, 1]$) was observed by the voters, then the outcome ($y \in [4, 12, 20]$) was reported in $t = 1.5$.

The only difference to the game of Schuett et al. (2018) appeared in the next period in $t = 1.6$. In this treatment instead of estimating μ the probability that the incumbent with whom voters were matched up with, voters needed to state their beliefs regarding politicians strategy choices in different situations. With the help of the estimated strategy choices the Bayesian Calculator reported μ depending on the situation(σ, ω, and a). In the next step, voters had to decide whether they want to reelect the incumbent

[6] See the screen instructions and more detail about the game and tasks in Appendix at page 64.

[7] ρ describes the probability that the signal is correct.

with whom they were playing with or they elect the challenger. The only information according to the challenger was the probability that the challenger was a high ability politician. Taking into consideration the calculated belief (μ) and the (random) percentage of the challenger voters had to decide whom to (re-)elect. If the incumbent got reelected (independently from his type) he received an additional 6€. If the challenger got elected, a randomly assigned politician received the additional 6€. The incentives to elect a high type politician for the voter was determined by the pay-off (see in Figure 2). In case they elected a high type politician they received 25€, otherwise 10€. However only one random period was paid for the subjects.

Figure 2: Asymmetrical outcome of the game

	Action of politician	
Real state of the world	$a = 0$	$a = 1$
$\omega = 0$	12	4
$\omega = 1$	12	20

2.2 Data description

The data for my thesis - treatment "CALC" - was collected in the Vienna Center for Experimental Economics (VCEE). 5 Sessions of this treatment were run in November 2017 and 2 additional sessions in March 2018. For the treatment "INFO" from Schuett et al. (2018), the first 5 Sessions were run in December 2016 and an additional 2 Sessions in March 2018 also in the VCEE. In both treatments 168-168 subjects participated in total. The experimental sample in case of the treatment "CALC" consists of approximately 55% female and 45% male students, with a mean age of 24,6 and on average the participants are enrolled at the university since 2013.

At the end of the game, participants had to fill out a questionnaire, where on average they estimated their risk aversion preferences 2.73 (1 = risk averse and 4 = risk loving), meaning that on average they were risk neutral. Through the game of Holt & Laury, 2002, subjects showed in the CALC treatment a behaviour on average 3.91 (1 = risk averse and 10 = risk loving). These results show more risk averse preferences, as subjects estimated their selves.
After the end of the game, subjects participated in a guessing game (Nagel, 1995), where in average their guess was 38.82. This is close to the value which represents that subjects were thinking on average close to degree 1 (Nagel, 1995).

In general there are no significant differences between the descriptive variables of the two treatments, except of the variable *yearuni*. However this difference comes from the 1,5 year time gap between running the two treatments.

Table 1: Summary statistics

	CALC			INFO			WRS
	count	mean	sd	count	mean	sd	
age	168	24.60	6.08	168	24.92	5.72	0.265
female	168	0.55	0.50	168	0.54	0.50	0.913
yearuni	168	2012.64	5.00	168	2010.61	10.25	0.001***
riskgeneral	168	2.73	0.70	168	2.59	0.76	0.810
choicebhl	168	3.91	2.70	168	3.82	2.50	0.810
guessbeauty	168	38.82	20.13	168	41.24	22.33	0.479

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

yearuni describes the year when the participant started at the university

riskgeneral describes the risk preference, ranked by themselves

choicebhl describes the risk preference, according to the game of Holt and Laury (2002)

guessbeauty describes the number estimated by the participants, in the Beauty contest

2.3 A new invention - The Bayesian Calculator

As mentioned above, the Bayesian Calculator calculates the beliefs of the voters, with the help of the by voter estimated strategies of the politicians and dependently from σ, ω, and a.

As was described in the previous section (Section 2.1), Nature drew randomly $\omega \in [0, 1]$, which described the real state of the world. Accordingly to the drawn omega $\sigma \in [0, 1]$ nature also drew the signal ($\sigma \in [0, 1]$) which described for voters and politicians the possible state of the world with 55% correctness. Depending on the action of the politician $a \in [0, 1]$ an asymmetrical outcome was determined (see Figure 1). All in all, voters were faced with six different events and the Bayesian Calculator adapted it's output μ according to the situation with what voters were faced with:

- $\sigma = 0, a = 0, y_O = 12$, as the signal was 0 and the politician acted according to the signal, the final outcome was 12 (independently from the real state of the world ω)
- $\sigma = 1, a = 0, y_O = 12$, as the signal was 1 but the politician acted against the signal and the final outcome was 12 (independently from the real state of the world ω)
- $\sigma = 0, a = 1, y_F = 4$, as the signal was 0 and the politician acted against the signal and the outcome was a failure (meaning that $\omega = 0$)
- $\sigma = 1, a = 1, y_F = 4$, as the signal was 1 and the politician acted according to the signal, however the outcome was a failure (meaning that $\omega = 0$)
- $\sigma = 0, a = 1, y_S = 20$ (unexpected success): as the signal was 0 and the politician acted contradictory to the signal and the outcome was a success (meaning that $\omega = 1$)
- $\sigma = 1, a = 1, y_S = 20$ (expected success): as the signal was 1 and the politician acted accordingly to the signal, meaning the outcome did not surprise the voter in the same extent as in the case of unexpected surprise. However the voter was still faced with the highest outcome (meaning that $\omega = 1$)

As situations where $y_F = 4€$ occured, rational voters would never reelect politicians, since it would serve as evidence that they did not know the real state of the world and therefore politicians picked the wrong action. However previous research (Schuett et al., 2018) serves presents evidence that voters overestimated the politicians' abilities in these cases.

The study of Schuett et al. (2018) also underlines that voters barely can distinguish between expected and unexpected success. They tend not to take into account what was the signal or the action, but they tend to pay particular attention to the outcome.

The idea of the Bayesian Calculator is to correct at least one part of the possible biases during belief elicitations of the voters. One advantage of the calculator is that it takes into account not just the outcome but also the signal and the action of the politician as it calculates μ (see Equation 1)[8], the probability that the incumbent with whom voters were matched up with was a low type, taking in to account how voters estimated the strategies of politicians. That already makes a difference, because it excludes the possibility that the voters form their beliefs according to the outcome. As one can see from the six possible situations above the outcome of the game is only one factor to determine the probability (μ) that the incumbent with whom the voter was playing with is a high type.

$$\mu(\sigma, \omega, y) = \frac{\lambda * [\rho * (1 - s_{\omega\sigma}) + (1 - \rho) * (1 - s_{-\omega\sigma})]}{\lambda * [\rho * (1 - s_{\omega\sigma}) + (1 - \rho) * (1 - s_{-\omega\sigma})] + (1 - \lambda) * (1 - s_{\sigma})} \tag{1}$$

The most important factors to form a rational belief about the politicians' ability are the following:

- $\lambda = Pr(\theta_H) = 20\%$ stands for the probability of playing with a high ability politician in general
- $\rho = 55\%$ stands for the probability that the signal is correct
- $s_{\omega\sigma}$ stands for the strategies of high ability politicians, which is represented by the percentage how often do they choose $a = 1$, depending on ω and σ.
- s_{σ} stands for the strategy choice of the low ability politicians, depending on the given knowledge they have which is σ

Voters were informed about $\lambda = 20\%$ and $\rho = 55\%$ in all treatments. However what is also observable in the paper of Schuett et al. (2018) is that people tend not be able to incorporate these factors even though they are informed about them a several times during the game. However a tendency is to detect, that on average they tend to form their beliefs with factors around 50%. That fact raised the question, whether voters faile to estimate the strategy of the politicians or whether they are not able to update the other known parameters(e.g. λ), which were given either in the instruction or on the screen during the game?

[8]based on the work of (Schuett et al., 2018)

The Bayesian Calculator is a tool which excludes the possibility that people are estimating their beliefs with a wrong λ or ρ, and makes observable how voters think about politicians' strategy choices. One of the main foci of my master thesis is to locate where exactly are the weaknesses of the voters as they estimate the strategy of the politicians, and on which level do these weaknesses influence their election decisions.

In my thesis I will focus mainly on voters' behaviour but it is essential also to explain the possible strategy choices of politicians. On the one hand it is important to describe rational behaviour, which only would occur if both parties (politicians and voters) are rational, since their interaction influences each other's behaviour. On the other hand it is important to mention how politicians actually behaved during the game. I will also explore in detail what differences are observable in politicians' empirical strategy choice between the treatment INFO (Schuett et al., 2018) and the treatment CALC.

After I analysed the behaviour of politicians behaviour I will show which differences are observable after introducing the Bayesian Calculator in the decision making of the voters. And finally I will try to find an explanation where voters fail to estimate the strategy choice of politicians and which impact it makes on their decisions.

3 Politicians and their strategy choices

3.1 General description of possible strategies

As described in Section 2.1 we learned that the probability for being a high ability politician is 20%. High ability politicians did not only learn the signal (σ) but also the truth state of the world (ω). In the other 80% of the cases a politician was a low type, meaning that he only knew the signal which is true with 55% accuracy. The signal suggested to choose action 0 (more safer action) or action 1 (more risky action).

All in all it means there were six different kind of strategy possibilities as a politician, depending the type of the politician θ, the forecast σ and the true state of the world ω. In the case of a high type politician the strategy (s) depended on the true state of the world ($\omega \in [0, 1]$) and on the signal ($\sigma \in [0, 1]$). As a low type politician your strategy depended only on the signal ($\sigma \in [0, 1]$), since politicians with low abilities did not have information about the true state of the world.

In the case of high type politicians strategies ($s_{\omega\sigma}$)the first digit describes the real state of the world ω, and the second the signal σ. In the case of low ability politicians the only descriptive digit is the signal σ, since for them is the true state of the world ω is unknown for low ability politicians.

The possible strategies of **high** type politicians were the following:

s11: describes the probability that high type politicians chose action $a = 1$, if the real state of the world was $\omega = \mathbf{1}$ and the signal reported with 55% probability $\sigma = \mathbf{1}$.

s10: describes the probability that high type politicians chose action a=1, if the real state of the world was $\omega = \mathbf{1}$ and the signal reported with 55% probability $\sigma = \mathbf{0}$.

s01: describes the probability that high type politicians chose action a=1, if the real state of the world was $\omega = \mathbf{0}$ and the signal reported with 55% probability $\sigma = \mathbf{1}$.

s00: describes the probability that high type politicians chose action a=1, if the real state of the world was $\omega = \mathbf{0}$ and the signal reported with 55% probability $\sigma = \mathbf{0}$.

The remaining two possible strategies for **low** type politicians were:

s0: describes the probability that low type politicians chose action a=1, if the signal reported with 55% probability $\sigma = \mathbf{0}$.
s1: describes the probability that low type politicians chose action a=1, if the signal reported with 55% probability $\sigma = \mathbf{1}$.

3.2 Empirical and Rational Theory

The Rational Theory assumes that voters and politicians would behave through the entire game rationally. This would mean on the one hand that voters possess all the necessary information which is playing a role with regard to their reelection decision. This is included in the experimental design, since they were reminded on all the screens which signal, action and outcome was achieved in the period and participants also contain the information about λ, the probability for playing with a high ability politician, and additionally voters knew the exact probability λ_C, which describes the probability that the challenger is a high ability politician. On the other hand it would mean that politicians chose their strategies rationally, according to the signal and real state of the world.

This would mean that if a high ability politician is rational he:

s11: would choose $a = 1$ with 100% probability if $\omega = 1$ and $\sigma = 1$
s10: would choose $a = 1$ with 100% probability if $\omega = 1$ and $\sigma = 0$
s01: would choose $a = 1$ with 0% probability if $\omega = 0$ and $\sigma = 1$
s00: would choose $a = 1$ with 0% probability if $\omega = 0$ and $\sigma = 0$

If the low ability politician would be rational, he would choose mixed strategies to optimise the outcome. Based on the calculations of (Schuett et al., 2018) rational low ability politicians' strategies are:

s0: he would choose $a = 1$ 16.05% in of the cases if the $\sigma = 0$
s1: he would choose $a = 1$ 70.65% in of the cases if the $\sigma = 1$

In contrast to the Rational Theory Predicted strategies (from now on RAT) the empirical theory strategies (from now on EMP) describe the actual strategy choice of the politicians during the 7 sessions we ran. Since the real state of the world ($P(\omega = 0) = 50\%$) and the signal ($P(\sigma = 0) = 50\%$) were drawn randomly by the nature and by being a high ability politician ($\lambda = P(\theta_H) = 20\%$) the number of observations in different strategies were not identical.

Since the outcomes designed to be asymmetrical (see Figure 2) and voters only knew the signal, which predicts only by 55% correctly the true state of the world, politicians might assume that voters would identify them as high type if they do not necessarily play according to the signal.

This means that high type politicians had the incentives to gamble in two different ways:

s11: politicians might act against the signal (by choosing $a = 1$) (and against the true state of the world) to signal the voter that they are high types and therefore they did not follow the signal

s10: in case politicians would choose according to the signal (and against the true state of the world), they signal that they were not willing to take the riskier action $a = 1$

s01/s00: in this case politicians had not really an incentive to choose $a = 1$, since they should know they will earn only 4€

As a low type politician the incentives for choosing the riskier action $a = 1$ might be higher, since they did not know the state of the world and a 55% probability did also not entirely ensure them of winning. The two different kinds of gambling were the following:

s0: politicians who were willing to play $a = 1$ (with 45% probability it would be correct) acted contradictory to the signal. In case they were lucky and earned 20€, voters were faced with unexpected success and might thought that the politicians were aware of ω and acted accordingly to the true state of the world.

s1: politicians who were more willing to play the safe action $a = 0$ avoided the chance that voters were faced with any kind of failure and might not be therefore reelected. Since the outcome is was 12€ (independently from ω), voters might think the politician was aware of the true state of the world and therefore he picked $a = 0$.

All in all since one would except that the Bayesian Calculator corrects for some biases of belief forming of voters, I would also except that the politicians would play on average closer to RAT than to EMP as they did in the INFO treatment. In the next session I will compare the results of politicians' behaviour in the two treatments.

3.3 Change in politicians' behaviour

Table 2 describes the six possible strategies (depending on ω and σ). The mean of (EMP_{CALC}) describes the percentage of politicians chose $a = 1$ depending on ω and σ. The RAT strategies are presented in the third column and they describe the percentage of rational politicians would choose $a = 1$. Next, on the right side of the table, the reelection rate of the politicians are represented, depending on the strategy type and the action, chosen by the politicians. The same table for (EMP_{INFO}) is represented in the Appendix (Table 16 at page 48).

Table 2: Reelection rate depending on the strategy choice of politicians compared to the rational theory predicted values

Strategy	**EMP**$_{CALC}$			**RAT**	**Reelection rate depending on a**$\in [0,1]$			
($s_{\omega\sigma}$)	Obs.	Mean	SD		action of politician	Obs.	Mean	SD
High ability politicians strategy of choosing *a = 1*								
s11	95	93.68	24.45	100		95	49.47	50.26
					$a = 1$	89	50.56	50.28
					$a = 0$	6	33.33	50.26
s10	80	87.50	33.28	100		80	71.25	45.55
					$a = 1$	70	74.29	44.02
					$a = 0$	10	50.00	52.70
s01	81	9.88	30.02	0		81	38.27	48.91
					$a = 1$	8	25.00	46.29
					$a = 0$	73	39.73	49.27
s00	78	10.26	30.54	0		78	21.79	41.55
					$a = 1$	8	25.00	46.29
					$a = 0$	70	21.43	41.32
Low ability politicians strategy choice of choosing *a = 1*								
s0	703	17.50	38.02	16.05		703	29.30	45.55
					$a = 1$	123	35.77	48.13
					$a = 0$	580	27.93	44.90
s1	643	51.63	50.01	70.65		643	39.81	48.99
					$a = 1$	332	38.55	48.75
					$a = 0$	311	41.16	49.29

All in all, in Talbe 2 one can observe a shift in politicians' behaviour compared to RAT. In general, high ability politicians choose less often $a = 1$ as $\omega = 1$ and more often $a = 1$ as $\omega = 0$. However, this action does not seem to be rational since the reelection rates show that even as politicians act against the real state of the world (ω) they get in 25% of the cases reelected.

Since low ability politicians have no information about the real state of the world, their decision is only influenced by the signal. As the signal is $\sigma = 0$, politicians get more often reelected on average if they choose $a = 1$ compared if they choose to act a=0. That might incentivize politicians to choose more often $a = 1$ as the RAT predicted. Meaning that they are slightly more willing to choose the riskier action $a = 1$ as the theory predicts especially because they are also motivated by irrational voters to do so.

The opposite tendency can be observed for $\sigma = 1$, as the forecast suggest to choose the riskier option. In this case politicians play almost 20% less often the risky action ($a = 1$), even though the signal with 55% probability suggest to do so. It is also observable, that if they take $a = 0$ they are more often reelected as they play $a = 1$, which might be more risky to choose. Again, the difference in the reelection rate could motivate politicians to play against the signal.

All things considered high ability politicians tend to deviate from RAT only in a small amount, but low type politicians tend to deviate from the signal especially in the case of $\sigma = 1$ in the CALC treatment.

These statements are not representative for the INFO treatment. Table 16(see in Appendix at page 48) represents the table with the same concept for INFO treatment. In general, in the INFO treatment a higher reelection rate is to observe. The strategy of high ability politicians seems to be similar in both treatments, except in the case of s01 ($\omega = 0, \sigma = 1$). The rate that politicians choose $a = 1$ (contradictory to $\omega = 0$) is double as much (24.66%) in the INFO treatment as in the CALC. However the standard deviation is also higher than in all the other cases. This irrational behaviour of the politicians can be explained that in general voters are more indulgent to the incumbent, therefore politicians are more self-reliant that they will be reelected.

Low ability politicians tend to play more safe in the CALC treatment independently from the signal, and therefore they also deviate more from the RAT values. Since they get reelected more often there than in the CALC treatment, they choose more often the safe option $a = 0$.

The reelection rate self cannot explain politicians behaviour, but the tendency is clear that politicians in general choose more often the safer action ($a = 0$) (all in all 62.5% of the cases in the CALC)[9] where the pay-off is $y_O = 12€$ (independently from the state of the world). As the signal is $\sigma = 0$ they choose 76.7%[10] of the cases $a = 0$ and 48.6%[11] as $\sigma = 1$. Low type politicians choose $a = 0$ more often (66.2% [12]) than high type politicians(48.6% [13]).

Even though σ and ω are always drawn on average 50% of the cases, politicians choose $a = 0$ often as the signal recommended to do so. Therefore I assume that the deviation (especially in the case of low ability politicians) can arise from the risk preferences of the politicians. This deviation is even more radical in the case of the INFO treatment, pointing out the more irrational behaviour of politicians in the INFO treatment.

[9] 64.2% in the INFO treatment.
[10] 79.69% in the INFO treatment
[11] 48.2% in the INFO treatment
[12] 68% in the INFO treatment
[13] 48.8% in the INFO treatment

Table 3: Politicians' decision explained by risk preferences, signal and personal attributes in both treatments

	Dependent variable is paction$\in [0,1]$							
	CALC				INFO			
	choicebhl		riskgeneral		choicebhl		riskgeneral	
VARIABLES	high	low	high	low	high	low	high	low
choicebhl	-0.017	0.111***			0.083**	0.073**		
	(0.026)	(0.034)			(0.038)	(0.033)		
riskgeneral			0.135	0.194			0.296**	0.648***
			(0.107)	(0.171)			(0.133)	(0.164)
signal	0.151	1.270***	0.167	1.270***	0.422***	1.425***	0.391**	1.425***
	(0.154)	(0.132)	(0.155)	(0.132)	(0.160)	(0.161)	(0.160)	(0.160)
age	-0.035*	0.041	-0.038*	0.026	-0.004	0.084***	-0.014	0.072***
	(0.020)	(0.028)	(0.020)	(0.028)	(0.014)	(0.020)	(0.014)	(0.017)
sex	-0.181	0.270	-0.159	0.278	-0.458***	0.243	-0.519***	0.293
	(0.127)	(0.184)	(0.131)	(0.194)	(0.156)	(0.234)	(0.163)	(0.204)
yearuni	-0.033	0.050	-0.038	0.021	-0.001	0.025***	-0.001	0.025***
	(0.026)	(0.035)	(0.026)	(0.035)	(0.003)	(0.009)	(0.003)	(0.008)
Constant	67.148	-104.335	77.171	-45.708	3.000	-53.538***	1.413	-54.736***
	(52.133)	(71.605)	(51.844)	(71.136)	(5.150)	(18.186)	(5.083)	(0.240)
Obs	334	1,346	334	1,346	320	1,360	320	1,360
Nr of subjectid	84	84	84	84	83	84	83	84
rho	6.61e-07	0.344	1.32e-10	0.372	0.0620	0.454	0.0586	0.396

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
clustered on subjectid
high describes only high ability politicians' behaviour
low describes only low ability politicians' behaviour
riskgeneral describes the risk preference, ranked by themselves
choicebhl describes the risk preference, according to the game of Holt and Laury (2002)
yearuni describes the year when the participant started at the university

Table 3 describes how the risk preferences affected politicians' decisions, depending on the type of the politician and the treatment. Two different type of measures represent the risk preferences of the players. The variable *choicebhl* is the measure constructed by the game of Holt and Laury (2002). The value 0 means that the subject chose always the risky option, meaning that he is highly risk averse. And the value 10 means that the person has chose always the risky option, in other words he is highly risk loving. The other variable *riskgeneral* describes subjects' self-perception, namely whether they consider themselves to be either risk averse(takes the value 1) or risk loving(takes the value 4).

In the case of the CALC treatment the variable *choicebhl* from Holt and Laury (2002) has a significant effect in the case of low type politicians. This means that low type politicians are willing to choose $a = 1$, the riskier action if they are more risk loving. In the case of high ability politicians risk preference variables are not significant. The signal $\sigma \in [0, 1]$ is also only in the case of low ability politicians significant. The probability increases significantly to choose $a = 1$ as $\sigma = 1$. In the case of high type politicians the interclass correlation (rho) is close to 0, meaning that the panel-level variance component is unimportant. In other words the panel estimator is not different

from the pooled estimator. In the case of low type politicians the interclass correlation tend to be higher, however in terms of the interpretation of Cicchetti (1994), it is also poor. In the case of low type politicians age has a small negative effect on the action (at $\alpha = 10\%$), meaning that high ability politicians tend to choose more often $a = 1$ the younger they are.

The right side of the table represents the same probit time series regressions (xtprobit) for the INFO treatment. Both risk preference measures are significant at least on a level of 5%. Surprisingly not just the decision of low ability politicians is based on risk aversion but also high ability politicians tend to choose $a = 1$ if they are more risk loving. The signal plays also a significant role independently from the type of the politician. The interclass correlation tend to be smaller in the case of describing the behaviour of high ability politicians' compared to low ability politicians' behaviour.

To sum up, in the CALC treatment the actions of low ability politicians are determined by their risk preferences and the signal, in contrast to high ability politicians, who's decision is neither influenced by risk aversion, nor by the signal. This corresponds to a rational behaviour. Even though no significant treatment effect could be detected (see Table 17) the results in the INFO treatment are different, where all kind of politicians' decisions are also determined not only by the signal, which should have no impact on their decision, but also by their risk preferences. This means that high ability politicians' behaviour is also determined by risk preferences and by the signal, even though they have full information and therefore their decisions should be determined only by the component ω.

These results lead me to conclude that the behaviour of politicians in the CALC treatment is more rational. On the one hand their strategies are closer to the RAT strategies and on the other hand high ability politicians' decision is not influenced by σ and their risk preferences. Politicians' conditions did not change over the treatments. Therefore I assume the more rational decision of voters result the more rational behaviour of politicians.

4 A general overview and effects of the Bayesian Calculator

The previous section provided a closer insight on the change of politicians' behaviour over the treatments. Considered that politicians tend to choose their strategies closer to the RAT strategies in the CALC treatment than in the previous treatment *INFO* from Schuett et al. (2018), this section explores whether the treatment had an effect on voters' behaviour.

To examine whether the voters' decision making was influenced by the Bayesian Calculator, I will study the differences in the reelection decisions of the voters. To understand the core of the findings I will provide a closer analysis of the differences in the elicited beliefs in the INFO treatment compared to the calculated beliefs in the CALC treatment.

4.1 Voters' reelection decisions

At the end of each period voters have to deal with an election decision. Given the information what they experience during the period (σ, a, y) they have to compare their belief which described the probability of the incumbent whom they were playing with being a high type with the probability of the challengers being a high ability politician. Regarding the comparison of the probabilities voters have to decide whether they elect the challenger or reelect the incumbent. Voters are incentivized rather to elect high ability politicians than low ability politicians (see Figure 2). In case they choose a low ability politician they receive 10€. In case they elect the high ability politician they receive 25€. Therefore distinguishing between low and high ability politicians is essential for voters.

Table 4: Reelection rate depending on the treatment and ability of the politician on session level

	CALC			INFO			WRS on
	count	mean	sd	count	mean	sd	Session level
Total	7	0.3655	0.0516	7	0.4756	0.0458	0.007***
Depending on the ability of politicians:							
High ability	7	0.4520	0.0720	7	0.5291	0.0974	0.180
Low ability	7	0.3438	0.0554	7	0.4625	0.0516	0.006***
WSR		0.028**			0.128		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 shows clearly that in the CALC treatment the reelection rate in general is significantly smaller than in the INFO treatment. As long as there is no significant difference between the reelection rate of high ability politicians, low ability politicians are reelected significantly less often. As long as in the INFO treatment there is no significant difference between the reelection rate of high and low ability politicians on Session level, in the case of CALC the difference is significant on $\alpha = 5\%$. However, the difference between the reelection rate of high and low ability politicians between the treatments is not significant ($p = 0.3379$), at least there is an evidence that voters in the CALC treatment could distinguish between the the type of politicians significantly, in contrast the INFO treatment.

To distinguishing between the different type of politicians is also important to be able to distinguish between the six different events mentioned in Section 2.3.

Especially in the case of the two evenets: expected and unexpected success. We know from Section 3.3 that low ability politicians act regarding their risk preferences, and on average they are risk averse. Hence low ability politicians are more likely to end up in an expected success as in an unexpected success event. However in the previous treatments (Schuett et al., 2018) voter almost did not distinguish between these two events.

Table 5: Differentiating between expected and unexpected success according to the reelection rate over the treatments

		CALC			INFO		WRS on
	count	mean	sd	count	mean	sd	Session level
$\sigma = 0, y = 12$	7	0.2755	0.0543	7	0.4739	0.0602	0.002***
$\sigma = 1, y = 12$	7	0.4114	0.0791	7	0.4210	0.0873	0.847
$\sigma = 0, y = 4$	7	0.1976	0.0480	7	0.1670	0.1431	0.522
$\sigma = 1, y = 4$	7	0.1996	0.0914	7	0.2643	0.1391	0.225
unexpected success:							
$\sigma = 0, y = 20$	7	0.6818	0.1268	7	0.7590	0.0646	0.244
expected success:							
$\sigma = 1, y = 20$	7	0.5257	0.1082	7	0.6671	0.1099	0.034**
WSR between exp./unexp. success:							
		0.063*			0.018**		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5 describes the reelection rates over the six different events on the session level. The two cases as the reelection rate decrease significantly are on the one hand $\sigma = 0, y = 12$ and on the other hand $\sigma = 1, y = 20$. In the first case ($\sigma = 0, y = 12$) politicians act accordingly to the signal and therefore achieve the safe outcome. As long as in the INFO treatment almost half of the voters are reelecting them, thinking that the incumbent is a high types. In the CALC treatment one can see that with the help of the calculator voters must have realized that there is a chance that the incumbent is a low type politician who is following the safe signal and hoping to be reelected. This could be explained by the change in the calculated beliefs compared to the elicited beliefs in the INFO treatment (see Section 4.2 below).

In case of expected success ($\sigma = 1, y = 20$) the reelection rate is also significantly lower in CALC than in the INFO treatment. As described above, expected success can also be a result that a low ability politician follows the signal. However people in the INFO treatment tend to ignore it and vote for the incumbent because of the high outcome.

This difference leads to the result that the reelection rate differs significantly in case of expected and unexpected success in the CALC treatment and also in the INFO treatment.

The difference between expected and unexpected success increased from 9.2 percentage points to 15.6 percentage points in the CALC treatment. However the difference between expected and unexpected success over treatments on the session level are not significant.

4.1.1 Rely on the calculated beliefs

The reelection rate shows a development in voters behaviour, which leads to the assumption that the calculated beliefs,which had to be compared with the probability that the challenger is a high type (λ_C) resulted the change in the decision making of the voters.

But before I examine the beliefs more in more detail it is important to compare whether voters made their decision regarding the calculated beliefs as much as voters did rely on their own elicited beliefs in the INFO treatment.

Table 6: Re-election rates conditional on challenger's ability by treatment

	CALC			INFO			WRS on
	count	mean	sd	count	mean	sd	Session level
Belief>λ_C	7	0.7856	0.0899	7	0.7692	0.0987	0.848
Belief<λ_C	7	0.1767	0.0364	7	0.2296	0.0488	0.048**

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6 describes the reelection rate conditional on the challenger's ability. The Wilcoxon-Ranksum Test provides an evidence that if the Bayesian Calculators' output is in favour to reelect the incumbent, than the same amount of people tend to rely on the calculated beliefs in the CALC treatment as to the elicited beliefs in the INFO treatment. However if the calculated belief suggests to elect the challenger, significantly less people relied on the calculated beliefs, as on their own elicited beliefs. In case we exclude the *polluted* observations(described in Section A.3.1) this difference is also not significant (see at Table 18 in Appendix page 49).

To sum up this section, the election decision depends as much on the calculated beliefs in the CALC treatment as much on the elicited belief in the INFO treatment. Therefore it is important in the following to compare the calculated and elicited beliefs between the two treatments.

4.2 Belief elicitation and calculation

This section serves to understand the reelection rate differences over the treatments. Therefore it is important to compare, as mentioned above, the calculated beliefs in CALC with the elicited beliefs in INFO.

Table 7: Difference of the average calculated and elicited beliefs on session level

	CALC			INFO			WRS on
	N	mean	sd	N	mean	sd	Session level
belief	7	23.64	1.52	7	47.70	2.65	0.002***

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

belief describes the calculated beliefs in CALC treatment and the evaluated beliefs in the INFO treatment

To avoid session effects I tested the difference between the two treatments with a Wilcoxon-Ranksum Test on the session level. Table 7 depicts a clear difference on the average beliefs between the two treatments. The calculated beliefs were significantly smaller (on average around 23.64%) compared to the elicited beliefs in the INFO treatment, where the estimated beliefs were around 47.70%.

I would like to point out that the Bayesian Calculator is calculating the beliefs with the strategy input of the voters, so it is correcting on the prior $\lambda = 20\%$. The average belief in CALC is substantially closer to the value of 21.47%, which describes the RAT predicted average beliefs. In the treatment INFO the average estimated belief is 47.70%. This significant differences to the CALC and to the RAT is in line with the finding of Holt and Smith (2009). This finding suggests me that voters are not able to correctly incorporate the factor λ if it is unequal to 50%. This result leads me to conclude to that voters' overestimation of politicians' abilities stem partly from the fact that voters are not able to incorporate in their estimation that the probability playing with a high ability politician is in general only $\lambda = 20\%$. The Bayesian Calculator corrects this bias, and so decreases the belief, μ (see Table 7). Therefore voters have a higher chance to make a more rational decision with the help of the Bayesian Calculator.

However the average only describes how voters performed in general but it is not possible to see the different calculated beliefs over the different events.

Table 8: Calculated and elicited beliefs over the events and the ability to differentiate between expected and unexpected success

	CALC			INFO			WRS on	RAT
	count	mean	sd	count	mean	sd	Session level	
$\sigma = 0, y = 12$	7	17.55	2.75	7	46.77	4.04	0.002***	14.07
$\sigma = 1, y = 12$	7	32.85	4.92	7	43.19	7.58	0.025**	27.77
$\sigma = 0, y = 4$	7	15.00	6.23	7	28.31	11.20	0.013**	0
$\sigma = 1, y = 4$	7	10.57	2.99	7	27.95	11.85	0.025**	0
unexpected success:								
$\sigma = 0, y = 20$	7	39.65	6.01	7	66.98	8.81	0.002***	60.90
expected success:								
$\sigma = 1, y = 20$	7	26.76	3.48	7	66.01	5.43	0.002***	26.14
WSR between exp./unexp. success:								
		0.018**			0.866			

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Since the average is significantly lower in the CALC treatment than in the INFO treatment, it is no surprise that in Table 8 it is visible that in each event the beliefs are smaller in the CALC treatment. What is more important to point out is that the difference in expected and unexpected success significantly differs in the case of CALC treatment, since in the INFO treatment they are almost equal. The Wilcoxon-Signrank Test also showed significant difference between the differences in expected unexpected success in INFO and CALC treatment($p = 0.048$, significant at $\alpha = 5\%$).

In addition the calculated beliefs are also closer to the RAT predicted beliefs compared to the INFO treatment. The only exception is in the case of unexpected success. People tend to estimate the ability of the politician in case of an unexpected success ($\sigma = 0, y = 20$) on average better in the INFO treatment than in the CALC treatment. For this reason it would be false to state that the belief elicitation fails in the INFO treatment only because voters are not able to update λ.

Hypothesis 1: Voters are failing to form equilibrium beliefs about politicians' abilities because they are not able to incorporate the correct prior (λ) into their calculations, and, importantly, because voters are failing to estimate in some aspect of politicians' strategies, even having the correct prior there is no guarantee of gaining equilibrium belief.

Table 8 provides evidence for Hypothesis 1: it shows that even if the beliefs are calculated (as in case of unexpected success), decisions still considerably deviate from equilibrium beliefs predicted by rational theory. To understand where else could fail the belief estimation of the voters in the further sections I will examine voters' estimation of politicians' strategy choices and compare it with the empirical (EMP) and rational (RAT) strategies. The validity of Hypothesis 1 will be researched in more detail in section 6 and 7.

4.3 Summary and advantages of the Bayesian Calculator

After comparing the two treatments either from the voters' point of view or the politicians' point of view one can state that the Bayesian Calculator has a significant impact on the behaviour of both parties.

Voters tend to reelect significantly less low ability politicians, hence they reelect the incumbent less often. This can be explained that calculated beliefs (CALC treatment) are significantly lower than evaluated beliefs without the help of the calculator (INFO treatment). The more rational reelection behaviour of the voters prompts politicians to act more rational in most of the situations.

Even though the outcomes are promising it is still important to discuss whether these substantial changes in the behaviour of voters are more driven because the calculator corrected on λ or because voters perform well at estimating the strategies of the politicians.
In the next two sections I will explore this point more in detail. I will discuss in which extent voters fail estimating politicians' strategies and where exactly. After having a deeper insight voters' weaknesses in politicians' strategy estimation, I will compare the evaluated beliefs with the Calculator's output changing the prior such, as the INFO treatment suggested on average. With that I gain an indirect overview in what extend voters are struggling with updating the prior λ.

5 Voters' strategy estimation

Since the Calculator eliminates the possibility that players are not able to update the correct prior λ, voters' belief calculation depends only on how they estimate the strategy of the politicians (see Equation 1 on page 9). The high level of differences between the mean and median value(see at Table 21 in Appendix A.3.2). (especially in the case of s11 and s00, which should be the most easiest to estimate out of the six strategies) attracted my attention towards the fact that the data might be noisy.

During the sessions and in the data one could observe that some of the subjects did not use the Calculator. Since I will analyse the strategy choice of the voters and their

impact from different perspectives I try to assess which subjects did not try to consider their strategy input and therefore made the results noisy. I constructed a criterion how to eliminate subjects who tend to ignore the stage of strategy inputs and therefore create some noise compared to subjects who put some effort in estimating the strategy choice of politicians.

On the one hand I considered subjects *polluted* who entered 0 for all 6 strategies more than 5 periods[14], showing the disinterest in the task (cause nr.1). On the second hand I went through the data manually and those who entered the same numbers for all the 6 strategies during all or most of the periods were recorded and checked on two different aspects (cause nr.2). One aspect considered how often they tried to calculate something new in order to understand the mechanism during the 20 periods. The other aspect considered how often they voted against the recommended output of the calculator. Based on these criteria I excluded 7 subjects.[15]

In this chapter the tables are going to be presented *without the polluted* observations. This means that the number of observations are going to be smaller. Since some of the noise is eliminated by the criteria, my results are going to be more conservative, and therefore in some cases less significant.[16] After excluding the polluted observations, the standard deviation decreases and the inputs approach approximate towards the EMP values in general.

5.1 Overview

To provide a first impression of the voters' estimation Figure 3 represents the distribution of the different strategy evaluations. On the top axis the EMP and RAT values are visible and in the graph the red lines represent the mean values and the dark blue lines the median voters' estimation.

A clear majority of the voters estimate the strategy of high ability politicians between the RAT and EMP values, however the mean and median values tend to deviate from EMP and RAT.

The strategies s11 ($\omega = 1 \,\&\, \sigma = 1$) and s00 ($\omega = 0 \,\&\, \sigma = 0$) are more likely to be estimated closer to RAT and EMP values in contrast to $\omega \neq \sigma$ (s01 and s10). This lead me to assume that if the signal(σ) differs from the real state of the world(ω) voters assume that politicians act against ω in favour of σ to prove that they are neither playing riskier (in case of s10) nor playing safe (in case of s01). Therefore instead of acting against the signal, they tend to act against the real state of the world.
In case of voters estimating low ability politicians' strategies (s0 and s1) the distribution of estimated values is more uniformly distributed when compared to the case of high type politicians' strategies. This can be interpreted such that voters have a less clear vision of low ability politicians' strategies than about high types' in general.

To express Figure 3 in numbers and learn more precise details about the estimation of the voters, one can observe in Table 9 the mean and median voter strategy estimation

[14]Subject 248 entered in the last 18 periods only 0 for all 6 inputs and 284 entered in the last 6 periods only 0 in all 6 strategies.

[15]Find more detail on the exclusion mechanism in Appendix A.3.1.

[16]Note: all tables in this section are going to be presented with all the observations in the Appendix in Chapter A.3 Voters' strategy estimation.

compared to EMP and RAT.

Such as in Figure 3 one can see that the median voter estimates s11 and s00 values are closer to EMP and RAT values compared to the estimated strategies where $\omega \neq \sigma$(s01 and s10). In the case of estimating high ability politicians' strategies the average values tend to be closer to EMP than to RAT strategies. However, voters still tend to underestimate the willingness of the high ability politicians to play according to the real state of the world as they actually did.

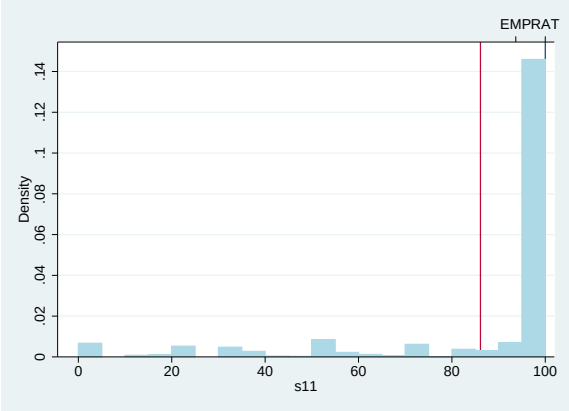
The deviations between the mean and median vales are small in the case where they estimated low ability politicians' strategies(s0 and s1). This means that the average voter has as little idea as the median voter when they tried to estimate low type politicians' strategies. Estimating s0 and s1 tend to cause more difficulties for voters, compared estimating high ability politicians' strategies.

In case of s0 ($\sigma = 0$)one can see that most of the time voters overestimate the willingness of politicians to act more risky and choose action $a = 1$ instead of acting according to the signal and earn the status-quo payoff $y_O = 12€$. This assumption of the voters corresponds to the observations which I made in Section 3. However, the extent of the deviation of politicians' behaviour to RAT is only 1.5%, in contrast to voters who estimated s0 almost double as much high as RAT or EMP values propose.

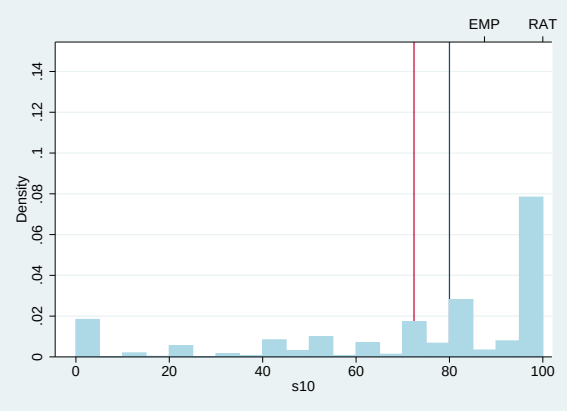
In case of s1 ($\sigma = 1$) there is a higher gap between RAT and EMP than in any of the other strategies. Median and mean voters' estimations are between these two values. This means that the average and the median voters overestimate the willingness of the politicians to act more risky and choose $a = 1$ to earn more than the status quo payoff $y_O = 12€$ compared to the actual politicians with whom voters were playing. But if we consider RAT as the benchmark value, then voters tend to underestimate that politicians are willing to play more often the safe action $a = 0$.

Figure 3: The distribution of voters' estimation about politicians strategy choice;
The red line represents the mean and the dark blue line the median;
EMP describes the empirical value and RAT the rational theory predicted value

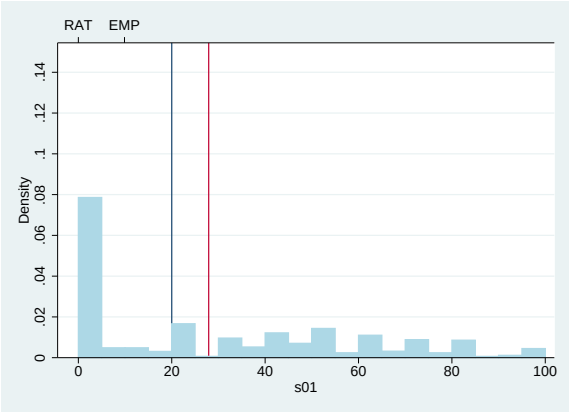
(a) s11



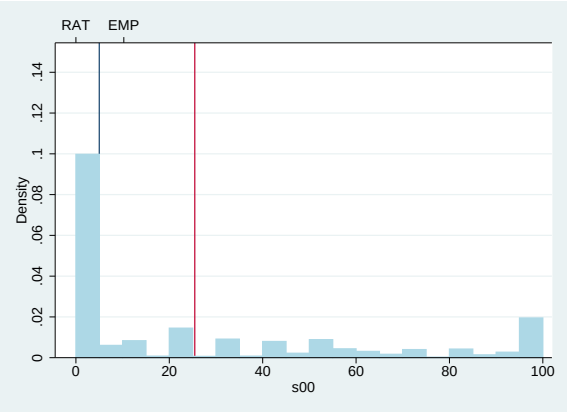
(b) s10



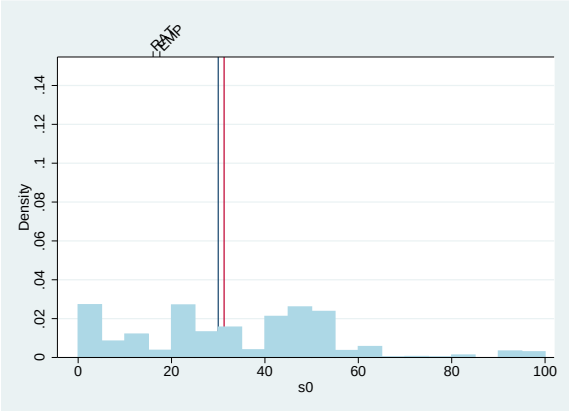
(c) s01



(d) s00



(e) s0



(f) s1

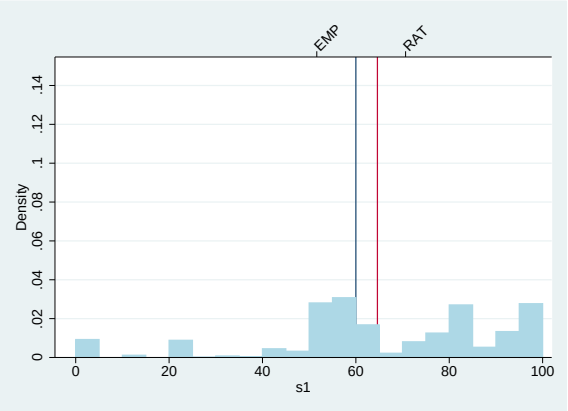


Table 9: Voters' estimation about the politicians' strategy choosing $a = 1$ depending on ω and σ, compared to EMP and RAT

Strategy	**Voter's prediction**				**EMP**$_{CALC}$			**RAT**
	Obs.	Mean	Median	SD	Obs.	Mean	SD	
Estimating high type pol.s strategy ($s_{\omega\sigma}$)								
s11	1560	86.11	100	27.11	95	93.68	24.45	100
s10	1560	72.41	80	31.85	80	87.50	33.28	100
s01	1560	27.91	20	29.17	81	9.88	30.02	0
s00	1560	25.46	5	34.23	78	10.26	30.54	0
Estimating lwo type pol.s strategy (s_{σ})								
s0	1560	31.26	30	21.75	703	17.50	38.02	16.05
s1	1560	64.62	60	25.15	643	51.63	50.01	70.65

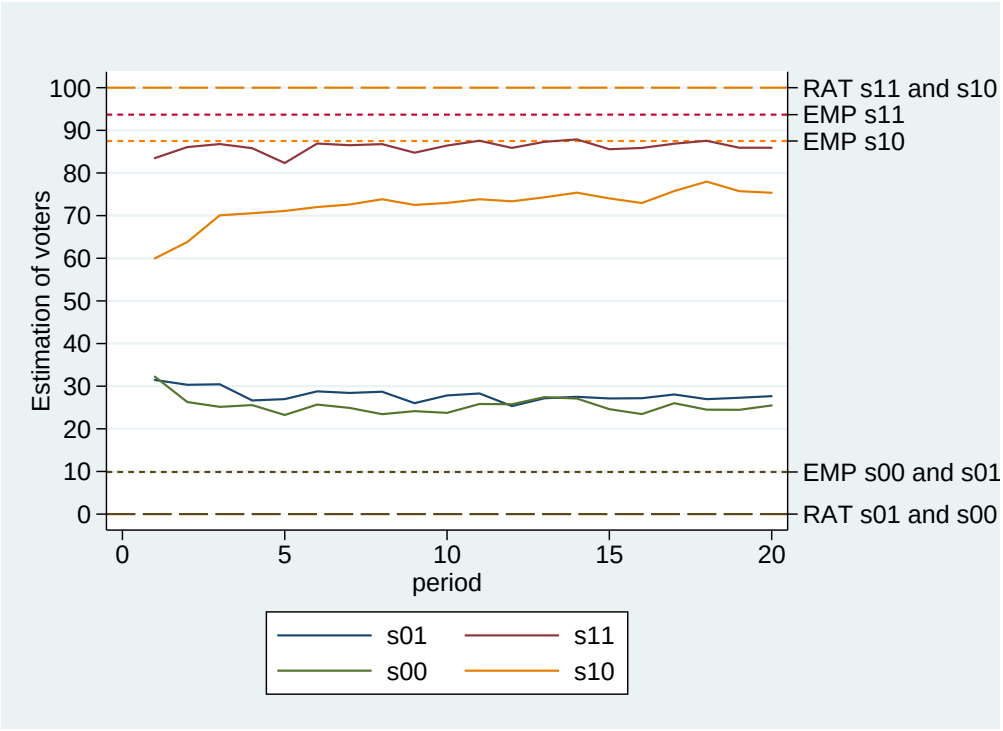
Since in this section I presented average and median results, we cannot assert how voters' estimation changes over time. In the next part I will obtain in which direction voters estimation developed over time. Are voters able to learn something about the different strategies of politicians? And if so, do they tend to change their estimation closer to EMP or to RAT? Can they learn over time more about high or about low ability politicians? Are voters more confused in the case of one signal(σ) than in the other?

5.2 Learning effects

A general change in the estimations of strategy choices of politicians over the periods are observable in Figure 4. In the case of estimating high ability politicians' strategy choice (see Figure 4a) one can observe that the difference between the strategies if $\omega = 1$ and $\omega = 0$ is smaller at the beginning. However, this difference increases over time and approaches the empirical value. This shows that voters understand over time that if high ability politicians find out that the real state of the world is 1 ($\omega = 1$) the probability to choose $a = 1$ increases, in contrast to the case if the real state of the world is 0 ($\omega = 0$) the probability that politicians choose $a = 1$ is decreasing. The most apparent change is observable in the case of s10, showing that voters quickly learn about s10. The difference between the estimations of s11 between the first and last period does not change much over time, however it starts already a the beginning very close to the EMP value. This means that voters understand very soon the high ability politicians' strategy of s11.

Figure 4: Development of voters' strategy estimation over time

(a) Strategies of high ability politicians



(b) Strategies of low ability politicians

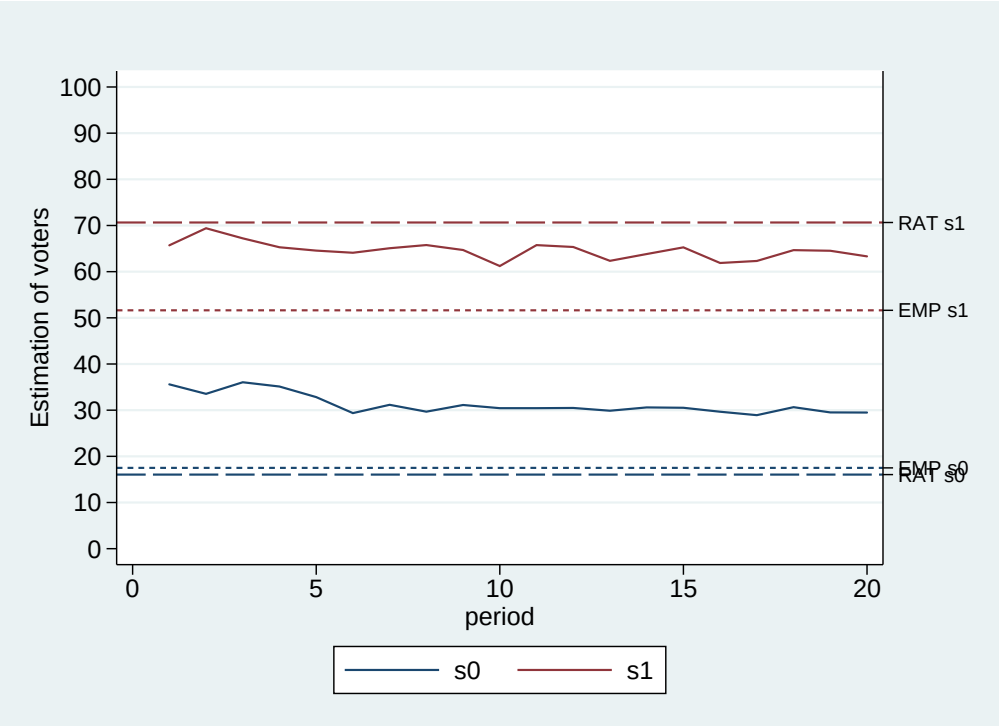


Figure 4b captures the change in voters' estimation of low type politicians' strategies over the periods. In the case of s0 the estimated value of this strategy is decreasing over time, approaching EMP and RAT. After a while it stays constant representing a constant belief of the voters according to politicians strategy, which still does not correspond completely neither to EMP nor to RAT. Voters still overestimate that politicians are willing to choose the riskier action $a = 1$ (contradictory to the signal) than they actually do.

In the case of s1 the average value is closer to RAT but in the first 10 period it starts to converge to EMP. However after the tenth period this value starts to fluctuate. This fluctuation can be explained by insecurity of voters in this one specific strategy, therefore they are guessing to see how their input changes their output.

To find some statistical evidence for the change regarding voters' estimations in the next tables I will compare the average results of the first 10 periods with the last 10 periods average results, either on the session level or on individual level. Since the players are randomly matched up in each period with some other player as in the previous round, it can cause some bias in the data. To exclude the session effects in the data I will explore the differences in the session level. Further, I will explore the differences on the individual level, in order to examine whether a development is observable in the individual participants.

Table 10 represents the changes between average values of the first and second half of the game in the strategy estimation of the voters.

This table provides evidence that the visible change in s10 is actually a significant development either on the session level or on the individual level. The estimated probability that a high ability politician chooses $a = 1$ in the case of s10 increases significantly from the first half to the second half of the game.[17] Additionally, voters tend to learn on session level that high ability politicians in the case of s01 ($\omega = 0$ and $\sigma = 1$) choose less often $a = 1$ than voters assumed in the first 10 periods. On session level there is no further significant learning effect observable. However, the tendency in all the 6 cases is to approach EMP and (except in the case of s1) RAT strategies.

To measure subjects' development over time I also used a Wilcoxon - Signrank Test on the individual level. Individuals learn most significantly about the politicians strategy choice as $\omega = 1$ and $\sigma = 0$ (s10) on a significance level of 1%. However this is not observable in the case of median voters (see at Table 23 im Appendix). Additionally, one can also observe a learning effect in the case of s11 and s0 on a significance level of $\alpha = 5\%$. In the case of s01 voters tend to learn, but it is only significant on $\alpha = 10\%$. Median voters show a tendency to learn only in the case of low ability politicians as the signal $\sigma = 0$ (s0).

All in all, voters do not tend to learn anything significantly in the case of s00 and s1.

[17] It also applies for the median voters on Session level.(see Table 23 in Appendix A.3.1.)

Table 10: Voters' estimation differences between first and second half session level(mean)

	First 10			Last 10			WSR on
	count	mean	sd	count	mean	sd	Session level
s11	7	85.71	6.05	7	86.80	7.78	0.398
s10	7	70.13	7.87	7	74.92	9.70	0.0280**
s01	7	28.47	6.07	7	27.13	5.17	0.091*
s00	7	25.32	8.09	7	25.51	8.02	0.735
s0	7	32.79	7.21	7	30.40	8.76	0.128
s1	7	65.24	8.14	7	63.86	9.07	0.128
	count	mean	sd	count	mean	sd	Individual level
s11	78	85.59	21.34	78	86.64	25.14	0.044**
s10	78	69.95	27.89	78	74.87	27.48	0.001***
s01	78	28.57	25.72	78	27.26	27.86	0.096*
s00	78	25.44	30.31	78	25.47	31.79	0.474
s0	78	32.49	17.27	78	30.02	18.95	0.026**
s1	78	65.30	20.74	78	63.93	23.20	0.661

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

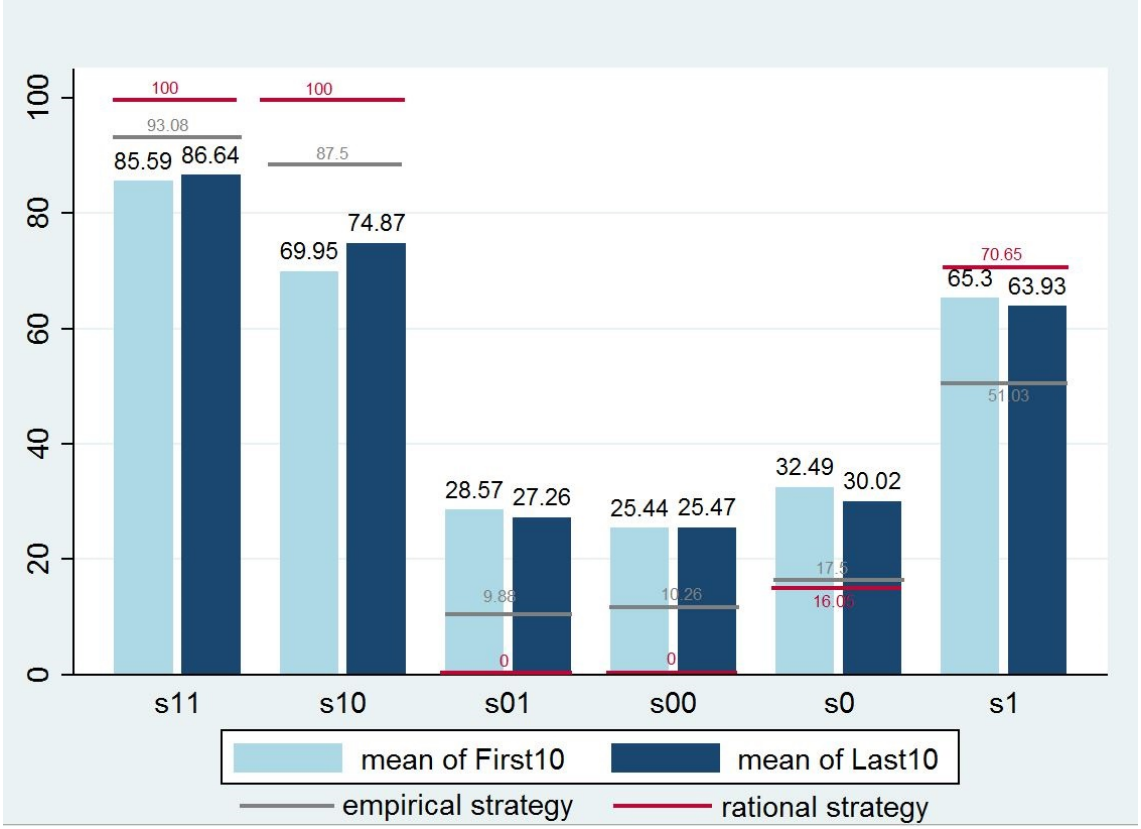
To sum up the results, the most significant learning effects are observable in the case of the signal $\sigma = 0$ (in the case of s10 and s0). Therefore the question arises: are subjects able to learn more about politicians strategy choices if the signal is 0 because they have bigger difficulties to estimate strategies with $\sigma = 0$ as $\sigma = 1$, or does this development occur only because it is easier to estimate strategies when the signal is 0, suggesting to choose the safer option?

To be able to answer these question I will discuss the deviation of the estimated strategies from the theory predicted values in more in detail in Section 6.

5.3 Summary

Figure 5 captures an overall overview of the change in voters' strategy elicitation over time. As mentioned in Section 3, politicians' behaviour (grey line) deviates from the rational theory predicted strategy values (red line). In most of the cases (s01,s00,s0,s1) voters overestimated the willingness of the politicians to choose the riskier action $a = 1$. But this mistake on average tends to decrease in the second half of the game when compared to the first half. In the case of s11 and s10 voters underestimate that politicians would act according to ω and choose $a = 1$. But over the time these values also approach towards EMP/RAT values. In general, the estimated strategies are closer to the EMP values than to RAT strategies. The only exception occurs in case of s1. However, over the time the average estimation of s1 decreases, showing a tendency to approach the EMP value.

Figure 5: The development of the voters' estimation regarding the strategy choice of politicians



After presenting the differences between EMP, RAT and voters' estimation it is important to take a closer look into the weighted absolute differences in the estimated strategies (see Figure 6). The deviation of the estimated values compared to EMP/RAT strategies is not representative, because the scale for making a mistake is different depending on the strategy chosen. In order to eliminate this effect I divided the mistakes by the number, which represents the scale in which voters are able to make mistakes. Value 0 means that the voter estimated the exact EMP/RAT value of that particular strategy, and value 1 occurs when the voter's estimation deviates as much as possible from the EMP/RAT value.

Figure 6: Absolute weighted mistake range of voters' strategy estimation compared to empirical values

(a) Compared to EMP values (b) Compared to RAT values

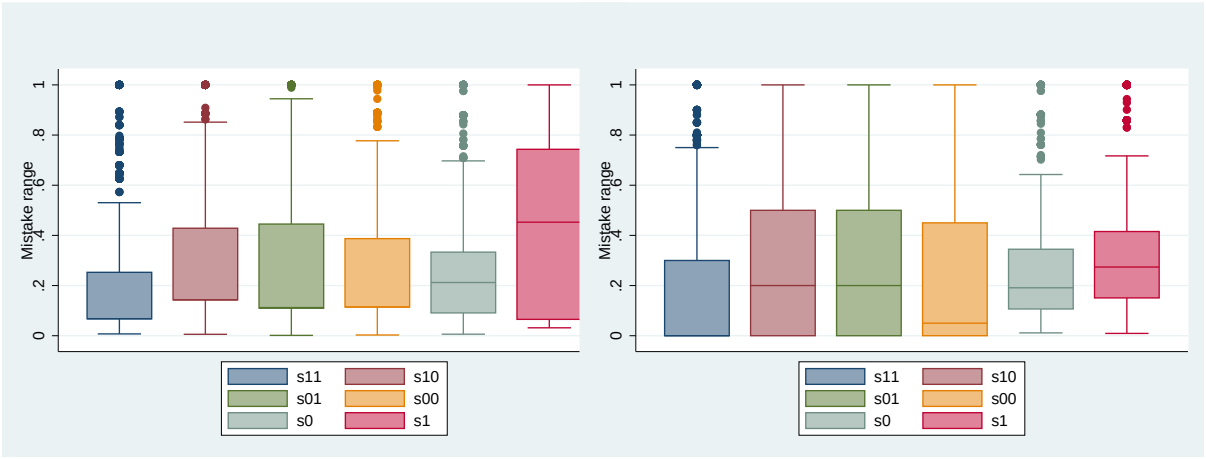


Figure 6 pictures clearly that voters' estimation is closer to the EMP than to RAT. In the other Figures (4, 5) the same is to observable, namely that estimations are closer to the EMP than RAT strategies. I will set my focus more on the comparison between the estimated values of the EMP strategies. I will report the same results for the comparison of the RAT values in the Appendix and mention the differences in footnote.

The median voter tends to estimate the high ability politicians' strategies with a smaller weighted mistake range (below of the value 0.2) as the low ability politicians' strategies (above of the value 0.2).

The fact that the scale of the whiskers and the outside values have a broad range especially in the case of estimating high ability politicians' strategies. This lead me to assume that the participants represented by these outliers tend to learn over time and therefore decrease the average of the mistake range over the second half of the game. This is in contrast to the case of low ability politicians' strategies estimation especially for s1. Voters tend to estimate s1 consistently with similar mistake ranges, but between the 25th and 75th percentile of the voters had the highest weighted absolute difference in their estimations compared to other strategies. This means that in the case of s1 voters tend to be consistently wrong, but in the case of all the other strategies voters tend to move between smaller mistake ranges, but with more outliers. The range between the 25th and 75th percentile is smaller in the case of s0 than in other estimated strategies, however the median value is also above the value of 0.2.

These results lead to the surmise on the one hand that voters had more problems to estimate low ability politicians' strategies and on the other hand that it caused more difficulties to estimate strategies with $\sigma = 1$.

6 The weaknesses of voters according to politicians' strategies

In the previous section I gave a general overview how voters estimate the six different strategies of the politicians and how they deviate from the EMP and RAT strategies. In this section I focus on the different aspects where voters are struggling to estimate politicians' strategies and on the impact of these aspects on their (re)election decisions. As mentioned in Section 5.3, voters tend to be able to estimate high ability politicians' strategies better in contrast to low ability politicians' strategies on the one hand. On the other hand they tend to show some difficulties to estimate strategies if $\sigma = 1$ compared to $\sigma = 0$. To be able to form a more concrete opinion on how those two aspects affect the decision making of voters, it is important to obtain the learning tendencies of voters and the development of voters' estimations over time.

6.1 Signal dependent

In this section I will gain a deeper insight into voters' estimation mistake range depending on the signal. For the first sight in Section 5.3 voters usually estimate strategies with $\sigma = 0$ better than with $\sigma = 1$. To find statistical evidence for this assumption I created two variables. One describes the average of the weighted absolute difference of strategies which depends on $\sigma = 0$ (s00,s10 and s0), and the other characterizes the average of weighted absolute difference of strategies which are related to $\sigma = 1$ (s11,s01 and s1).

I would like to emphasize that in this part of my thesis I will only compare voters' estimation with the EMP strategies. Although the Wilcoxon-Signrank test declined the null hypothesis that the two created variables compared to the EMP strategy would be equal to the same variables compared to the RAT values, I focus on the voters' estimation compared to the EMP strategies, since voters' estimation converge more to the EMP strategies than to the RAT strategies. However, I presented the same tables also for RAT values (see in Appendix 4.1 Table 25 at page 54).

Table 11: The change in weighted mistake ranges on session and individual level depending on the signal

	First 10			Last 10			WSR on	Total
	N	mean	sd	N	mean	sd	mean	
Estimation mistake ranges on Session level								
$\sigma = 0$	7	0.2948	0.0522	7	0.2715	0.0581	0.063*	0.2832
$\sigma = 1$	7	0.3146	0.0389	7	0.3075	0.0379	0.398	0.3111
WSR		0.499			0.3105			0.499
Estimation mistake ranges on Individual level								
$\sigma = 0$	84	0.2948	0.1697	84	0.2715	0.1695	0.001***	0.2832
$\sigma = 1$	84	0.3146	0.1553	84	0.3075	0.1867	0.121	0.3111
WSR		0.078*			0.104			0.086*

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11 describes how the weighted mistake ranges depending on the signal develop over the first and second half of the game. In general, on session level there is no significant difference between the first and second half of the game. On individual level this difference is significant however, only on a significance level of $\alpha = 10\%$[18]. Further, one can observe a significant decrease in the weighted mistake ranges of the estimation of strategies as $\sigma = 0$. In the case of estimating strategies when $\sigma = 1$ there is no significant change over time[19].

These results lead me to conclude that the ability of being good at estimating strategies as $\sigma = 1$ must be outstanding. Therefore I conclude that voters, who struggled more at estimating strategies as $\sigma = 1$, might behave less rationally, and therefore reelect the incumbent more often, compared to those who tend to perform better at estimating strategies with $\sigma = 1$.

Hypothesis 2: Voters who are good in estimating strategies, where $\sigma = 1$, decide more rationally in the reelection phase, than those who are not. Therefore the reelection rate will decrease in their cases.

6.2 Type dependent

In this section I would like to compare whether voters tend to estimate the mistake ranges of high ability politicians or low ability politicians better. Such as in the case of Section6.1, I created two new variables, which describe the average weighted absolute difference between the estimated strategy of a high(low) ability politician and the EMP/RAT value. I took the average of the absolute mistake ranges of s1,s0 for θ_L and s11,s10,s01,s00 for θ_H).

As before, I will consider in the following subsection only the differences between the estimated values and EMP strategies, since voters' estimation approaches always to the EMP strategy values during the game (see Figure 4). Additionally, I considered also the same differences compared to the RAT values and added this into the Appendix (page 55).

[18]This is not significant in case of RAT.

[19]In case of RAT there is a significant learning tendency on the individual level, however the significance level α is higher (see Table 25).

Table 12: The change in weighted mistake ranges on session and individual level depending on the type of the incumbent

	First 10			Last 10			WSR on	Total
	N	mean	sd	N	mean	sd		
Estimation mistake ranges on Session level								
high ability	7	0.2795	0.0335	7	0.2649	0.0361	0.063*	0.2722
low ability	7	0.3552	0.0335	7	0.3388	0.0217	0.091*	0.3470
WSR		0.018**			0.018**			0.018**
Estimation mistake ranges on Individual level								
high ability	84	0.2795	0.1614	84	0.2649	0.1698	0.007***	0.2722
low ability	84	0.3552	0.1478	84	0.3388	0.1595	0.069*	0.3470
WSR		0.001***			0.003**			0.001**

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As pointed out in Section 5.3, on the first sight voters have less difficulties to estimate the strategy of high ability politicians. Comparing the created variables which describes the weighted average mistake range as estimating the strategy of high- and low ability politicians, one can find a significant difference. This difference is significant on a significance level of 5% both on the session level and on the individual level[20]. Since the statistical evidence points out that estimating low ability politicians' strategy choice causes significantly more difficulties for voters than estimating high ability politicians' strategies, I would expect that at the end of the game voters can estimate both types of the politicians' strategies equally well. Voters show a learning tendency in both cases[21]. However, in contrast to my assumptions in the case of high ability politicians' strategies voters show a more significant learning effect compared to what they learn about the low type politicians' strategies. This means that subjects can learn more about the strategies of those politicians with whom strategy's are more familiar with from the beginning.

Regarding the results presented in Table 12 I would expect that people who are better at estimating low ability politicians' strategies make more rational decisions during the reelection stage since they stand out from the population due to their abilities.

Hypothesis 3: Voters who are good at estimating low ability politicians' strategies decide more rationally during the reelection phase over those who are not. Therefore the reelection rate will decrease in their cases.

[20]This is statistically different only on the individual level in the case of RAT.

[21]In the case of RAT only if voters estimate the strategies of high ability politicians on the session level (see Table 26).

6.3 Explaining the reelection decision depending on the estimation abilities of the voters

In this section I will prove whether the above analysed factors have a significant role in election decisions of the voters. In the first part I would like to show the importance of the calculated beliefs in the election decisions. Since the calculated beliefs are based on the strategy inputs of the voters, I will explore the impact of the above analysed factors on the reelection decisions.

6.3.1 Variables' description and methodology

As a first step I will consider a more general descriptive variable (*belief*) for the reelection decision, than the above described measures. Subjects decide on the grounds of comparing the calculated belief with the belief of the challenger. Therefore it is important to take into consideration for the voters what type of politician the challenger is (*challtype*) and whether it really has a significant effect on their decision what kind of type the incumbent with whom the voters were playing with is (*poltype*). Since the voters are reminded through the whole game what the action was (*pact_v*) I would expect that the *signal* and the outcome (*payoff1*) would play a significant role in voters' decisions. Since the players are playing this game over more periods, one would think that the outcome of the previous round would have an impact on their decisions for this round, I included the variable *winprev* into my regression. I will regress these variables on reelection rate in different situations to see whether the impact of the belief forming changes over the situations.
In the first part I will only consider the calculated belief as a main explanatory variable for the reelection decision. However, the aim of this section is to find the weaknesses of voters regarding their estimations on politicians' strategies. To observe which weakness has the most impact on their decisions I will use further variables as a focus for the regression for reelection rate in the upcoming section:

wgoodemp: a dummy variable, created by median split over the median value of the average of the weighted absolute difference of the six strategy estimations compared to EMP (= 1 half of the population closer to the EMP value, = 0 other half of the population)
wgoodemp0: a dummy variable, created by median split over the median value of the average of the weighted absolute difference of the strategies depending on $\sigma = 0$ (s10,s00,s0) estimations compared to EMP (= 1 half of the population closer to the EMP value, = 0 other half of the population)
wgoodemp1: a dummy variable, created by median split over the median value of the average of the weighted absolute difference of the strategies depending on $\sigma = 1$ (s11,s01,s1) estimations compared to EMP (= 1 half of the population closer to the EMP value, = 0 other half of the population)
wgoodempl: a dummy variable, created by median split over the median value of the average of the weighted absolute difference of the strategies of low ability politicians (sa and s0) estimations compared to EMP (= 1 half of the population closer to the EMP value, = 0 other half of the population)
wgoodemph: a dummy variable, created by median split over the median value of the average of the weighted absolute difference of the strategies of high ability

politicians (sa and s0) estimations compared to EMP (= 1 half of the population closer to the EMP value, = 0 other half of the population)

Voters and politicians were randomly matched with each other in each round over the 20 periods, hence we cannot exclude the possibility that the observations within one session have an influence on each other. To take into consideration the time dimension as well I will use a time series analysis. Since in the experiment we tried to control our parameters, I will use the xtprobit regression in Stata, which is described as a Random-effects and population averaged probit model to explain reelection decision as a dummy variable.

My main focus targets subjects' decisions making. I will cluster for *subjectid*, which assigns to each subject an ID number. I do not only regress the variables on reelection rate in general, but also to see whether the learning effects has an impact on the decisions. Later I conduct a regression in the *First and Second half* of the game. To be able to distinguish of the variables' effect on different type of politicians' reelection rate, I also provide a regression in the case of *High and Low ability* politicians.
Since I emphasized the importance of expected and unexpected success over the thesis, I also draw attention to it in the following subsections.

6.3.2 Results - Belief

Starting with the belief and its impact on the reelection decisions of the voters, Table 13 represents the results of the xtprobit regression over 7 different situations. One can immediately observe that the calculated beliefs have a significant impact on the election decisions of voters in six out of seven situations. Neither the significance level ($\alpha = 1\%$) nor the amount of the impact of the belief changes over the six different situations. The higher the calculated belief is the higher the probability to reelect an incumbent becomes.

Table 13: Reelection rate explained by the calculated beliefs in different perspectives

	Dependent variable is reelection decision (= 1 reelect incumbent, = 0 elect challenger)						
VARIABLES	general	Period 1-10	Period 11-20	θ_H	θ_L	$\sigma = 1 w = 20$	$\sigma = 0 w = 20$
belief	0.018***	0.019***	0.017***	0.015***	0.018***	0.019***	0.019
	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.006)	(0.014)
winprev	0.055	0.133	-0.029	-0.011	0.061	-0.204	-0.255
	(0.077)	(0.112)	(0.104)	(0.161)	(0.085)	(0.173)	(0.483)
poltype	-0.024	-0.019	-0.009			-0.248	0.691
	(0.095)	(0.140)	(0.129)			(0.191)	(0.568)
challtype	-0.783***	-0.710***	-0.865***	-0.453***	-0.858***	-0.765***	-1.492*
	(0.082)	(0.119)	(0.122)	(0.163)	(0.090)	(0.176)	(0.799)
signal	0.052	0.069	0.026	-0.154	0.110		
	(0.086)	(0.112)	(0.119)	(0.171)	(0.088)		
action	0.095	0.010	0.161	0.227	0.050		
	(0.086)	(0.123)	(0.116)	(0.232)	(0.092)		
payoff1	0.054***	0.053***	0.055***	0.049	0.054***		
	(0.010)	(0.015)	(0.013)	(0.032)	(0.011)		
Constant	-1.231***	-1.247***	-1.191***	-1.174***	-2.138***	0.035	0.535
	(0.139)	(0.182)	(0.191)	(0.394)	(0.152)	(0.203)	(0.707)
Observations	1,579	749	830	313	1,266	250	112
Nr of subjects	84	84	84	83	84	78	63
Rho	0.122	0.097	0.141	0.120	0.105	0.172	0.746

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
xtprobit model, clustered for subjects
belief describes voters' calculated belief
winprev is a dummy variable, whether the voter experienced a success in the last round
poltype describes politicians' type (= 1 if high type, = 0 if low type)
challtype describes challengers' type (= 1 if high type, = 0 if low type)
signal describes the signal in the round
action describes the action of the politician
payoff1 describes the payoff of the round

In contrast to my expectations the signal and the action of the politician do not seem to be relevant in voters' decision making. Early literature discusses that subjects tend to update poorly from signals (see (Peterson & Beach, 1967)), even if they are faced with a less complex task, as e.g., balls-and-urn. In contrast to signal and action, subjects consider the outcome as an informative variable regarding their decision. This serves as a proof that voters focus mostly on the outcome out of the three components. Additionally, the probability that the challenger is a high type is in all cases significant as well. However, the type of the politician with whom the voter is playing has no significant role in the decision making process(*poltype*).

To conclude, the calculated belief is a crucial factor according to voters' reelection decisions. Therefore in the next section I will research in more detail whether those who performed better at estimating politicians' strategy have an advantage in decision making compared to those who performed below the median voter.

6.3.3 Results - Estimation abilities of the voters

As in the previous section, I take also the calculated beliefs into consideration in the regressions. This increases the interclass correlation, in other words the panel-level variance component becomes slightly more important. Since the signal and the action do not play a significant role and the outcome is strongly depending on these other two factors, I exclude the signal from my regression in the following sections. Variables such as the ability of the challenger and outcome to stay significant and their sign and their extent do not change over the different regressions.

The dummy variable *wgoodemp* which describes in general the abilities of the voters to estimate on average the six different strategies has only an impact on the reelection decision when I excluded the variable *belief*. The negative sign serves as evidence that being better at estimating on average the six strategies results in a decreasing probability to reelect the politician and elect the challenger instead. Since it is more likely on average to play with a low ability incumbent, this result supports the idea that those who can estimate the strategies better will be faced with more rational calculated beliefs. Therefore it decreases the probability to reelect the incumbent, who has on average only 20% chance to be a high ability politician, as long the challengers' ability on average is 50%.

Table 14 further shows significant effects of the ability of being good at estimating strategies as $\sigma = 0$ either as *belief* is included in the regression or without the variable *belief*. It shows a significant decrease in the probability to reelect the incumbent if someone is good at estimating strategies as $\sigma = 0$. In contrast to the significant impact of *wgoodemp0*, the regression did not report any significant impact of the variable *wgoodemp1*. This means that being good at estimating strategies as $\sigma = 1$, has no significant effect on the reelection decision.

Table 14: General xtprobit regression to understand reelection decisions of voters

Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)						
	good in general		good in signal		good in type	
belief	0.018***		0.018***		0.018***	
	(0.003)		(0.003)		(0.003)	
poltype	-0.031	-0.003	-0.036	-0.007	-0.031	-0.002
	(0.095)	(0.098)	(0.095)	(0.097)	(0.095)	(0.098)
challtype	-0.772***	-0.730***	-0.769***	-0.729***	-0.771***	-0.732***
	(0.082)	(0.077)	(0.082)	(0.077)	(0.082)	(0.077)
pact_v	0.106	0.057	0.101	0.052	0.101	0.058
	(0.083)	(0.083)	(0.082)	(0.083)	(0.083)	(0.084)
payoff1	0.058***	0.075***	0.058***	0.075***	0.058***	0.075***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
wgoodemp	-0.133	-0.181**				
	(0.086)	(0.084)				
wgoodemp0			-0.245***	-0.210***		
			(0.084)	(0.081)		
wgoodemp1			0.115	0.010		
			(0.099)	(0.099)		
wgoodemph					-0.229**	-0.157*
					(0.091)	(0.087)
wgoodempl					-0.047	-0.185**
					(0.092)	(0.088)
Constant	-1.161***	-0.928***	-1.175***	-0.921***	-1.100***	-0.842***
	(0.128)	(0.136)	(0.144)	(0.151)	(0.147)	(0.153)
Observations	1,663	1,680	1,663	1,680	1,663	1,680
Number of subjects	84	84	84	84	84	84
rho	0.109	0.0973	0.0967	0.0913	0.104	0.0920

Robust standard errors in parentheses
xtprobit regression clustered by subjects
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
belief describes voters' calculated belief
poltype describes politicians' type (= 1 if high type, = 0 if low type)
challtype describes challengers' type (= 1 if high type, = 0 if low type)
pact_v describes the action of the politician
payoff1 describes the payoff of the round
wgoodemp strategy estimation ability of voters in general
wgoodemp0 strategy estimation ability of voters if $\sigma = 0$
wgoodemp1 strategy estimations ability of voters if $\sigma = 1$
wgoodemph ability of voters regarding estimating high ability politicians' strategies
wgoodempl ability of voters regarding estimating low ability politicians' strategies

To sum up, the results suggest that being good at estimating strategies if $\sigma = 0$ has a significant impact on the reelection decision. This is in contrast to the outcomes according to the variable which describes the upper and lower half of the population depending on their ability estimating strategies $\sigma = 1$ and voters performing worse on average to estimate these strategies, this has no significant impact on the reelection decisions.

The sign and the significance of the variables *wgoodemp0* and *wgoodemp1* do not change over time.

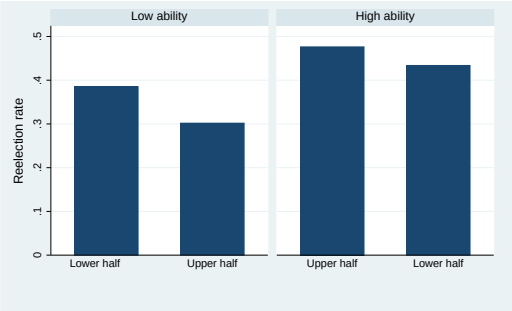
In case of being good or bad at estimating the strategies of different type of politicians the results are less clear. When the variable *belief* is included only the variable *wgoodemph* has a significant impact and *wgoodempl* has not. But if one does not include the calculated belief as an explanatory variable in to the regression *wgoodemph* becomes less significant and *wgoodempl* becomes more significant. This can be explained by the learning process of subjects (see Table 12 at page 33). As long as in the first half of the game only the variable *wgoodemph* had a significant role in the regression (independently whether variable *belief* was included or not), in the last 10 rounds the significance of *wgoodempl* becomes more dominant, but only when the variable *belief* is excluded (see Table 28 and 29).

This can be interpreted as voters who have better estimations on strategies of high ability politicians stand out more in the first half of the game than in the second half of the game (because of significant learning tendencies). This means that during the second half of the game voters who are bad at estimating high ability politicians strategy acquired also a similar knowledge as those who are good at estimating the strategies of high ability politicians at the beginning. Therefore, the ability of being good at estimating high ability politicians stands out less for the second half of the game. This is in contrast to being good at estimating low ability politicians. Since the learning tendency to be less significant means that on average subjects learned less about the strategies of politicians with low abilities, the second half of the game *wgoodempl* becomes significant in contrast to *wgoodemph*.

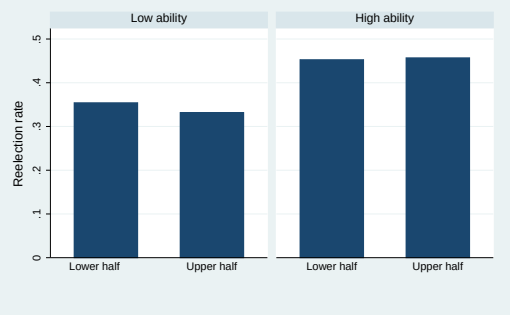
The fact that some of these variables have a significant impact on the decision of voters on the election stage does not corroborate completely Hypothesis 2 and 3 since deciding more rationally would mean to decrease in the reelection rate of low ability politicians significantly. Figure 7 and Table 33 (on page 62) illustrates the main finding of these question.

Figure 7: Reelection rate depending on the type of politicians and on the ability of estimating politicians' strategies

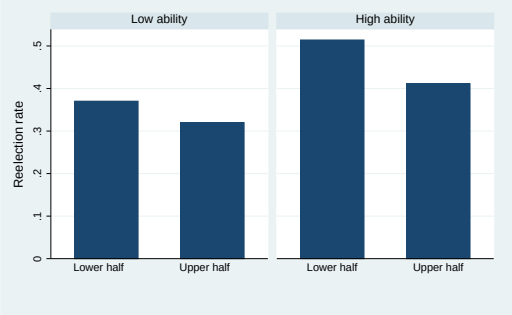
(a) Reelection rate depending on the ability of estimating strategies depending if $\sigma = 0$



(b) Reelection rate depending on the ability of estimating strategies depending if $\sigma = 1$



(c) Reelection rate depending on the ability of estimating strategies of low ability politicians



(d) Reelection rate depending on the ability of estimating strategies of high ability politicians

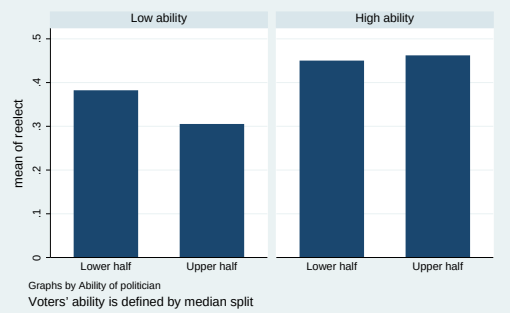


Table 14 suggests clearly that being good at estimating strategies as $\sigma = 0$ has a significant impact on the reelection decisions in general. The coefficient of the variable *wgoodemp0* has a negative sign, showing that the probability reelecting the incumbent decreases if the voter has good abilities to estimate strategies with $\sigma = 0$. This stands in line with the findings in Figure 7. A significant decrease is visible in the case of reelecting low ability politicians and an increase is visible in the case of reelecting high ability politicians (see Figure 7a and Table 33 in Appendix at page 62). Therefore, the overall differences in the reelection rate between being good or bad at estimating strategies with $\sigma = 0$ causes a significant decrease in the reelection rate.

Being good at estimating strategies as $\sigma = 1$ has no significant impact in the reelection rate, neither according to Table 14 nor according to Table 33. On Figure 7b one can observe a slight decrease in the reelection rate of low types and in general. However, these differences are not significant on the session level.

Given these results we can reject Hypothesis 2 that being good at estimating strategies depending on $\sigma = 1$ leads to a more rational decision making process during the election stage. However, I would suggest to accept an alternative hypothesis that being good at estimating strategies depending on $\sigma = 0$ leads to a more rational decision making process during the election stage.

Estimating strategies according to the ability of the politicians Table 14 suggests that during the first half of the game being good at estimating high ability politicians' strategies has a significant impact on the election decision. This is in contrast what

the results suggest during the second half of the game. In this case it turns out that being good at estimating low ability politicians' strategy has a significant impact on the election decisions. However, only if the variable belief is excluded, which decreases slightly the interclass correlation. This result does not provide a clear explanation which variable has a more substantial impact on the reelection making process. Therefore it encourage me to consider Hypothesis 3 in a more attentive manner.

Figure 7c illustrates that after the median split the upper half of the group, those who tend to be better at estimating low ability politicians' strategies, reelect low ability politicians slightly but not significantly less often. Those who tend to be worse at estimating low ability politicians' strategies tend to reelect high ability politicians significantly more often. This fact explains the significant impact of the variable *wogoodempl* on the reelection decisions. This suggests that being good at estimating low ability politicians' strategy decreases the probability of reelecting the incumbent. These results suggest that voters who tend to be better at estimating low ability politicians' strategy tend to reelect high ability politicians significantly less often, which contradicts Hypothesis 3. This suggests that this group of people would make more rational decisions during the election stage.

The group of people who tend to be better at estimating high ability politicians' strategies reelect low ability politicians significantly less often and high ability politicians (not significantly but) more often according to Figure 7d. In general, those who are better at this tend to reelect incumbents less often. However, this is not significant on the Session level. But the other two facts are in line with the suggestion of Table 14, that being good at estimating high ability politicians' strategy has a significant impact on the reelection rate. Based on these results one can reject Hypothesis 3, in the favour of the alternative hypothesis that being good at estimating high ability politicians' strategy leads to a more rational decision.

6.3.4 Summary

In this section I analysed reelection decisions from two perspectives. From the aspect of being good or bad at estimating strategies depending on the signal and from the aspect of being good or bad at estimating strategies depending on the politicians' ability.

It turned out that voters tend to learn and understand better strategies when the signal is $\sigma = 0$, which suggests to choose the safe option. This can be explained by the fact that voters failed mostly estimating s1, which suggest to choose the riskier.

Further, it becomes clear that voters can estimate high ability politicians' strategies better over low ability politicians' strategies. Over the periods voters learn more about high ability politicians' strategies than about low ability politicians' strategies. However, although understanding low ability politicians' strategies causes more struggle for voters, it has no significant impact on their decision.

Above all, the most surprising result what I found is that voters learn the most about strategies which they tend to understand better from the beginning. Further voters' decisions depend significantly on the aspects where voters tend to perform better from the beginning.

7 Is it the strategy estimation or updating the priors?

In the last section I search for the fundamental points where voters are not able to estimate the strategy of the politicians. However, it is neither possible to find any confirmation to Hypothesis 1, nor to be able to answer the question whether voters fail in the other treatments because they are not able to estimate the strategies of the politicians or because they are not able to update λ.

Since the comparison between these two treatments does not allow me to answer the question directly I predicted values for the belief with the strategy estimation of the voters, but instead of calculating with the correct factor $\lambda = 20\%$ from Equation 1, I inserted the average belief of voters' elicitations in the treatment INFO for $\lambda_{INFO} = 47.70\%$. This allows me to compare voters elicited beliefs (INFO treatment) with beliefs that are based on strategy estimation of politicians with the factor, which represents the average belief of voters in the INFO treatment.

The general overview in Table 15 illustrates the differences in mean and median value between the INFO treatment and the predicted calculated values *predINFO*. Even though the strategies of the voters are calculated with the mean value of the elicited beliefs in the INFO treatment($\lambda_{INFO} = 47.70\%$), the predicted belief on average differs from the INFO values. However, the Wilcoxon-Ranksum test does not show any differences either between the average values or in the median values.

Table 15: The predicted beliefs compared to the average belief from INFO treatment

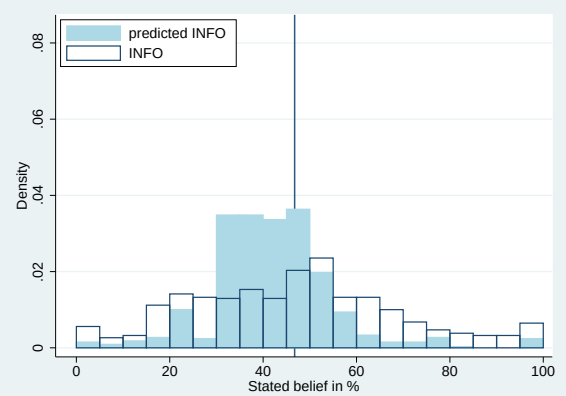
	predINFO				INFO				WRS	
	count	mean	p50	sd	count	mean	p50	sd	mean	p50
(general) belief	1656	46.93	47.70	20.95	1680	47.70	49.65	27.10		
(session) belief	7	46.93	46.14	1.28	7	47.70	46.62	2.65	0.848	0.142
(subject) belief	84	46.95	45.61	5.86	84	47.70	48.27	11.10	0.518	0.518

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

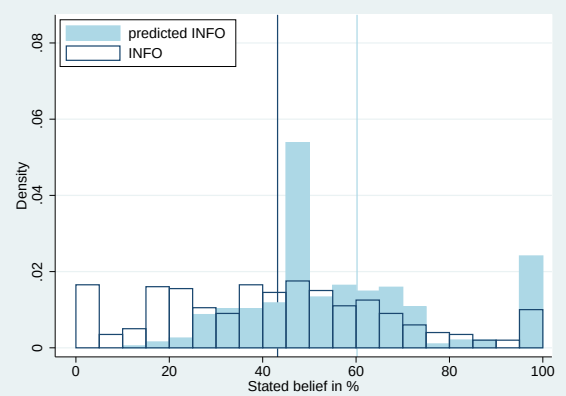
Even though the average and the median values are similar in general between the two treatments, the distribution of the elicited and predicted beliefs between them seems to be different over the six events (see Figure 8).

Figure 8: Distribution of beliefs of the 6 different events - INFO vs the predicted values dark blue stands for the average of beliefs in INFO ; light blue line represents the average of beliefs in predINFO

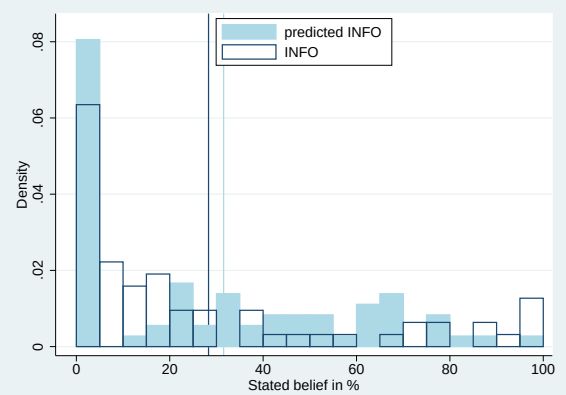
(a) $\sigma = 0, y = 12$



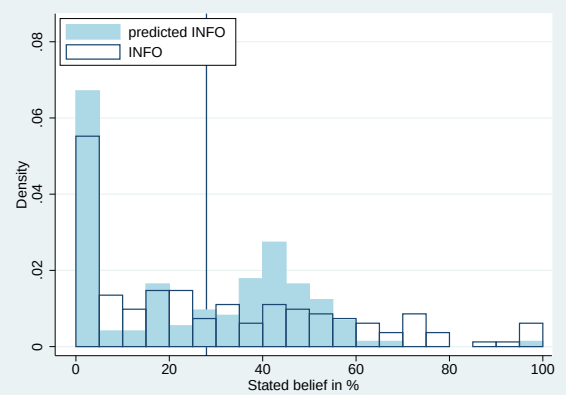
(b) $\sigma = 1, y = 12$



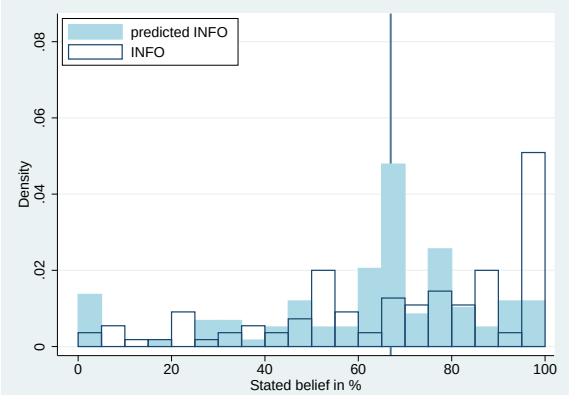
(c) $\sigma = 0, y = 4$



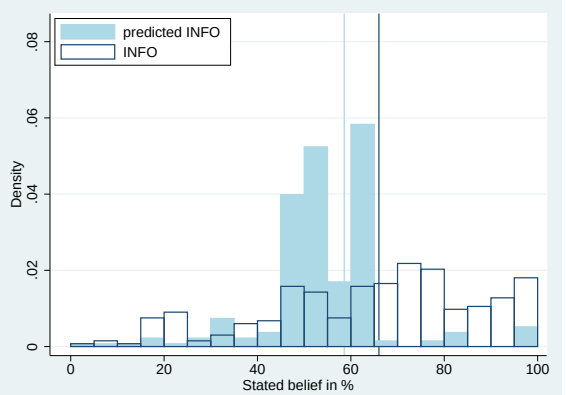
(d) $\sigma = 1, y = 4$



(e) $\sigma = 0, y = 20$
unexpected success



(f) $\sigma = 1, y = 20$
expected success

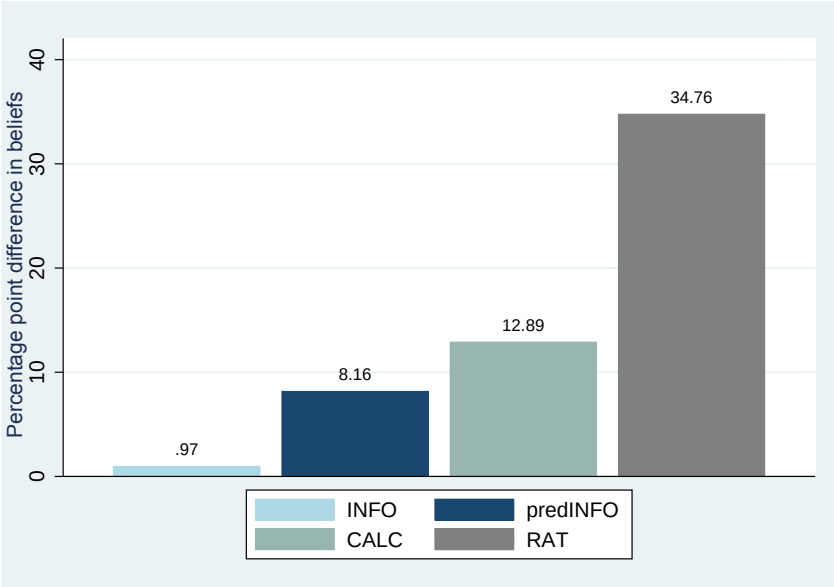


The average of beliefs in predINFO are represented with a light blue line and the average of the beliefs in INFO treatment are represented with a dark blue line. In three out of 6 cases only the dark blue line is visible, meaning that the two average values are almost the same. Significant differences are observable for $\sigma = 1, y = 12$ and $\sigma = 1, y = 20$ (see Table 34 in Appendix at page 62). For $\sigma = 1, y = 12$ the predicted average value is further from the RAT values than the average of the elicited belief in the INFO treatment. This arises from the fact that a big share of the voters undershoot the probability of reelecting the incumbent with whom they are playing in this case. Voters might interpret that the incumbent with whom they are playing with, is a low ability politicians, and chooses $a = 0$ to ensure the status qou outcome. That leads to the fact that a high share of voters evaluate the incumbent as a low ability politicians. But these voters do not considered in this case, that high ability politicians know a the real state of the world and therefore elected $a = 0$ contradictory to the signal. Therefore they undershoot the probability that the incumbent is a high ability politician.

In the case of $\sigma = 1, y = 20$ the predINFO value is closer to the theoretical values and it differs significantly from the INFO treatment elicited beliefs. This means that people in the case of an expected success overestimate the politicians' abilities and do not take into consideration that the politicians might act only according to the signal, and not necessarily according to the real state of the world.

Considering that the predicted values in the case of expected success are significantly smaller than in the INFO treatment, it is not surprising that the percentage point difference between expected and unexpected success is closer to the rational theory predicted value (see Figure 9). This difference, such as in the case of CALC treatment, is significant in contrast to the INFO treatment (see Table 34).

Figure 9: Percentage point differences between the event expected and unexpected success depending on treatment compared to predicted and rational theory predicted values



Even though the averages are similar between INFO treatment and the predicted

beliefs, one can see in Figure 8 that over- and undershooting during eliciting beliefs in the INFO treatment is more common than the calculator would predict. Especially since the politician achieves in these cases success (see Figure 8e and 8f).

Since we learned in the previous section (Section 6.1) that voters have difficulties to estimate strategies of politicians as $\sigma = 1$, the high deviation of the predicted beliefs and the estimated beliefs in the INFO treatment in the above mentioned two events make the comparison even more outstanding. In one case($\sigma = 1, y = 20$) the predicted values tend to be closer to the RAT values, in contrast to the other case ($\sigma = 1, y = 12$) where the predicted beliefs deviate more from the RAT predicted values than from the beliefs in the INFO treatment. Additionally, this dissimilarity between the outcomes and the different distributions of the two cases over the six events lead me to conclude that the Bayesian Calculator corrects the over- and undershooting of beliefs (especially in the case of the difference between expected and unexpected success). This over and undershooting of beliefs could be explained by the fact that voters are not able to take into account the correct λ when they are eliciting their beliefs. But the comparison between the distribution of their elicited belief with updated prior and the calculated beliefs shows inconsistency. Therefore the prior alone cannot serve as a single explanation.

However, it is also observable in the predicted values that besides the updated prior problem voters still struggle with estimating the strategies of politicians (especially in the case of strategies of low ability politicians and when the signal is 1). The wrong estimation of strategies when $\sigma = 1$ can be responsible for the predicted beliefs which are deviating significantly from the elicited beliefs in the INFO treatment.

Given the indirect analysis, Hypothesis 1 cannot be declined. However, I found direct evidence neither to verify nor to decline my hypothesis. In section 6 I will yield evidence that in some aspects voters are struggling to estimate politicians' strategies. Nevertheless, I do not have data which could explain the direct connection between belief formation and strategy estimation.

8 Possible extensions

The treatment CALC is appropriate to analyse how voters estimate politicians' strategies on average. However, to understand how exactly the belief elicitation of voters relates to their estimation of the strategy of politicians, I would recommend an in-between treatment. In this in-between treatment voters would have to estimate the six strategies of politicians and afterwards they should elicit their belief according to what they think the probability is that the incumbent with whom they are playing is a high type, without reporting them the calculated beliefs.

This in-between treatment would allow us to understand how the estimation of strategies influences the elicited beliefs μ. It would help to understand, people who are struggling to estimate strategies where $\sigma = 1$ elicit their beliefs differently and thus, were able to make more rational decisions compared to those who understood strategies better where $\sigma = 1$. This suggestion applies also to voters who are struggling to estimate strategies especially in the case of low ability politicians. Furthermore, it would be worth to analyse, whether those who overestimate the politicians' willingness to act more risky as they actually do, evaluate their belief differently than those who

underestimate the willingness of politicians to act more risky. [22]

Besides the extension of my master thesis after explaining μ with all the estimated strategies one could predict the factor λ with what voters were calculating with on average and hence gain a more precise overview on the belief elicitation process. Since we would have all these informations about the process how voters form their beliefs, one could analyse on the one hand whether voters who have better estimations about the strategy choice of politicians' are able to update λ better. And on the other hand one could explore in more detail which available individual characteristics (such as the level of hindsight biased, long term memory, working memory...etc.) play a significant role in the ability updating λ.

Last but not least I would suggest to additionally consider whether the extra amount of time and thoughts, that is spend by voters to consider more thoughtfully the different strategies of politicians' has an impact on their belief elicitation. Enke (2015) showed in his research that "higher response times are significantly associated with less neglect". In the case of CALC treatment the stage Bayesian Calculator would force people to consider the possible strategies of politicians more consciously and therefore, would perhaps enable voters to form more precise beliefs.

9 Conclusion

Elections provide the possibility for voters to express their political preferences. But from an economical point of view voters' aim is to maximise their utility and their wealth. Therefore, they want to elect a leader who can provide it them. To make election decisions is about forming beliefs about different politicians and making a rational choice about whom to elect. However, forming beliefs about politicians is a complex task. To be able to take all available information into account, and weight these with respect to our preferences is an intricate process. Especially, taking into consideration the lack of information that voters are suffering from.
Previous research has shown that voters are more indulgent to politicians than rational theory predicts. Furthermore, past studies have found that people struggle with correctly updating the priors when they are estimating probabilities. Since earlier studies investigated mostly elementary models of Bayesian belief updating, I considered a more complex form of belief which includes more components. This serves to understand how voters construct and interpret politicians' behaviour and strategy. This study adds a deeper understanding of voters' decision making in elections by examining in more detail how voters assess the strategies of politicians.
One of my main finding is that voters tend to fail correctly updating the prior and therefore, their way of belief forming fails. After the implementation of the Bayesian Calculator and thus, being able to control some factors, the results showed a significant change in the calculated beliefs compared to the elicited beliefs in previous treatments. The calculated beliefs approach the equilibrium beliefs. Since calculated belief serves as a tool for the voters to consider whom to elect, the development in the beliefs led to

[22] Since treatment CALC did not allowed me to investigate this specific question and this aspect was not significant on the election decisions (see Table 27 in Appendix at page 56) I did not provided any further details in my master thesis.

more rational election decisions as well.
Furthermore, the study shows that as voters estimate the strategies of politicians, they fail in several ways. Average voters cannot estimate how politicians act in cases where politicians do not have all the necessary information; especially when it is recommended to the incumbent to take risk instead of acting according to the status quo.
However, it is important to emphasize that this study alone does not take all the necessary components into account to compare the strategy estimation abilities of voters with their elicited beliefs. Therefore, one cannot directly tell in which dimension which voter fails to incorporate the correct prior (which is actually a common knowledge in the game). But in an indirect way I found evidence, that a correction of failing to update the factors correctly is alone not the key problem of the voters. On the one hand the calculator corrects not only the prior but also for the over- and undershooting evaluation of the abilities of politicians in case of success or failure. On the other hand, because voters fail at several points to estimate politicians' strategies besides updating priors, it is not even with the help of the calculator possible to produce the equilibrium strategies. However, it has been clear that to gain a precise insight into voters' evaluation method of beliefs further extensions are needed.
This study showed that more rational election decisions of voters indicate more rational action of the politicians. Moreover, it highlighted the fact that if voters were able to incorporate correctly the available information in their belief elicitation, it would also inspire politicians to act more rational and not be driven by their risk preferences.

Appendix A Tables

A.1 Politicians and their strategy choices

Table 16: Reelection rate depending on the strategy choice of politicians compared to the rational theory predicted values in the INFO treatment

Strategy	**EMP**$_{INFO}$			**RAT**	**Reelection rate depending on a**$\in [0,1]$			
($s_{\omega\sigma}$)	Obs.	Mean	SD		action of politician	Obs.	Mean	SD
High ability politicians strategy of choosing $a = 1$								
s11	88	90.91	28.91	100		88	54.55	50.01
					$a = 1$	80	57.50	49.75
					$a = 0$	8	25.00	46.29
s10	70	90	30.21	100		70	72.86	44.79
					$a = 1$	63	73.02	44.74
					$a = 0$	7	71.43	48.80
s01	73	24.66	43.40	0		73	38.35	48.96
					$a = 1$	18	16.47	38.35
					$a = 0$	55	45.46	50.25
s00	89	6.47	25.22	0		89	47.19	50.20
					$a = 1$	6	50.00	54.77
					$a = 0$	83	46.99	50.21
Low ability politicians strategy of choosing $a = 1$								
s0	693	15.01	35.74	16.05		693	46.47	49.91
					$a = 1$	104	44.23	49.90
					$a = 0$	589	46.86	49.94
s1	667	49.65	50.00	70.65		667	46.18	49.89
					$a = 1$	331	50.15	50.08
					$a = 0$	336	42.26	49.47

Table 17: Politicians' decision explained by risk preferences, signal and personal attributes

	Dependent variable is paction$\in [0,1]$			
	choicebhl		riskgeneral	
VARIABLES	high	low	high	low
choicebhl	0.029	0.086***		
	(0.020)	(0.024)		
riskgeneral			0.185**	0.422***
			(0.083)	(0.121)
qsignal	0.295***	1.342***	0.296***	1.342***
	(0.108)	(0.103)	(0.108)	(0.102)
age	-0.013	0.047***	-0.014*	0.040***
	(0.008)	(0.016)	(0.008)	(0.013)
sex	-0.327***	0.230	-0.320***	0.251*
	(0.097)	(0.147)	(0.100)	(0.146)
yearuni	-0.003	0.032**	-0.004	0.023***
	(0.002)	(0.016)	(0.002)	(0.009)
calc	0.020	-0.018	0.045	0.043
	(0.100)	(0.149)	(0.100)	(0.143)
Constant	6.664	-67.527**	7.525	-49.847***
	(4.874)	(31.681)	(4.577)	(17.297)
Observations	654	2,706	654	2,706
Number of subjectid	167	168	167	168
rho	2.10e-05	0.411	1.29e-05	0.399

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
clustered on subjectid
paction describes politicians action
high describes only high ability politicians' behaviour
low describes only low ability politicians' behaviour
riskgeneral describes the risk preference, ranked by themselves
choicebhl describes the risk preference, according to the game of Holt and Laury (2002)
yearuni describes the year when the participant started at the university
calc describes the treatment variable

A.2 General overview and comparison

Table 18: Re-election rates conditional on challenger ability on session level - unpolluted version

		INFO			CALC		WRS on
	count	mean	sd	count	mean	sd	Session level
Belief>λ_C	7	0.7856	0.0899	7	0.7918	0.0909	0.848
Belief<λ_C	7	0.1767	0.0364	7	0.2136	0.0463	0.142

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.3 Voters' strategy estimation

A.3.1 Excluding observations

According to Table 19 I would exclude those who more than 50% of the cases did not listen to the calculator and added suspicious inputs.[23] Most of them did not even changed their inputs over the periods. However in the case of subject 296 he changed his input in almost each periods but he did not listen to the calculators output 65% of the cases. All in all i would exclude 7 subjects from my further observations, two on the hand of cause nr.1 and a further 5 according cause nr.2.

Table 19: Suspicious strategy choice of voters

		number of votes against the calcul beliefs		
subjectid	*calculed*	**0 if belief>λ_C**	**1 if belief<λ_C**	against belief
266	19/20	2/5	8/15	**50%**
296	1/20	1/4	12/16	**65%**
314	2/20	4/6	2/14	30%
322	17/20	5/8	6/12	**55%**
350	20/20	0/4	5/11	25%
356	17/20	1/6	0/14	5%
368	14/20	2/3	4/17	30%
380	18/20	2/9	0/11	10%
486	1/20	1/6	1/14	10%
490	19/20	2/4	9/16	**55%**
502	10/20	1/6	2/14	15%

calculed describes the variable how often they recalculated their beliefs out of 20 period
belief describes the calculated belief of the subject
λ_C describes the % that the challenger is a high ability politician
against belief describes the % how often voters voted against the calculators' suggestion

Table 20 shows the differences between the polluted subjects and all the other observations. We can observe in 4 out of the 6 cases a big difference between the estimation of polluted and unpolluted subjects. And on average all the inputs for all the six strategy possibilities are similar, meaning that subjects used the same numbers for all the 6 inputs.

Since the analysis in this section focused on the strategy estimation of voters, I will took only the unpolluted population in to account but in all cases the results with all observations can be found in the following part

[23] On average people 24% did not acted according to the calculator.

Table 20: Difference in the estimation of strategies if the subject is considered as polluted or unpolluted

	Unpolluted			Polluted		
	count	mean	sd	count	mean	sd
s11	1560	86.11	27.11	120	29.74	27.62
s10	1560	72.41	31.85	120	30.94	27.41
s01	1560	27.91	29.17	120	25.74	26.90
s00	1560	25.46	34.23	120	23.00	23.64
s0	1560	31.26	21.75	120	36.02	33.91
s1	1560	64.62	25.15	120	34.18	28.12

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

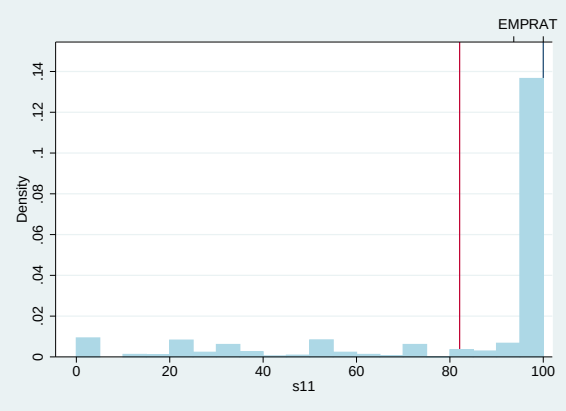
A.3.2 Overview

Table 21: All voters' estimation about the politicians' strategy choice compared to EMP and RAT

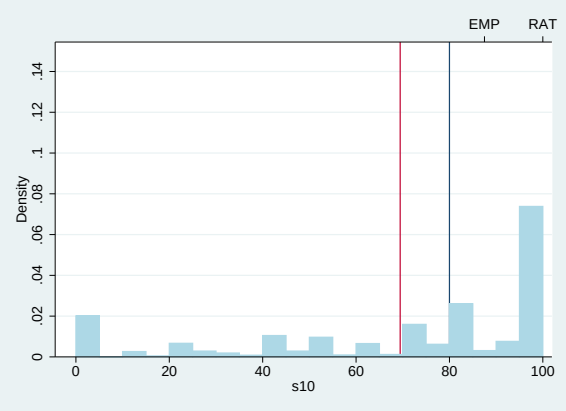
Strategy	**Voter's prediction**				**EMP**$_{CALC}$			**RAT**
	Obs.	Mean	Median	SD	Obs.	Mean	SD	
s11	1680	82.09	100	30.78	95	93.68	24.45	100
s10	1680	69.45	80	33.30	80	87.50	33.28	100
s01	1680	27.76	20	29.01	81	9.88	30.02	0
s00	1680	25.28	5	33.58	78	10.26	30.54	0
s0	1680	31.60	30	22.54	703	17.50	38.02	16.05
s1	1680	62.44	60	26.55	643	51.63	50.01	70.65

Figure 10: The distribution of voters' estimation about politicians strategy choice;
The red line represents the mean and the dark blue line the median;
emp describes the EMP and RAT the rational theory predicted value

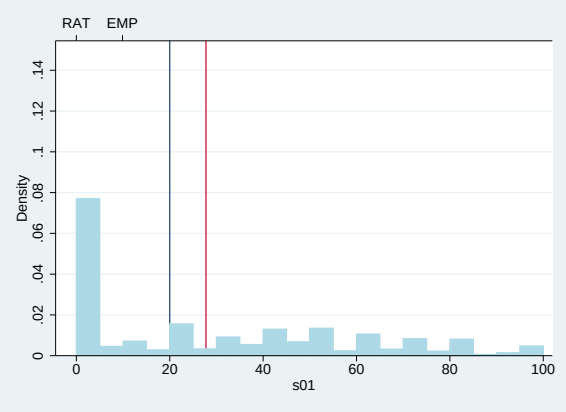
(a) s11



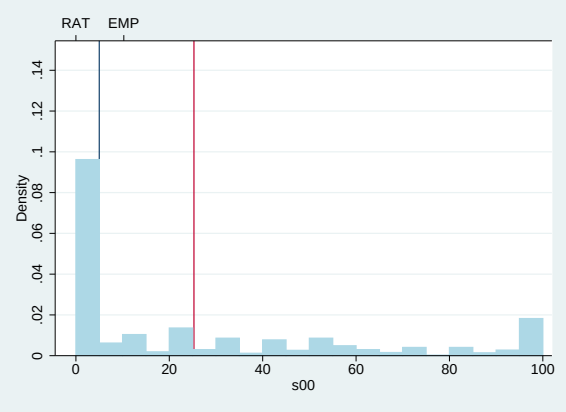
(b) s10



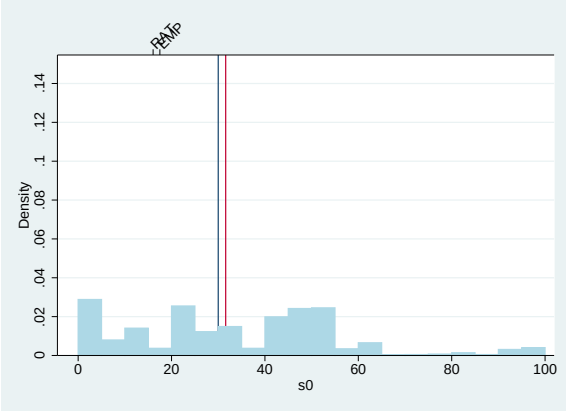
(c) s01



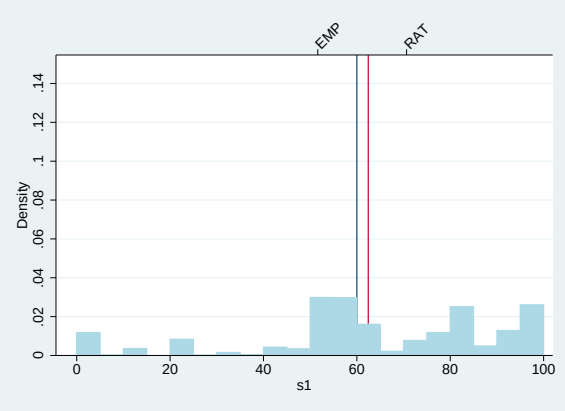
(d) s00



(e) s0



(f) s1



A.3.3 Learning effects

Table 22: Voters' estimation differences between first and second half session level(collapsed by the mean values) - with all observation

	First 10			Last 10			WSR on
	count	mean	sd	count	mean	sd	Session level
s11	7	81.90	5.82	7	82.27	6.96	0.866
s10	7	67.58	7.18	7	71.31	10.06	0.063*
s01	7	28.59	5.79	7	26.93	5.72	0.091*
s00	7	25.69	7.42	7	24.87	7.12	0.311
s0	7	32.85	7.16	7	30.35	8.15	0.091*
s1	7	63.41	6.96	7	61.47	8.83	0.091*
	count	mean	sd	count	mean	sd	Individual level
s11	84	81.90	24.83	84	82.27	29.24	0.1642
s10	84	67.58	28.45	84	71.31	29.64	0.009***
s01	84	28.59	25.25	84	26.93	27.47	0.084*
s00	84	25.69	29.55	84	24.87	31.01	0.232
s0	84	32.85	17.51	84	30.35	19.36	0.013**
s1	84	63.41	21.66	84	61.47	24.74	0.4222

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 23: Voters' estimation differences between first and second half session level (collapsed by the median values)

	First 10			Last 10			WSR on
	count	mean	sd	count	mean	sd	Session level
s11	7	100	0.38	7	100	0.19	0.317
s10	7	80	8.98	7	80	11.59	0.031**
s01	7	20	15.38	7	20	15.96	0.914
s00	7	5	17.42	7	0	14.93	0.326
s0	7	40	10.61	7	30	10.75	0.446
s1	7	63	11.22	7	63	8.37	0.666
	count	median	sd	count	median	sd	Individual level
s11	78	100	24.15	78	100	26.85	0.815
s10	78	80	29.78	78	80	29.92	0.261
s01	78	20	27.42	78	20	28.11	0.373
s00	78	7.5	32.55	78	1.25	33.75	0.478
s0	78	30	19.17	78	30	20.09	0.076*
s1	78	60	22.10	78	60	23.98	0.194

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 24: Voters' estimation differences between first and second half (collapsed by the median values)- with all observations

	First 10			Last 10			WSR on
	count	mean	sd	count	mean	sd	Session level
s11	7	99.86	0.38	7	99.93	0.19	0.317
s10	7	75.71	8.26	7	81.71	9.49	0.031**
s01	7	20.14	13.35	7	18.64	15.50	0.722
s00	7	9.64	17.23	7	12.36	14.85	0.326
s0	7	29.00	10.42	7	32.00	10.31	0.446
s1	7	66.14	10.76	7	62.86	8.93	0.439
	count	mean	sd	count	mean	sd	Individual level
s11	84	83.20	28.34	84	81.61	31.31	0.935
s10	84	70.52	31.31	84	70.54	32.34	0.417
s01	84	27.29	26.90	84	26.43	27.70	0.482
s00	84	24.79	31.84	84	25.49	32.89	0.969
s0	84	31.82	20.13	84	29.89	20.70	0.064*
s1	84	64.28	23.45	84	62.05	25.87	0.155

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.4 The weaknesses of voters according to politicians' strategies

A.4.1 Signal dependent

Table 25: The change in weighted mistake ranges on session and individual level depending on the signal - compared to RAT strategies

	First 10			Last 10			WRS on	Total
	N	mean	sd	N	mean	sd	mean	
Estimation mistake ranges on Session level								
$\sigma = 0$	7	0.2844	0.0520	7	0.2614	0.0611	0.063**	0.2832
$\sigma = 1$	7	0.2588	0.0324	7	0.2529	0.0375	0.398	0.3111
WSR		0.311			0.866			0.612
Estimation mistake ranges on Individual level								
$\sigma = 0$	84	0.2844	0.1945	84	0.2614	0.1932	0.005***	0.2729
$\sigma = 1$	84	0.2588	0.1671	84	0.2529	0.1923	0.039**	0.2559
WSR		0.772			0.731			0.940

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.4.2 Type dependent

Table 26: The change in weighted mistake ranges on session and individual level depending on the type of politician - compared to RAT strategies

	First 10			Last 10			WRS on	Total
	N	mean	sd	N	mean	sd		
Estimation mistake ranges on Session level								
high ability	7	0.2620	0.0344	7	0.2455	0.0357	0.028**	0.2538
low ability	7	0.2908	0.0495	7	0.2803	0.0540	0.499	0.2856
WSR		0.237			0.237			0.176
Estimation mistake ranges on Individual level								
high ability	84	0.2620	0.1994	84	0.2455	0.2054	0.020**	0.2538
low ability	84	0.2908	0.1307	84	0.2803	0.1453	0.009***	0.2856
WSR		0.128			0.088*			0.080*

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.4.3 Explaining reelection rate

Table 27: General xtprobit regression with the variables over and under estimation of politicians' strategies - empirical values

	Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)							
	good in general		good in signal		good in type		over/under estimation	
vbelief	0.018***		0.018***		0.018***		0.018***	
	(0.003)		(0.003)		(0.003)		(0.003)	
poltype	-0.031	-0.003	-0.036	-0.007	-0.031	-0.002	-0.040	-0.010
	(0.095)	(0.098)	(0.094)	(0.097)	(0.095)	(0.098)	(0.095)	(0.098)
challtype	-0.772***	-0.730***	-0.769***	-0.729***	-0.771***	-0.732***	-0.776***	-0.735***
	(0.082)	(0.077)	(0.082)	(0.077)	(0.082)	(0.077)	(0.082)	(0.077)
action	0.106	0.057	0.101	0.052	0.101	0.058	0.100	0.055
	(0.083)	(0.083)	(0.082)	(0.083)	(0.083)	(0.084)	(0.084)	(0.084)
payoff1	0.058***	0.075***	0.058***	0.075***	0.058***	0.075***	0.057***	0.074***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
wgoodemp	-0.133	-0.181**						
	(0.086)	(0.084)						
wgoodemp0			-0.245***	-0.210***				
			(0.084)	(0.081)				
wgoodemp1			0.115	0.010				
			(0.099)	(0.099)				
wgoodemph					-0.229**	-0.157*		
					(0.091)	(0.087)		
wgoodempl					-0.047	-0.185**		
					(0.092)	(0.088)		
wmoreaverse							-0.158	-0.128
							(0.110)	(0.098)
Constant	-1.161***	-0.928***	-1.175***	-0.921***	-1.100***	-0.842***	-1.183***	-0.977***
	(0.128)	(0.136)	(0.144)	(0.151)	(0.147)	(0.153)	(0.127)	(0.134)
Obs.	1,663	1,680	1,663	1,680	1,663	1,680	1,663	1,680
Nr of subjects	84	84	84	84	84	84	84	84
rho	0.109	0.0973	0.0967	0.0913	0.104	0.0920	0.110	0.103

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
xtprobit regression clustered by subjects
vbelief describes voters' calculated belief
poltype describes politicians' type (= 1 if high type, = 0 if low type)
challtype describes challengers' type (= 1 if high type, = 0 if low type)
action describes the action of the politician
payoff1 describes the payoff of the round
wgoodemp strategy estimation ability of voters in general
wgoodemp0 strategy estimation ability of voters if $\sigma = 0$
wgoodemp1 strategy estimations ability of voters if $\sigma = 1$
wgoodemph ability of voters regarding estimating high ability politicians' strategies
wgoodempl ability of voters regarding estimating low ability politicians' strategies
wmoreaverse = 1 if the voter estimated that the politicians are willing to take less risk as they actually did
= 0 if the voter estimated that the politicians are willing to take more risk as they actually did

Table 28: Effects in the first 10 periods - empirical values

	Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)					
	good in general		good in signal		good in type	
vbelief	0.019***		0.019***		0.019***	
	(0.004)		(0.004)		(0.004)	
poltype	-0.022	-0.001	-0.039	-0.015	-0.024	0.001
	(0.139)	(0.137)	(0.139)	(0.137)	(0.141)	(0.138)
challtype	-0.678***	-0.677***	-0.670***	-0.675***	-0.674***	-0.681***
	(0.114)	(0.107)	(0.113)	(0.107)	(0.112)	(0.107)
action	0.035	-0.016	0.024	-0.026	0.029	-0.020
	(0.116)	(0.114)	(0.114)	(0.112)	(0.114)	(0.113)
payoff1	0.059***	0.079***	0.059***	0.079***	0.060***	0.079***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
wgoodemp	-0.169	-0.208*				
	(0.111)	(0.106)				
wgoodemp0			-0.265**	-0.232**		
			(0.109)	(0.103)		
wgoodemp1			0.163	0.069		
			(0.111)	(0.108)		
wgoodemph					-0.261**	-0.219**
					(0.107)	(0.105)
wgoodempl					-0.018	-0.139
					(0.114)	(0.110)
Constant	-1.146***	-0.928***	-1.198***	-0.953***	-1.111***	-0.849***
	0.169)	(0.174)	(0.184)	(0.189)	(0.183)	(0.187)
Observations	833	840	833	840	833	840
Number of subjectid	84	84	84	84	84	84
rho	0.0600	0.0453	0.0472	0.0411	0.0558	0.0429

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
xtprobit regression clustered by subjects
vbelief describes voters' calculated belief
poltype describes politicians' type (= 1 if high type, = 0 if low type)
challtype describes challengers' type (= 1 if high type, = 0 if low type)
action describes the action of the politician
payoff1 describes the payoff of the round
wgoodemp strategy estimation ability of voters in general
wgoodemp0 strategy estimation ability of voters if $\sigma = 0$
wgoodemp1 strategy estimations ability of voters if $\sigma = 1$
wgoodemph ability of voters regarding estimating high ability politicians' strategies
wgoodempl ability of voters regarding estimating low ability politicians' strategies

Table 29: Effects in the last 10 periods - empirical values

	Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)					
	good in general		good in signal		good in type	
vbelief	0.017***		0.017***		0.017***	
	(0.004)		(0.004)		(0.004)	
poltype	-0.010	0.015	-0.014	0.017	-0.010	0.015
	(0.130)	(0.132)	(0.130)	(0.132)	(0.130)	(0.132)
challengerha	-0.864***	-0.783***	-0.861***	-0.781***	-0.861***	-0.779***
	(0.122)	(0.111)	(0.123)	(0.112)	(0.122)	(0.111)
pact_v	0.161	0.109	0.155	0.101	0.161	0.121
	(0.110)	(0.106)	(0.110)	(0.106)	(0.111)	(0.108)
payoff1	0.055***	0.070***	0.055***	0.071***	0.055***	0.070***
	(0.013)	(0.012)	(0.013)	(0.012)	(0.013)	(0.012)
wgoodemp	-0.158	-0.222*				
	(0.129)	(0.126)				
wgoodemp0			-0.289**	-0.257**		
			(0.117)	(0.114)		
wgoodemp1			0.022	-0.109		
			(0.128)	(0.123)		
wgoodemph					-0.205*	-0.119
					(0.122)	(0.120)
wgoodempl					-0.096	-0.243**
					(0.116)	(0.109)
Constant	-1.114***	-0.881***	-1.066***	-0.815***	-1.051***	-0.812***
	(0.193)	(0.194)	(0.210)	(0.207)	(0.208)	(0.211)
Observations	830	840	830	840	830	840
Number of subjectid	84	84	84	84	84	84
rho	0.142	0.139	0.130	0.133	0.132	0.123

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
xtprobit regression clustered by subjects
vbelief describes voters' calculated belief
poltype describes politicians' type (= 1 if high type, = 0 if low type)
challtype describes challengers' type (= 1 if high type, = 0 if low type)
action describes the action of the politician
payoff1 describes the payoff of the round
wgoodemp strategy estimation ability of voters in general
wgoodemp0 strategy estimation ability of voters if $\sigma = 0$
wgoodemp1 strategy estimations ability of voters if $\sigma = 1$
wgoodemph ability of voters regarding estimating high ability politicians' strategies
wgoodempl ability of voters regarding estimating low ability politicians' strategies

Table 30: General xtprobit regression - RAT values

	Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)							
	good in general		good in signal		good in type		over/under estimation	
vbelief	0.018***		0.018***		0.018***		0.018***	
	(0.003)		(0.003)		(0.003)		(0.003)	
poltype	-0.030	-0.004	-0.036	-0.010	-0.029	-0.004	-0.037	-0.009
	(0.096)	(0.099)	(0.095)	(0.098)	(0.096)	(0.098)	(0.095)	(0.097)
challengerha	-0.772***	-0.731***	-0.768***	-0.728***	-0.775***	-0.734***	-0.775***	-0.733***
	(0.081)	(0.077)	(0.081)	(0.077)	(0.081)	(0.077)	(0.082)	(0.077)
pact_v	0.104	0.056	0.097	0.051	0.097	0.050	0.102	0.055
	(0.083)	(0.084)	(0.082)	(0.083)	(0.083)	(0.083)	(0.084)	(0.085)
payoff1	0.059***	0.076***	0.059***	0.076***	0.059***	0.076***	0.057***	0.074***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)
wgoodrt	-0.261***	-0.243***						
	(0.092)	(0.088)						
wgoodrt0			-0.345***	-0.297***				
			(0.087)	(0.084)				
wgoodrt1			0.088	0.038				
			(0.098)	(0.095)				
wgoodrth					-0.274***	-0.205**		
					(0.086)	(0.084)		
wgoodrtl					-0.079	-0.156*		
					(0.099)	(0.092)		
moreaverse							-0.091	-0.090
							(0.104)	(0.090)
Constant	-1.116***	-0.910***	-1.117***	-0.902***	-1.059***	-0.845***	-1.196***	-0.984***
	(0.129)	(0.135)	(0.135)	(0.143)	(0.133)	(0.141)	(0.126)	(0.134)
Observations	1,663	1,680	1,663	1,680	1,663	1,680	1,663	1,680
Number of subjectid	84	84	84	84	84	84	84	84
rho	0.105	0.0959	0.0918	0.0873	0.0997	0.0901	0.113	0.105

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors in parentheses

xtprobit regression clustered by subjects

vbelief describes voters' calculated belief

poltype describes politicians' type (= 1 if high type, = 0 if low type)

challtype describes challengers' type (= 1 if high type, = 0 if low type)

action describes the action of the politician

payoff1 describes the payoff of the round

wgoodemp strategy estimation ability of voters in general

wgoodemp0 strategy estimation ability of voters if $\sigma = 0$

wgoodemp1 strategy estimations ability of voters if $\sigma = 1$

wgoodemph ability of voters regarding estimating high ability politicians' strategies

wgoodempl ability of voters regarding estimating low ability politicians' strategies

moreaverse = 1 if the voter estimated that the politicians are willing to take less risk as the rational theory predicts

Table 31: Effects in the first 10 periods - RAT values

	Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)					
	good in general		good in signal		good in type	
vbelief	0.019***		0.019***		0.019***	
	(0.004)		(0.004)		(0.004)	
poltype	-0.022	-0.006	-0.035	-0.018	-0.019	-0.003
	(0.141)	(0.139)	(0.140)	(0.138)	(0.141)	(0.138)
challengerha	-0.669***	-0.671***	-0.661***	-0.670***	-0.668***	-0.671***
	(0.112)	(0.106)	(0.111)	(0.106)	(0.112)	(0.106)
pact_v	0.028	-0.021	0.026	-0.023	0.029	-0.019
	(0.115)	(0.113)	(0.113)	(0.112)	(0.114)	(0.113)
payoff1	0.061***	0.081***	0.060***	0.080***	0.060***	0.080***
	(0.013)	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)
wgoodrt0			-0.477***	-0.381***		
			(0.107)	(0.104)		
wgoodrt1			0.177	0.100		
			(0.112)	(0.110)		
wgoodrt	-0.330***	-0.317***				
	(0.105)	(0.099)				
wgoodrth					-0.342***	-0.288***
					(0.104)	(0.098)
wgoodrtl					0.008	-0.072
					(0.116)	(0.107)
Constant	-1.106***	-0.904***	-1.116***	-0.909***	-1.078***	-0.858***
	(0.169)	(0.173)	(0.172)	(0.177)	((0.171)	(0.177)
Observations	833	840	833	840	833	840
Number of subjectid	84	84	84	84	84	84
rho	0.0464	0.0356	0.0309	0.0306	0.0475	0.0356

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
xtprobit regression clustered by subjects
vbelief describes voters' calculated belief
poltype describes politicians' type (= 1 if high type, = 0 if low type)
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Table 32: Effects in the lasst 10 periods - RAT values

	Dependent variable is reelection decision(= 1 reelect incumbent, = 0 elect challenger)					
	good in general		good in signal		good in type	
vbelief	0.017***		0.017***		0.017***	
	(0.004)		(0.004)		(0.004)	
poltype	-0.010	0.016	-0.012	0.014	-0.008	0.016
	(0.130)	(0.132)	(0.130)	(0.132)	(0.130)	(0.132)
challengerha	-0.866***	-0.783***	-0.862***	-0.781***	-0.866***	-0.784***
	(0.122)	(0.111)	(0.122)	(0.112)	(0.121)	(0.111)
pact_v	0.164	0.113	0.153	0.104	0.158	0.111
	(0.111)	(0.107)	(0.110)	(0.106)	(0.109)	(0.106)
payoff1	0.055***	0.070***	0.056***	0.071***	0.055***	0.070***
	(0.013)	(0.012)	(0.013)	(0.012)	(0.013)	(0.012)
wgoodrt0			-0.258**	-0.265**		
			(0.126)	(0.123)		
wgoodrt1			-0.003	-0.022		
			(0.132)	(0.124)		
wgoodrt	-0.206*	-0.197				
	(0.123)	(0.123)				
wgoodrth					-0.201	-0.135
					(0.124)	(0.125)
wgoodrtl					-0.191*	-0.251**
					(0.115)	(0.114)
Constant	-1.100***	-0.901***	-1.075***	-0.862***	-0.997***	-0.800***
	(0.188)	(0.187)	(0.198)	(0.198)	(0.198)	(0.199)
Observations	830	840	830	840	830	840
Number of subjectid	84	84	84	84	84	84
rho	0.141	0.139	0.132	0.131	0.129	0.124

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors in parentheses
xtprobit regression clustered by subjects
vbelief describes voters' calculated belief
poltype describes politicians' type (= 1 if high type, = 0 if low type)
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Table 33: Re-election rates depending to the politician ability and estimation abilities of voters

	Upper half			Lower half			WSR on
	count	mean	sd	count	mean	sd	Session level
*In general **depending on signal***:							
Being good estimating strategies if $\sigma = 0$:							
Low ability	676	0.3018	0.4594	670	0.3851	0.4870	0.063*
High ability	166	0.4337	0.4971	168	0.4762	0.5009	0.499
Total	842	0.3278	0.4697	838	0.4033	0.4909	0.028**
Being good estimating strategies if $\sigma = 1$:							
Low ability	660	0.3318	0.4712	686	0.3542	0.4786	0.7353
High ability	186	0.4570	0.4995	148	0.4527	0.4994	0.8658
Total	846	0.3593	0.4801	834	0.3717	0.4835	0.866
*In general **depending on type***:							
Being good estimating strategies low ability politicians' strategy:							
Low ability	722	0.3199	0.4668	624	0.3702	0.4832	0.237
High ability	192	0.4115	0.4934	142	0.5141	0.5016	0.028**
Total	914	0.3392	0.4737	766	0.3969	0.4896	0.176
Being good estimating strategies high ability politicians' strategy:							
Low ability	664	0.3042	0.4604	682	0.3812	0.4860	0.043**
High ability	167	0.4611	0.5000	167	0.4491	0.4989	0.735
Total	831	0.3357	0.4725	849	0.3946	0.4890	0.128
*Being good depending **on the average** of the estimation of all six strategies*:							
Low ability	665	0.3098	0.4627	589	0.3616	0.4809	0.176
High ability	174	0.4425	0.4981	132	0.4470	0.4991	0.612
Total	839	0.3373	0.4731	721	0.3773	0.4850	0.128

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.5 Is it the strategy estimation or updating the priors?

Table 34: Differences between beliefs over treatments and the predicted values

	CALC			predictedINFO			INFO			WRS on
	N	mean	sd	N	mean	sd	N	mean	sd	Session level
$\sigma = 0, w = 12$	7	17.55	2.75	7	46.65	3.78	7	46.77	4.04	0.949
$\sigma = 1, w = 12$	7	32.85	4.92	7	60.21	4.21	7	43.19	7.58	0.002***
$\sigma = 0, w = 4$	7	15.00	6.23	7	31.54	12.14	7	28.31	11.20	0.655
$\sigma = 1, w = 4$	7	10.57	2.99	7	28.00	7.08	7	27.95	11.85	0.655
$\sigma = 0, w = 20$	7	39.65	6.01	7	66.74	6.12	7	66.98	8.81	0.949
$\sigma = 1, w = 20$	7	26.76	3.48	7	58.58	3.71	7	66.01	5.43	0.006***
WSR between exp/unexp. success:		0.018**			0.028**			0.866		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

WRS between CALC and predINFO is significant in all 6 cases at $\alpha = 5\%$

Appendix B On-screen Instructions

Calculator

In the following you are asked to predict whether the politician you interact with is of high competence. Recall that initially the politician had a 20% chance of being of high competence.

You are given a special calculator to predict how likely it is that the politician you interact with is of high competence. For this calculator, you need to answer 6 questions about the chance that a politician chooses action B on the next screen.

Given your answers and the situation in the period (public forecast and outcome), **the computer will calculate for you a statistical prediction about the likelihood that the politician in this period is of high competence.**

In order to maximize your payment from the task, the best you can do is to state in each question exactly the chance with which you think the politician will choose action B.

At the end of the experiment, the statistical prediction of one period will be randomly selected for payment. The better this prediction is, the more you earn. You receive 1 Euro if your prediction is exactly correct.

Description of task

Please answer each of the following 6 questions about the chance that a politician chooses ACTION B. In each question, please state a probability between 0% and 100%. Choosing 0 (%) means that you are absolutely certain that the politician will NOT choose action B. Choosing 100 (%) means that you are absolutely certain that the politician will choose action B.

After you answered all questions, please click "Calculate". A special calculator will help you to predict how likely it is that the politician you interact with in this period is of high competence. Given your 6 answers and the current situation (public forecast and outcome), **the computer will calculate a statistical prediction about the likelihood that the politician is of high competence.**
Note: a low-competence politician only receives the public forecast about which action is appropriate while a high-competence politician also knows with certainty which is the appropriate action.
PUT IN NEW VALUES ONLY IF YOU WANT TO CHANGE THE CURRENT PREDICTION. OTHERWISE PRESS CONTINUE.

	Your previous estimation in % (about the decision of the politician)	**Your current estimation in %** Please enter a value between 0 and 100
What do you think is the chance that a HIGH-COMPETENCE politician chooses ACTION B...		
... if the public forecast is **action B leads to a higher payoff than A** and the politician knows that **the appropiate action is B**	80.0	
... if the public forecast is **action B leads to a lower payoff than A** and the politician knows that **the appropiate action is B**	80.0	
... if the public forecast is **action B leads to a higher payoff than A** and the politician knows that **the appropiate action is A**	60.0	
... if the public forecast is **action B leads to a lower payoff than A** and the politician knows that **the appropiate action is A**	40.0	
What do you think is the chance that a LOW-COMPETENCE politician chooses ACTION B...		
... if the public forecast is **action B leads to a higher payoff than A**	50.0	
... if the public forecast is **action B leads to a lower payoff than A**	20.0	
Summary of current situation: the public forecast is: **action B leads to a higher payoff than action A** The politician chose: **action A** The outcome for this part is: **medium payoff (12€)**		
Given your 6 answers about the behavior of the politician and the situation in this period (public forecast and outcome), the statistical prediction about the likelihood that the politician is of high competence is (in %):	12.7	

Only click "Calculate" for a new prediction if you changed the inputs. The computer will calculate for you a statistical prediction about the likelihood that the politician you interact with in this period is of high competence.
The statistical prediction the computer will calculate for you depends on your 6 answers **and** the given situation (public forecast and outcome). The more precise your 6 answers about the politician's chance of choosing action B are, the more precise is the statistical prediction the computer makes for you.
You can change each of your 6 answers as often as you wish. Each time you click "Calculate", the computer updates the statistical prediction how likely the politician is to be of high competence. If you DO NOT want to change the prediction, please click "Continue".

Calculate Continue

Figure 11: Screen where voters estimate the strategy of politicians

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References

Achen, C. H., & Bartels, L. M. (2004). Blind retrospection: Electoral responses to drought, flu, and shark attacks.

Ashworth, S., & De Mesquita, E. B. (2014). Is voter competence good for voters?: Information, rationality, and democratic performance. *American Political Science Review*, *108*(3), 565–587.

Bisin, A., Lizzeri, A., & Yariv, L. (2015). Government policy with time inconsistent voters. *American Economic Review*, *105*(6), 1711–37.

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological assessment*, *6*(4), 284.

Enke, B. (2015). What you see is all there is.

Fischbacher, U. (2007). z-tree: Zurich toolbox for ready-made economic experiments. *Experimental economics*, *10*(2), 171–178.

Gennaioli, N., & Shleifer, A. (2010). What comes to mind. *The Quarterly journal of economics*, *125*(4), 1399–1433.

Gigerenzer, G., & Hoffrage, U. (1995). How to improve bayesian reasoning without instruction: frequency formats. *Psychological review*, *102*(4), 684.

Gonzalez, R., & Wu, G. (1999). On the shape of the probability weighting function. *Cognitive psychology*, *38*(1), 129–166.

Greiner, B. (2015). Subject pool recruitment procedures: organizing experiments with orsee. *Journal of the Economic Science Association*, *1*(1), 114–125.

Grether, D. M. (1980). Bayes rule as a descriptive model: The representativeness heuristic. *The Quarterly Journal of Economics*, *95*(3), 537–557.

Grether, D. M. (1990). Testing bayes rule and the representativeness heuristic: Some experimental evidence.

Healy, A., & Lenz, G. S. (2014). Substituting the end for the whole: Why voters respond primarily to the election-year economy. *American Journal of Political Science*, *58*(1), 31–47.

Healy, A. J., Malhotra, N., & Mo, C. H. (2010). Irrelevant events affect voters' evaluations of government performance. *Proceedings of the National Academy of Sciences*, *107*(29), 12804–12809.

Holt, C. A., & Anderson, L. R. (1996). Classroom games: Understanding bayes' rule. *Journal of Economic Perspectives*, *10*(2), 179–187.

Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. *American economic review*, *92*(5), 1644–1655.

Holt, C. A., & Smith, A. M. (2009). An update on bayesian updating. *Journal of Economic Behavior & Organization*, *69*(2), 125–134.

Huber, G. A., Hill, S. J., & Lenz, G. S. (2012). Sources of bias in retrospective decision making: Experimental evidence on voters' limitations in controlling incumbents. *American Political Science Review*, *106*(4), 720–741.

Kahana, M. J. (2012). *Foundations of human memory*. OUP USA.

Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. *Cognitive psychology*, *3*(3), 430–454.

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological review*, *80*(4), 237.

Kahneman, D., & Tversky, A. (1977). *Intuitive prediction: Biases and corrective procedures* (Tech. Rep.). DECISIONS AND DESIGNS INC MCLEAN VA.

Levy, G., & Razin, R. (2015). Correlation neglect, voting behavior, and information aggregation. *American Economic Review*, *105*(4), 1634–45.

Mullainathan, S. (2002). A memory-based model of bounded rationality. *The Quarterly Journal of Economics*, *117*(3), 735–774.

Nagel, R. (1995). Unraveling in guessing games: An experimental study. *The American Economic Review*, *85*(5), 1313–1326.

Peterson, C. R., & Beach, L. R. (1967). Man as an intuitive statistician. *Psychological bulletin*, *68*(1), 29.

Schuett, F., & Wagner, A. K. (2011). Hindsight-biased evaluation of political decision makers. *Journal of Public Economics*, *95*(11-12), 1621–1634.

Schuett, F., Wagner, A. K., & Tyran, J.-R. (2018). Bad memory, bad policy?

Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological review*, *90*(4), 293.

Wilson, A. (2014). Bounded memory and biases in information processing. *Econometrica*, *82*(6), 2257–2294.

Wolfers, J., et al. (2002). *Are voters rational?: Evidence from gubernatorial elections*. Graduate School of Business, Stanford University.