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„Selection Of Politicians Under Hindsight-Bias“

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Contents

List of Tables

List of Figures

Chapter 1

Acknowledgements

This master thesis is related to an ongoing research project by Schuett, Tyran and Wagner (see Schuett et al., 2017). The empirical data analyzed in this work was collected as part of a pretest of the above project.

I handed in supplementary material with more details about the pretest data, a description of the additional measures and a variable definition together with the thesis.

I am grateful to my family for making it possible for me to study.

Chapter 2

Abstract

Schuett and Wagner (2011) present a political agency model in which politicians of different competence (high and low) interact with voters that are either rational or hindsight biased. Hindsight bias makes people increase their recalled prediction of the likelihood of events after they hold outcome information. A possible consequence of the bias is that voters underestimate the political competence needed to realize good policy outcomes because in their recollection the result seems obvious. This behavior has an effect on the election decision of the voter, either to reelect the incumbent or vote for the challenger. The two conducted treatments (memory vs. no memory) are designed to test the model and to result in different levels of hindsight-bias. As predicted this leads voters to different evaluations of a politicians competence. Voters in the hindsight-bias treatment are worse in differentiating between high and low competence politicians, elect high types less often and therefore produce a lower social welfare. Under hindsight-biased evaluation voters make wrong inferences about the competence level because they wrongly recall a signal that makes the observed outcome most likely. Confirming the theoretical hypothesis, differences in beliefs come from wrongly recalled signals. The levels of voter beliefs differ from theoretical point predictions but differences between treatments follow the expected direction. Low competence politicians hide behind the status quo in cases where they could be revealed as low types if they would opt for reform. Equilibrium strategies of politicians change in response to voter behavior influenced by the memory condition.

Chapter 3

Introduction

The thesis presents the results from an economic experiment carried out to validate the predictions based on a political-agency model by Schuett and Wagner (2011). Their model describes an interaction between politicians and voters with bounded rationality. Politicians have different ability which is expressed as knowledge about which policy action is appropriate given the future state of the world. High-competence politicians know which policy action is appropriate while low-competence politicians only know that with a probability of 55%. Voters have the task to elect politicians and it is in their interest to elect high-competence leaders. Voters are assumed not to be fully rational and the systematic bias that voters exhibit is called hindsight bias. Hindsight bias is connected with imperfect memory and leads people to overestimate the predictability of events after they hold outcome information. This effect leads voters to overestimate probabilities of policy outcomes and makes it difficult to differentiate between types of politicians. Having trouble differentiating types, hindsight-biased voters are worse in selecting high-competence politicians and get a lower social welfare.

In this thesis I implement and analyse two pretest sessions, each session testing a different treatment. The focus of my work is the treatment design in order to achieve a difference in behavior between the two sessions. In one treatment participants get help to be as rational as possible called "MEMORY" (M) and in the other hindsight bias should be displayed called "NO MEMORY" (NM). In both treatments participants receive the same information about states of the world, actions and outcomes. I ran the two sessions on my own in the computer laboratory of the Vienna Center for Exper-

imental Economics (VCEE) where I worked as laboratory assistant for the past year. The second focus of my work is to transform the data gathered in the experiment and analyse it which leads to the results section. Placing my thesis in the field of behavioral political economy, I take the validity of the approach as given and concentrate on hindsight bias in economic experiments and psychological publications. The introduction states the research question and gives details about hindsight bias and its implication on voting decisions laying the foundation to understand model and experiment.

3.1 Research Question

The research question of the thesis is twofold. First, do the treatments lead to significant differences in behavior and second, if so, can theoretical predictions of the model be validated? Both parts of the question will be answered in the results section of the thesis.

3.2 Hindsight Bias

Hindsight bias is first documented by Fischhoff (1975) where he investigates two questions: "(a) How does receipt of outcome knowledge affect judgement?" and "(b) How aware are people of the effects that outcome knowledge has on their perceptions?" (p. 288). Intuitively hindsight bias occurs when people have the feeling they "knew all along" (Slovic and Fischhoff, 1977) that a specific outcome will be realized, after they hold outcome information. The cartoon[1] in figure 3.1 visualizes this point bluntly. Recognizing ourselves in the cartoon, it is no exaggeration to state that hindsight bias is common and touches many aspects of life. A great visualization of the bias provides figure 3.2 from an experiment of Danz et al. (2015) where participants are asked to estimate (and later recall their estimate) winning chances of soccer teams during the 2010 soccer World Cup in Germany. In total 419 subjects participate in the online experiment, where they have to answer two types of questions: (1) "What is the likelihood of

[1]Source: http://mercercognitivepsychology.pbworks.com/f/1290489345/hindsight%20bias%20picture1.jpg

Figure 3.1: Cartoon hindsight bias
Source: http://mercercognitivepsychology.pbworks.com

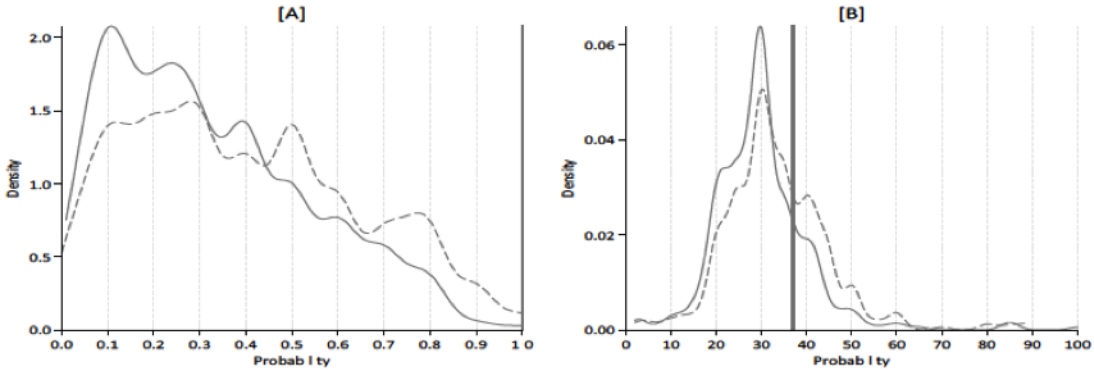


Figure 3.2: Hindsight Bias in sports
"Kernel density estimates of actual predictions (solid lines) and recalled predictions (dashed lines) of Spain's likelihood of entering the final (panel A) and the number of goals (panel B). Solid vertical lines indicate the true value of the true outcomes (1 and 37 respectively)". Source: Danz et al. (2015, p. 17)

[Argentina, Spain, Germany] reaching the final of the World Cup 2010?" and (2) "How many goals will be scored during the eighth-final, quarter-final and semi-final (with regular playing time, 14 matches overall)?" (p.13). The first stage of the experiment is conducted during the preliminary round of the World Cup. After the semi-finals start, and sport fans have outcome knowledge, which nation is a likely contender for winning the World Cup, the second stage is conducted where participants have to recall their original answers. Spain entered the semi-finals, and finally did win the World Cup 2010, and while the average likelihood participants "assigned ex ante to Spain's participation in the finals was 32,5 % [a]fter Spain was known to be participating in the finals, the subjects average recalled likelihood was 39,6 %." (Danz et al., 2015, p.17). You see the shift in direction of the outcome (towards the right side) in both panels in figure 3.2. With this shift in direction of the outcome, I too, will measure the degree of hindsight bias in my experiment.

Roese and Maniar (1997) investigate hindsight bias in the context of college football games and Bonds-Raacke et al. (2001) find that in predicting the outcome of Super Bowl XXXIII not even psychology students that know about hindsight bias are immune to it.

The second example I want to mention is, that judges, jury members and the legal system as a whole are also subject to hindsight bias according to, for example, Rachlinski (1998). Harley (2007) provides a review of research dealing with hindsight bias in legal decision making. Jurors, judges and experts face the situation that they have to ignore outcome information in order to make fair judgements.
Hindsight bias and learning from experience are not in conflict with each other and should not be pitted against each other. Most of the times learning about an outcome should lead you to update your beliefs, actions and likelihood estimates. This is the simple process of incorporating all information into a decision about the future. Incorporating outcome information to rejudge past actions and events, you fall prey to hindsight bias. When rejudging past events people behave as "if they were supposed to learn from the outcome, even though that was not their chore" (Rachlinski, 1998, p. 577).

3.2.1 Designs to study hindsight bias

To elicit hindsight bias two approaches called "memory design" and "hypothetical design" are established in the literature. In the memory design, a within-subject procedure, participants give two judgements. One before and one after they hold outcome information called original and recalled judgement. "Hindsight bias is defined as the difference between the foresight and hindsight likelihood estimates" (Roese and Voss, 2012, p. 412). The hypothetical design is a between-subject design where different groups either receive outcome information or not. Based on the information they have subjects in the groups have to make likelihood estimates about future events. Imagine as example a study that investigates the effect electric cars have on mobility. Participants in the experimental group are informed about a finding that with the use of electric cars the average driven kilometers per household will double by 2050. Participants in the control group do not have this information. Both groups have to estimate the likelihood that electric cars will increase driven kilometers in the future. The point here is, that it is very hard to unlearn the knowledge about the outcome of the study and make an judgement like the group that has no outcome information. Not being

able to unlearn the information leads participants to likelihood estimates into direction of the outcome information. The situation captured in the memory design though is more in line with everyday situations.

Hertwig et al. (1997) use the name "hindsight bias" for the effect obtained with the memory design and "knew it all along effect" for results from the hypothetical design to differentiate between the two procedures and underlying mechanisms while many other use the two names interchangeably. Blank et al. (2008) split hindsight bias into three "aspects of the hindsight experience". They distinguish between "impressions of necessity", "impression of foreseeability" and "memory distortions". Impressions of necessity describe situations where after learning the outcome of a situation it seems highly likely that a given outcome will occur. Impressions of foreseeability capture what others call the "knew it all along effect" where after an outcome, people assume, they would have predicted it. Finally memory distortion describes situations where, after the outcome is known, peoples recollection of their original judgement is closer to the outcome than their original estimate. The authors argue that the three aspects capture "different, empirically separable hindsight components" (p. 1410) that can either occur together or on their own. A visual model of hindsight bias is presented in figure 3.3 where inputs, aspects of hindsight bias and consequences are depicted.

Hoffrage et al. (2000) propose a model on how to understand underlying mental processes of hindsight bias in situations of memory distortion. They call their model "Reconstruction after Feedback with Take the Best" (RAFT). Their model makes three assumptions:

"First, if (and only if) the original response cannot be retrieved from memory, it will be reconstructed by rejudging the problem. Second, the rejudgment involves a recall of the cues and cue values underlying the original choice. Third, knowledge, in particular uncertain knowledge, is automatically updated by feedback. According to the RAFT model, feedback does not directly affect the memory trace for the original response but indirectly by changing (i.e., updating) the knowledge that is used as input for the reconstruction process. Although the process of knowledge updating is adaptive because it enables individuals to improve their inferences over time, it has a by-product: the hindsight bias." (p. 3).

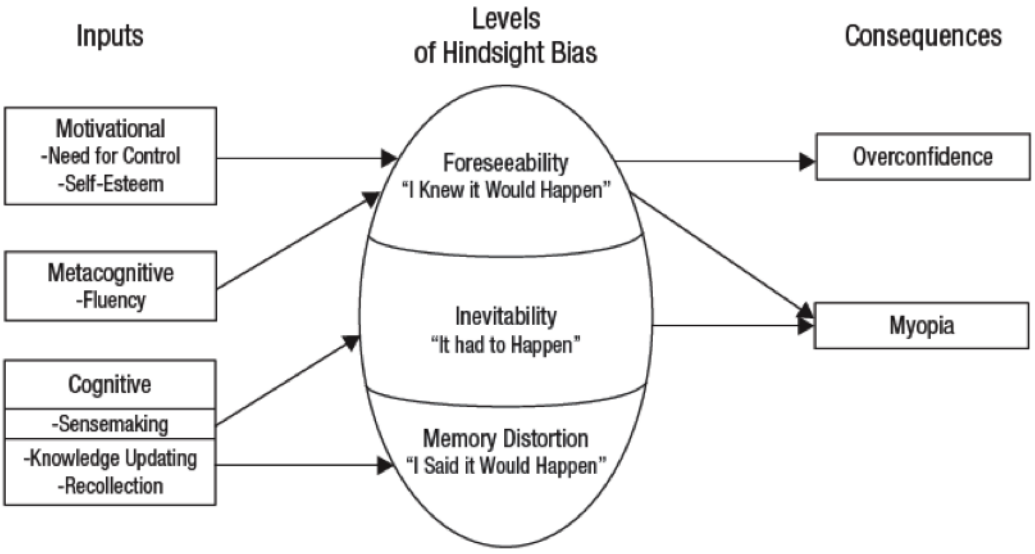


Figure 3.3: A model of hindsight Bias
A model of hindsight bias with the three aspects of hindsight bias: "impression of foreseeability", "impressions of necessity" (Inevitability), and "memory distortions"
Source: Roese and Voss (2012, p. 413)

3.2.2 Measurement of Hindsight Bias in the Experiment

I use a memory based design focusing on what Blank et al. (2008) call the memory distortion component of hindsight bias. For each participant an individual measure of hindsight bias is recorded as in Schuett et al. (2017). This allows to analyze behavior in relationship to the degree of hindsight bias the participant displays. The bias measure is based on 20 almanac questions (general knowledge questions) taken from Bernstein et al. (2011). The questions are difficult so participants are encouraged to make a best guess if they do not know the answer and are told that correct answers are rewarded with 50 cents to incentivize answers. The set of 20 questions is divided into two, so that there are two sets, K and L, with 10 questions each. The K-set is used as feedback condition and the L-set as control condition. Each participant has to answer all 20 questions once in the voting game phase (round 1) and once after the 20 rounds of the voting game are finished (round 2). The correct answer to all 20 questions is a whole number between 0 and 100. In the voting game phase, for each question a best guess (or the correct answer) has to be stated. After the voting game has finished again all 20 questions have to be answered. But this time for the 10 questions in the K-set the correct answer is stated below the question and participants are asked to recall what their original judgement was. For 10 questions from the L-set, the control condition, the original judgement has to be recalled without knowing the correct answer. In both rounds the K + L questions are shown to participants in a random order. In the second round questions from the K and L sets are alternated but the order is still random. With this setup either perfect recall or hindsight bias can be documented. Perfect recall is defined that the participant recalls the answers to all 20 questions correctly and gives the same answers in both rounds. Hindsight biased participants shift their answer in the second round into the direction of the true outcome when learning the correct answer for the questions from the K-set. They think, that their original guess was closer to the true outcome than it really was. This move into the direction of the true outcome is defined as hindsight bias like depicted above in figure 3.2 regarding the Soccer World Cup.

A necessary prerequisite for hindsight bias is imperfect memory. In addition to measuring hindsight bias I also measure the degree of perfect/imperfect recall. Perfect recall

($R_i = 1$) would be, that the individual, in the second round, for all K + L questions states the same answers as in the first round. Only for questions where there is no perfect recall hindsight bias can occur. Note that it is possible that a participant has perfect recall for some questions and is biased on others.

Chapter 4

Theoretical Model

4.1 General

Schuett and Wagner (2011) present a two-period political agency model with asymmetric information in which politicians signal competence via the actions they take and outcomes they are able to produce. Outcomes depend on the action taken by the politician and the randomly drawn state of the world which determines if the action is appropriate or not. Outcomes can be interpreted as social welfare (W). In every game voters observe a signal about the state of the world, the chosen action of the politician and the outcome. Politicians differ in ability $\theta \in \{\theta_{H,}\theta_L\}$ referred to as high or low competence and each politician knows her ability in the game. Competence is modeled as private information about the state of the world which means that high-competence politicians know for sure which action is appropriate given the state of the world and therefore have an information advantage regarding the welfare-maximizing policy. Low-competence politicians and voters only receive an informative signal $\sigma \in \{\sigma_0, \sigma_1\}$ which action is appropriate. The signal is correct with 55% in the experimental implementation. The signal has to be informative, meaning the implied state of the world is more likely than not. Intuitively the signal can be interpreted as a low quality forecast of a research institute that a certain action (reform or no reform) is welfare maximizing. σ_0 implies that a reform is unlikely to succeed while σ_1 signals that a reform is likely to succeed. Politicians hold career concerns and their utility is derived in the

form of $u = W_1 + Pr\,[reelection]\,R$ where W_1 is the social welfare in period 1 while $Pr\,[reelection]R$ expresses their career concern where R is a rent for getting reelected and being in office in period 2 that is realized with a certain probability. Voters focus on social welfare and out of self interest try to elect the official (incumbent or challenger) that most likely produces a high social welfare in the future - the second round of the game. Their utility function takes the form of $u = W_1 + W_2$ which is the sum of first and second period social welfare.
The prior probability $\lambda \in \{0, 1\}$ that a politician is a high type is common knowledge and is set to 30% in the experiment.

In each period of the game the state of the world ω can be 0 or 1. Depending on the state of the world one of the two possible actions $a \in \{a_0, a_1\}$ yields the higher outcome $y \in \{0, \kappa, 1\}$. Table 4.1 presents the possible outcomes of period 1 given the state of the world and the politicians action which range from 3€ to 15€. In the original version of the model the outcome after a_0 depends on ω only with probability p and with probability (1-p) a payoff of κ is determined irrespective of the state of the world. The version described here for the experiment is the asymmetric adaptation of the model where $p = 0$ and therefore after a_0 the outcome also only depends on ω. Low-competence politicians and voters receive only the imperfect public signal σ about the state of the world and have to make their decisions based on it, which shows the difficulty low ability politicians have in the game. High-competence politicians receive the signal and the state of the world. An intuitive wording for the policy actions given the state of the world is the following: Call a_1 "reform" and a_0 "no reform" or "status quo". For low-competence politicians there is also the option of a policy gamble after signal σ_0 which points to an state of the world where no reform is recommended. A low-competence politician can play reform (a_1) and hope for a state of the world ω_1 opposite to the signal σ_0. With a policy gamble the official can present herself as of high competence if she is lucky and wins her gamble.

State of the world	Politician chooses	
	a_0	a_1
ω_0	9 €	3 €
ω_1	9 €	15 €

Table 4.1: Social Welfare depending on state of the world and action

4.2 Parameter overview

a	action the politician can take, $a \in \{a_0, a_1\}$
θ	Type of politician, $\theta \in \{\theta_H, \theta_L\}$ for high and low type
λ	Prior probability that incumbent is a high type, set to 0,3 in the experiment
λ_c	Probability that the challenger is a high type, $\lambda_c \, U \, \{0, 1\}$
σ	Signal about state of the world, $\sigma \in \{\sigma_0, \sigma_1\}$
W	Social Welfare
ω	State of the world, $\omega \in \{0, 1\}$
y	Outcome, $y \in \{0, \kappa, 1\}$ is the period 1 payoff of politicians

Intuitive wording of parameters

a_0	no reform
a_1	reform
σ_0	no reform warranted
σ_1	reform warranted

4.3 Timing of the game and game trees

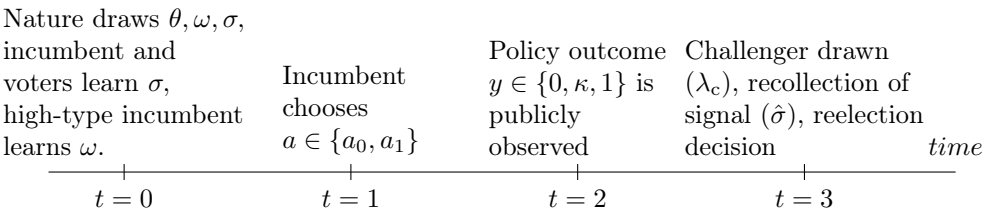


Figure 4.1: Timing of the game (period 1)
Source: Schuett and Wagner (2011), p.1624

It is a two period game where each period can be interpreted as a term in office. Period 1 is shown in detail in Figure 4.1. At the beginning of stage 1 (t = 0) nature randomly draws the type of the politician, the state of the world and the signal. High-types know the state of the world and the signal at t = 0 while low-types and voters only receive the imperfect signal. After politicians receive the signal they have to decide which action to take at t = 1. The policy outcome is publicly observed at t = 2 and at t = 3 voters make their inference about an officials competence and decide whether to reelect the incumbent or vote for the challenger. The probability that the challenger is of high competence λ_c is randomly drawn and presented to the voter. After the election, stage 2 begins where a new state of the world is drawn and based on the politicians competence payoffs are realized. In stage 2, there are no more reelection concerns and politicians try to maximize payoffs. After stage 2 the game ends. In the experimental implementation politicians get 4€ if they are reelected while voters receive 5€ if they elect a low-competence politician and 20€ if they elect a high-competence politician. There is no more interaction in stage 2.
Figures 4.2 and 4.3 show the extensive form of stage 1 for high and low types. While high types are in a situation of complete information low types face incomplete information highlighted through the colored information sets. At the three hollow nodes marked with "N" nature randomly determines the parameters of the game.

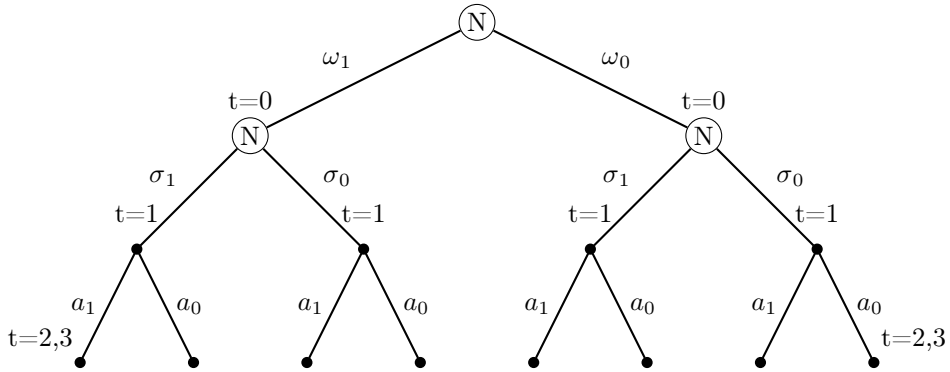


Figure 4.2: Game Tree for Θ_H for period 1

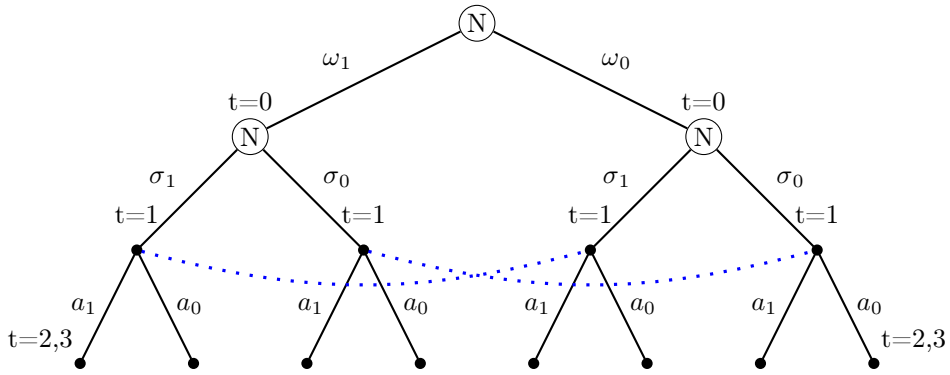


Figure 4.3: Game Tree for Θ_L for period 1

4.4 Hindsight-bias in the model

The model distinguishes between the recollection of the original signal $\hat{\sigma}$ and the original signal itself. While rational voters correctly recall the original signal $\hat{\sigma} = \sigma$, hindsight-biased voters recall $\hat{\sigma}$ different from σ. Table 4.2 provides an overview over situations where hindsight biased voters might make mistakes in their recollection. Only voters display hindsight-bias in the model while politicians are assumed to be fully rational.

4.5 Hypotheses

Hypothesis 1 to 5 are quoted from the article of Schuett et al. (2017). For voters and low competence politicians there are two hypotheses each, because behavior is different under rational and hindsight biased evaluation. High competence politicians display the same behavior in both cases as stated in hypothesis 5. This is a change I made from the six hypotheses in the original because there high competence politicians have a hypothesis each under rational and under biased evaluation.

4.5.1 Voter

Hypothesis 1: "A rational voter reelects the incumbent if and only if the posterior belief $\mu(\sigma, a, y)$ about the incumbent being Θ_H is larger or equal to the ability of the challenger."
A rational voter should reelect the incumbent iff $\mu(\sigma, a, y) \geq \lambda_c$ with λ_c being the prior probability that the challenger is a high type.

Hypothesis 2: "A hindsight biased voter still follows the reelection strategy in Hypothesis 1, but constructs her posterior belief about the type of politician $\mu(\hat{\sigma}, a, y)$ from her recollected signal $(\hat{\sigma})$ about the state of the world."

public signal	action	realised state of the world	outcome	recollection of voter with HB after outcome knowledge	rational voter
σ_0 (no reform)	a_0 (no reform)	$\omega = 0$ or 1	9		Θ_H or Θ_L
σ_0 (no reform)	a_1 (reform)	$\omega = 0$	3		incumbent is Θ_L
σ_0 (no reform)	a_1 (reform)	$\omega = 1$	15	HB-voter will think signal was σ_1, less reputation	Θ_H or Θ_L
σ_1 (reform)	a_0 (no reform)	$\omega = 0$ or 1	9		Θ_H or Θ_L
σ_1 (reform)	a_1 (reform)	$\omega = 1$	15	HB-voter might think incumbent is high type	Θ_H or Θ_L
σ_1 (reform)	a_1 (reform)	$\omega = 0$	3	HB-voter will think signal was σ_0	incumbent is Θ_L

Table 4.2: Possible recollection of voters depending on cases

4.5.2 Low competence politician

Hypotheses 3: "The behavior of politicians of type Θ_L [under rational evaluation[1]] depends on the informativeness of the public forecast: she plays the pure strategy a_0 for $v < \underline{v}^{\mathrm{R}}$, a_1 for $v > \overline{v}^{\mathrm{R}}$, and randomizes between a_0 and a_1 for $\underline{v}^{\mathrm{R}} < v < \overline{v}^{\mathrm{R}}$."

If a low ability politician is evaluated by hindsight biased voters the following change takes place:

Hypothesis 4: "A low-ability politician changes behavior with respect to the rational case and plays a_1 less often after σ_0, that is, reduces policy gambles: $s^{HB}(\sigma_0) \leq s^{R}(\sigma_0)$. His behavior after σ_1 is unchanged: $s^{HB}(\sigma_1) = s^{R}(\sigma_1)$."

4.5.3 High competence politician

Hypothesis 5: "Politicians of type (Θ_H, ω) always chooses the welfare-maximizing policy: a_1 if ω_1 (reform if warranted) and a_0 if ω_0 (no reform if unwarranted)."

4.5.4 Implications of the equilibrium

The social welfare of 3€ is fully revealing about the type of politician because a high-competence politician with career concerns will never play a_1 given ω_0 knowing that this will lead to the lowest possible payoff. Voters should never reelect an official that produces a social welfare of 3€.
Low-competence politicians have an incentive to play against the signal trying to present themselves as of high competence. This is a policy gamble - playing a_1 after σ_0. If they are lucky and the realized state of the world is the opposite of what is signaled it will look to a voter that only has the imperfect signal as if the politician knew more than he did. For a voter this can look like the politician is of high competence.
Two equilibrium effects you can expect with hindsight-biased voters in the model. One is a decrease in the reelection of high quality politicians from voters and one is a decrease in the number of policy gambles from low competence politicians. Not electing high types

[1] added by the author

as often is the selection effect where hindsight biased voters are worse in recognizing types because they are not impressed by the result they see. The selection effect in turn leads to a control effect. Low competence politicians observe that successful policy gambles are not rewarded by reelection and therefore have less incentive to take the risks of one. While the selection effect is negative, the control effect is a positive upshot of the hindsight-biased equilibrium.

Chapter 5

Experimental Design

5.1 From model to experiment

The model asks of voters to assess the competence of a politician after they hold outcome information. The sequence of events (signal, action, outcome, inference about competence of politician) makes it possible for voters to be influenced by outcome information in their judgement about a politicians competence. In that sense the timeline of the model is similar to the timing of experimental setups to elicit hindsight bias via questions for the participants where the order is: original judgement, observation of outcome and recalling the judgement. Assuming that people display hindsight bias, in one of the two treatments a manipulation helping subjects to suppress it, takes place and in the other not. Details on that follow shortly. An experiment conducted by Boekel et al. (2016), where they show that by varying the retrieval conditions that hold during the time subjects recall the original judgement, hindsight bias can be reduced, serves as a inspiration for my experimental implementation. I also looked at other possible treatment manipulations such as cognitive load ((Kessler and Meier, 2014), (Bednar et al., 2012)), counterfactuals (Petrocelli and Sherman, 2010) or surprises (Ofir and Mazursky, 1997) but the latter two can not be applied in the model I want to test[1] and cognitive load would have made the game even more complicated than it already

[1]Counterfactuals such as "If the signal would have been XY how would you assess the current situation" will focus the participants on the signal and through repeating the question they will learn that their recollection the signal is the element of interest.

is. Also literature finds mixed evidence of cognitive load on hindsight bias so that in some cases the group with less cognitive load shows greater hindsight bias.

5.1.1 The retrieval based approach

I present the "retrieval based approach" as Boekel et al. (2016) call their method and discuss in the next section how to apply their findings to the present model. They use general knowledge questions and find, that by informing subjects during the retrieval phase that the original judgement and the correct answer have to be recalled allows subjects to discriminate more clearly between the memory traces and hindsight bias is reduced. This works as they claim because "... every conscious experience is encoded as a trace, and that once a trace is encoded, it is not modified by subsequent processing" (Boekel et al., 2016, p. 4). Their experiment is conducted with high school students in the US and consists of three phases:

Phase 1

- subjects are given 20 written questions
- they are told, that the questions are difficult ("Even you science teacher would have difficulty answering them" (p.6))
- as much time as they need to answer
- the answers of the subjects constitute their original judgement (OJ)
- takes approximately 10 minutes

30 minute filler task

This was the regular science class to fill the working memory of the subjects.

Phase 2

- The experimenter reads aloud the answers for 10 out of 20 questions
- Those constitute the correct answers (CA) for the subjects

Phase 3

Phase 3 follows immediately after phase 2. Here they have 4 different experimental setups.

- Experiment 1 has the purpose to establish hindsight bias in the particular setting. Subjects are told that there is a surprise memory task and are given a response sheet with the 20 original questions. They are asked to recall their OJ made during Phase 1. These answers constitute the recalled original judgement (ROJ). Experiment 1 uses the standard memory design and here hindsight bias is visible.
- Experiment 2 evaluates the prediction, that hindsight bias will be eliminated, if subjects are instructed at the beginning of Phase 3 that they have to recall both their OJ and the CA. The surprise response sheet they get, asks them, to simultaneously recall the OJ from Phase 1 and the CA from Phase 2. The response sheet is a surprise, because they were not told at the beginning of the experiment that recalling either the OJ or the CA will be asked of them.

  - Letting the subjects read on the response sheet that they will recall both OJ and CA, leads to the effect that they form compound retrieval cues that discriminate OJ traces from CA traces and eliminated hindsight bias

- Experiment 3 addresses this issue of recall versus reconstruction. In Phase 3 subjects again get a surprise response sheet that asks them to recall both traces.

But this time one side of the sheet asks for the OJ from Phase 1 and the other side for the CA from Phase 2. The answers are given in a successive order. There are two groups, one, ROJ-first, recalls the OJ first and the CA second while the other, RCA-first, recalls the CA first and the OJ second. Both groups show no evidence of hindsight bias.

- Experiment 4 changes the conditions at Phase 3. It replicates the ROJ-first and RCA-first conditions but in one additional condition participants no longer are told that the will make both recalls. Instead subjects recall their OJ and only afterwards as a surprise the CA. This condition is called RCA-surprise. The group in the RCA-surprise condition gets no information at the beginning of Phase 3 on the recalls. The RCA-surprise group showed hindsight bias because they were not able to form compound retrieval cues to discriminate OJ traces from CA traces.

5.1.2 Treatment Design

Looking at the result of experiment 2 and 3, that reminding people that there is an original judgement eliminates hindsight bias, shows the direction a treatment design that helps people to be as rational as possible, can take. The retrieval based approach that serves as template and the experiment I want to run are very different in their complexity, so my treatment manipulation has to be as simple as possible. While in the retrieval based approach the whole experiment consists of asking the general knowledge questions and later recalling them under different conditions this task is only one small element (to establish individual hindsight bias) in my experiment. The game described in chapter 3 is played 20 rounds with the general knowledge question embedded in each voting round. Following the setup of the retrieval based approach participants in the voter-role in one treatment have to be reminded about their memory trace of the original signal providing them with help to be as rational as possible. ***The easiest form of recollection is seeing the information again. This is the treatment difference***. The manipulation only focuses on voters. Participants in the role of politician in both treatments see the same screens. In both treatments participants in the voter-role receive the same information about signal, action and outcome, at the same screens

MEMORY		
	New Information	Summary Box
Screen 1	σ	-
Screen 2	$a \in (a_{0,}a_1)$	σ
Screen 3	y	σ, $a \in (a_{0,}a_1)$
Screen 4	probability (base rate) that incumbent is high type	σ, $a \in (a_{0,}a_1)$, y
NO MEMORY		
Screen 1	σ	-
Screen 2	$a \in (a_{0,}a_1)$	-
Screen 3	y	-
Screen 4	-	-

Table 5.1: Information displayed to voters at successive screens

when the information is displayed for the first time in the game. In one treatment, MEMORY, participants in the voter-role additionally see a summary about past events of signal, action and outcome while the other, NO MEMORY, does not display the summary. The screens for the NO MEMORY treatment have the same layout but the summary box is not displayed. See table 5.1 for an overview which information is displayed for voters in the two treatments. Voters in M also see a reminder from the instruction about the base rate probability that the incumbent is a high competence politician on the screen where the voting decision is made.

5.1.2.1 Additional Measures

On top of the implementation of the game I include a number of additional measures such as risk elicitation based on Holt and Laury (2002) or a beauty contest to get a degree of individual reasoning capability making it possible to compare subject groups. The additional measures are not necessary to answer the research question and make the main points of the thesis, therefore all information is in the supplementary material I handed in with my master thesis.

Chapter 6

Results

Two treatments with 24 subjects each have been carried out in the lab of the Vienna Center for Experimental Economics (VCEE) using z-Tree (Fischbacher, 2007), which leads to a total of 48 observations, 24 observations of each role (politician, voter) and 12 observations for each role in each of the two treatments which can be compared directly with each other. This is a low number of observations for statistical tests. Another limitation with the data is the violation of the necessity of independent observations. Observations are connected in two ways with each other. First, each participant plays the voting game for 20 rounds leading to the fact that strictly speaking only the first round is an independent observation. In addition, participants interact with random counterparts in each of the rounds leading to the possibility that future rounds are influenced by past interactions. My approach to work with the limited amount of observations is the "as if" approach where for each participant each round is treated as if it where an independent observation. For each participant there are 20 observations leading to a total of 480 "as if" observations.

Five hypothesis regarding the behavior of either politicians or voters are established in section 4.5. Results to each hypothesis are presented and are split after voter, low- and high-competence politician.

The subjects for the two treatments are similar to each other regarding age, sex, risk assessment and other personal characteristics as you can see in section 6.6. Findings that are not central to the main results are presented in the appendix.

6.1 Voter

Voters get a treatment manipulation reading the summary of information of past events they see at different stages in the game and their task is to make an inference about the competence of the incumbent based on signal, action and outcome and decide whether to reelect her or vote for the challenger. Results of both their beliefs and their behavior are presented.

6.1.1 Reelection rates

A central question of the thesis is how the reelection behavior differs between the M and NM treatment. The hypothesis from section 4.5 concerning the voter state, that a voter should always reelect the incumbent iff $\mu(\sigma, a, y) \geq \lambda_c$. Focusing on the reelection decision in figure 6.1 you see large differences between the treatments. In the M treatment voters reelect high types in 78,67 % of the cases while in NM only in 52,22 % of the cases. Reelection rates are about twice as high as predicted but the movement of the changes is in the correct direction. Section 6.5 gives details about model precision and the match between prediction and the realized levels. The difference in reelection rates between treatments of high types is 26,45 percentage points and between low types 4,5 ppt. The two-tailed non-parametric Wilcoxon Rank-Sum test statistic reported for the between subject test rejects the H_0 that samples are from populations with the same distribution at the 5 % level for the case of high types with a p-value of $p = 0,0105$. The same test for low competence politicians yields a p value of $p = 0,4900$ so this H_0 cannot be rejected. The difference in the reelection rates shows you the quality of the differentiating ability of voters and you see that voters in NM have difficulty recognizing types. The thesis is titled "Selection of politicians under hindsight bias" and figure 6.1 reveals the decline in the quality of selection. Hindsight biased voters are worse in selecting high competence politicians and in the figure you see that selection effect. While it is a reassuring finding that voters in M elect high types more often they also do so with low types.

I also test within subjects if voters where able to differentiate high from low types.

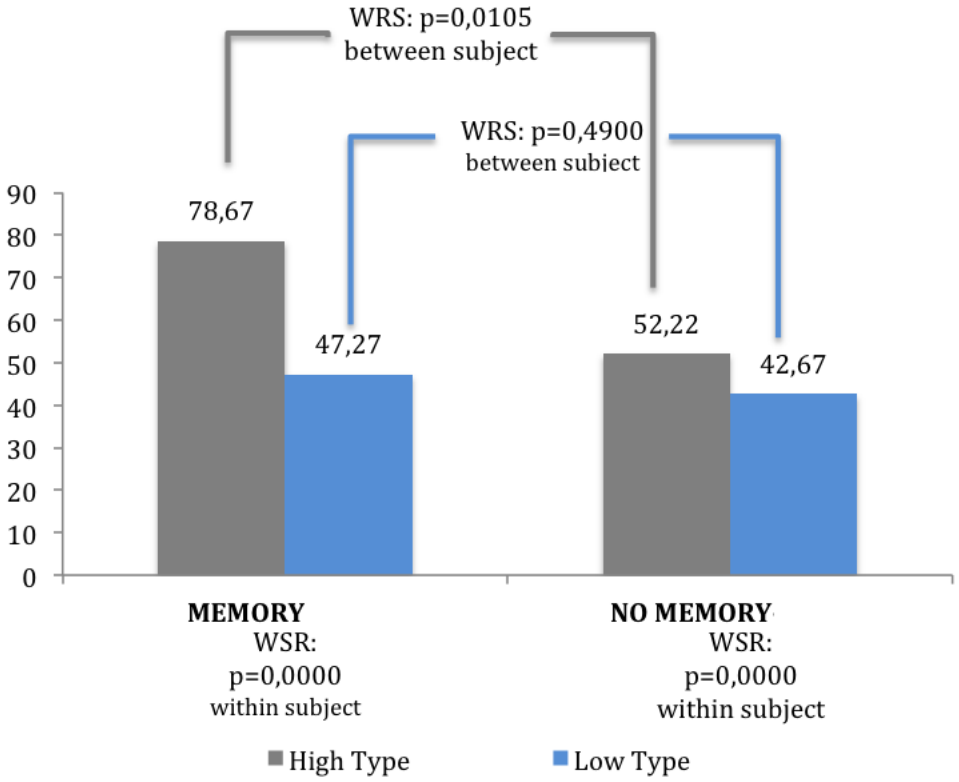


Figure 6.1: Reelection rates depending on treatment

You see the results at the bottom of the figure as Wilcoxon Signed-Rank (WSR) test. Here in both treatments I can reject H_0 of equality and say that voters were able to differentiate between types. It would be a little bit greater if in NM they could not distinguish between types at all, but that is not the case.

The reelection rate of both types of politicians combined in M is 57,08 % and in NM 46,25 % with $p = 0,0177$ from a two tailed Wilcoxon Rank-Sum test showing that even if you look at all politicians at the same time there is a difference in reelection behavior between treatments.

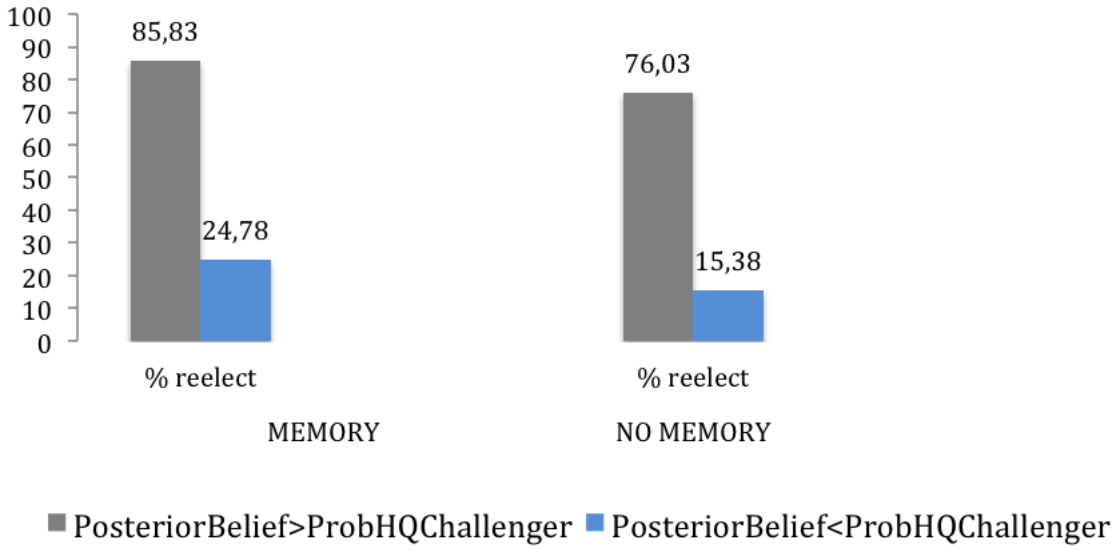


Figure 6.2: Belief Action Correspondence
Posterior Belief: stated belief of the voter about the probability that the incumbent is a high type (Variable: Belief2)
ProbHQChallenger: randomly determined probability in the game that the challenger is a high type

6.1.2 Reelect or vote for challenger

In each round a voter has to state her belief about the probability that the current incumbent is a high type called PosteriorBelief in figure 6.2. The probability that the challenger is of high competence (ProbHQChallenger) is randomly determined and stated on the screen where the voting decision is made. In combination with the voting decision a voter takes you can see how well actions and beliefs fit together. Reelection in line with stated belief is 9,8 ppt higher in M which means the belief-action correspondence is weaker in NM. A possible conjecture for this finding is that voters do not belief themselves what they state as posterior beliefs. This shows their uncertainty about evaluating the types. Numbers of observations are given in table 6.1.

	MEMORY		NO MEMORY	
	% reelect	Num Obs	% reelect	Num Obs
PosteriorBelief>ProbHQChallenger	85,83	109	76,03	92
PosteriorBelief<ProbHQChallenger	24,78	28	15,38	18

Table 6.1: Number of observations for Belief Action Correspondence
Posterior Belief: stated belief of the voter about the probability that the incumbent is a high type (Variable: Belief2)
ProbHQChallenger: randomly determined probability in the game that the challenger is a high type

			MEMORY			NO MEMROY		
Signal	Action	Out come	Avg. Stated Beliefs	Belief Theoreti-cal Strategies	% re-elected	Avg. Stated Belief	Belief Theoreti-cal Strategies	% re-elected
$\sigma = 0$	PA = 0	9	50,30	20,19	51,65	50,03	19,08	38,95
$\sigma = 1$	PA = 0	9	52,98	36,55	50	47,88	36,55	36
$\sigma = 0$	PA = 1	3	18,13	0	71,43	29,62	0	20
$\sigma = 1$	PA = 1	3	45,02	0	36,36	40,67	0	42,11
$\sigma = 0$	PA = 1	15	82,98	79,8	93,33	69,44	39,18	66,67
$\sigma = 1$	PA = 1	15	69,58	39,18	71,43	70,27	39,18	66,04

Table 6.2: Average Stated Posterior Belief given signal, action and outcome with actual reelection rates

6.1.3 Posterior belief

Hindsight biased voters still follow the rationale from hypothesis 1 but construct their posterior belief from their recalled signal. It is a central part of the theoretical model that wrongly recalled signals drive differences in belief.

Table 6.2 presents all possible event combinations of signal, action and outcome. Recall that is the same way the posterior belief is constructed: $\mu(\sigma, a, y)$. The posterior belief of the voters is called Average Stated Belief in the table because an average over all stated posterior beliefs of each voter is reported. You also see for each treatment one column with beliefs based on theoretical strategies. Those beliefs are the beliefs voters should have based on the theoretical equilibrium strategies of politicians. Section 6.5

			MEMORY			NO MEMORY			
Signal	Action	Out come	Avg. Stated Beliefs	Std. Err.	Num Obs	Avg. Stated Beliefs	Std. Err.	Num Obs	Difference of Belief
$\sigma = 0$	PA = 0	9	50,30	2,75	91	50,03	2,75	95	**0,27**
$\sigma = 1$	PA = 0	9	52,98	3,42	56	47,88	3,99	50	5,1
$\sigma = 0$	PA = 1	3	18,13	6,62	7	29,62	15,47	5	-11,49
$\sigma = 1$	PA = 1	3	45,02	5,8	22	40,67	8,62	19	**4,35**
$\sigma = 0$	PA = 1	15	82,98	5,13	15	69,44	7,73	18	13,54
$\sigma = 1$	PA = 1	15	69,58	3,73	49	70,27	2,90	53	**-0,69**

Table 6.3: Number of Observations, Std. Err. and Differences of Belief

gives details about best responses on equilibrium strategies and model precision. The predictions based on the model are included to highlight the fact that in events with an outcome of 15 the model predicts equal beliefs in case of hindsight bias as you see in the second to last column where the predicted belief voters should hold that the incumbent is a high type is 39,18 %.

The hypothesis has at its core, that hindsight biased voters recall wrong signals given outcomes, with the largest predicted difference in case the outcome is 15. If signal and action are consistent (last row in the table) the average posterior belief is nearly the same with 70 % (69,58 % and 70,27 %). If you look at the situation where signal and action are not in the same direction (line above) you see the largest difference of all cases with 82,98 % in M and 69,44 % in NM. Both observations are equally important and are exactly as predicted by theory which you see in the columns stating the belief based on theoretical strategies in table 6.2. Hindsight biased voters have the same belief after the outcome is 15 regardless of the original signal. They recall the signal being 1 and therefore have the same posterior belief in both cases. Posterior beliefs in NM after the outcome of 15 are nearly the same with 69,44 % and 70,27 % probability that the incumbent is a high type. It is most reasonable for them that the best possible outcome is a result of a signal that pointed in this direction. Table 6.2 is a confirmation of the theory that differences in belief between rational and hindsight biased voters are driven by wrongly recalled signals. Table 6.3 provides the differences of belief for each

Signal	Action	Outcome	Avg. stated Belief	Stated Belief if $HBiCorrrected < 0$	Stated Belief if $HBiCorrrected > 0$
$\sigma = 0$	PA = 0	9	50,30	48,78 (#55)	52,64 (#36)
$\sigma = 1$	PA = 0	9	52,98	61,15 (#30)	43,56 (#26)
$\sigma = 0$	PA = 1	3	18,13	21,33 (#4)	13,87 (#3)
$\sigma = 1$	PA = 1	3	45,02	44,55 (#12)	45,58 (#10)
$\sigma = 0$	PA = 1	15	82,98	86,85 (#9)	77,19 (#6)
$\sigma = 1$	PA = 1	15	69,58	72,36 (#30)	65,18 (#19)

(a) MEMORY

Signal	Action	Outcome	Avg. stated Belief	Stated Belief if $HBiCorrrected < 0$	Stated Belief if $HBiCorrrected > 0$
$\sigma = 0$	PA = 0	9	50,03	38,38 (#31)	55,67 (#64)
$\sigma = 1$	PA = 0	9	47,88	58,45 (#16)	42,91 (#34)
$\sigma = 0$	PA = 1	3	29,62	65,38 (#2)	5,77 (#3)
$\sigma = 1$	PA = 1	3	40,67	43,11 (#7)	39,25 (#12)
$\sigma = 0$	PA = 1	15	69,44	76,31 (#6)	66,02 (#12)
$\sigma = 1$	PA = 1	15	70,27	70,03 (#18)	70,39 (#35)

(b) NO MEMORY

Table 6.4: Average stated belief of voters based on degree hindsight bias split at 0

case together with numbers of observations and highlights in bold font the tree cases where signal and action are consistent and where the smallest differences are observable. Looking at the differences in average belief about the probability of facing a high type we can interpret them as driven by inconsistencies. Events where signal and action are consistent have very similar beliefs in both treatments.

Posterior beliefs are influenced by hindsight bias and in table 6.4 you can see the differences in case voters have a degree of hindsight bias smaller or lager than zero. Based on the theoretical predictions participants with hindsight bias should have beliefs smaller or equal to the ones held by rational voters.

In most of the cases subjects in the voter-role make one estimate about the competence of the incumbent. In 77 out of 480 cases (16 %) voters did not enter a probability

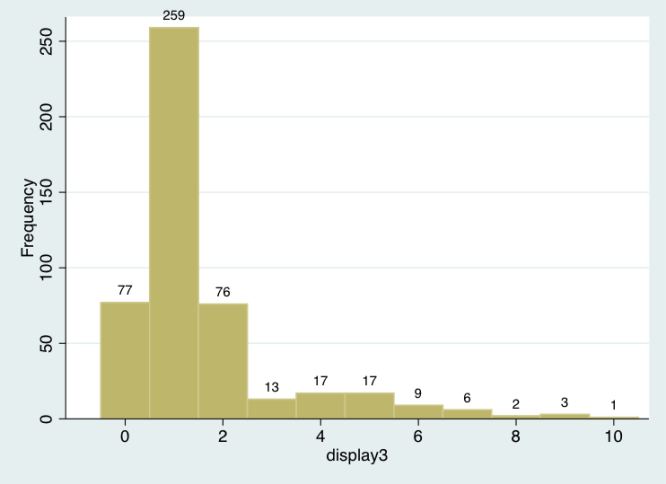


Figure 6.3: Number of changes in competence estimation - Combined
"display3" counts the number of times a voter moves the silder when estimating a politicians competence

estimate as can be seen in figure 6.3 that shows the number of times voters changed their probability estimate for both treatments combined. A value of one for the variable "display3" means that the voter enters his estimate with one click on the slider that by default is set to 50 %. The same graph split after treatments and a figure which voters did not enter estimates can be seen in the appendix in figures 8.7 to 8.9. Subject ID 24 only enters 1 estimate and Subject ID 30 none in all 20 rounds. Distributions of stated beliefs for each event combination are also documented in the appendix in section 8.3.1.

6.1.4 Cost of reelection

Electing a low type is costly for voters because instead of a profit of 20€ in the second part of the round they only get 5€. Voters do not get a profit in the first part of the game to incentivize the election decision. I call the payoff in the second part of each round "Stage2Payoff". The Stage2Payoff realized through reelection and the Stage2Payoff realized through electing the challenger has to be added together. Table 6.5 shows payoffs voters achieve and the costs of the election decisions. Focusing on total payoffs

is misleading somehow because the number of high types in the two sessions is set to 30% but is determined randomly and therefore is 31,25% in M and 37,5% in NM. This leads to the fact that in NM there are much more cases of not electing a high type (43 in NM vs. 16 cases in M) which leads to much higher payoffs in the second round in NM. In 30 out of the 43 cases voters in NM elect a high competence politician when not reelecting a high competence incumbent. Voters in M also have a good track record of electing high types when not reelecting high competence politicians (14 out of 16 cases) but have much less opportunities to do so. To see the cost of reelection (foregone profits) look at the last row that states the loss in social welfare by not electing a high type when they have the chance to do so. To calculate forgone profits I subtract the payoff from electing a challenger when facing a high type from the potential payoff voters can have if they reelect the high type in office (profits not realized in the table).

6.2 Low-Competence Politician

6.2.1 Randomization

Low-competence politicians receive a signal with an informativeness of 55 %. This is relatively uninformative and result in a lot of randomization. Informally randomization means that a low type plays a_1 more often after σ_1 than after σ_0, i.e. the politician follows the signal. This is captured in hypothesis 3 that "A low type politician randomizes between the two strategies". To see this look at the figures 6.4 and 6.5 which show the actions of low type politicians given the signal. First we see that after σ_0 – what I call status quo here - low type politicians follow the signal and play a_0 much more often than not. This is good, that's what we want to see based on our hypothesis. In case of σ_1 this is not the case. Here both actions are played with "equal" probability which I interpret as "hiding behind status quo". In case the signal tells you that a reform is the recommended option as a low type you face a difficult decision. Either you follow the signal and gain reputation if you are successful ($y = 15$) or you are revealed as a low

	MEMORY		NO MEMORY	
	% reelected	Stage2Payoff of voters	% reelected	Stage2Payoff of voters
High Type	78,67	1180 €	52,22	940 €
Payoff from Challenger in case of high type		290 €		665 €
Low Type	47,27	390 €	42,67	320 €
Payoff from Challenger in case of high type		1275 €		1330 €
Sum		3135 €		3255 €
	% not reelected	profits not realized	% not reelected	profits not realized
High Type	21,33	320 €	47,78	880
		foregone profits		foregone profits
		30 €		215 €

Table 6.5: Voters payoffs in total numbers and foregone profits for both treatments

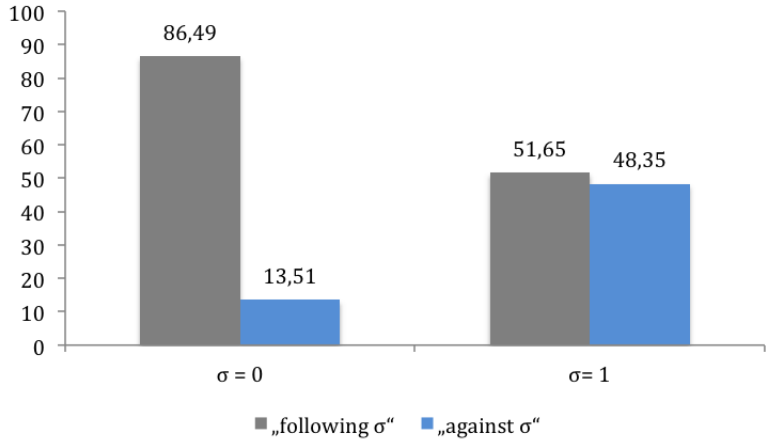


Figure 6.4: Percentage of policy actions given σ in MEMORY

	Percentage of policies	
MEMORY		
Signal	following σ	against σ
$\sigma = 0$	86,63	13,73
$\sigma = 1$	50,91	49,09
NO MEMORY		
$\sigma = 0$	88,80	11,20
$\sigma = 1$	49,71	50,29

Table 6.6: Randomization based on average figures

type if the outcome is 3. In order to avoid that, you can play against the signal and take a_0 which produces as social welfare of 9 in both cases. This is the safe way out: hiding behind status quo and not make a reform. This is a clear difference in the behavior between low and high type and shows that low competence politicians understood the decision structure they where facing. In the experiment neutral language is used but reform (a_1) and status quo (a_0) are the concepts behind the decision structure.

The behavior of low competence politicians is a key element of the thesis and I also present results on average basis. For every individual the frequency of following the signal is calculated and then the average over the 24 observations is taken. Doing so leads to the results in table 6.6 which show small differences to the "as if" approach.

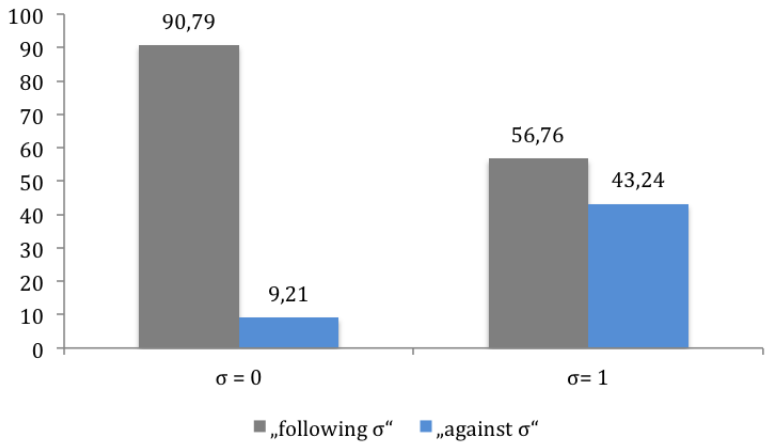


Figure 6.5: Percentage of policy actions given σ in NO MEMORY

6.2.2 Policy gambles

That low ability politicians participate less in policy gambles under hindsight-biased evaluation is postulated by hypothesis 4. The argument is that politicians get less credit for a good outcome under hindsight-biased evaluation because voters recall the wrong signal and think that the outcome was a sure event. Looking at figure 6.4 and 6.5 you see the percentage of policy gambles. The number of policy gambles, playing a_1 after σ_0, is 13,51 % in M and 9,21 % in NM. This is a small difference but under hindsight biased evaluation policy gambles are a little less likely. Testing if the two percentage figures of the policy gambles are statistically different with a two-sample test of proportions yields that the H_0 of equality cannot be rejected with $p = 0,4059$. The difference of policy gambles between treatments is not statistically significant. But in the treatments there are only 74 cases in M and 76 cases in NM where policy gambles would have been possible so the power of the test is limited.

6.2.3 Belief of reelection probability

The outcome of 3 is fully revealing that the incumbent is a low type but still some voters reelected them. In M in the case where $\sigma = 0, PA = 1, y = 3$ the incumbent

MEMORY							
			Avg ProbReelected			Actual Reelected	
Signal	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
$\sigma = 0$	PA = 0	9	57,71	2,87	64	42,19	27
$\sigma = 1$	PA = 0	9	52,22	3,74	44	43,18	19
$\sigma = 0$	PA = 1	3	32,37	14,30	6	66,67	4
$\sigma = 1$	PA = 1	3	20,36	5,31	21	33,33	7
$\sigma = 0$	PA = 1	15	78,27	10,33	4	100	4
$\sigma = 1$	PA = 1	15	81,65	4,44	26	65,38	17

Table 6.7: Estimated reelection probability vs. actual reelection rates - MEMORY

gets reelected four times out of 6. Checking that not all instances come from one subject reveals that subject 6 reelected an incumbent in such a situation two times and subjects 14 and 18 once each. Table 6.7 and 6.8 show the average estimates about reelection probability low types make depending on which outcome they produce. In the same tables in the last two columns the actual rate of reelection and the number of observations are provided. Figures 6.6 and 6.7 display the distribution of stated beliefs. Comparing the distribution of stated beliefs between low and high competence politicians shows that subjects in the role of high competence politician were much more confident about their reelection chances. Compare figure 6.7 and 8.11 to see the difference. Participants in the role of low competence politician enter far more evenly distributed estimates that go all the way down to 0 % reelection chances in the case of some subjects.

6.3 High-Competence Politician

By design the number of high competence politicians is set to 30%. The actual number of high competence politicians is 31,25% in M and 37,5% in NM. This is some difference but a gap like this, can still happen by chance. Looking at the actions of high competence politicians functions as a rationality test. Did participants in the role of high competence politicians understand that they have to follow the state of the world

NO MEMORY							
			Avg ProbReelected			Actual Reelected	
Signal	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
$\sigma = 0$	PA = 0	9	53,84	3,28	69	39,13	27
$\sigma = 1$	PA = 0	9	42,30	5	32	37,50	12
$\sigma = 0$	PA = 1	3	18	8,81	5	20	1
$\sigma = 1$	PA = 1	3	31,06	6,45	18	44,44	8
$\sigma = 0$	PA = 1	15	79,98	18,96	2	50	1
$\sigma = 1$	PA = 1	15	84,91	3,95	24	62,50	15

Table 6.8: Estimated reelection probability vs. actual reelection rates - NO MEMORY

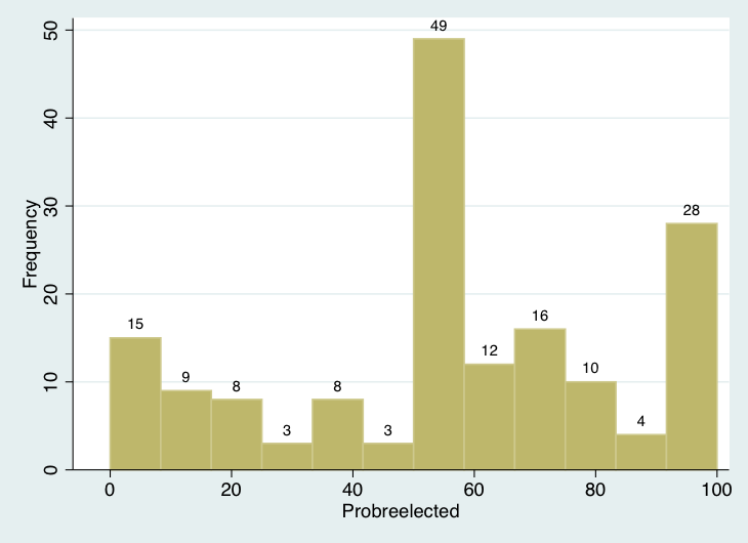


Figure 6.6: Distribution of stated beliefs - MEMORY
"Probreelected" measures the probability a politician assigns to her reelection chances

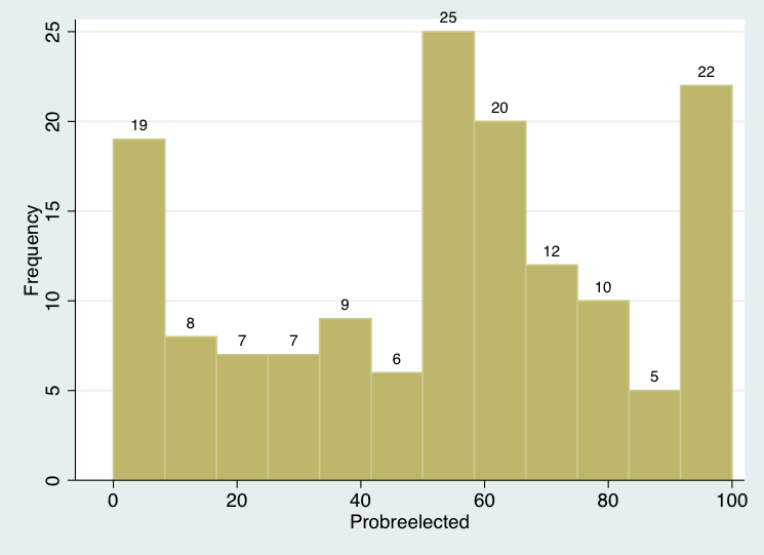


Figure 6.7: Distribution of stated beliefs - NO MEMORY
"Probreelected" measures the probability a politician assigns to her reelection chances

to maximize social welfare and their chances of reelection?

6.3.1 Policy choices

Hypothesis 5 for high-competence politicians both under rational and hindsight biased evaluation is formulated as "High competence politicians always choose the welfare maximizing policy". Because the behavior of high types should be the same in both treatments the results are presented combined for M and NM in figure 6.8 as well as for each treatment in table 6.9 which also gives the numbers of observations. High competence politicians follow the state of the world very well in both treatments, nonetheless it is of some help, if the signal is in line with the state of the world as you can see in table 6.10. Even high types follow the signal more often if it is for status quo than for reform. But overall I can say that participants in the role of high type understand that they should focus on ω to make their policy choice. They also follow this rationale in the NM treatment which means they understand that evaluations by voters are of less significance than the state of the world.

	Percentage of policies			
State of the world	following ω	Num Obs	against ω	Num Obs
Both treatments combined				
$\omega = 0$	96,1	74	3,9	3
$\omega = 1$	89,8	79	10,2	9
MEMORY				
$\omega = 0$	94,44	34	5,56	2
$\omega = 1$	87,18	34	12,82	5
NO MEMORY				
$\omega = 0$	97,56	40	2,44	1
$\omega = 1$	91,84	45	8,16	4

Table 6.9: Policy choices of high types in line with ω - combined and split after treatment

		Percentage of Policies			
State of the world	Signal	following ω	Num Obs	against ω	Num Obs
Combined					
$\omega = 0$	$\sigma = 0$	98	49	2	1
$\omega = 0$	$\sigma = 1$	92,59	25	7,41	2
$\omega = 1$	$\sigma = 0$	87,10	27	12,90	4
$\omega = 1$	$\sigma = 1$	91,23	52	8,77	5
MEMORY					
$\omega = 0$	$\sigma = 0$	96,15	25	3,85	1
$\omega = 0$	$\sigma = 1$	90	9	10	1
$\omega = 1$	$\sigma = 0$	84,62	11	15,38	2
$\omega = 1$	$\sigma = 1$	88,46	23	11,54	3
NO MEMORY					
$\omega = 0$	$\sigma = 0$	100	24	0	-
$\omega = 0$	$\sigma = 1$	94,12	16	5,88	1
$\omega = 1$	$\sigma = 0$	88,89	16	11,11	2
$\omega = 1$	$\sigma = 1$	93,55	29	6,45	2

Table 6.10: Policy choices of high types after ω and σ

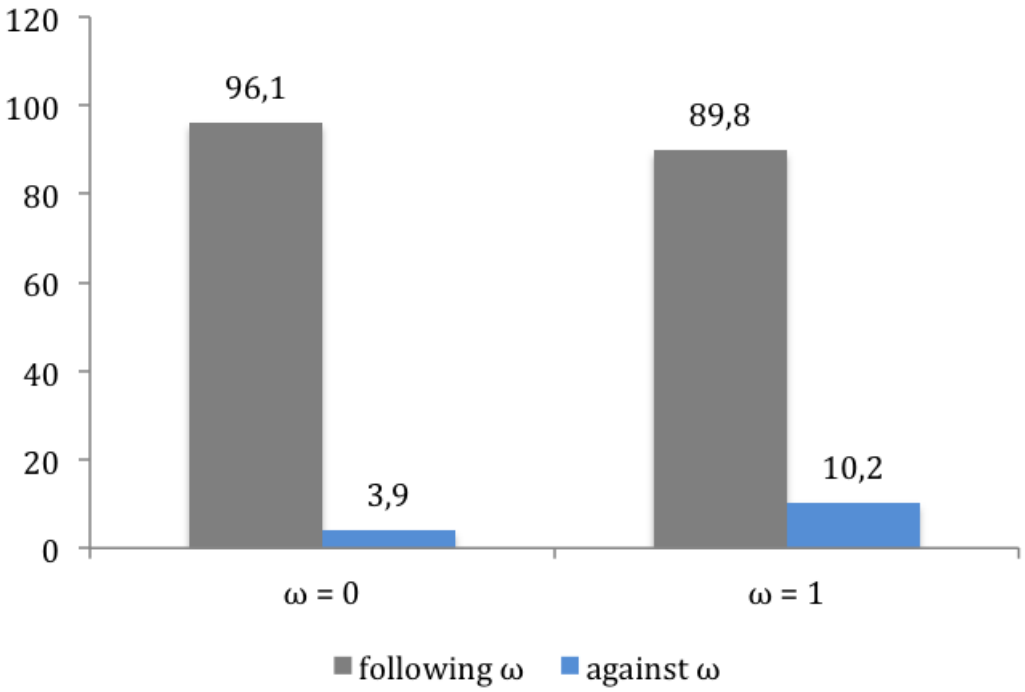


Figure 6.8: Policy choices of high types in line with ω for treatments combined

MEMORY							
			Avg ProbReelected			Actual Reelected	
Signal	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
$\sigma = 0$	PA = 0	9	72,06	3,71	27	74,07	20
$\sigma = 1$	PA = 0	9	60,65	7,03	12	75	9
$\sigma = 0$	PA = 1	3	50	-	1	100	1
$\sigma = 1$	PA = 1	3	99,65	-	1	100	1
$\sigma = 0$	PA = 1	15	87,27	4,50	11	90,91	10
$\sigma = 1$	PA = 1	15	82,86	4,04	23	78,26	18

Table 6.11: Estimated reelection probability vs. actual reelection rates - MEMORY

6.3.2 Belief of reelection probability

Politicians are asked in each round how they estimate their reelection probability given signal, action and outcome. High competence politicians have different average estimates depending on the treatment they are in. They change their behavior in response to the behavior they observe from voters. This means that participants that had no treatment manipulation whatsoever (politicians) also changed their behavior. In table 6.11 you see the average estimate a high competence politician gives in M for each event combination as well as the actual reelection rate. Table 6.12 displays the same information for NM. Politicians in NM have lower estimated reelection probabilities and lower actual reelection rates. This means that voters in NM gave less credit for a success and politicians learned that. Over time politicians in M learn that they can increase their estimate if the outcome is 15 while in NM participants have to decrease it, what they did, but in both treatments they overestimate their chances in the second half of the experiment. The change over time is documented in the appendix in section 8.4.1 in tables 8.4 and 8.5.

6.4 Social welfare produced by politicians

How many times, did which type of politician, produced which outcome? The social welfare in part 1 are the outcomes produced by the politician (3 €, 9 € or 15 €). Social

NO MEMORY							
			Avg ProbReelected			Actual Reelected	
Signal	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
$\sigma = 0$	PA = 0	9	68,11	5,22	26	38,46	10
$\sigma = 1$	PA = 0	9	59.68	5,46	18	33,33	6
$\sigma = 0$	PA = 1	3	-	-	-	-	-
$\sigma = 1$	PA = 1	3	39,33	-	1	0	0
$\sigma = 0$	PA = 1	15	77,62	7,06	16	68,75	11
$\sigma = 1$	PA = 1	15	77,14	3,64	29	68,97	20

Table 6.12: Estimated reelection probability vs. actual reelection rates - NO MEMORY

welfare in part 2 is the payoff the voters get which is 20 € for electing high types and 5 € for electing low types. The stage 2 payoff of politicians of 4 € is not considered because in each round one elected politician, incumbent or challenger, gets this bonus so there is no difference which type is elected. For each treatment and each outcome table 6.13 specifies in percent the number of times either a high or low competence politician achieved the specific outcome. Knowing which outcome is produced how many times social welfare for period 1 and period 2 can be calculated by multiplying the number of events with the respective payoffs. High types produce an average social welfare of 27,41 € in M and 22,37 € in NM. Low competence politicians produce an average social welfare of 11,47 € in M and of 11,25 € in NM. The difference of 5,04 € of high types between M and NM can be explained with more high types in NM (31,25 % vs. 37,5 %) and lower reelection rates which lead to less chances for high types in NM to realize the payoff of 20 € in period 2. Even tough there are 15 more realizations of high types in NM stage 2 payoff is 240 € lower than in M.

6.5 Model precision

The model allows to calculate equilibrium strategies of high and low competence politicians based on their knowledge about the state of the world or signal. Knowing the

Outcome	High competence	Num Obs	Low competence	Num Obs
MEMORY				
15	45,33 %	34	18,18 %	30
9	52 %	39	65,45 %	108
3	2,67 %	2	16,36 %	27
Achieved social welfare in part 1	876 €		1503 €	
Achieved social welfare in part 2	1180 €		390 €	
Average social welfare	27,41 €		11,47 €	
NO MEMORY				
15	50 %	45	17,33 %	26
9	48,89 %	44	67,33 %	101
3	1,11 %	1	15,33 %	23
Achieved social welfare in part 1	1074 €		1368 €	
Achieved social welfare in part 2	940 €		320 €	
Average social welfare	22,37 €		11,25 €	

Table 6.13: Realized social welfare by type of politician

Signal	Action	Outcome	Avg. stated Belief	Belief Theoretical Strategies	Belief Empirical Strategies
$\sigma = 0$	PA = 0	9	50,30	20,91	22,83
$\sigma = 1$	PA = 0	9	52,98	36,55	29,34
$\sigma = 0$	PA = 1	3	18,13	0	10,88
$\sigma = 1$	PA = 1	3	45,02	0	7,66
$\sigma = 0$	PA = 1	15	82,98	79,8	72,9
$\sigma = 1$	PA = 1	15	69,58	39,18	42,33

Table 6.14: Average stated belief of voters in comparison to theoretical and empirical point predictions in MEMORY

equilibrium strategies of politicians best responses of voters regarding their belief can be calculated. Doing so gives you theoretical point predictions of voter belief. With the data from the experiment the same point predictions can be calculated based on the empirical equilibrium strategies politicians choose. The difference between those predictions gives you the fit of the model. Comparing the beliefs voters should hold calculated based on theoretical and empirical strategies shows that they are close to each other. This is a good validation of the model and means that empirical behavior of politicians is close to the theoretical equilibrium strategies. You see this in tables 6.14 and 6.15 in the last two columns.
The intuition behind the calculated beliefs voters should hold is the following: The outcome of 9 is non revealing – therefore voters should stay with the base rate of 30% that a politician is of high competence instead they have values around 50%. The values of 41,4% and 39,18 % in case the outcome is 15 are because the base rate is 30% and then as a voter you should add some percentage points because the best outcome is realized. But voters add much more than they should and reach values around 70%. This is a base rate neglect. The outcome of 3 is fully revealing that the incumbent is a low type and therefore the belief should be zero.

You see in tables 6.14 and 6.15 that the beliefs obtained in the experiment and the ones predicted based on calculated equilibrium strategies are up to 30 ppt apart. This means that levels are not correct but the direction between the cases is in the right direction. The cases where social welfare is 15 are the ones where the largest

Signal	Action	Outcome	Avg. stated Belief	Belief Theoretical Strategies	Belief Empirical Strategies
$\sigma = 0$	PA = 0	9	50,03	19,08	22,07
$\sigma = 1$	PA = 0	9	47,88	36,55	31,27
$\sigma = 0$	PA = 1	3	29,62	0	0
$\sigma = 1$	PA = 1	3	40,67	0	0
$\sigma = 0$	PA = 1	15	69,44	39,18	41,4
$\sigma = 1$	PA = 1	15	70,27	39,18	41,4

Table 6.15: Average stated belief of voters in comparison to theoretical and empirical point predictions in NO MEMORY

differences are predicted therefore table 6.16 highlights the relationships for those two cases. In this table you see the directions beliefs should have and that the results from the experiment take the same directions.

6.6 Summary statistics

Summary statistics present data to establish that the two subject groups are sufficiently similar to each other so that differences in behavior are not driven by underlying differences in the participants. Table 6.17 shows descriptive statistics of the participants in both treatments. While age and risk assessment are close to each other, participants in M have more experience in the lab with an average of 8,91 experiments they participated in. In both treatments more women than man participated.
Average Guess, Two-thirds and Winning Guess are the results of the beauty contest described in the supplementary material I handed in and give additional information about the participants. The numbers reported in table 6.17 show differences between the two groups. Because the numbers I report in the table differ from what other experiments find I give a brief overview and interpretation. Nagel (1995) reports mean first period choices for the beauty contest of 36,73 in a lab experiment which is very close to the result in M but shows that choices in NM are far of, being 8,84 higher than

Signal	Action	Outcome	Avg. Stated Belief	Belief Theoretical Strategies	Belief Empirical Strategies
MEMORY					
$\sigma = 0$	PA = 1	15	82,98	79,8	72,9
			larger than	larger than	larger than
$\sigma = 1$	PA = 1	15	69,58	39,18	42,33
NO MEMORY					
$\sigma = 0$	PA = 1	15	69,44	39,18	41,4
			$\sim$ equal to	equal to	equal to
$\sigma = 1$	PA = 1	15	70,27	39,18	41,4

Table 6.16: Levels and directions of belief highlighted

in M, which shows a weakness regarding the reasoning ability of NM-participants. The beauty contest is not only a game for laboratory experiments but it is also possible to play the game via newspapers. The game is explained and readers are asked to send in their best guess with the same possibility as in the lab experiments to win some prize. The advantage of this approach is that a large number of people, up to 3700, can participate. Bosch et al. (2002, p. 1694) report the following findings: an average of 35,13 for lab experiments, an average of 26,64 for classroom experiments, an average of 22,16 for internet newsgroup experiment and an average of 23,08 for newspaper experiments. The average guess in M again is close to the value reported for the lab experiments while all other results are lower than the ones I got with 47,5 from NM again being far off. Nagel (1995, p. 1315) writes about the interpretation of the average numbers that: "a player is strategic of degree 0 if he chooses the number 50. (This can be interpreted as the expected choice of a player that chooses randomly from a symmetric distribution...)". Following this interpretation is not flattering for the participants in NM.

	MEMORY			NO-MEMORY		
	Mean	Std. Dev.	Num Obs	Mean	Std. Dev.	Num Obs
Age	27,5	4,42	24	26,58	6,02	24
Experience	8,91	7,13	24	6,95	5,44	24
Risk Assessment	2,79	Std. Err. 0,13	24	2,58	Std. Err. 0,17	24
Male	45,8 % (# 11)			37,5 % (# 9)		
Female	54,2 % (# 13)			62,5 % (# 15)		
Average Guess	38,66			47,5		
Two-thirds	25,77			31,66		
Winning Guess	25			30		

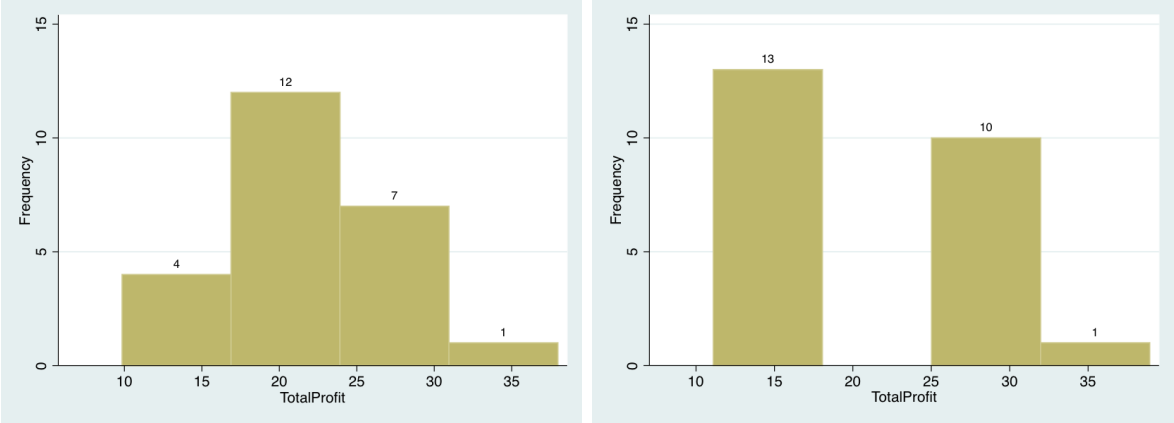
Table 6.17: Summary statistics

6.6.1 Average Earnings

Earnings of participants depend on their assigned role, their individual performance in the game and on the randomly drawn period that was selected for payment. Table 6.18 displays the average earnings of participants in the two treatments based on their role. Participants in both roles receive approximately the same payments with politicians earning 1,11 € more if looking at both treatments combined. In both sessions subjects received 5 € extra on top of the payments displayed in the table because the experiment took longer than expected. The following histograms give a visual display of the earnings described in Table 6.18.

Pooled			
	Average Total Profit	Std. Err.	# Obs
Politician	21,71	0,273	24
Voter	20,60	1,757	24
MEMORY			
Politician	22,58	2,214	12
Voter	18,29	2,387	12
NO-MEMORY			
Politician	20,84	1,210	12
Voter	22,90	2,500	12

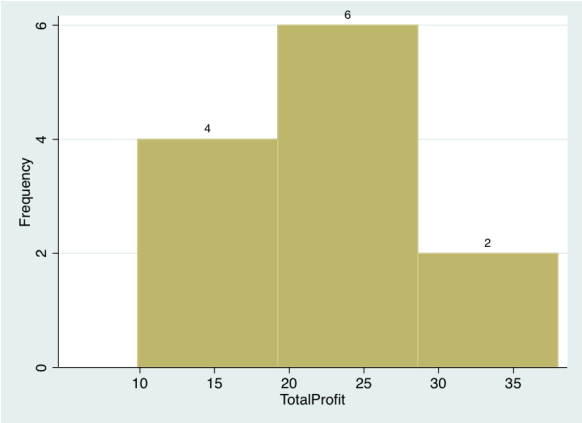
Table 6.18: Earnings based on assigned role



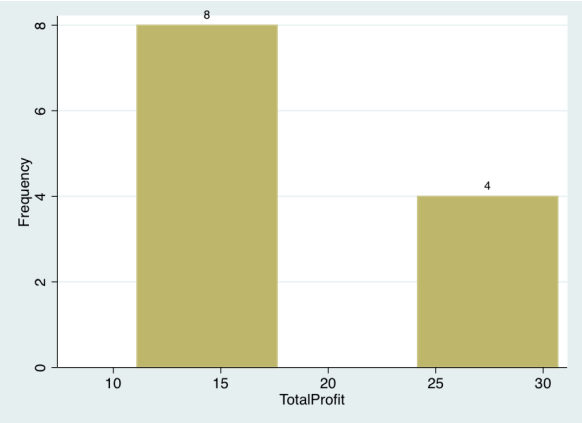
(a) Politician

(b) Voter

Figure 6.9: Histogram Earnings Pooled

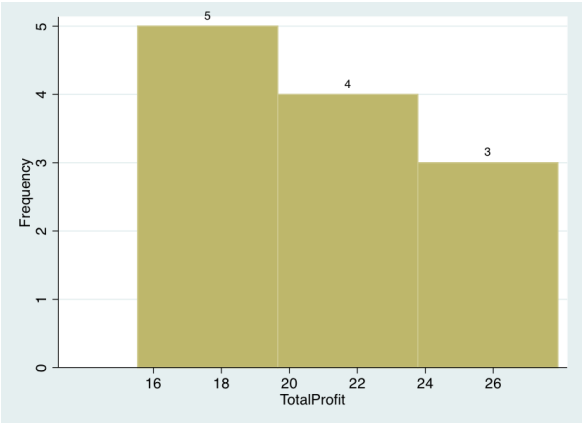


(a) Politician

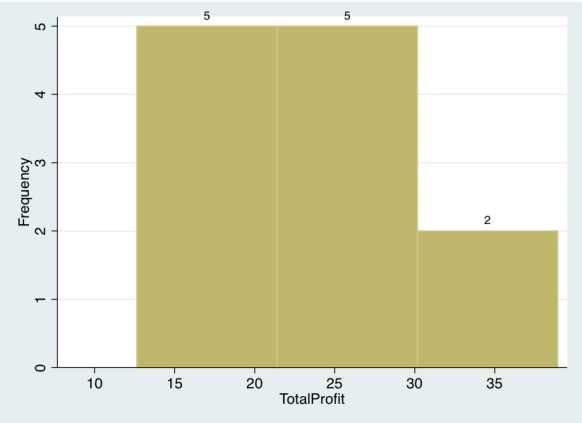


(b) Voter

Figure 6.10: Histogram Earnings MEMORY



(a) Politician



(b) Voter

Figure 6.11: Histogram Earnings NO MEMORY

Chapter 7

Conclusion

Citizens living in democracies have the privilege that they can vote for politicians and parties they prefer most and influence the political agenda of their country for the coming years. As voter, you have a say in shaping the future of the country you live in. Nonetheless, the voting process is often far from ideal and expectations. There are irregularities in the process (Austrian presidential election 2016 overturned by the constitutional court[1]) cases of voter fraud and vote rigging (see for example Romania[2]) and possibilities of influencing decisions by publishing opinion polls[3]. On top of this there is indifference regarding the election on behalf of the voters resulting in low voter turnout, ignorance about facts [4] as well as attractiveness of candidates and draughts[5] that have nothing to do with politics but still may influence elections. And then there is hindsight bias. The ideals and hopes of democratic elections get muddled with reality and part of reality is hindsight bias. As people we tend to overestimate our predictive abilities about the future after we know how things turned out. For politicians this means that after they successfully implement policies that increase welfare recognition

[1]https://www.vfgh.gv.at/downloads/VfGH_W_I_6-2016_Bundespraesidentenwahl.pdf (visited 19.06.2017)

[2]http://www.economist.com/news/europe/21711729-despite-its-leaders-voting-fraud-conviction-democratic-party-wins-landslide-romania (visited 19.06.2017)

[3]http://nrwschool.de/wp-content/uploads/2013/10/waz07.08.2013_korte.pdf (visited 19.06.2017)

[4]https://www.forbes.com/sites/jaredmeyer/2016/06/27/american-voters-are-ignorant-but-not-stupid/#74b8b4707ff1(visited 20.06.2017)

[5]http://www.bbc.com/future/story/20150506-the-dark-psychology-of-voting (visited 19.06.2017)

is lower than merited.

Participants in the role of high competence politician understand that they have to focus on ω in order to decide which policy action to take. Being rational in their policy action they change their expectations about reelection from the first to the second half of the game into the direction of the actual reelection rate. This means that they learn that voters do not evaluate them as they deserve. Low competence politicians behave as expected following the signal if no risk is involved and hiding behind status quo if chances are that they will be revealed as of low competence. As predicted sometimes they try to gain reputation by playing policy gambles keeping in line with theory that the number of policy gables is lower under hindsight biased evaluation. This difference although is not statistically significant. Hindsight biased voters are worse in recognizing types and so they elect high types less often. The experiment confirms the hypothesis that hindsight biased voters recall the wrong signal and therefore have different beliefs than expected under rational evaluation. When welfare is as high as possible hindsight biased voters can only imagine a signal that points in this direction. The point predictions of voter belief calculated based on the model of Schuett and Wagner (2011) are not met in my experiment. Levels of voter beliefs are up to 30 percentage points higher that calculated but importantly the directions the beliefs take between the two treatments and the different outcomes within the treatments are in line with the predictions. Both parts of the research question can successfully be answered: The treatment manipulation, showing subjects a summary box about past events, works and produces behavior more in line with rational evaluation and behavior between the two treatments follow the predictions of the theoretical model.

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Chapter 8

Appendix

The Appendix gives additional analysis of the data. Numbers on top of bars indicate the number of observations. Because of requirements from the University of Vienna an abstract and a german version of the abstract has to be included in the appendix.

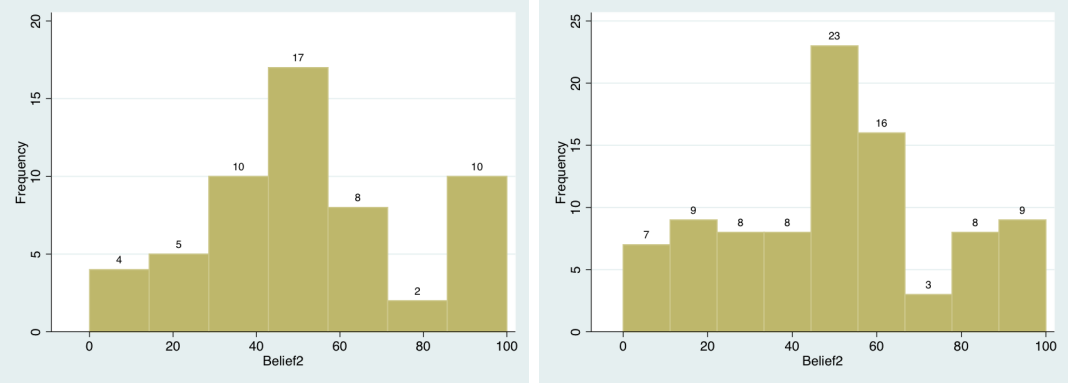
8.1 Abstract

Schuett and Wagner (2011) present a political agency model in which politicians of different competence (high and low) interact with voters that are either rational or hindsight biased. Hindsight bias makes people increase their recalled prediction of the likelihood of events after they hold outcome information. A possible consequence of the bias is that voters underestimate the political competence needed to realize good policy outcomes because in their recollection the result seems obvious. This behavior has an effect on the election decision of the voter, either to reelect the incumbent or vote for the challenger. The two conducted treatments (memory vs. no memory) are designed to test the model and to result in different levels of hindsight-bias. As predicted this leads voters to different evaluations of a politicians competence. Voters in the hindsight-bias treatment are worse in differentiating between high and low competence politicians, elect high types less often and therefore produce a lower social welfare. Under hindsight-biased evaluation voters make wrong inferences about the competence level because they wrongly recall a signal that makes the observed outcome most likely. Confirming the theoretical hypothesis, differences in beliefs come from wrongly recalled

signals. The levels of voter beliefs differ from theoretical point predictions but differences between treatments follow the expected direction. Low competence politicians hide behind the status quo in cases where they could be revealed as low types if they would opt for reform. Equilibrium strategies of politicians change in response to voter behavior influenced by the memory condition.

8.2 Abstract German

Schuett and Wagner (2011) präsentieren ein spieltheoretisches Modell in dem Politiker mit unterschiedlicher Kompetenz (hoch oder niedrig) sich der Wiederwahl von Wählern stellen, die entweder rational oder mit einem Rückschaufehler (hindsight bias) agieren. Dieser systematische Rückschaufehler den Menschen haben, lässt sie die Wahrscheinlichkeiten von Ereignissen zu hoch einschätzen, nachdem sie wissen wie diese ausgegangen sind. In einem politischen Kontext, kann das bedeuten, dass Wähler die benötigte Kompetenz um ein Ergebnis herbeizuführen als zu gering einschätzen. Das durchgeführte Experiment besteht aus zwei Durchgängen wobei die Erwartung ist, dass die beobachteten Rückschaufehler aufgrund des Designs des Experiments unterschiedlich sind. Wähler in dem Design, dass den Rückschaufehler aufweisen soll, sind schlechter darin zwischen den Typen von Politikern zu unterscheiden und wählen Politiker mit hoher Kompetenz seltener wieder. Wie postuliert vertauschen Teilnehmer im Durchgang mit dem Rückschaufehler die Signale die zu dem beobachteten Ergebnis geführt haben. Das tun sie, da sie das Signal in Einklang mit dem Ergebnis bringen. Die Wahrscheinlichkeitsschätzungen die von den Teilnehmer abgeben werden, sind höher als im Modell berechnet, aber zwischen den beiden Durchgängen zeigen die Bewegungen im Verhalten in die richtige Richtung. Politiker mit niedriger Kompetenz verstecken sich hinter dem Status Quo und vermeiden Reformen. Die Gleichgewichtsstrategien von Politikern ändern sich, in Reaktion auf das Verhalten der Wähler, die durch die Design-Unterschiede zwischen den beiden Durchgängen beeinflusst werden.



(a) $\sigma = 0, PA = 0, y = 9$ (b) $\sigma = 1, PA = 0, y = 9$

Figure 8.1: Stated Beliefs for outcome of 9 - MEMORY

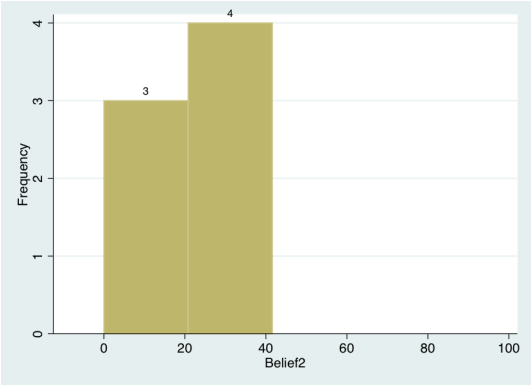
8.3 Voter

8.3.1 Stated Beliefs

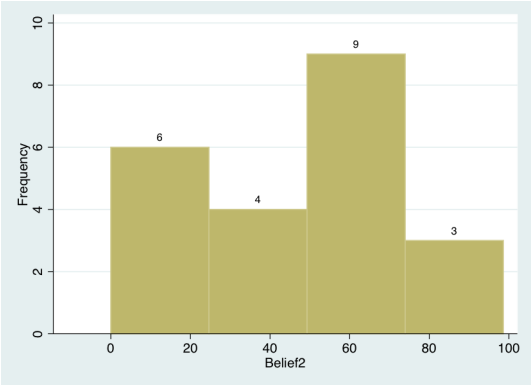
Figure 8.1 to 8.6 display how many subjects stated which belief given the specific event combination. You see that it is skewed to the left in case the outcome is 15, beliefs that roughly resemble a normal distribution if the outcome is 9 and some difference in beliefs in case the outcome is 3 depending on the signal.

In addition to the distribution of the beliefs figures 8.7 and 8.8 show how often voters changed their estimate regarding the competence of the incumbent and figure 8.9 displays which subjects how often did not enter estimates at all.

Stated posterior beliefs can be analyzed depending on the actual type a participant is facing when making his estimate. Tables 8.1 and 8.2 provide those numbers for both treatments and show details split after outcomes. Note that estimates split after outcome are very similar between treatments.

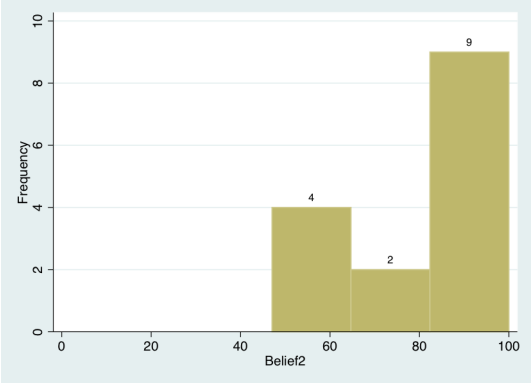


(a) $\sigma = 0, PA = 1, y = 3$

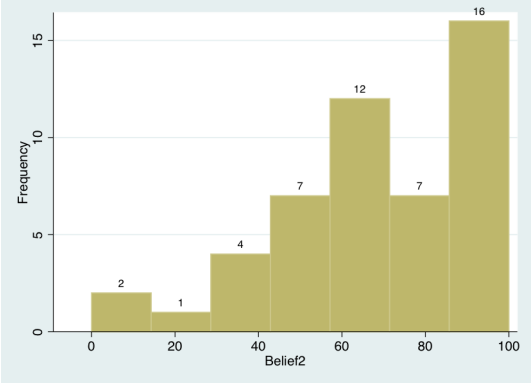


(b) $\sigma = 1, PA = 1, y = 3$

Figure 8.2: Stated Beliefs for outcome of 3 - MEMORY



(a) $\sigma = 1, PA = 1, y = 15$

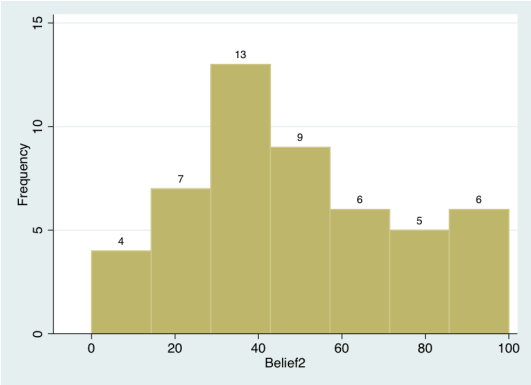


(b) $\sigma = 1, PA = 1, y = 15$

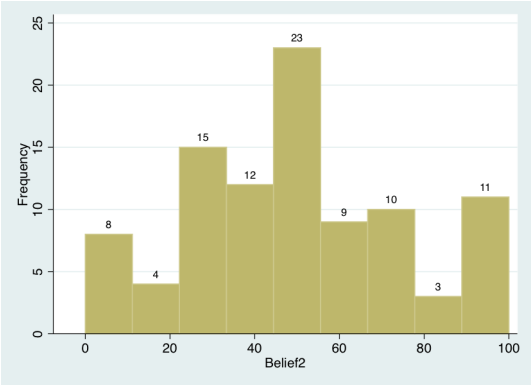
Figure 8.3: Stated Beliefs for outcome of 15 - MEMORY

	MEMORY			NO MEMORY		
Actual Type	Estimate High Type - Mean	Std. Err	Num Obs	Estimate High Type - Mean	Std. Err	Num Obs
High Type	62,24	3,34	75	59,91	3,06	90
Low Type	52,41	2,12	165	50,99	2,38	150

Table 8.1: Posterior Belief vs. Actual Type

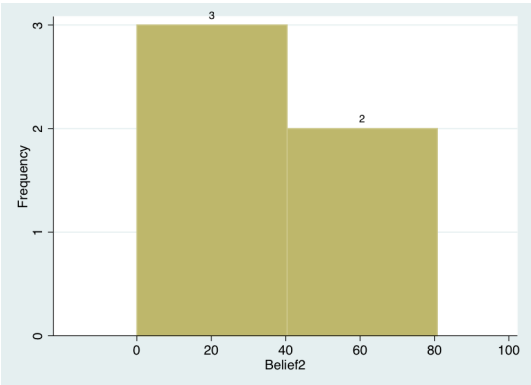


(a) $\sigma = 0, PA = 0, y = 9$

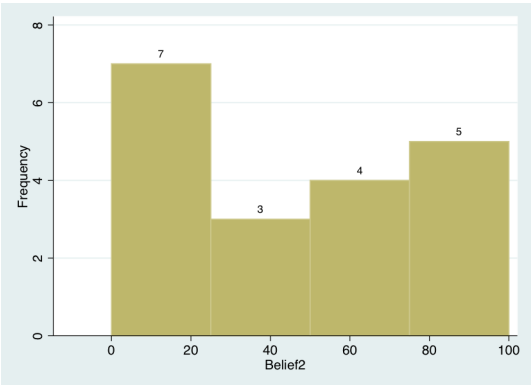


(b) $\sigma = 1, PA = 0, y = 9$

Figure 8.4: Stated Beliefs for outcome of 9 - NO MEMROY

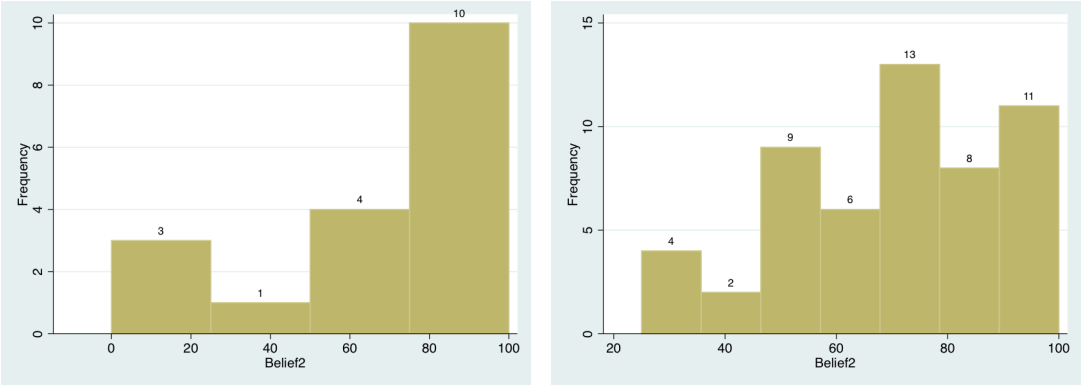


(a) $\sigma = 0, PA = 1, y = 3$



(b) $\sigma = 1, PA = 1, y = 3$

Figure 8.5: Stated Beliefs for outcome of 3 - NO MEMROY



(a) $\sigma = 0, PA = 1, y = 15$ (b) $\sigma = 1, PA = 1, y = 15$

Figure 8.6: Stated Beliefs for outcome of 15 - NO MEMROY

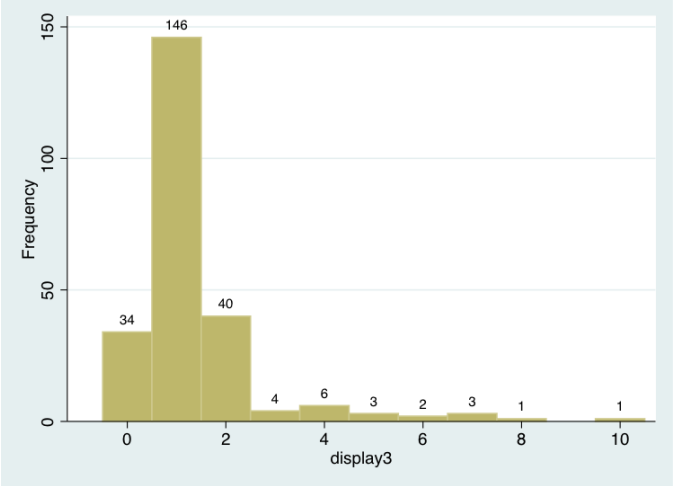


Figure 8.7: Number of changes in competence estimation - MEMORY

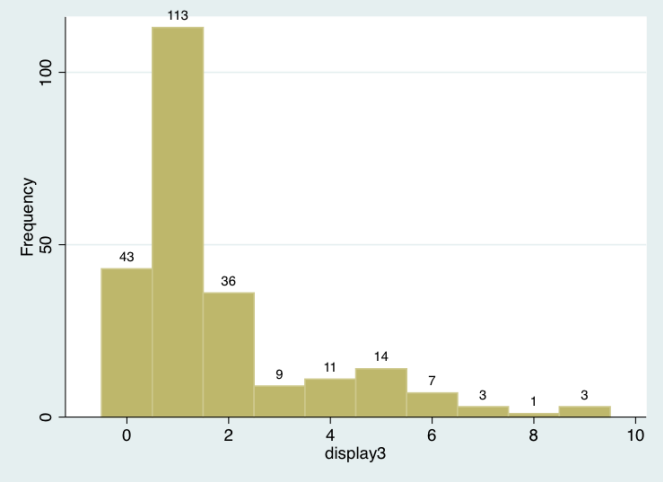


Figure 8.8: Number of changes in competence estimation - NO MEMORY

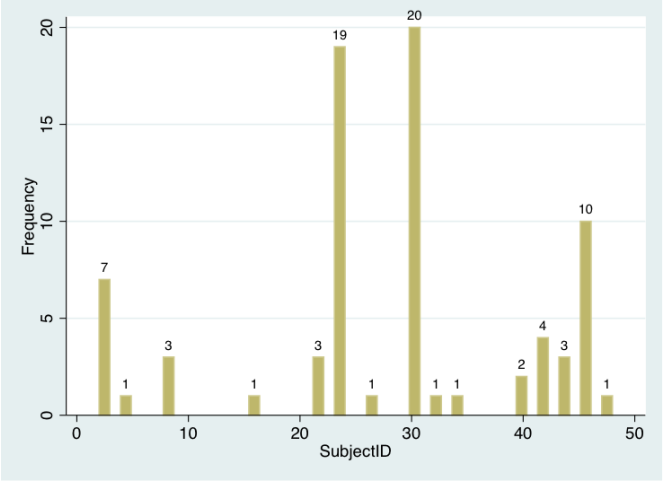


Figure 8.9: Subjects that did not state estimate - Combined

Outcome	Actual % High Type	Actual % Low Type	Estimate High Type		
MEMORY					
9	26,53	73,47	51,32	2,14	147
3	6,90	93,10	38,52	5,11	29
15	53,12	46,88	72,71	3,16	64
NO MEMORY					
9	30,34	69,66	49,28	2,26	145
3	4,17	95,83	38,36	7,45	24
15	63,38	36,62	79,06	2,89	71

Table 8.2: Posterior Belief vs. Actual Type conditional on Outcome

Combined							
			Avg ProbReelected			Actual Reelected	
Signal	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
$\sigma = 0$	PA = 0	9	70,12	3,16	53	56,60	30
$\sigma = 1$	PA = 0	9	60,07	4,24	30	50	15
$\sigma = 0$	PA = 1	3	50	-	1	100	1
$\sigma = 1$	PA = 1	3	69,49	30,15	2	50	1
$\sigma = 0$	PA = 1	15	81,55	4,60	27	77,78	21
$\sigma = 1$	PA = 1	15	79,67	2,71	52	73,08	38

Table 8.3: Estimated reelection probability vs. actual reelection rates - Combined

8.4 High-Competence Politician

8.4.1 Belief of reelection probability

Table 8.3 displays the estimated reelection probabilities for high competence politicians combined. Tables 8.4 and 8.5 show the evolvement of the stated reelection probability over time. Because high competence politicians followed the state of the world very closely the analysis is done conditional on the state of the world which results in four possible combinations. For the M treatment there is a positive learning effect in case of outcome 15. Starting from a lower probability of reelection than actually realized in the first half, politicians overestimate their chances of reelection in the second half of the game. For NM there is also a movement toward the true reelection rate in case of

MEMORY							
			Average Probreelected			Actual Reelected	
State of the world	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
Periods 1-10							
$\omega = 1$	PA = 1	15	75,80	5,36	15	86,67	13
$\omega = 1$	PA = 0	9	50	-	3	66,67	2
$\omega = 0$	PA = 0	9	65,86	5,81	16	75	12
$\omega = 0$	PA = 1	3	50	-	1	100	1
Periods 11-20							
$\omega = 1$	PA = 1	15	90,98	2,79	19	78,95	15
$\omega = 1$	PA = 0	9	50	-	2	100	2
$\omega = 0$	PA = 0	9	76,08	4,54	18	72,22	13
$\omega = 0$	PA = 1	3	99,65	-	1	100	1

Table 8.4: Estimated reelection probability over time

15 but in the other direction, yet they also overestimate their reelection chances in half two.

In most of the cases (101 out of 192) high types set their opinion regarding their reelection chances once. Figure 8.10 provides a frequency plot for all cases. The variable "display2" is set to 0 by default so the 21 cases where there is no change indicated means that the participant did not change the slider and left the probability estimate on the default of 50 %. Figure 8.11 provides a histogram of the stated beliefs that is skewed to the left.

NO MEMORY							
			Average Probreelected			Actual Reelected	
State of the world	Action	Outcome	Mean	Std. Err.	Num Obs	% reelected	Num Obs
Periods 1-10							
$\omega = 1$	PA = 1	15	81,12	4,42	27	70,37	19
$\omega = 1$	PA = 0	9	58,04	5,40	3	-	3
$\omega = 0$	PA = 0	9	69,34	6,51	18	33,336	6
$\omega = 0$	PA = 1	3	-	-	-	-	-
Periods 11-20							
$\omega = 1$	PA = 1	15	71,60	5,11	18	66,67	12
$\omega = 1$	PA = 0	9	90,38	-	1	-	0
$\omega = 0$	PA = 0	9	60,56	5,27	22	45,45	10
$\omega = 0$	PA = 1	3	39,33	-	1	-	0

Table 8.5: Estimated reelection probability over time

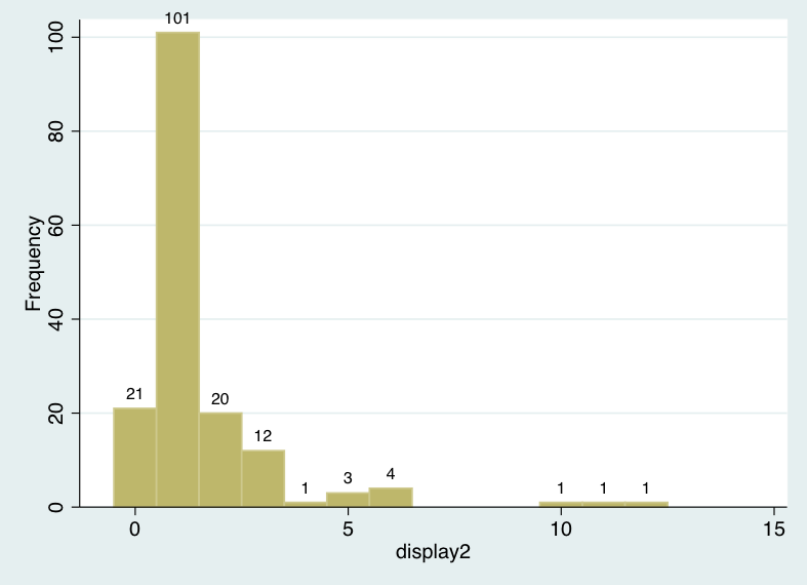


Figure 8.10: Number of changes in reelection estimation

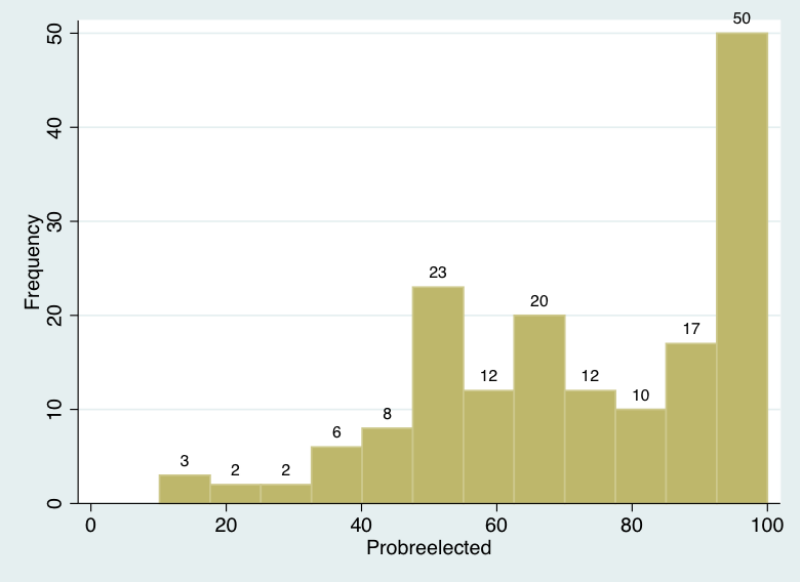


Figure 8.11: Distribution of stated beliefs