How Economic Laypeople Perceive Economic Growth and Inflation

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> "The concepts of people, their mindsets, are in many cases more important for the direction of economic policy than the economic facts themselves."
> (Walter Eucken (1952), *Grundsätze der Wirtschaftspolitik*)

1. General Overview

Economic theory provides us with knowledge on economic facts. This knowledge is also drawn upon in making recommendations for political decision makers and thus contributes to the implementation of policies which are designed to help increase welfare. However, political decision makers face the problem of depending on voter acceptance. In turn, this acceptance depends on the voters' understanding of the benefits associated with the economic and political measure in question. The present dissertation therefore addresses the perspective of the voter by focusing on two phenomena which play a central role in the implementation of economic and political reform measures, namely biases in the perception of the economy and the stability of peoples' concepts on the economy. Both phenomena are important for political decision makers. Biases in the perception of the economy may contribute to the rejection of reform measures which from an economist's point of view are reasonable. A stability of peoples' concepts of the economy would implicate that it is extremely difficult to modify inadequate beliefs which may be based on biased perceptions of the economy.

Based on the example of economic growth, Chapter 2 discusses the problem of biases in the perception of the economy. In a series of four experiments, economic laypeople were required to estimate long-term economic growth. Study 1 revealed clear underestimations of true values for growth rates above 1%. In Study 2, the effect of presenting the task in the context of a financial investment scenario was

investigated. Estimates were found to be slightly more accurate than in the economic growth scenario. Study 3 examined the influence of expertise on the accuracy of estimations. While experts provided more accurate estimations than laypeople, they also tended to underestimate true values. No effect of incentives, but a positive influence of the need for cognition on the accuracy of estimations was observed. Male participants were further found to provide more accurate estimates than female participants. Study 4 used the so-called *thinking aloud method* to gain deeper insight into the reasons for the observed underestimations. Underestimations were found to be the result of a common application of inappropriate solution procedures.

Chapter 3 addresses the stability of lay beliefs on the economy, even in the light of evidence of a clearly contradictory nature, using the example of the euro introduction. Based on the framework of the Theory of Lay Epistemics, 156 replies to a newspaper article which contradicted the belief that the introduction of the euro was inflationary were subject to content analysis. According to this theory, five different reactions were predicted which should promote high perceived inflation despite counter persuasive evidence. As expected, these five reactions appeared more frequently when subjects were convinced that the introduction of the euro was inflationary.

Finally, Chapter 4 examines the interplay of biases in the perception of economic phenomena and belief perseverance based on the example of a value added tax increase in Germany at the beginning of 2007. In a within-subjects design, two surveys were carried out; one two months prior to and the other two months following the value added tax increase. 307 participants were required to judge the actual, prospective and past prices of eight products. In the first survey, remarkable price increases of approximately 10% were expected, and there were no differences in expectation between

products affected and those not affected by the value added tax increase. Although perceived price increases in the second survey were lower (around 5%) than the expected increases in the first survey, there were once again no differences in the perceived price increase of products affected and those not affected by the value added tax increase. Perceived price increases were further found to substantially deviate from real price development as measured by the German Federal Statistical Office, thus indicating that biased expectations of price increases prior to the value added tax increase significantly influenced perceived price increases following the value-added tax increase.

However, before addressing the subsequent chapters in detail, it would appear useful to mention a central methodological challenge when dealing with lay perceptions of economic phenomena, and to discuss the extent to which these difficulties were considered in the present dissertation.

A central problem when discussing biased perceptions of economic phenomena or the formation and perseverance of inaccurate beliefs is the necessity for comparison with an objective and valid reality. A discussion of these aspects only appears worthwhile given that perceptional phenomena or beliefs can be compared to the way things "really" are. Yet whether economics as a science is principally able to adequately describe how the economy really works appears at the very least questionable. This becomes clear when considering that even professional economists very often disagree about the right economic policy (Fetchenhauer & Haferkamp, 2007). From this perspective, it could even be argued that biases in the perception of and belief formation on the economy do not exist. Such an extreme position can be derived from Moscovici (1984), who concludes from his Theory of Social Representations that biases are nothing other than differences in perspective between heterogeneous individuals or groups. Biases therefore do not necessarily express a social or

cognitive deficit but rather a normal difference in perspective between heterogeneous individuals or groups within a society.

In order to circumnavigate the problems connected with this issue, the studies in the present dissertation focused on phenomena which could be compared to mathematically true values, such as the estimation of long-term economic growth. A further technique adopted in dealing with this problem was relying on the work of the German Federal Statistical Office and the fact that this institution is able to provide more or less accurate measurements of price development. Although measuring inflation rates using baskets of commodities may be associated with certain difficulties, for example refined products (DESTATIS, 2003), this official price information was selected for use given that it appears, on the whole, to closely reflect "real" price development. It must nonetheless be critically noted that correctly capturing objective reality when dealing with lay perception and lay beliefs on the economy may often prove extremely difficult, thus constraining fields of research in which some measure of objective reality or an appropriate surrogate is required.

Chapters 2, 3, and 4 are intended for submission to future publications, or already submitted, respectively, and can therefore be read separately.

2. The illusion of living in a linear world – How laypeople and experts underestimate the effect of economic growth

2.1. Introduction

Imagine two countries, A and B, with the same initial level of wealth. If it is assumed that country A shows zero growth over the next years and country B grows with an annual growth rate of 5%, how long would it take country B to double its initial level of wealth compared to country A?

The answer is that it would take country B only slightly more than 14 years to double its initial level of wealth compared to country A. A closer look at current statistics on growth rates (e. g. EUROSTAT, 2007) clarifies that it is not difficult to fill the labels "A" and "B" of the different countries with content. Whereas countries such as Denmark, France, Hungary, and Portugal had modest growth (0.5% to 1.6%) during recent years, countries such as Latvia, Slovakia, and Estonia had significantly higher growth rates (7.7% to 11.0%). The same applies for China, which, for a considerable time, grew with annual rates between 8% and 11.5% and is, therefore, assumed to overtake countries such as Germany very soon (Spiegel-Online, 2007) (at least as far as the absolute gross domestic product is concerned).

These examples clarify that economic growth is profoundly dynamic and that different growth rates in different countries are suited to change the meaning and wealth of different economies within relatively short time frames. Therefore, these examples are also suited to demonstrate the importance of economic growth and, therefore, of political measures aimed to stimulate economic growth for a particular country. Nonetheless, such political measures require the acceptance of the voters. This acceptance, in turn, should depend on

the voters' ability to understand the impact of economic growth in the long run and the meaning of higher or lower growth rates.

For this reason, in a series of four studies, the degree to which people are able to understand and estimate the dynamics behind economic growth and what influences the accuracy of their estimations were examined. The main question the participants were asked to answer in all four studies was: "What is the overall rise in national income within the next 25 years if the economy rises with an annual rate of 5%?" The true answer to this question is 238.64%, which is calculated according to the following formula:

$$[(1 + 0.05)^{25} - 1] * 100 \tag{1}$$

Hand on heart, would you have provided a reasonably accurate estimation? If not, you are in good company since it is a ubiquitious phenomenon that people have enormous difficulties correctly predicting the future. For example, terms such as presentism (Gilbert, Gill, & Wilson, 2002) or projection bias (Loewenstein & Angner, 2003) both describe the general phenomenon that people rely too much on current states when prediciting the future. Based on these general phenomena, it is, therefore, not a surprising finding that previous research dealing with estimations of exponential growth rates suggests enormous difficulties when it comes to predicting the outcome of exponential growth in the future.

In a classical experiment by Wagenaar and Sagaria (1975), participants were asked to extrapolate a hypothetical development of pollution, which was presented in table form. The remarkable finding was that two-thirds of the participants drastically underestimated the true value of 25.000 and provided estimations lower than 2.500, reaching only 10% or less of the true value. Very similar results were found in a study by Benzion, Granot, and Yagil (1992) using the example of financial investments. In this study, participants were asked to estimate the end value of a money investment of $100 for various durations and interest rates. Beside the fact that the end

values and, therefore, the exponential growth rates were clearly underestimated, it was also found that the underestimations were clearly increased with the length of the duration and with the magnitude of the interest rate. Even though these findings suggest that the tendency to underestimate exponential effects becomes even stronger with longer periods, the findings from Wagenaar and Sagaria (1975) clarify that this tendency also appears when relatively short time frames of five years are considered.

One could now object that the underestimations are possibly rooted in people's difficulties when dealing with numerical information. This should, in particular, be the case when people must deal with percentages (e. g., Paulos, 1988), for example, when estimating economic growth in the long run.

In another study, however, Wagenaar and Timmers (1979) used the so-called pond-and-duckweed problem to investigate participants' ability to estimate exponential growth rates in a non-numerical manner. Participants were exposed to a square, which represented a pond. This pond included 256 small squares, which represented duckweed. The duckweed and, therefore, the number of small squares grew with a constant growth rate, indicating the exponential growth. Most subjects heavily overestimated the time it would take until the duckweed would overgrow the whole pond. It was, therefore, shown that participants' tendency to underestimate exponential effects is not only a function of lacking numerical abilities, but it also appears when they are confronted with concrete and obvious processes.

To summarize, it has been shown that most people tend to underestimate the effects of exponential growth rates in a number of different domains. According to our knowledge, however, whether this general finding extends to the effects of different levels of growth rates on the economic wealth of a given country has not been tested. This question is addressed in Study 1, which examines how far findings

from previous research (e.g., Wagenaar & Sagaria, 1975; Dörner, Kimber, & Kimber, 1997) can be transferred to the context of economic growth. Study 2 examines the influence of the setting of the estimation task and, therefore, to what degree a lack of ability to transfer the logic behind exponential effects to the context of economic growth may account for possible underestimations. Study 3 aims to discover what influences the quality of the estimations by addressing to what degree expertise is suited to improve accuracy. Additionally, motivational effects are examined, which were either induced experimentally (using incentives) or based on individual dispositions (considering the influence of the personality trait need for cognition). Finally, Study 4 aims to gain insight into the mental processes and possible sources of errors underlying the solution of the estimation task dealing with economic growth by using the thinking-aloud method.

2.2. Study 1

Based on findings from previous research, it was expected that people, in general, would tend to underestimate economic growth in the long run. Furthermore, it was expected that this tendency would become stronger with rising growth rates. Therefore, this study used various growth rates, ranging from 1% to 5%. Participants were asked to estimate the overall growth in national income in 25 years.

2.2.1. Method

2.2.1.1. Participants

Participants were 80 students from the Faculty of Management, Economics, and Social Sciences of the University of Cologne in an advanced study period. Therefore, it was expected that they would be familiar with economic phenomena in general and also with economic growth and exponential effects because their curricula contain

(among others) various courses dealing with financial investments and even a course dealing with growth theory.

The main part of this sample consisted of students of business administration (73.8%) and economics (12.5%). The remaining participants were students of social sciences and health economics.

2.2.1.2. Procedure

The experiment was carried out in an introductory lecture on economic and social psychology. The participants were requested to fill out a questionnaire and answer all questions in any case, even in case of uncertainty. Furthermore, they were requested not to talk to their neighbors and not to use calculators. Using a between-subjects design, the questionnaire started with the question, "*What is the overall rise in national income within the next 25 years if the economy rises with an annual rate of 1% (or 3%, or 5%, respectively)?*" Afterwards, they were asked to fill in their course of study. The debriefing with a short discussion of the results took place in the following lecture.

2.2.2. Results and discussion

Based on the theoretical considerations, it was expected that the participants would clearly tend to underestimate the true values, at least for the 3% and 5% growth rate. Furthermore, the inaccuracy of the estimations was expected to increase with the magnitude of the growth rates due to a stronger impact of exponential effects.

First, a remarkable range of estimations was observed, ranging from 0% to 130% for the 1% growth rate, from 0% to 300% for the 3% growth rate, and from 0% to 400% for the 5% growth rate. A subsequent Kolmogorov-Smirnov test for all growth rates was not signicant at a 5% significance level, thus indicating that the estimations were approximately normally distributed. A closer look at Figure 1 reveals that, with the exception of the 1% growth rate, participants clearly tended to underestimate the true values and that

the inaccuracy of the estimations increased with the magnitude of the growth rates.
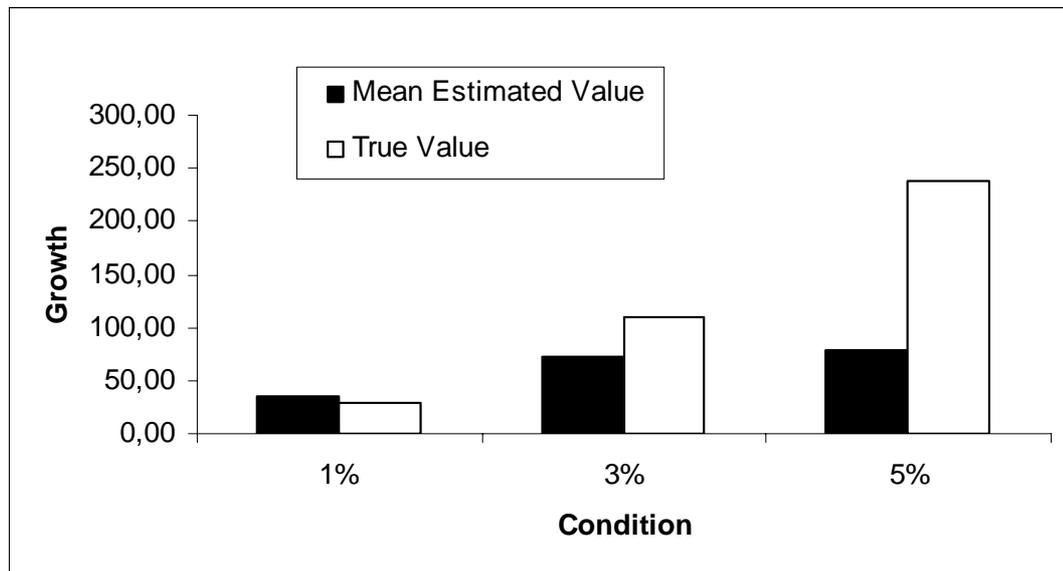
Figure 1: Mean Estimations and True Values for a 1%, 3%, and 5% Growth-Rate

For the 1% growth rate, the mean estimated value of 34.14% did not significantly differ from the true value of 28.24%, $t(26)$ = .82. Accordingly, our expectation that participants would provide quite accurate estimations for a low growth rate was confirmed. It appears that, for this growth rate, the exponential effects were still within a conceivable range for the participants.

The situation however differed for the 3% and 5% growth rates. For the 3% growth rate, the mean estimated value of 72.48% was found to be a significant underestimation of the true value of 109.38%, $t(26)$ = 2.53, $p < .05$. As expected, this inaccuracy became even stronger for the 5% growth rate. Here, the mean estimated value of 78.54% represents an extreme underestimation of the true value of 238.64%, $t(23)$ = 9.04, $p < .01$. These findings indicate that, as expected, the underestimation became stronger with the rising impact of exponential effects, which were strongest for the 5% growth rate. In sum, it was found that people were quite good in estimating economic

growth for a low growth rate of 1%. However, this situation dramatically differed with rising growth rates.

A subsequent ANOVA revealed a significant main effect of the growth rates on the estimated values, $F(2, 75) = 3.18$, $p < .05$, $\eta^2 = .08$, but a subsequent Games-Howell post-hoc test revealed only marginally significant differences between the estimations for the 1% growth rate and the estimations for the 3% growth rate or the estimations for the 5% growth rate, respectively (ps < .10). At the same time, no significant difference was observed between the estimations for the 3% and 5% growth rates. This indicates that these estimations were quite similar, which is a remarkable finding because there is a 129.26% difference between the true values. Therefore, it appears as though people become increasingly helpless with rising growth rates.

2.3. Study 2

Study 1 revealed a strong tendency to underestimate the cumulative effects of economic growth rates over a longer period of time. A possible explanation for this tendency could be that some participants simply did not recognize that economic growth underlies the effect of exponentiality, such as in financial investments, for example. For this reason, Study 2 aimed to replicate this main finding from Study 1 in the context of financial investments. The basic assumption was that, in general, participants are more familiar with compound interest effects and the corresponding exponential growth in a financial investment setting. Therefore, it was expected that those participants who were not capable of transferring their knowledge on exponential effects in a financial investment setting to an economic growth setting would tend to provide lower estimations in the economic growth setting due to the negligence of exponential effects.

2.3.1. Method

2.3.1.1. Participants

Participants were 293 students (129 females, 164 males) of different courses of study who were randomly recruited on the campus. One participant was removed from the subsequent data analysis because he provided only an estimate for the financial investment setting. Furthermore, because there was no upper limit for the range of the estimations, we had to deal with the problem of outliers. It was decided to follow a common procedure to deal with outliers and to exclude estimations beyond a range of three standard deviations (see for example Roth & Switzer, 2002). For this reason, 5 participants were excluded from analysis, though the central results were also obtained when the outliers were not removed from the sample.

2.3.1.2. Procedure

The participants were asked if they were willing to participate in a survey dealing with the psychology of economic growth, and they were told that they could participate in a lottery. If they agreed, they were given the questionnaire and told that they were not allowed to use any devices such as calculators. In the questionnaire, the participants were informed that they were about to answer two estimation tasks and that they should anwer these tasks in all cases, even in case of uncertainty. The sequence of the two estimation tasks (economic growth versus financial investment setting) was randomized to control for sequence effects; however, no such effects occurred. Then, the participants were asked to answer the question, *"What is the overall rise in national income within the next 25 years if the economy rises with an annual rate of 5%?"* and the question, *"What is the overall growth of a money investment of 100 Euro within the next 25 years if there is an annual interest rate of 5%?"* Each question was presented on a separate page to avoid possible influences of the other question. Nonetheless, the participants were allowed to page forward/back.

After answering these two questions, they were asked to decide whether the mathematical procedure was identical for both estimation tasks or not. It was found that 113 (38.15%), more than one-third, of the participants in fact believed that the mathematical procedure for both estimation tasks was not identical.

Finally, gender, age, and course of study were recorded. Then, the participants were told that they could participate in a lottery in which four book tokens were drawn. For this purpose, they could either disclose their email address or telephone number. By request, the participants were informed about the true values of the estimation tasks using diagrams that showed the developments of the financial investment and the economic growth.

2.3.2. Results and Discussion

First, it was found that the estimations were not normally distributed, which was confirmed in a significant Kolmogorov-Smirnov test ($D = 2.98$, $p < .01$). This was mainly due to the fact that low estimations and numbers such as 5, 10, 25, 30, 50, 100, 125, 150, 200, and 300 were slightly overrepresented. Therefore, the estimations were assigned to seven different classes so that the distribution of the resulting variable, in turn, roughly equaled a normal distribution. Finally, all analyses were carried out with this variable and the raw estimations of the participants; the results were identical. For clarity, we present the results with the raw estimations of the participants.

Compared to Study 1, an even more remarkable range of estimations was found, ranging from 1.5% to 600% in the economic growth setting and from 2.5% to 600% in the money investment setting. The true value of 238.64% was underestimated by 92.1% of the participants in the economic growth setting and by 90.8% in the money investment setting. It is, therefore, not surprising that the mean estimated value in the economic growth setting, $M = 82.76$, $SD = 93.56$, $t(292) = 28.47$, $p < .01$, and the mean estimated value in the

financial investment setting, M = 89.55, SD = 95.79, $t(292)$ = 26.42, p < .01, were significantly lower than the true value of 238.64%. This replicated the effect of underestimation from Study 1 for the 5% growth rate. Furthermore, it was found that this effect also appeared when participants were asked to judge the end value of a financial investment, thus indicating that a more familiar setting does not prevent participants' underestimation.

It was, however, assumed that a higher familiarity with compound interest effects in the financial investment setting would lead at least to more accurate estimations compared to the economic growth setting. This notion was tested with a repeated measures ANOVA using the within-subjects factor setting (economic growth versus financial investment) and the between-subjects factor mathematical procedure, which captured if participants believed the underlying mathematical procedure in both settings were identical or not. Furthermore, the between-subjects factor gender was considered. The following main effects proved to be significant: the estimations in the financial investment setting were higher than in the economic growth setting, and males made better estimations than females. Furthermore, a significant interaction between setting and mathematical procedure was observed.

As expected, a closer comparison of the whole sample revealed a significant difference between the estimations in the economic growth and the financial investment setting, $F(1, 288)$ = 13.87, p < .01, η^2 = .05. Accordingly, participants' estimates in the economic growth setting reached an average of only 82.76% (SD = 93.56), whereas the estimates in the financial investment setting reached an average of 89.76% (SD = 95.89).

Nonetheless, a difference in the estimations for the two settings was expected to occur for only those participants who believed that the mathematical procedure was not identical. Not surprisingly, a significant interaction between setting and mathematical procedure

was found, $F(1, 288) = 13.94$, $p < .01$, $\eta^2 = .05$. Figure 2 substantiates this interaction. Hence, those participants who believed that both mathematical procedures were identical, in fact, provided very similar mean estimations of 94.34% ($SD = 104.11$) for the financial investment setting and 94.46% ($SD = 106.18$) for the economic growth setting. In contrast, the participants who believed that both mathematical procedures were not identical provided higher mean estimations of 82.50% ($SD = 81.09$) in the financial investment setting than in the economic growth setting, where the estimations reached only 64.23% ($SD = 65.28$). This finding clarifies that the magnitude of the estimations was influenced by the setting, but only for those 113 participants (38.15%) who believed that both mathematical procedures were not identical.
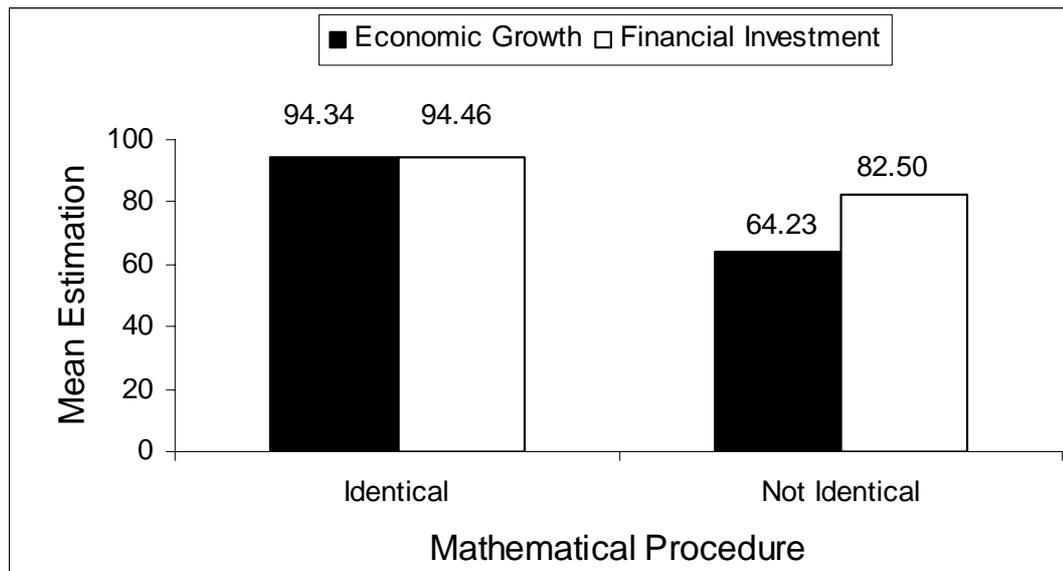
Figure 2: Mean Estimations for the Economic Growth and Financial Investment Setting for Participants who believed that the Mathematical Procedures were and were not identical, respectively.

Furthermore, substantial gender effects were observed, $F(1, 288) = 7.32$, $p < .01$, $\eta^2 = .03$. Male participants provided substantially higher and therefore better estimations (economic growth: $M = 99.46\%$, $SD = 101.80$; financial investment: $M = 112.74\%$, $SD = 103.19$) than female participants (economic growth: $M = 69.74\%$, $SD = 84.65$; financial investment: $M = 71.82\%$, $SD = 85.90$). Therefore, it

appears as though female participants are more greatly affected by the tendency to underestimate exponential effects than male participants.

The analyses thus far indicate that most participants are wrong when they estimate cumulative growth in the long run. The results also indicate that most participants tend to underestimate the true values. However, 21 (7.16%) participants overestimated the true value in the economic growth setting, and 25 (8.53%) overestimated the true value in the financial investment setting. It could be that a considerable number of male participants provided estimations of 350% or higher. This, in turn, could also have contributed to higher, but not necessarily better, estimations by male participants. To consider the effects of overestimation, a second dependent variable, *valid estimations*, was introduced. For the generation of this variable, the estimations in the financial investment and the economic growth setting, respectively, were assigned to two different categories in a first step. The first category included more or less accurate estimations, lying within a range of 50% less and 50% more than the true value of 238.64%. All remaining estimations were assigned to a second category, including more or less inaccurate estimations. Consequently, 19 (6.5%) participants who provided accurate estimations for both settings were assigned to the category valid estimations, whereas 274 (93.5%) participants who provided inaccurate estimations in one or both of the two settings were assigned to the category nonvalid estimations.

In a subsequent binary logistic regression analysis with the dependent variable valid estimations and the independent variables mathematical procedure (identical/not identical) and gender, significant positive logit coefficients for mathematical procedure ($b = 1.20$, $p < .05$) and gender ($b = .97$, $p < .01$) were observed. A closer look at the odds ratio in Table 1 shows that participants who believed that the mathematical procedure was identical had a 3.30-fold higher

chance of providing valid estimations. Male participants had a 2.64-fold higher chance of providing valid estimations.

Table 1: Summary of Binary Logistic Regression Analysis. Regression Coefficients for Mathematical Procedure and Gender predicting Valid Estimations in Both Settings

Variables	*b*	*SE b*	*Wald*	*OR*	*OR 95% CI*
Mathematical Procedure	1.20**	.51	5.53	3.30	(1.22 – 8.94)
Gender	.97***	.32	9.12	2.64	(1.41 – 4.96)
Constant	–3.57***	.49	53.65	.03	

Note. OR = odds ratio; CI = confidence interval
Nagelkerkes R² = .21. -2 log likelihood = 115.77. Correctly classified = 93.5%.
The dependent variable *Valid Estimations in both settings* was coded with 0 = No Valid Estimations and 1 = Valid Estimations. The independent variable *Mathematical Procedure* was coded with 0 = not identical and 1 = identical. The independent variable *Gender* was coded with 0 = Female and 1 = Male.

*p < .10, **p < .05, *** p < .01

It is, therefore, not a surprising finding that 18% of the male participants who believed that the mathematical procedures were identical, in fact, provided valid estimations for both settings. On the contrary, none of the female participants who believed that the mathematical procedures were identical were able to deliver valid estimations in both settings. This replicates the findings from the ANOVA discussed in the section above.

In sum, it was found that the result from Study 1 could be replicated, both in an economic growth setting and in a financial investment setting. It was further found that those participants who were not capable of transferring their knowledge on exponential effects from a financial investment setting to an economic growth setting provided lower estimations in the latter setting. Evidence for this result was also found in the debriefing, as one participant told us: "These diagrams remind me of diagrams, that a guy from an insurance company has shown me. I cannot believe these things at all. Above all, I wonder what these things have to do with economic growth."

2.4. Study 3

A subsequent question of interest is what influences the accuracy of people's estimations. An important factor could be the *expertise* of people with the estimation of exponential growth. It seems plausible that familiarity with phenomena underlying the logic of exponential effects should result in a higher ability to estimate economic growth in the long run. However, the findings from previous research are not clear. Benzion, Shachmurive, and Yagil (2004) examined whether or not participants owning money investments differ from participants without money investments when it comes to estimating future values of money investments, but no such differences were observed. In one experiment, Wagenaar and Sagaria (1975), found that subjects who were assumed to have daily experience with growth processes also tended to underestimate the effects of exponential growth. Nonetheless, in another experiment, one of two groups of students was instructed on the characteristics of expontial growth and informed that people tend to underestimate exponential effects. Subsequently, the participants had to solve an extrapolation task. Although this group also tended to underestimate the true values, the estimations were better than the estimations from a control group of students who were not instructed (Wagenaar & Sagaria, 1975).

Similar results were found in a study by Eisenstein and Hoch (2005), who found that people may, in fact, provide significantly better estimations if they are trained in the logic behind exponential growth. After participants had received a specific training on how to calculate exponentional effects, the estimations became twice as good as previous ones. Finally, Keren (1983) found that daily experience with exponential growth rates improves the accuracy of estimations. According to his findings, people who regularly have to deal with high inflation rates are able to provide more accurate estimations on exponential effects. Based on all of these previous findings, it was expected that participants with expertise in dealing with exponential

growth rates should, in fact, provide more accurate estimations than participants without expertise. For this reason, Study 3 considers differences between participants more and less familiar with exponential growth.

Another explanation for the remarkable underestimation of exponential effects in Study 1 and Study 2 could be rooted in *lacking motivation*. In particular, many economists share the view that experimental tasks have to matter to the participants to obtain proper data (Hertwig & Ortmann, 2001; Rydval & Ortmann, 2004). For example, Smith and Walker (1993) state that increased financial rewards contribute to more rational behavior of the participants and reduce the variance of data. Nonetheless, other authors stress the importance of cognitive abilities (e. g., Camerer & Hogarth, 1999). Following a review of 74 experiments, these authors conclude that when looking at the modal results, no effect of incentives on performance is found. Accordingly, depending on the task, cognitive abilities may play a more central role for the outcomes of experiments than incentives. In line with this deliberation, Jenkins et al. (1998) found in a meta-analysis with 47 studies from applied psychology journals that incentives lead to quantitative effects on the output in simple tasks. However, no effects on the quality of performance were observed in this meta-analysis. These studies argue in favor of the importance of cognitive abilities when estimating economic growth in the long run. It was, therefore, expected that the effects of incentives on the accuracy of the estimations would be rather low. Nonetheless, because of a controversial discussion on the efficacy of incentives, Study 3 examined to what extent incentives cause more accurate estimations.

Yet another motivational effect could be rooted in *interindividual motivational differences*. It could be that some people display a stronger dispositional motivation than others when it comes to solving such estimation tasks. An appropriate personality measure to

capture the engagement and pleasure associated with the solving of brainteasers is the need for cognition (Cacioppo & Petty, 1982). For this reason, Study 3 wanted to extend previous research by considering to what extent this personality trait accounts for interindividual differences in the accuracy of the estimations. It was expected that the motivation in consequence of a strong need for cognition leads to a higher familiarity with the solving of complex and abstract tasks in general. This familiarity should, in turn, contribute to the application of more appropriate solution strategies. For this reason, it was expected that participants high in need for cognition would provide more accurate estimations.

Finally, Study 3 aimed to find possible explanations for the gender effect observed in Study 2. One possible explanation for this effect is that women are, in general, less interested in politics and economics. This, in turn, could contribute to a misunderstanding of the meaning of economic growth, which could explain why the impact of economic growth in the long run was more likely to be underestimated by female participants. In fact, a nationwide survey in 2002 found that the political interest of women is lower than the political interest of men (GESIS, 2002). Hence, it might be that the gender effect identified in Study 2 could, at least in part, be explained by differences in the general interest in political and economical questions. For this reason, Study 3 also considered the influence of a general interest in politics and economics and whether this interest explains the gender effects observed in Study 2.

2.4.1. Method

2.4.1.1. Participants

The entire sample consisted of 402 students. Thereof, 180 (79 females, 101 males) were advanced students of economics and business administration. Their curricula contain (among others) various courses dealing with financial investments and a course

dealing with growth theory. Therefore, it was assumed that these students were familiar with exponential effects and the logic behind economic growth rates. For this reason, this group of students served as *experts*.

The remaining 222 students (141 females, 81 males) attended various courses of study (e.g., education, psychology, law). The majority of this group consisted of future teachers. Since the curriculums of these participants do not contain courses dealing with financial investements and growth theory, this group of students served as *laypeople*. To deal with the problem of outliers, the same procedure as that done in Study 2 was applied (that is, estimations going beyond a range of three standard deviations were excluded).

2.4.1.2. Procedure

The participants were randomly asked on the campus if they were interested in participating in an experimental study. After the participants agreed to participate, they were asked for their course of studies. To ensure that the students of economics and business administration were "real" experts, only those from an advanced study period were recruited. Then, the participants were lead into a laboratory with four computers and each participant was placed in front of a computer. The experimental procedure began, and the participants were electronically guided through the questionnaire, which started with a general introduction of how to complete the different questions. Then, they were asked to answer the items from the need for cognition scale. Subsequently, the estimation task was introduced. The participants were requested to answer this question in all cases, even in case of uncertainty. In the winning condition, they were additionally informed that the best estimation was rewarded with 100 euro, the second best with 50 euro, the third best with 25 euro, and the fourth best with 10 euro. In the non-winning condition, only the estimation task was introduced. Then, they were asked to solve the 5% estimation task by answering the question,

"*What is the overall rise in national income within the next 25 years if the economy rises with an annual rate of 5%?*"

Finally, questions concerning interest in politics and economics, gender, age, and the course of study were asked. Additionally, the participants in the winning-condition were asked for their email addresses to ensure the possibility of informing them in case they won a prize for a good estimation. Finally, the participants were debriefed by the experimenters.

2.4.1.3. Measurements

To measure the need for cognition, the German version (Bless, Wänke, Bohner, Fellhauer, & Schwarz, 1994) of the need for cognition scale originally developed by Cacioppo and Petty (1982) was used. This scale aims to measure the engagement and pleasure associated with the solving of brainteasers. This scale proved to be a reliable measure, with α = .85.

Interest in politics and economics was measured with a self-developed scale, including seven items such as "I enjoy dealing with issues of economic policy" or "I am reading the business section of a newspaper regularly". This scale also proved to be a reliable measure, with α = .89.

2.4.2. Results and Discussion

2.4.2.1. Manipulation Check

In a first step, whether the chance of winning up to 100 euro provided the desired incentive was controlled. An indirect manipulation check revealed that the manipulation was successful. When measuring the time to complete the estimation task, it was found that participants in the winning condition (M = 113.18, SD = 94.65) took significantly more seconds to complete the estimation task than participants in the neutral condition, M = 96.26, SD = 70.46, $F(1, 400)$ = 4.09, p < .05, η^2 = .01.

2.4.2.2. Effects of incentives, expertise, need for cognition, gender and interest in politics and economics

First, it was found that, for the entire sample, the true value of 238.64% was clearly underestimated. This was shown in a mean estimation of 108.99%. Furthermore, some participants appeared to have no clue about how to solve the task, which was demonstrated by the remarkable range of the estimations (from 0.5% to 650%). The true value of 238.64% was underestimated by 91.5% of the participants. All of these results replicated the findings from Studies 1 and 2.

For the analyses to follow, the continuous variable need for cognition was dichotomized using a median split. Since the distribution of this dichotomized variable was virtually identical for all experimental conditions and no significant gender differences were observed, it was included in an ANCOVA with the remaining factors (expertise, incentives, gender, and the covariate interest in politics and economics) to predict the dependent variable estimations. The following main effects proved to be significant: experts made better estimations than laypeople, participants scoring high on need for cognition made better estimates than participants scoring low on need for cognition, and males made better estimations than females. Incentives and interest in economics and politics did not influence the accuracy of the estimations. No interaction effects were identified.

In fact, a significant main effect of expertise was observed, $F(1, 385) = 9.03$, $p < .01$, $\eta^2 = .02$. Accordingly, the students of economics and business administration provided better estimates of 137.61% ($SD = 119.98$) than the remaining students who served as laypeople and provided lower estimates of 85.79% ($SD = 82.27$). Furthermore, no significant effect of the incentives was observed, $F(1, 385) = .02$, thus indicating that the underestimations from Studies 1 and 2 were a result of lacking not motivation but ability. It appears that cognitive

abilities play a significantly more important role than the motivational effects of financial incentives.

As expected, a significant influence of the need for cognition was observed, $F(1, 385) = 4.23$, $p < .05$, $\eta^2 = .01$. Whereas the mean estimates from participants scoring high on need for cognition reached 125.01% (SD = 105.58), the estimates by the participants scoring low on need for cognition reached only 93.75% (SD = 100.43). To invalidate methodological objections associated with the dichotomization of continuous variables, it seems worth mentioning that all of the results presented thus far could also be replicated with a regression analysis, using the continuous variable need for cognition. Therefore, with the need for cognition, a psychological variable could be identified, which is (at least to some extent) suited to explain why some people may be less subject to an underestimation of economic growth in the long run than other people.

Furthermore, as in Study 2, a substantial gender effect was observed, which did not disappear when controlling for the slightly different gender distribution between experts and laypeople, $F(1, 385) = 9.03$, $p < .01$, $\eta^2 = .02$. While males' estimates had an average of 135.54% (SD = 107.73), females' average estimates reached only a value of 87.03% (SD = 95.67).

But to what extent could the effects observed thus far be explained by the interest in politics and economics? First, no significant influence of the covariate interest in politics and economics on the accuracy of the estimations was found, $F(1, 385) = 1.99$. It appears, therefore, that estimating economic growth in the long run is an abstract cognitive task that has nothing to do with knowledge about politics and economics. Furthermore, when excluding the covariate interest in politics and economics from the analysis, the effects reported above by and large remained stable. Even though it was found that female participants (M = 2.51, SD = .84) displayed a significantly

lower interest in politics and economics than male participants, $M = 3.27$, $SD = .97$, $t(361) = 8.27$, $p < .01$, $d = .83$, these differences were (on the whole) not accountable for the gender effect. The same applies for the effects of expertise and need for cognition, which cannot be reduced to interindividual differences in interest in politics and economics.

A final result of interest was differences in the time to complete the task. Female participants ($M = 93.61$, $SD = .62.14$) took significantly less time to complete the task than male participants, $M = 118.79$, $SD = 103.33$, $t(284) = 2.88$, $p < .01$, $d = .30$. A possible explanation is that female participants used different solution strategies when judging economic growth in the long run than male participants, which, in turn, could account for the gender differences observed in Studies 2 and 3.

Finally, similar to Study 2, the estimations were not normally distributed, which was confirmed in a significant Kolmogorov-Smirnov test ($D = 2.98$, $p < .01$). For this reason, all analyses were replicated with a classified variable for the estimation consisting of seven classes and roughly equaling a normal distribution. Again, all central results could be replicated when using this procedure.

To examine if the effects described above apply only to the effect of underestimation or if they can explain valid estimations in general, in analogy to Study 2, a second dependent variable (*valid estimations*) was introduced. Therefore, 42 participants (10.4%) were assigned to the first category of valid estimations, which included more or less accurate estimations, lying within a range of 50% less and 50% more than the true value of 238.64%. The remaining 360 participants (89.6%) were assigned to a second category of nonvalid estimations, including more or less inaccurate estimations. In a subsequent binary logistic regression analysis (including the independent variables incentives, expertise, need for cognition, and gender to predict the dependent variable valid estimations), nonsignificant logit

coefficients for incentives (b = −.04) and expertise (b =.25) and significant positive coefficients for need for cognition (b =.55, $p < .01$) and gender (b =.60, $p < .01$) were observed.

Table 2: Summary of Binary Logistic Regression Analysis. Regression Coefficients for Predictors of Valid Estimations

Variables	*B*	*SE b*	*Wald*	*OR*	*OR 95% CI*
Incentives	−.04	.17	.06	.96	(.69 – 1.34)
Expertise	.25	.18	2.08	1.29	(.91 – 1.82)
Need for Cognition	.55***	.19	8.16	1.73	(1.19 – 2.51)
Gender	.60***	.19	10.35	1.83	(1.27 – 2.65)
Constant	−2.46***	.21	137.89	.09	

Note. OR = odds ratio; CI = confidence interval
Nagelkerkes R² = .14. -2 log likelihood = 241.50. Correctly classified = 89.5%.
The dependent variable *Valid Estimations* was coded with 0 = No Valid Estimations and 1 = Valid Estimations. The independent variable *Incentives* was coded with 0 = no Incentives and 1 = Incentives. The independent variable *Expertise* was coded with 0 = Laypeople and 1 = Experts. The independent variable *Need for Cognition* was coded with 0 = low Need for Cognition and 1 = high Need for Cognition. The independent variable *Gender* was coded with 0 = Female and 1 = Male.
*p < .10, **p < .05, *** p < .01

A closer look at Table 2 indicates that participants with high need for cognition displayed a 1.73-fold higher chance of providing valid estimations. Additionally, male participants displayed a 1.83-fold higher chance of providing valid estimations. However, the logit coefficient for expertise was nonsignificant. Therefore, it appears that, even though the experts provided higher estimations than the laypeople, they did not necessarily provide more valid estimations, presumably due to overestimations. A closer look at the frequency distributions reveals that this was exactly the case. Whereas only 6 laypeople (2.7%) provided estimations higher than 238.64%, 28 experts (15.56%) overestimated the true value.

In sum, Study 3 yielded four central results. First, it appears as though the underestimations from Studies 1 and 2 were not a consequence of lacking motivation because no effect of the incentives on the accuracy of the estimations was found. This supports the finding from Rydval and Ortmann (2004) that cognitive abilities are

more important than financial incentives. Second, congruent with some findings from previous research (e. g., Wagenaar & Sagaria, 1975; Eisenstein & Hoch, 2005; Keren, 1983), it was found that the underestimation of exponential growth was, in fact, stronger for those participants with less expertise in dealing with economic growth and exponential effects (the laypeople). Nonetheless, the experts also displayed a stronger tendency to overestimate exponential effects. The results of Study 2 offered the explanation that many laypeople did not recognize that the estimation of economic growth in the long run is also based on exponential growth (as is a financial investment). Third, with the need for cognition, a personality variable was identified, which (at least to some extent) is suited to explain why some participants provide more accurate estimations than others. Fourth, the gender effect from Study 2 did not disappear when controlling for differences in the interest in politics and economics. This, and the fact that the other results also did not disappear when controlling for this variable, should contribute to an increased validity of the results obtained thus far.

Figure 3 summarizes the central results obtained in Study 3.
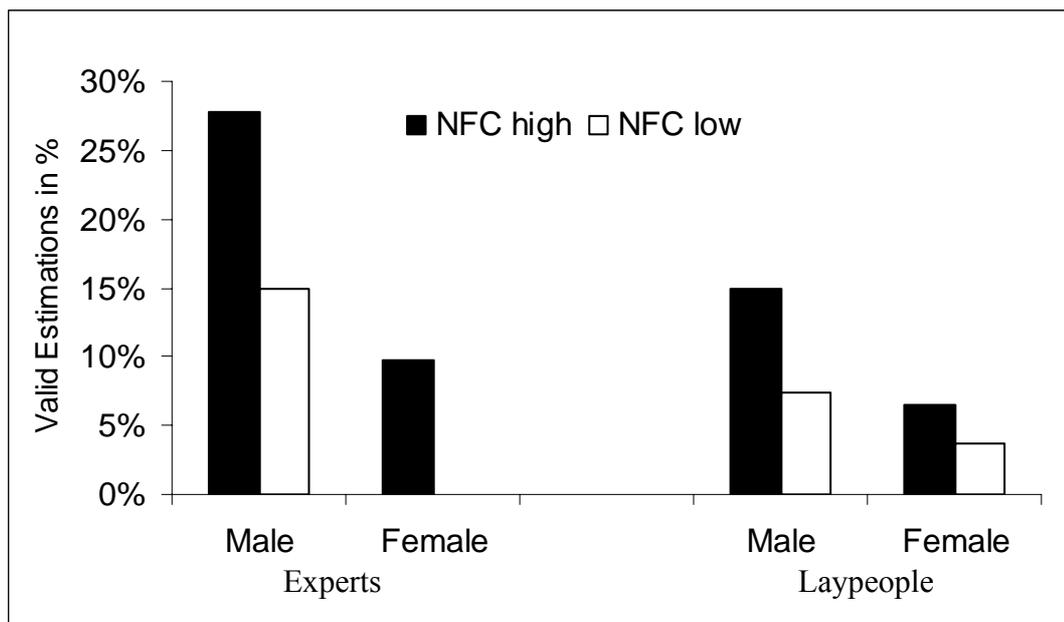
Figure 3: Valid Estimations in % by Expertise, Need for Cognition, and Gender

It was found that male students of economics and business administration with a high need for cognition provided valid estimations in 27.78% of the cases, whereas this was the case for female students of other courses of study in only 3.75% of the cases.

2.5. Study 4

Thus far, Study 3 has contributed many answers to the central question, "What influences the accuracy of people's estimations on economic growth in the long run?" However, one central question still remains unanswered that can, at best, be answered indirectly, namely: Which procedures are applied when people make such estimations?

Previous research has identified inadequate calculation procedures as a source of error, explaining why people underestimate exponential effects. Based on the findings in their experiments, Wagenaar and Sagaria (1975) suggest that people systematically tend to underestimate the exponent from the exponential function. The same conclusion is drawn by Keren (1984), who suggests that people try to compensate for the underestimations due to a insufficiently high exponent by adding a multiplicative factor (bigger than one) to compensate for the low exponent. This correction is, however, not high enough, which finally leads to the underestimations. Benzion et al. (2004) concluded that their participants roughly used a linear function, adding an additional amount to account for the effects of exponentiality.

Nonetheless, all of the studies presented fit the data to mathematical models and, therefore, tried to find ex post explanations for the underestimations. Without doubt, it appears very plausible that a considerable number of participants used a linear function and added an additional amount to account for exponential effects. Nonetheless, it could also be that many people are following a logic

that is totally different; in particular, when it comes to the estimation of economic growth in the long run, which is (at least semantically) a different task than, for example, the estimation of the development of a financial investment.

This argument is strengthened by the fact that an enormous variance was observed in the estimations in Studies 1 to 3. The application of one common solution method, such as using a linear function and adding an additional amount to account for exponential effects, should not result in such a huge variance. This could also indicate that very different solution methods are used when participants judge economic growth in the long run.

Therefore, this manuscript extends previous research with Study 4 by using the so-called "thinking-aloud method" to gain insight into the mental processes underlying the solution of the estimation task dealing with economic growth. This procedure aims to discover what actually happens in the minds of the participants during the calculations. With this procedure, the aim was to identify the real sources of error leading to the underestimations.

Furthermore, it was aimed to identify the reasons underlying the worse estimations by the female participants in Studies 2 and 3. A subsequent question of interest was if female participants would tend to use more inadequate solution strategies than male participants.

2.5.1. Method

2.5.1.1. Participants

Similar to the procedure in Studies 2 and 3, estimations beyond a range of three standard deviations were excluded. Therefore, two participants were removed from the analysis to control for outliers. Finally, 99 participants (51 females, 48 males) found their way into the analysis. Thereof, 36 participants studied economics and business administration and, therefore, served as experts, whereas the remaining 63 participants served as laypeople. The gender

distribution was equal for both groups of participants. The participants were randomly recruited and anonymity was guaranteed.

2.5.1.2. Procedure

The participants were recruited on the campus and asked for their courses of studies. Since the methodology used in this study is sensitive toward expectations and the activation of certain decision routines, the participants were not informed about the topic to avoid unintended effects. If they agreed, they were led into single-workrooms at the library of the University of Cologne. These rooms provided a silent environment to avoid disturbances and distractions during the interviews. Furthermore, a proper recording of the interviews was ensured. Then, the participants were introduced to the thinking-aloud method (Ericsson & Simon, 1993) and informed that they should describe what they are thinking by talking aloud. This should be done without thinking about how to verbalize certain ideas. In doing so, the participants should try to speak as continuously as possible.

Following this introduction into the thinking-aloud method, the participants were informed that they were going to solve a task and that their particular solution method was the main interest of this study. Then, they were told that they were not allowed to use devices such as calculators or to do calculations in written form. Furthermore, they were advised to name an estimated value, even in case of uncertainty. They were informed that the interviews were recorded with a tape-recorder. Then, they were asked in writing, "*What is the overall rise in national income within the next 25 years if the economy rises with an annual rate of 5%?*" When answering this question, there was no time limit. In general, there were no comments from the interviewer during the answering, with the exception of explicit advice to think aloud during longer breaks. In some cases, this was necessary due to the unfamiliar situation of thinking aloud. After the interviews, the participants were thanked

and, by request, they were informed about the true result of the estimation task.

Subsequently, the interviews were transcribed. A transcription technique developed by Kallmeyer and Schütze (1976) was used, which not only considers the wordings but also phonetical information such as noticeable accentuation, drawling, and the insertion of breaks. The transcripts were, subsequently, analyzed with methods of qualitative content analysis (Krippendorf, 1980; Mayring, 2003; Weber, 1990). This method allows for the systematical analysis and examination of material that is based on any form of communication.

At the end of an iterative process, which required three repetitions, the material could satisfactorily be assigned to seven different categories, which are presented and discussed in the results section.

2.5.2. Results and discussion

As in the previous studies, the true value of 238.64% was clearly underestimated, which is demonstrated in a mean estimation of 117.25% (SD = 113.76) for the entire sample, with estimations ranging from 2% to 600%. A closer look at the distribution of estimations revealed that the true value was underestimated by 88.9% of the participants.

However, the central task of this study was the identification of different approaches that are used when solving the task. Seven different approaches were identified, which can help explain how the underestimations arise.

More than one-third of the participants (n = 35, 35.35%) used linear addition, simply multiplying the growth rate (5%) with the number of years (25). The effect of exponentiality was completely ignored, resulting in a mean estimation of 127.86% (SD = 30.78), which does not exactly equal the product of 5 and 25 because some participants did not calculate this product correctly.

The second largest group (n = 24, 24.24%) used linear addition and added an additional amount to account for exponential effects. Not surprisingly, this group provided better estimations than the group previously discussed, which is found in a mean estimation of 212.92% (*SD* = 146.65). This estimation was remarkably close to the true value of 238.64%.

The third largest group (n = 14, 14.14%) used an anchor value from the estimation task; that is, these participants either used the value "5" or "25". Not too surprisingly, this procedure resulted in a poor mean estimation of 10.36% (*SD* = 8.87).

This group was followed by participants (n = 11, 11.11%) who had no clue about how to answer the question and, therefore, guessed arbitrarily. These participants provided modest, albeit better, mean-estimated values than the group previously discussed of 51.73% (*SD* = 72.67).

Furthermore, seven participants were found who were basically on the right track and used a technique that we called "method of addition", which can be described according to the following formula (with B_0 as initial value and p as the percentage of the annual growth rate):

$$\{ [B_0 + B_0 * (1 + p)] + [B_0 + B_0 * (1 + p)] * (1 + p)] + ...\} \qquad (2)$$

These participants were aware that the simple linear addition was not appropriate because exponential effects are ignored. They added 5% to the initial value and then added 5% to this value and so on. Unfortunately, this group did not use the appropriate initial value (100), but various, arbitrarily chosen, initial values lower than 100, which finally resulted in a modest mean estimation of 46.14% (*SD* = 40.40). It appears remarkable that this group clearly underestimated the true value of 238.64% even though the participants of this group were aware that the simple linear addition (and, therefore, an estimation of 125%) was not appropriate because exponential effects were not considered. The underlying reasons for this result are

twofold. First, the participants used incorrect initial values. Second, it was impossible to keep up this calculation method over 25 periods. Hence, these participants could perform only partial computations over a few periods and extrapolate the end value. Unfortunately, this extrapolation was already based on the wrong partial computation. Evidence for the impact of partial computations on performance differences was also provided by Tversky and Kahneman (1973), who demonstrated that the product of a series of descending numbers (such as 8 * 7 * 6...1) was estimated more correctly than the product of a number of ascending numbers (such as 1 * 2 * 3...8). This effect was explained by the participants' performing only partial computations. Because the results of the first few steps of multiplication (performed from left to right) are larger in the descending sequence than in the ascending sequence, the former expression was judged larger than the latter. The same explanation can be applied to the participants using the method of addition. Because these participants used incorrect and low initial values, the first steps of multiplication indicated to the participants that they were not dealing with a number as large as 238.64%.

Yet another smaller group of 6 participants (6.06%) used a part of the correct formula:

$$(1 + 0.05)^{25} \tag{3}$$

Very similar to the participants previously described, these participants completely lost sight of appropriate estimations when solving this formula, which finally resulted in a clear underestimation, as the mean estimation of 97.67% (SD = 197.75) demonstrates. Finally, two participants used the correct formula, resulting in a comparatively accurate estimation of 200%.

In a subsequent ANOVA including the variables expertise and gender to predict the dependent variable estimations, the result from Study 3 concerning gender was replicated, but no significant effect of the variable expertise was observed. While males' estimates reached an

average of 144.54% (SD = 129.69), females' average estimates reached a value of only 91.57% (SD = 90.37), $F(1, 95)$ = 5.58, $p < .05$, η^2 = .06. In a next step, similar to the procedure in Studies 2 and 3, the validity of the estimations was also considered. Fifteen participants (15.2%) were assigned to the first category of valid estimations, which included more or less accurate estimations, lying within a range of 50% less and 50% more than the true value of 238.64%. The remaining 84 participants (84.8%) were assigned to a second category of nonvalid estimations, including more or less inaccurate estimations. Table 3 summarizes the results from a binary logistical regression analysis, including the independent variables gender and expertise to predict the dependent variable valid estimations. Significant logit coefficients were observed for both expertise (b =.75, $p < .05$) and gender (b = −.66, $p < .05$), thus indicating that experts had a 2.11-fold higher chance of providing valid estimations, whereas females had a 0.52-fold lower chance of providing valid estimations.

Table 3: Summary of Binary Logistic Regression Analysis. Regression Coefficients for Expertise and Gender Predicting Valid Estimations

Variables	b	$SE\ b$	Wald	OR	OR 95% CI
Expertise	.75**	.30	6.33	2.11	(1.18 – 3.77)
Gender	−.66**	.33	4.02	0.52	(0.27 – 0.98)
Constant	−2.05***	.36	32.38	0.13	

Note. OR = odds ratio; CI = confidence interval
Nagelkerkes R^2 = .19. -2 log likelihood = 72.90. Correctly classified = 84.8%.
The dependent variable *Valid Estimations* was coded with 0 = Nonvalid Estimations and 1 = Valid Estimations. The independent variable *Expertise* was coded with 0 = Laypeople and 1 = Experts. The independent variable *Gender* was coded with 0 = Male and 1 = Female.

*p < .10, **p < .05, *** p < .01

In sum, it was found that the gender effect could be completely replicated in Study 4. It was further found, in the section above, that the participants used very different solution strategies. It could be that the nonvalid estimations by female participants resulted from the application of inadequate solution strategies. In this case, the relation between gender and validity of the estimations should be

mediated by the application of more or less adequate solution methods.

Upon a closer look at the methodology used in the seven solution methods discussed above, it appears that two solution methods could be considered adequate. First, using the linear addition and adding an additional amount to account for exponential effects seemed a comparatively promising solution method since it was based on the correct idea and facilitated a mental arithmetic that could contribute to fairly good estimations. Second, using the correct formula naturally appeared to be a promising solution method, even though this method was used by only two participants. For this reason, these two solution methods were considered to be adequate methods for the analyses to follow, whereas the remaining five solution methods were considered inadequate methods since these methods were conceptually wrong.

To account for the particularities associated with the application of a dichotomous mediator, a standardization procedure suggested by Kenny (2008) was used. To test whether the application of adequate/inadequate solution methods is a mediating variable of the relationship between gender and valid estimations, three conditions must be fulfilled, according to Baron and Kenny (1986): (1) the independent variable must influence the mediator; (2) the mediator must influence the dependent variable; and (3) the influence of the independent variable on the dependent variable must be substantially lower when the influence of the mediator is controlled. Therefore, a series of regression analyses was conducted. It was found that the gender effect was, in fact, mediated by the application of adequate/inadequate solution methods.

First, the influence of the independent variable gender on the mediator (adequate/inadequate solution methods) was significant, $b = -0.18$, $|t(99)| = 2.03$, $p < .05$. The second equation, regressing the mediator adequate/inadequate solution methods on the dependent

variable valid estimations, was significant, b = 0.40, $|t(99)|$ = 5.58, p < .01. In the final step, whether statistical control of adequate/inadequate solution methods reduced the influence of gender towards valid estimations was examined. Whereas the logit coefficient for gender was b = − 0.15, $|t(99)|$ = 2.12, p < .05 without the mediator, if the variable adequate/inadequate solution methods was controlled for, the logit coefficient was no longer significant (b = − 0.08, $|t(99)|$ = 1.25, p > .21). It is, therefore, concluded that the relation between gender and valid estimations is partially mediated by the application of adequate or inadequate solution methods.

In sum, the findings indicate that the explanations from previous research (Benzion et al., 2004; Keren, 1984; Wagenaar & Sagaria, 1975) – underestimation of the exponent of the exponential function, using linear addition and adding an additional amount to account for exponential effects – can be applied to some of the participants in this study, in particular, the group using linear addition and adding an additional amount to account for the exponential effects. However, the results from this study show that many participants use calculation methods that go beyond these explanations (such as a simple linear addition) completely ignoring exponential effects or using anchor values from the estimation task. Another interesting finding was that half-knowledge of the correct formula could also account for the underestimations observed in Studies 1 to 3. For this reason, this study could, in fact, identify further sources of error, which may account for underestimations when people estimate economic growth in the long run.

2.6. General Discussion

In a series of four experiments, the extent to which people are able to understand and estimate the dynamics behind economic growth and what influences the accuracy of their estimations was examined. It was found that most participants were dramatically off the mark.

Only around 10% to 15% of the participants provided estimations within a range of 50% less and 50% more than the true value of 238.64%. It was further found that the majority of the false estimations were systematically below the true value of 238.64%, which was underestimated by 88.9% to 92.1% of the participants.

Further, Study 2 showed that the setting of the estimation task was, likewise, suited to influence the quality of the estimations – at least for those participants who did not recognize that economic growth and the development of a financial investment follow the same logic. A central finding from Study 3 was that people with high expertise in judging exponential effects, indeed, provided higher estimations than people with low expertise. Nonetheless, even these "experts" became victims of the general tendency of underestimation. It was further found that participants high in need for cognition were less subject to underestimations than participants low in need for cognition. Furthermore, no influence of incentives on the accuracy of the estimations was observed. Finally, Study 4 identified further wrong or "strange" calculation methods, such as using anchor values from the estimation task or arbitrarily guessing, thereby going beyond the explanations found in previous research.

Besides the fact that people, on the whole, tended to underestimate economic growth in the long run, various insights emerged regarding what influences the quality of these estimations. First, Study 1 yielded the remarkable finding that no significant difference was observed between the estimations for the 3% and the 5% growth rate. A possible explanation is provided by Study 4. Given that a noteworthy amount of participants used arbitrary techniques (such as anchor values from the task or guessing), this result can also be explained with a general lack of knowledge about how to estimate economic growth in the long run appropriately. Nonetheless, it is a surprising finding that these results were obtained with a sample of advanced students in economics and business administration.

Second, Study 2 yielded the finding that the setting of the estimation task influenced the quality of the estimations, at least for those participants who did not recognize that economic growth and the development of a financial investment are based on the same logic of exponential growth. This finding could be explained with the fact that the financial investment setting was suited to activate experience-based, intuitive knowledge and, therefore, lead to higher and better estimations. Hence, it could be shown that presenting exponential tasks in more familiar formats enhances the quality of performance (Van Dooren, De Bock, Janssens, & Verschaffel, 2007).

Third, Study 3 showed that using incentives did not improve the quality of the estimations. This supports the conclusion drawn from Camerer and Hogarth (1999) that a narrow-minded focus on incentives alone is misguided. Therefore, it appears as though incentives may have the intended effects only if the outcome is not limited by cognitive abilities. It was further found that, on the whole, the experts provided better estimations than the laypeople; thus, stressing the importance of experience when dealing with exponential processes. This is in line with the finding from Keren (1983), who demonstrated that previous experiences with high inflation rates improved the prediction of exponential growth. Another interesting finding in the current study was the positive influence of the need for cognition on the accuracy of the estimations. This finding extends previous research by pointing out that certain personality dispositions may also explain why some people provide better estimations than others.

Fourth, Studies 2 to 4 showed that female participants provided inferior estimations than male participants. This effect did not disappear when controlling for interest in politics and economics. Since this is an unexpected result, it is difficult to provide appropriate explanations. A similar result was also obtained in a study by Kemp (1987) dealing with perception of inflation. His

explanation is mainly based on the fact that female participants display a higher purchase frequency of convenience goods. According to the principle of interference (e. g., Woodworth & Schlosberg, 1955), the higher purchase frequency may contribute to a replacement of remembered prices with current prices and, therefore, account for worse estimations of past prices by female participants. However, this explanation cannot be transferred to the context of economic growth. Study 4 provided another explanation, indicating that female participants displayed a stronger tendency to use inappropriate solution strategies. Nonetheless, this unexpected gender effect requires further investigation. Possibly inspired by the findings from Study 4, the questions of if and why females have more difficulties when dealing with the fourth dimension time (Dörner, Kimber, & Kimber, 1997) and exponential effects could be examined in further research.

Finally, Study 4 found that, at least within the context of economic growth, the reasons for the underestimations go beyond the explanations from Wagenaar and Sagaria (1975) and Keren (1984), who identified an underestimation of the exponent. The same is true for the findings from Benzion et al. (2004), who concluded that their participants roughly used a linear function and added a too small amount to account for the exponential effects. It was found that the most chosen solution strategy was the linear addition completely ignoring exponential effects. This could be explained with a dominant linearity concept, which is even used in situations that require a non-linear approach (Confrey & Smith, 1995; Van Dooren, De Bock, Hessels, Janssens, & Verschaffel, 2005). According to this interpretation, linear functions are used as a default in situations that require a non-linear approach as long as it is not clear which approach needs to be applied to a particular situation. Other participants used the wrong formula or arbitrary and inappropriate solution strategies. Therefore, it appears that many people have difficulties transferring their knowledge on exponential effects (if such

knowledge exists) to the context of economic growth. What are the practical implications of this study?

First, the findings have implications for the economic education of the general public. It appears as though people, in general, have enormous difficulties when dealing with exponential growth rates. Nonetheless, it has been shown that this ability can be improved by learning (e. g., Dörner et al., 1997; Eisenstein & Hoch, 2005). In line with this consideration, it seems an encouraging finding that even 7-year-olds seem to have a preliminary understanding of exponential processes (Ebersbach, Lehner, Resing, & Wilkening, 2008). Hence, findings from developmental psychology indicate an early intuitive knowledge about the characteristics of non-linear growth-rates long before non-linear functions are communicated at school (Ebersbach & Wilkening, 2007). Therefore, it appears that, to some extent, the ability to deal with exponentiality is inherent and, therefore, needs only to be developed. Another education-political implication is the importance of making people more familiar with situations in which the logic behind exponential effects applies. It cannot be excluded that a noticeable number of participants in our studies simply did not recognize that economic growth follows the logic of exponential effects. This stresses the importance of enabling people to transfer their knowledge on exponential effects to a variety of contexts where these effects apply.

Second, the findings have implications for economic policies. Given that many people tend to extremely underestimate economic growth in the long run, it is just corollary that they have no idea about the economic impact of different growth rates over longer periods. Therefore, the fact that many people may not understand the importance of economic growth in the long run may, in turn, make it extremely difficult to implement economic and social reforms aimed to stimulate the economy. Therefore, this phenomenon deprives political communication of an important and convincing argument.

Considering that people appear to do better when judging non-linear processes if they are confronted with the corresponding processes in more familiar formats (Van Dooren et al., 2007), it could be a promising measure to present growth rates in less abstract forms than percentages and to stress analogies to other exponential processes with which people are more familiar.

Another implication for economic policy is found when looking at the social security systems, in particular, the introduction of a funding principle. The idea of a funding principle is that an employee regularly pays certain amounts that are invested in the capital market. When this employee has retired, the accumulated capital is used to finance the pension. Contrary to a pay-as-you-go system, the funding principle is not vulnerable to changes in the age structure of a population. The funding principle is based on financial investments for each employee, but various studies (Benzion et al., 1992; Eisenstein & Hoch, 2005) show that people tend to underestimate the compounding and cumulative growth of financial investments. Now, if people tend to underestimate their accumulated capital in the future, it becomes likely that they underestimate their future pensions. This, in turn, could lead to reluctance against changes in the social security systems, even though they may be necessary to adapt the systems to changes in the age structure.

Third, the findings have implications for the entire society and can be applied to overpopulation (Bartlett, Fuller, Plano Clark, & Rogers, 2004), pollution (Wagenaar & Sagaria, 1975), or the diffusion of epidemics (Dörner et al., 1997). Another field of application is finance, in which the false estimation of growth may lead to unwished share prices (Harvey, Bolger, & McClelland, 1994).

Finally, according to our findings, it appears as though the physician Albert A. Bartlett is correct when he concludes: "The greatest shortcoming of the human race is our inability to understand the exponential function" (2002). Nonetheless, some people understand

more than they appear to understand, as shown in the following quotation from one participant in Study 4, who provided a fairly good estimation in spite of an unconventional solution method: "...now if the compound interest calculation is suspended...ehm..let me think about it...we are paying off our apartment and there is..if there 2% ehm...then there are 5%....I think these are around 200%."

3. "I only believe in statistics that I faked myself" – How laypeople react when their beliefs on the economy are contradicted by experts

3.1. Introduction

For laypeople, economic issues are extremely complex and obscure. Nonetheless, the person in the street is continuously exposed to questions pertaining to economic issues and consequences, such as "Will I still have a job in 3 years?", "Should I invest in stocks or property?" or "Which political party should I vote for?" Lay beliefs on the economy help laypeople to find their way in a complex and obscure economic world (Lewis & Furnham, 1986). These beliefs provide support, when it comes to economic decision making and the expression of opinion (a comprehensive overview on different lay beliefs is found in Furnham, 1988). The downside of lay beliefs is, however, that these may never be challenged and may therefore continue to exist, despite the fact that their validity is sometimes more than questionable. Hence, it should be a shocking experience for most laypeople, when their beliefs are contradicted by experts.

This study aims to examine the reactions of economic laypeople, when their beliefs are contradicted by an economic expert. To this end, a German sample of replies to a newspaper article was subjected to content analysis. The newspaper article contradicted the widespread belief that the introduction of the euro was inflationary and provided comprehensive statistical evidence from the German Federal Statistical Office. Content analyses of the replies assessed the extent to which people still believed that the introduction of the euro was inflationary after having read the article. Furthermore, the nature of their reactions was evaluated. Using this non-reactive approach, we aimed to contribute to a triangulation of research addressing lay beliefs on the economy. Given that corresponding

research has thus far predominantly concentrated on reactive methods such as experiments or surveys (e. g., Kemp & Burt, 2001; Leiser & Drori, 2005; Boeri, Börsch-Supan, & Tabellini, 2001; Fetchenhauer & Haferkamp, in press), a non-reactive approach appeared to be worthwhile. It is assumed that the procedure adopted may provide insights into lay theories which extend beyond the scope of those provided by reactive methods including experiments and questionnaires. Previous studies have, for example, shown that insights into lay theories gained from individuals' free discourse differ considerably from those obtained from questionnaires. In a study by Williamson and Wearing (1996), the cognitive models of economic laypeople based on open-ended questions revealed that laypeople appeared to understand the connection between government revenue and expenditure, whereas questionnaire responses suggested otherwise. We argue that the free discourse of individuals, as found in voluntary replies to a newspaper article rather than induced by questions, may contribute to a more complete understanding of the nature of lay beliefs on the economy.

With regard to the methodological limitations of this procedure, Furnham (1986) has argued that using letters to the editor as data for an investigation of lay beliefs or theories is problematic for a number of reasons. He first brings forward the argument that newspaper readership is highly specific in terms of age, class, and geographic area. In order to secure total anonymity of the authors of the replies to the newspaper article in the present study, socio-demographic data were not requested in any form. No information on the authors was therefore available. However, in order to mitigate Furnham's objection, newspaper readership data were analyzed (Koelner-Stadtanzeiger, 2007). Readership was found to exhibit a structure very similar to that of the population in the area of circulation. It must nonetheless be conceded that only highly involved readers with the urge to express their opinion are likely to reply to a newspaper article. Furnham's second point of criticism concerns the

pre-selection of letters; not all letters submitted to a newspaper are printed. In the present study, no such pre-selection on the part of the newspaper (e. g., the sorting out of very "poor" replies) took place, so that all replies to the article were included in our analysis.

Why use the introduction of the euro as a means of investigating the persistence of lay beliefs? The "inflation" topic is currently experiencing a renaissance, as can be seen in comprehensive news coverage (e. g. Fischer, Brück, Wildhagen, Busch, Henry, Kamp, & Sprothen, 2007). This current popularity is mainly based on the fear of global inflation. This renaissance is also reflected in a considerable amount of current research which addresses perceived inflation and predominantly shows it to be constantly higher than the official inflation rate (e. g. Brachinger, in press; Traut-Mattausch et al., 2004; Christandl & Fetchenhauer, in preparation-a).

In summary, two different theoretical approaches can be discerned which could explain why so many people believe the introduction of the euro to have been inflationary. The first explanation is based on the confirmation bias (e. g. Traut-Mattausch, Schulz-Hardt, Greitemeyer, & Frey, 2004). Accordingly, numerous articles and reports lead to the generation of inflation expectations before the introduction of the euro, which were subsequently confirmed by the seeking or interpreting of evidence (e. g., biased perception of price increases) in such a way as to confirm these expectations. A second explanation is based on the framework of Prospect Theory (Brachinger, in press), according to which price increases for particular products are coded as losses and therefore subjectively overestimated.

However, the current study did not aim to address the question as to how perceived inflation comes about and why so many people believe the introduction of the euro to have been inflationary. We rather aimed to extend previous research by examining why this belief remains stable even in the light of contradictory evidence from official

institutions such as the German Federal Statistical Office. The *Theory of Lay Epistemics* (Kruglanski, 1989, 1990) provides a useful theoretical framework which explains why closure on a certain topic – i. e., subjectively definite knowledge – proves helpful to lay people, when economic issues are concerned. The term closure refers to "a firm answer to a question" (Kruglanski & Webster, 1996, p. 264); a question which can stem from any thinkable area of human life. Closure can thus be achieved with respect to all possible questions (e.g. "What will the weather be like tomorrow?") by arriving at subjectively definite answers. Lay beliefs on the economy help provide answers to and thus closure on economic questions. These answers are adaptive for a variety of reasons. First, they provide support when it comes to economic decision making. Second, they aid the expression of opinion in discussions on economic and political issues. Third, they protect (at least some) individuals from unpleasant information processing with respect to complex economic issues. Against the backdrop of these functional advantages, it can be assumed that many people have a strong desire for subjectively definite knowledge on economic topics. This in turn should contribute to a strong need for cognitive closure (Kruglanski & Webster, 1996; Webster & Kruglanski, 1998).

The fact that many people report being extremely confident in their perception of significant accompanying price increases in consequence of the euro introduction indicates the presence of a widespread lay belief. This confidence was reflected in cross national studies of the European Commission at the beginning of 2002 (European-Commission, 2002) and at the end of 2003 (European-Commission, 2003). According to these studies, a large majority of people in all countries in the euro zone were certain that prices had tendentially been converted to the detriment of the consumer upon introduction of the euro. In 2003, this tendency became even stronger. What follows the formation of such beliefs?

When an individual possesses definitive knowledge on a certain topic – in the case of this study knowledge on the economy –, a strong need for closure prompts a freezing of this closure. The term freezing describes the preservation of past knowledge (Kruglanski & Webster, 1996) and entails the maintaining of knowledge or beliefs impervious to subsequent, potentially relevant information. If, for example, a person has frozen upon the belief that "The sun is going to shine tomorrow", it is highly likely that this belief will be maintained, even in the light of contradictory evidence, e. g. an unpleasant weather forecast. In the present study, economic laypeople were confronted with a newspaper article containing evidence that contradicted the widespread belief that the introduction of the euro was inflationary. Therefore, those who were convinced that the introduction of the euro lead to significant price increases were expected to display a strong freezing-tendency due to a high need for closure. Freezing of the lay belief (preservation of the belief that the introduction of the euro was inflationary) should lead people who have read the article to stick to their previous judgment. Perceived inflation, as reflected in reader replies to the article, would in this case remain high. Consequences of the freezing-tendency under a heightened need for closure have been examined in a large number of studies (comprehensive overviews are found in Kruglanski & Webster, 1996; Webster & Kruglanski, 1998). Based on these studies and further theoretical considerations, five different reactions – each resulting from freezing due to a high need for cognitive closure – were expected. The magnitude of these reactions was expected to determine the extent to which individuals still believed the introduction of the euro to have been inflationary after having read the article.

The first possible reaction is *one-sided enumeration of examples*. In this case, people contradict the expert-information by recounting and expressing examples of inflationary experiences. The fact that a low inflation rate does not necessarily imply constant prices for all products is ignored. On the contrary – particular inflationary

experiences are generalized to all products. The one-sided enumeration of examples appears to be similar to the preference of prototypical over diagnostic information. This preference was examined in a study (Kruglanski & Mayseless, 1988) that required participants to judge whether or not a target person belonged to a given professional category. Results indicated that subjects with a heightened need for closure were more likely to seek prototypical information (information exclusively regarding prototypical features of the professional category), whereas subjects avoiding cognitive closure were more likely to request diagnostic information (Trope & Bassok, 1983), that is information regarding typical and non-typical features of the professional category. A positive hypothesis testing strategy such as that adopted by those subjects with a strong need for closure is also performed when people single out isolated inflationary experiences in order to confirm the hypothesis that the introduction of the euro was inflationary. At the same time, non-inflationary occurrences – which objectively exist – are neglected. Based on these considerations, it is expected that the greater subjects' tendency to use a one-sided enumeration of examples in their replies to the newspaper article, the stronger the perceived inflation reflected in these replies should be.

The second possible reaction is *one-sided argumentation.* The rationale behind this reaction is also based on the positive hypothesis testing strategy discussed above. Compared to the enumeration of examples, however, the generation of arguments such as "lots of insolvencies in the retail trade indicate that excessive price increases were realized" requires a higher level of prior knowledge on the topic in question. Given such higher levels of prior knowledge, a high need for closure should lead to a biased memory search (Kruglanski, Webster, & Klem, 1993), which enhances the rejection of the message in the newspaper article by retrieving one-sided arguments from memory. With regard to the freezing tendency, it is expected that the greater subjects' tendency to use a one-sided argumentation in their

replies to the newspaper article, the stronger the perceived inflation reflected in these replies should be.

The third possible reaction is *self-centeredness*. Self-centered subjects focus on the self, which is reflected in the way that they argue. They are closed-minded to the perspectives of others and there is no abstraction from their own perspective. A theoretical explanation for this phenomenon is that due to a strong need for closure and subsequent freezing, the individual's mental efforts are reduced when new information is processed. Experimental studies have shown that under a heightened need for closure, the freezing tendency leads to a predominant self-focus (Kruglanski et al., 1993) and a reduction in perspective taking and empathic concern (Webster, Findley, & Irvin, 1995). Based on these theoretical considerations and empirical findings, it is expected that the greater subjects' tendency to adopt a self-centered argumentation in their replies to the newspaper article, the stronger the perceived inflation reflected in these replies should be.

The fourth possible reaction is *emotionality*. People reacting with high emotionality display displeasure and anger. If a person believes that the introduction of the euro was inflationary, confrontation and processing of expert information arguing the converse leads to cognitive inconsistency. According to dissonance-theoretical considerations (Festinger, 1957), emotionality should be stronger, the more people have already invested in their belief that the introduction of the euro was inflationary. According to Kruglanski (1989), logical inconsistencies can undermine one's confidence in a knowledge structure. If a certain knowledge structure or belief is frozen upon due to a strong need for cognitive closure, its undermining through inconsistent information should induce negative affect. Based on these theoretical considerations, it is expected that the higher the emotionality displayed in the replies to the newspaper article, the stronger the perceived inflation reflected in these replies should be.

The fifth possible reaction is the *discrediting* of the communicator of the counter persuasive message, the German Federal Statistical Office. Group experiments investigating the freezing tendency due to a strong need for cognitive closure have found that persons displaying a deviant opinion are devaluated, when a high need for closure is induced (Kruglanski & Webster, 1991). The very same devaluating reaction might arise in response to the communicator of the counter persuasive message in the present study. Such devaluation may also be realized by discrediting the message of the communicator instead of the communicator him/herself. In this study, this would entail the discrediting of statistical information or statistics in general. Based on these theoretical considerations, it is expected that the greater subjects' tendency to discredit statistics or the German Federal Statistical Office in the replies to the newspaper article, the stronger the perceived inflation reflected in these replies should be.

Interactions between these reactions pose a subsequent question of interest. The framework provided by the Theory of Lay Epistemics first of all suggests that all these different reactions are a consequence of the freezing tendency which arises from a strong need for closure. Hence, these reactions should appear simultaneously and be positively correlated. Nonetheless, a more differentiated view of these different reactions could also suggest inter-individual differences. For instance, it appears plausible that differential replies can be expected from individuals with comparatively sophisticated knowledge on the inflation topic and those with only modest knowledge. Accordingly, an individual with sophisticated knowledge might tend to offer arguments which contradict the article, whereas the individual with modest knowledge will find another way to react, such as, for example, by generating counter-examples which may in turn be guided by high self-centeredness.

In order to examine laypeople's reactions when their beliefs are contradicted by an economic expert, a total of 156 replies were subjected to content analysis.

3.2. Method

3.2.1. Sample

In a first step, all replies to the newspaper article were collected. These replies consisted of either letters that had been sent to the newspaper or comments in a web forum. The authors of the letters were garbled by the editor in order to assure total anonymity. The sample comprised a total of 103 letters and 53 comments in the web forum. A comparison of the two reply types revealed no significant differences, with the exception self-centeredness, which was slightly higher in the letters. The two types of reply were otherwise very similar and were thus treated as a single sample.

3.2.2. Stimulus

In the present study, reactions to a newspaper article that appeared in a respectable urban German newspaper (Koelner Stadtanzeiger) were subject to content analysis. The article addressed the question as to whether the introduction of the euro was inflationary and argued predominantly against a general price increase, conceding only a few inflationary experiences mentioned by customers. In contrast, extensive reasoning and statistical evidence from the German Federal Statistical Office was provided, which indicated that the introduction of the euro was not inflationary. The article appeared during the second half of 2004, more than 2.5 years after the introduction of the euro.

3.2.3. Procedure

All variables were derived from theoretical considerations regarding the freezing tendency due to a strong need for closure. These

considerations yielded the variables *Two-sided Examples*, *Two-sided Arguments*, *Self-centeredness*, *Emotionality* and *Discrediting*. The variable *Perceived Inflation* was introduced as a measure of whether participants' replies generally reflected the opinion that the introduction of the euro was inflationary after having read the article.

For the measurement of the variables Two-sided Examples, Two-sided Arguments, Discrediting and Perceived Inflation, two raters were used. These raters were extensively familiarized with the variables in a first step comprising informative literature with definitions and explanations. Examples of extreme values were provided in a second step. On the basis of these examples, the values of the variables as well as possible difficulties when rating the replies were extensively discussed. In a third step, ten comments were rated and the results discussed in depth. This procedure was designed to uncover discrepancies between the two raters and difficulties in understanding. Raters were then first required to rate the 156 replies for the variable Perceived Inflation. Two weeks later, they separately rated the 156 replies for the remaining variables by completing a questionnaire for each reply.

The variable *Perceived Inflation* measured the extent to which a reply agreed or disagreed with the newspaper article. This variable was measured on a 7-point scale, ranging from 1 = absolutely no price increase to 7 = a definite price increase. When rating this variable, raters were advised to read the whole reply before holistically evaluating the perceived inflation expressed by the author. Interrater reliability, which was measured as the correlation between the two raters, was r_k = .96. An excerpt from a reply with a low perceived inflation value is "In contrast to the absolute majority in our country, I am convinced that there has been absolutely no price increase due to the introduction of the euro", whereas a high value is reflected in an excerpt such as "I see the introduction of the euro as inflationary. What has been done to our money is absolute brazenness." As can be

seen in Row 1 of Table 4 (Perceived Inflation), a large majority of the replies disagreed with the expert information provided by the German Federal Statistical Office (M = 6.06, SD = 1.79). This finding supports the assumption of a widespread belief that the introduction of the euro was inflationary. Nonetheless, 17.9% of the replies were of the opinion that the introduction of the euro was not inflationary, so that a more detailed comparison of the replies which agreed and disagreed with the newspaper article was possible.

The variable *Two-sided Examples* measured the extent to which people tended to use or neglect a two-sided enumeration of examples. Examples of price increases and no price increases in the replies were thus measured first. To this end, raters counted the examples of products which had become more expensive and those which had not become more expensive due to the introduction of the euro. A new score was subsequently computed as a measure of peoples' tendency to neglect a two-sided enumeration of examples. A reply was assigned the value "1", given that at least one example of a price increase and one example of no price increase was mentioned. The value "1" thus denotes a two-sided enumeration of examples. Otherwise, the value "0" was assigned.   This denotes a one-sided enumeration of examples. In this way, the indicator variable Two-sided Examples was formed. A two-sided enumeration of examples was found in 26.28% of the replies.

The variable *Two-sided Arguments* measured the extent to which people tended to use or neglect a two-sided argumentation. Arguments supporting and disputing a general price increase due to the introduction of the euro were rated first. In order to measure the arguments supporting a general price increase, raters were instructed to judge how many arguments a reply used to justify that the introduction of the euro had been inflationary. This measurement was based on a 7-point scale ranging from 1 = absolutely no arguments supporting a price increase to 7 = many arguments

supporting a price increase. Interrater reliability was r_k = .81. The following quote is an example of argumentation, which is supportive of a general price increase: "I think the retail trade is in trouble because of the price increases which occurred when the euro was introduced. Obviously, they tried to earn lots of money with the introduction of a new currency. This can be seen in unused industrial real estate as well as in numerous insolvencies. The low price increases for food may be explained by the fact that many merchants started to increase their prices back in the middle of 2001, so that a correct conversion at the beginning of 2002 was possible".

Raters also judged the arguments disputing a general price increase due to the introduction of the euro. A 7-point scale ranging from 1 = absolutely no arguments disputing a price increase to 7 = many arguments disputing a price increase was used. Interrater reliability of this variable was r_k = .81. The following quote exemplifies a reply with a comparatively high number of arguments disputing a price increase: "When the euro was introduced, some "rotten apples" were certainly to be found. But they were in the minority. They have already been punished by the consumers. Furthermore, competition in Germany is so strong that huge price increases are doomed to failure. Moreover, mass media have contributed to this negative price image. There has hardly been any discrimination."

In line with the procedure adopted for the variable Two-sided Examples, a new score was also computed for Two-sided Arguments. Accordingly, a subject was assigned the value "1", when at least one argument supporting and disputing a general price increase was mentioned. Otherwise, the value "0" was assigned to denote one-sided argumentation. This procedure yielded the variable Two-sided Arguments. Only 7.05% of the replies used a Two-sided Argumentation, indicating that the classical structure of essay writing with a consideration of pros and cons scarcely occurred.

The variable *Self-centeredness* measured the egotism of the argumentation, i.e. the extent to which the perspective of others was ignored. In replies to a newspaper article, a strong self-centeredness could be discerned from a frequent use of words characterizing a preoccupation with one's own perspective (I, my, we and our). Therefore, this variable was operationalized as the number of such self-reference words occurring in a reply. In order to ensure comparability between long and short replies, these words were subsequently divided by the total number of words in the reply. The resulting number thus reflected the proportion of words displaying egotism. The following statement is a typical highly self-centered reply: „This week my refrigerator broke down. I draw a small pension. I called the social welfare office and was informed that a small amount of 41 euros is available per month as basic financial help for such purchases. In the very same call, I was told that another payment has been reduced from 144 euros to 61 euros. I have severe problems with my back. How am I supposed to pay for help with 61 euros?" As seen in column 1 for the variable Self-centeredness, 3.36% of the words used in the replies were self-centered words such as "I" and "we".

The variable *Emotionality* measured displeasure and anger reflected in the writing style. Two different measurements for capturing this variable were considered. First, the raters judged the level of emotionality reflected in the writing style of the authors on 7-point scales. However, because it was at least questionable whether these ratings would appropriately capture the emotionality of the replies, a second measure was introduced. This measure was based on the notion that displeasure and anger should be reflected in an increased usage of exclamation marks. For this reason, the number of exclamation marks occurring in each reply to the newspaper article was counted. In line with the procedure adopted for the variable self-centeredness, the number of exclamation marks was subsequently divided by the total number of words in a reply in order to ensure

comparability between long and short reactions to the newspaper article. A closer examination of the distribution of this score revealed that no exclamation marks were used in slightly less than 50 % of the replies. A small group of replies were characterized by a large number of exclamation marks. In order to account for such extreme values, replies were trichotomized. An examination of the distribution of the trichotomized variable Emotionality shows that 44.2% of the replies belonged to the lowest category (0 = no emotionality), 34.6% to the medium category (0.5 = medium emotionality) and 21.2% to the highest category (1.0 = high emotionality). This resulted in a mean value of 0.38 for this variable. Due to a correlation of r_s = .51, p < .01 of this measurement with the ratings, we decided to use the exclamation mark measure as a more objective measure of emotionality. The following statement represents a highly emotional writing style: "What a load of trash!! I don't know where and how the statisticians conducted their survey, but it certainly can't have been in Germany or even on this planet! To my mind, life has become bloody expensive since the introduction of this damned euro. These statisticians and politicians with their killer wages should simply buy food for a week and see what it costs!!!"

The variable *Discrediting* measured several aspects of the replies. First, it covered the general questioning of statistics, e. g. the claim that statistics are ambivalent, inaccurate etc. This aspect is reflected in a statement such as "anything can be proved with statistics". Second, the variable covered the use of statements which critically targeted the basket of commodities used by the German Federal Statistical Office. Third, Discrediting also covered statements assuming sugar-coated numbers as well as manipulable and purchasable statisticians. Aspects two and three are reflected in the following statement: "Churchill said "I only believe in statistics that I faked myself". That is why the basket of commodities compiled by the 'experts of the German Federal Statistical Office' according to their own wishes, does not constitute proper measurement. In my

experience, these constructed statistics are wrong. They are nothing more than public palaver and take us for a fool". The Discrediting of statistics or the German Federal Statistical Office occurred in 24.36% of the replies. For the rating of this variable, the raters identified whether statistics were discredited in the newspaper replies. The value "0" was assigned, when no discrediting occurred and "1", when discrediting occurred. Interrater reliability was r_k = .98.

In summary, 156 replies to a newspaper article were analyzed according to the categories *Perceived Inflation*, *Two-sided Examples*, *Two-sided Arguments*, *Self-centeredness*, *Emotionality* and *Discrediting*. The descriptive statistics for these variables are summarized in columns two and three of Table 4.

Table 4: Means, standard deviations and correlation coefficients for the variables Perceived Inflation, Self-centeredness and Emotionality and percentages and correlation coefficients for the variables Two-sided Examples, Two-sided Arguments and Discrediting

	M	*SD*	1	2	3	4	5	6
1. Perceived inflation	6.06[a]	1.79	–	–.22**	–.29**	.16*	.23**	.28**
2. Two-sided examples	0.26[b]			–	.14	–.07	–.11	.07
3. Two-sided arguments	0.07[b]				–	–.04	–.13	–.09
4. Self-centeredness	3.36[c]	2.23				–	.09	–.05
5. Emotionality	0.38[d]	0.39					–	.05
6. Discrediting	0.24[b]							–

Note. [a]The variable *Perceived Inflation* was measured on a 7-point scale (1 = absolutely no price increase, 7 = a definite price increase). [b]Since *Two-sided Examples, Two-sided Arguments* and *Discrediting* are dichotomous variables, values represent the fraction of replies in which the enumeration of two-sided examples, two-sided arguments or discrediting of statistics occurred. [c]Values of the continuous variable *Self-centeredness* represent the mean percentage (in %) of self-centered words. [d]Values of the discontinuous variable *Emotionality* range from 0 = no emotionality to 1 = high emotionality.

*p < .05. **p < .01

3.3. Results

In a first step, bivariate correlations were considered. Correlations between the continuous variables Perceived Inflation, Self-centeredness and the discontinuous variable Emotionality were computed using Spearman rank correlation coefficients. Correlations between the continuous or discontinuous variables Perceived Inflation, Self-centeredness, Emotionality and the dichotomous variables Two-sided Examples, Two-sided arguments and Discrediting were computed using biserial (rank-) correlations. Phi correlations were computed as a measure of association between dichotomous variables. A closer look at the correlations between the predictor variables Two-sided Examples, Two-sided Arguments, Self-centeredness, Emotionality and Discrediting reveals none of them to have been significant. This suggests differential reactions of economic laypeople who are confronted with evidence contradicting their beliefs on the economy.

Based on theoretical considerations surrounding the freezing tendency due to a strong need for closure, people's conviction that the introduction of the euro was inflationary after reading the article was expected to be the stronger, the more the five reactions one-sided enumeration of examples, one-sided argumentation, self-centeredness, emotionality and discrediting appeared. As seen in Table 5, a simultaneous regression analysis including the five reactions as predictors of Perceived Inflation reveals that this was indeed the case. Hence, a negative regression coefficient for *Two-sided Examples* ($\beta = -.18$, $p < .05$) and *Two-sided Arguments* ($\beta = -.21$, $p < .01$) was observed. These coefficients indicate that the lower the tendency of subjects to list examples and arguments in a balanced manner, the higher their *Perceived Inflation* after having read the article. In contrast, subjects who tended to consider evidence for both views by and large did not believe the introduction of the euro to have been inflationary. These findings confirm the

assumption that the freezing tendency due to a strong need for closure leads to a positive hypothesis testing strategy and in turn to a one-sided enumeration of examples and argumentation. A positive regression coefficient was observed for *Self-centeredness* (β = .16, *p* < .05). This confirms the assumption that self-centered argumentation is associated with high perceived inflation in reaction to the article. Additionally, as expected, the cognitive inconsistency triggered by undermining the belief that the introduction of the euro was inflationary, lead to emotional reactions, as seen in the positive coefficient for *Emotionality* (β = .16, *p* < .05). Finally, *Discrediting* of the communicator of the counter persuasive information – the German Federal Statistical Office – was also a significant predictor variable for Perceived Inflation (β = .27, *p* < .01).

Table 5: Summary of Simultaneous Regression Analysis. Regression coefficients for Predictors of Perceived Inflation

Variable	β
Two-sided examples	−.18*
Two-sided arguments	−.21**
Self-centeredness	.16*
Emotionality	.16*
Discrediting	.27**

Note. R^2 = .24. $F(5, 150)$ = 9.42, p < .01.
*p < .05. **p < .01

All hypotheses thus far were confirmed by simultaneous regression analysis. Nonetheless, the reasons for the comparatively weak correlations between the independent variables remain unclear. One possible explanation is that particular reactions are common to particular groups of people. This should be reflected in different clusters of replies, with homogeneous replies within a cluster and heterogeneous replies between clusters. Given that both continuous and dichotomous variables were used, a two-step cluster analysis based on log-likelihood distances was conducted using Two-sided Examples, Two-sided Arguments, Self-centeredness, Emotionality

and Discrediting as active variables. Despite the fact that the data did not completely comply with the requirements of a normal distribution for continuous variables and a multinomial distribution for categorical variables, this procedure appeared legitimate given that the algorithm is also assumed to function reasonably well when these assumptions are not met (Norušis, 2007). Applying the Schwarz Bayesian Criterion, three clusters which substantially differed in their patterns of argumentation were identified. Results of the two-step cluster analysis are presented in Table 6. A closer investigation of the differences between these clusters reveals that, with the exception of the variable self-centeredness, significant differences were observed. This is indicative of homogeneity within and heterogeneity between the different clusters and therefore of a satisfactory cluster solution.

Table 6: Results of two-step-cluster analysis using Two-sided Examples, Two-sided Arguments, Self-centeredness, Emotionality and Discrediting as active variables

	1	2	3
	Simplifiers	*Conspiracy theorists*	*Statisticians*
	$n = 84$	$n = 40$	$n = 32$
Two-sided examples	0.00_a	0.33_b	0.87_c
Two-sided arguments	0.00_a	0.03_a	0.28_b
Self-centeredness	3.57_a	3.33_a	2.83_a
Emotionality	0.41_b	0.44_b	0.25_a
Discrediting	0.00_a	0.95_b	0.00_a

Note. Values of the dichotomous variables *Two-sided Examples, Two-sided Arguments* and *Discrediting* represent the fraction of replies in a particular cluster which used two-sided examples, two-sided arguments or discrediting, respectively. Values of the continuous variable *Self-centeredness* represent the mean percentage (in %) of self-centered words used in a particular cluster. Values of the discontinuous variable *Emotionality* represent mean use of exclamation marks in a particular cluster, ranging from $0 = $ no emotionality to $1 = $ high emotionality.

Means in the same row that do not share subscripts differ at $p < .05$ in LSD post hoc multiple comparisons for the continuous variable *Self-centeredness* and the discontinuous variable *Emotionality*. Means in the same row that do not share subscripts differ at $p < .05$ according to the χ^2 statistics for the dichotomous variables *Two-sided Examples, Two-sided Arguments* and *Discrediting*.

Cluster 1, the group of *Simplifiers* (53.85%, Column 2 of Table 6) displayed an unelaborate and comparatively emotional style of argumentation. This group completely ignored examples and arguments indicating that the introduction of the euro was not inflationary. This was seen in a complete lack of two-sided enumeration of examples and argumentation. No discrediting of statistics occurred in this group. To summarize, this large group adopted a very simple pattern of argumentation which consisted of the enumeration of a few inflationary experiences with particular products.

Cluster 2, the group of *Conspiracy Theorists* (25.64%, Column 3 of Table 6) also predominantly neglected examples and arguments supporting the view point that the introduction of the euro was not inflationary. At the same time, this group strongly discredited statistics and the German Federal Statistical Office and therefore invested considerable effort in their counter-argumentation which was guided by comparatively high emotionality.

Cluster 3, the group of *Statisticians* (20.51%, Column 4 of Table 6) displayed a balanced enumeration of examples. This was shown in the frequent enumeration of products with stable prices as well as of those for which price increases had been realized. Furthermore, compared to the Simplifiers and Conspiracy Theorists, this group tended to consider evidence for both views significantly more often, as seen in a comparatively high level of two-sided arguments. Finally, the statisticians did not discredit statistics in any way and displayed low emotionality.

The more differentiated comparison of different clusters of replies clarified that three different patterns of argumentation occurred. The large group of simplifiers displayed a highly superficial pattern, whereas the smaller groups of conspiracy theorists and statisticians invested considerable effort into their argumentation. The statisticians displayed greater openness with respect to the examples

and arguments cited in the newspaper article, whereas the simplifiers and conspiracy theorists argued against or ignored these examples and arguments and were guided by higher emotionality. Given these different patterns of argumentation, it is not surprising that the three clusters differed in *Perceived Inflation, F*(2, 153) = 19.93, *p* < .01, η² = .21. Indeed*, Perceived Inflation* was significantly lower for the statisticians (*M* = 4.55, *SD* = 2.11) than for both the simplifiers (*M* = 6.19, *SD* = 1.79, p < .01) and the conspiracy theorists (*M* = 6.94, *SD* = 0.20, p < .01).

3.4. Discussion

This study aimed to examine the reactions of economic laypeople when their beliefs were contradicted by an expert. A number of interesting results were yielded. First, a variety of reactions which can be considered typical for the "freezing" tendency due to a strong need for cognitive closure were observed. People preferred a one-sided enumeration of examples and counter-arguments, despite the objective existence and even presentation of several examples and arguments supporting the expert information in the newspaper article. People also tended to focus on the self and were closed-minded to the perspective of others. Furthermore, their urge to maintain closure was guided by increased emotionality when their belief on the economy was attacked. Finally, the freezing tendency caused people to discredit the communicator of the counter persuasive evidence; in this study, the German Federal Statistical Office, which is a reputable and credible institution. The non-reactive approach adopted in this study therefore demonstrated the validity of the theory of lay epistemics beyond the realms of the laboratory, showing that it can indeed be applied to real-world phenomenon such as the introduction of the euro.

Second, these reactions were found to occur independently of one another. Faced with counter persuasive evidence from the German

Federal Statistical Office, very different reactions contributed to high perceived inflation after having read the newspaper article. This was particularly evident when examining different clusters of replies. The simplifiers and conspiracy theorists – the two groups which both strongly disagreed with the newspaper article – displayed very different efforts and patterns of argumentation. One possible explanation for the differential reactions could be rooted in different levels of education. It would appear plausible that the oversimplification carried out by the simplifiers was largely due to nothing other than a lack of knowledge. This lack of knowledge prevented a more sophisticated level of argumentation.

The fact that people neglect a two-sided enumeration of examples and arguments when they are convinced that the introduction of the euro was inflationary, affirms that individuals seek or interpret evidence in line with existing beliefs. This is known as the confirmation bias (Nickerson, 1998). However, the confirmation bias does not occur when people agree with the message of the newspaper article; these individuals tend to use a two-sided enumeration of examples and arguments. It would therefore appear that there are further preconditions for the occurrence of the confirmation bias; for example, freezing as a consequence of a heightened need for closure.

The discrediting of statistics and the German Federal Statistical Office - a competent and trustworthy institution - is a further remarkable finding. This reaction could have been fostered by the fact that – at least some – economic laypeople have difficulty understanding what experts do and say, for instance the logic of measuring inflation rates with baskets of commodities. This difficulty of understanding is a phenomenon which has also been referred to as the curse of expertise (Hinds, 1999). The assumption that experts are often difficult to understand is corroborated by studies addressing lay knowledge on the economy in the context of governmental expenditure, inflation, old age insurance, and economic policies (e. g.,

Simon Kemp & Burt, 2001; Leiser & Drori, 2005; Boeri, Börsch-Supan, & Tabellini, 2001; Fetchenhauer & Haferkamp, in press), which suggest that laypeople are in general only moderately equipped with knowledge on the economy. Such difficulties in understanding may foster misinterpretation of serious and well-founded expert information. Here, parallels can be drawn with medical communication and the phenomenon that many patients do not even understand what disease they are suffering from. This lack of knowledge decreases compliance and increases the tendency to attribute a lack of cure to a lack of competence on the part of the attending physicians (Ley & Llewelyn, 1995). We will now turn to the practical implications of the results of the present study.

It was demonstrated that lay beliefs on the economy are highly resistant to active attempts of counter persuasion, regardless of the credibility of the communicator or the quality of the arguments used. These findings are important in the context of economic policies and the process of political persuasion. It would, for example, appear almost impossible to find consent for measures of economic and social reform which are not in line with existing economic beliefs. An economic expert who explains, for instance, that the cutback of coal subsidies leads to a decrease in unemployment (Fetchenhauer & Haferkamp, in press) is likely to be met with reactions similar to those observed in this study, i.e. characterized by one-sided examples (e.g. the "poor" coal miners) and arguments (which for example ignore the fact that the money could be used otherwise), self-centeredness, emotionality and the discrediting of the economic expert.

In conclusion, the adeptness with which people are able to disprove the clear evidence and solid arguments of a highly credible institution in order to maintain their belief that the introduction of the euro was inflationary is most remarkable. Nonetheless, some people prove more creative than others. Here is a quote from the reader who was hit hardest: "To my mind, there has been a quadruplication of prices!

Before the introduction of the euro my pension was 1.000 DM and now it's 500 euros, which is 50 % less. At the same time, a scoop of ice-cream has doubled in price from 0.80 DM to 0.80 Cents, which is the equal to 1.60 DM. According to my calculation, prices have therefore been increased four-fold!!!!!!!! Is there anyone able to prove that black is white?"

4. The biggest tax increase all-time! – An examination of the confirmation bias in a real-world setting

4.1. Introduction

People tend to seek or interpret evidence in ways that are partial to existing beliefs, expectations or a certain hypothesis in hand. This phenomenon is called *confirmation bias* and has received comprehensive attention in various experimental situations and was found to be a stable and ubiquitous phenomenon (a comprehensive review on research dealing with the confirmation bias is found in Nickerson, 1998). Nonetheless, up to now its practical relevance in real-world settings has hardly been explored, despite it could be of immense importance in the area of political decision making and communication. If for example the impact of wrong beliefs on political measures such as tax increases or changes in the health care systems etc. is considered, a confirmation bias may lead to the exaggerated perception of negative consequences, which objectively might not exist. This in turn may be followed by public unhappiness and as the case may be consumer reticence, guided by setbacks in economic activity.

This study used a value-added tax increase in Germany at the beginning of 2007 to address two questions. First, it was examined in how far a confirmation bias can be observed in consequence to a real-world event such as a value-added tax increase. Second, it was examined if such a confirmation bias in a real-world setting is rather based on expectations, predominantly ignoring the factual price development, or if it is the result of a biased perception of confirming or diconfirming evidence, respectively. To answer these questions, this study used a panel design.

In a first survey two months before the value-added tax increase, the general price increase expectation was measured for 307 participants. Besides they also had to judge the current prices and anticipated future prices for eight different products. In a second survey two months after the value-added tax increase, the same 307 participants were asked again. They were asked to judge the current prices and the experienced price increases. Using this procedure we aimed at uncovering in how far the expectations from the first survey were confirmed or disconfirmed, respectively, after the value-added tax increase. Recent research dealing with the Euro introduction has already examined the confirmation of expectations in the light of disconfirming evidence (e. g. Greitemeyer, Schulz-Hardt, Traut-Mattausch, & Frey, 2005; Traut-Mattausch et al., 2004). However, to the best of our knowledge this study is the first attempt measuring expectations before a real-world event occurred and afterwards examining, in how far these expectations were confirmed or disconfirmed, respectively.

After Friday, 19 May 2006, when the Lower House of German Parliament decided the value-added tax rate to be increased from 16% to 19%, the German media scene consistently reacted with a loud outcry. This was shown in newspaper headings such as "Lower House of German Parliament decides the biggest tax increase since 1949" (Spiegel-Online, 2006) or "The biggest tax rip-off all-time" (Express-Online, 2006). On the whole, many signs indicated that a little while after the decision to increase the value-added tax rate a widespread and undifferentiated belief was established that the value-added tax increase would lead to noticeable price increases. On the contrary, the German Federal Statistical Office (DESTATIS) expected moderate price increases of maximum 1.4% (DESTATIS, 2006).

A closer look at research dealing with perceived inflation due to the Euro introduction in Germany (Brachinger, in press; Greitemeyer et

al., 2005; Traut-Mattausch et al., 2004) suggests that people clearly tended to overestimate the price trend following the Euro introduction. To a certain extent, parallels between the value-added tax increase and the Euro introduction can be drawn, because in both cases people expected noticeable price increases. Furthermore, the confirmation bias is likely to occur in situations that are inherently complex and ambiguous (Nickerson, 1998). Without doubt it can be said that the perception of price increases may indeed be characterized by high complexity and ambiguitiy, because many different prices for different products exist. Based on all these considerations, it was therefore expected that the confirmation bias would cause a significant overestimation of the real price trend.

However, the public discussion following the value-added tax increase completely neglected that many convenience goods such as groceries and newspapers were not affected at all by this value-added tax-increase. All these products were subjected to the so-called "reduced tax rate" of 7%, which was not affected by the value-added tax increase. This tax-based experimental variation offered an excellent opportunity to address another question – in how far the factual price development was taken into account.

Here, it appears useful to distinguish between two different ways a confirmation bias may come about. First, people may indeed take the real price development into account, but tend to a biased weighting of evidence, i. e. by mainly remembering experiences, where noticeable price-increases were realized. This in turn may contribute to the confirmation of the hypothesis that the value-added tax increase lead to noticeable price increases. This biased weighting of evidence will in the following be considered as bottom-up approach. Second, people may not take the real price development into account at all. To be more precise, when asked to estimate the price increase of a particular product, people provide estimations, which are in line with their expectation that the value-added tax increase lead to noticeable

price increases. At the same time, these estimations are not correlating with the real price development. This non-considering of evidence will in the following be considered as top-down approach.

The literature dealing with the confirmation bias on the one side provides comprehensive evidence for the bottom-up approach consisting in a biased weighting of evidence. One example is the so-called my-side bias (J. Baron, 2000), which is the tendency of people to recall reasons supporting the side they favour on a controversial issue and not to recall reasons supporting the other side (Nickerson, 1998). Another example is found in a classical study by Lord, Ross & Lepper (1979), showing that people with initially conflicting views on death penalty can examine the same evidence and both find reasons for increasing the strength of their existing opinions. Nonetheless, in all these cases the evidence – albeit in a biased fashion – is considered.

The literature dealing with the confirmation bias on the other side also also provides at least some evidence for the top-down approach, consisting in a non-considering of evidence. Yet this facet of the confirmation bias can be observed in a study of Bruner and Potter (1964), who showed people the same picture on a series of slides. While the first slide was defocused so that the picture was not recognizable, the focus was made clear on successive slides. It was found that a wrong hypothesis formed on the basis of a defocused picture persisted, even after the picture was in sufficiently good focus and therefore an objective standard existed. Hence, people who had not looked at the poorly focused picture were able to identify it correctly. Akin to these results were findings by Traut-Mattausch et al. (2004), who found that people clearly overestimated prices in a new currency, despite an objective standard of comparison was given by the old prices in German Marks and the new prices in euro. This was explained by expectations of price increases after the euro

transition. The subsequent question arises, which of the two approaches appears appropriate in the case of the current study.

There is no definite answer to this question. Nonetheless, when asking people about their price increase judgements for particular products, these two approaches make different predictions. According to the bottom-up approach, people would overweight their price increase experiences with particular products and neglect non price increase experiences with other products. Nonetheless, when asked for the price increases for specific products people should be able to provide price increase estimations, which are at least rudimentary within the boundaries of the factual price development. Hence, in a study by Perkins, Farady, and Bushey (1991) dealing with the my-side bias the participants in fact were capable of generating reasons for holding a view counter to their own when explicity asked to do so. Analogue, people should be able to provide roughly accurate price increase estimations.

On the other hand, according to the top-down approach, people would ignore the real price development and therefore provide price increase estimations in accordance with their belief that the value-added tax increase lead to noticeable price increases. This could also be pandered by a low price knowledge of German consumers (Evanschitzky, Kenning, & Vogel, 2004). Given low price knowledge, it would appear possible that people are not even capable of using the real prices for a comparison. This in turn would allow for an assimilation of the price increase judgements to the belief, that the value-added tax increase lead to noticeable price increases.

Because until now little research on the confirmation bias has been done in real-world settings, it seemed desirable to examine in how far it can be applied to a real-world event such as the value-added tax increase in Germany. Accordingly, two surveys were carried out two months before and after the value-added tax increase, where the participants had to judge the actual, prospective and past prices for

eight different products. By this procedure we sought to examine, if people tend to overestimate the factual price development and if the confirmation bias is based on a bottom-up or top-down approach.

4.2. Method

4.2.1. Participants

The sample was recruited with randomized phone numbers, which were provided by the ZUMA (Zentrum fuer Umfragen, Methoden und Analysen, Mannheim), based on the Gabler-Haeder-Design (Haeder & Gabler, 1998). This design is assumed to allow for the drawing of a statistical representative sample of the German population. To control for systematical errors when contacting households, the last birthday principle was applied. Using these procedures, $N = 453$ participants could be recruited successfully for the first survey. Thereof, $N = 307$ participants could then be successfully recruited for the second survey and clearly assigned to the measurements from the first survey. Compared to the distribution in the German population, female participants were slightly overrepresented ($n = 174$, 56.4%). The mean age of the participants was 43 years, $SD = 15.21$, thus almost perfectly equalling the age distribution in the German population. The different federal states were approprietely represented. One-person households were slightly overrepresented, whereas remaining socioeconomic attributes such as income and education were close to the distribution in official statistics. On the whole, it appeared that in fact a statistical representative sample of the German Population was recruited.

4.2.2. Procedure

Sixteen advanced students of economics, business administration and psychology, who participated in a practical course in research methodology, served as interviewers. Before the survey, these students were extensively familiarized with survey techniques and the

particularities of telephone interviews. Furthermore, they were extensively familiarized with the questionnaire and afterwards practiced the interview situation in role plays under supervision of the first author. Then a pretest with $N = 70$ participants was carried out, which on the one hand ought to uncover possible weaknesses of the questionnaire and on the other hand ought to allow the students a real practice in the field. After this pretest, the experiences and difficulties when interviewing were extensively discussed. Afterwards, the field phase started.

The first survey has been carried out in November 2006. The interviewers introduced themselves as employees of the University of Cologne, who were doing a survey on the value added tax increase. They told the participants that the survey was aiming at finding out, what people think of the value-added tax increase and what they expect. Then the participants were told that they were selected by random. After the participants agreed to participate in the study, the survey started.

First, the participants were asked, if they believed that the value-added tax increase would lead to price increases. Second, the participants were asked to estimate the current prices and the prices after the value-added tax increase is realised for eight different products. These products were preselected according to the two criteria in how far the product categories are affected by the value added tax increase and the expected purchase frequency.

Table 7: Classification of the eight Products

Expected Purchase Frequency	Affected by the Value-added Tax Increase	
	Yes	*No*
High	*Toothpaste, orange juice*	*Butter, newspapers*
Low	*Shoe polish, multi purpose cleaner*	*Sugar, vinegar*

Table 7 summarizes this classification. The products toothpaste, orange juice, shoe polish and multi purpose cleaner were affected by the value-added tax increase, whereas the products butter, newspapers, sugar and vinegar were subject to the so-called reduced tax rate and therefore not affected.

A closer look at Figure 4 shows the factual price increases for these products.
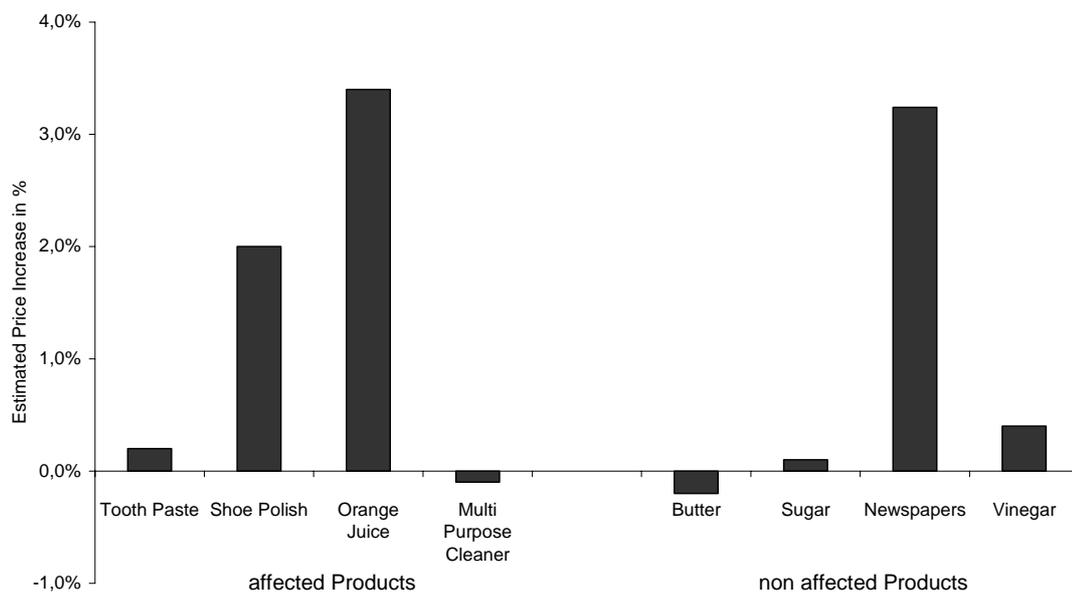
Figure 4: Percentaged Estimations by the German Federal Statistical Office (DESTATIS) of the Price Increases from October 2006 to February 2007

It was found that the prices for multi purpose cleaner, tooth paste, vinegar, butter and sugar practically did not increase at all. On the other hand, a decent increase for shoe polish and a comparatively strong increase for newspapers (3.2%) and orange juice (3.4%) was observed. It has to be mentioned that this price development was not quite as expected, because the prices for tooth paste and multi purpose cleaner, which were affected by the value-added tax increase, remained stable. At the same time, the prices for newspapers, which were not affected by the value-added tax increase, went off. Nonetheless, because the average price increases for the affected

products (1.38%) were still higher than for the non affected products (0.89%), this classification was also used for the second survey. On the whole, the average price increases for the eight products used in this study by 1.13% almost perfectly equalled the increase of the consumer price index by 1.0% in the period from October 2006 to February 2007.

The expected purchase frequency was derived from plausibility considerations. Nonetheless, in this first survey the factual purchase frequency was also measured on a 5-point scale (1 = never, 5 = often). It was found that the products with an expected low purchase frequency in fact had a significantly lower purchase frequency (M = 2.27, SD = 0.70) than the products with an expected high purchase frequency, M = 3.28, SD = 0.81, $t(306)$ = 21.52, $p < .01$. The order of these two question types – total judgement and price increase expectations for the different products was randomized in order to control for sequence effects. However, no such sequence effects were observed.

Afterwards, various attitude and personality scales were measured, whose results will not be discussed in this article. Then, the demographic and socioeconomic characteristics were captured. Finally, the participants were thanked and they were asked, if they agreed to participate in a second survey in February 2007. In case of compliance, they were finally asked for their first name to make sure, that the "right" participant is questioned in the second survey. On request, they were given the phone number of the first author to allow for questions and complaints.

The second survey has been carried out in February 2007. The participants were reminded of their first participation in the year 2006 and told that they had agreed to participate in this survey. Then, the participants were asked to estimate the current prices and the prices before the value-added tax increase was realised for the eight products. Afterwards, they were asked to judge on a 5-point

scale, how often they purchased the eight products after the value-added tax increase (1 = never, 5 = often). Finally, the participants were asked for their first name again and thanked for their participation in the second survey.

To sum up, two surveys were carried out two months before and after the value-added tax increase, respectively. The participants had to judge the actual, prospective or past prices. This procedure was used in order to get an insight into the confirmation bias in a real world setting.

4.2.3. Results

4.2.3.1. First survey before the value-added tax increase

It was first expected that people would tend to overestimate the consequences of the value-added tax increase. To capture the anticipated price increases *(API)*, the mean expected prices for the different products after the tax increase (P_{E1}) were related to the mean estimated current prices for the different products before the tax increase (P_0), according to the following formula:

$$API = 100(P_{E1} - P_0)/ P_0 \tag{1}$$

As expected, the factual price development measured by the German Federal Statistical Office (1.13%) was drastically overestimated with a mean API of 10.25%, SD = 8.78.

A subsequent question was in how far people anticipated the prospective differences for the different tax rates. Here, a closer analysis for the products which were affected by the value-added tax increase (tooth paste, shoe polish, orange juice and multi purpose cleaner) and not affected (butter, newspapers, sugar and vinegar), respectively, revealed that people did not anticipate the different price developments for the different tax rates at all. This is shown in a mean API of 10.14% (SD = 8.41) for the affected products compared to 10.42% (SD = 10.31) for the non affected products, $t(306)$ = 0.76, not significant.

Hence, people expected a substantial price increase for all products, detached from the fact if products were affected by the value-added tax increase or not. Now it was expected that the confirmation bias contributes to a perpetuation of the belief that the value added tax increase lead to significant price increases in the light of disconfirming evidence. For this reason, the same subjects were questioned again two months after the value added-tax increase.

4.2.3.2. Second survey after the value-added tax increase

The first question was if people – after the value-added tax increase was realized - would tend to overestimate the modest factual price development of 1.13%. To measure the experienced price increases (EPI), the mean estimated current prices for the different products after the tax increase (P_1) were related to the mean remembered prices for the different products before the tax increase (P_{R0}), according to the following formula:

$$EPI = 100(P_1 - P_{R0})/ P_{R0} \tag{2}$$

As expected, the factual price development (1.13%) was clearly overestimated with mean EPI of 5.27%, SD = 6.77. Nonetheless it has to be noted that the mean EPI after the value-added tax increase was significantly lower than the mean API before the value-added tax increase (M = 10.25%, SD = 8.78), $t(306)$ = 9.28, $p < .01$, $d = .64$. Hence, albeit the participants still clearly overestimated the factual price development, a noticeable adjustment was observed.

A subsequent question was, if people noticed the different price developments for the products which were affected (tooth paste, shoe polish, orange juice and multi purpose cleaner) and not affected (butter, newspapers, sugar and vinegar) by the value-added tax increase. Comparing the EPI for the affected products (M = 5.98%, SD = 6.94) with the non-affected products (M = 4.92%, SD = 7.81), $t(303)$

= 2.66, *p* < .01, *d* = .14, it is in fact denoted that people did anticipate the different price developments. However, this slight effect should not be overinterpreted, because a closer comparison of the factual price increases by the German Federal Statistical Office and the experienced price increases by the participants indicates that objective and subjective price developments practically have nothing in common.
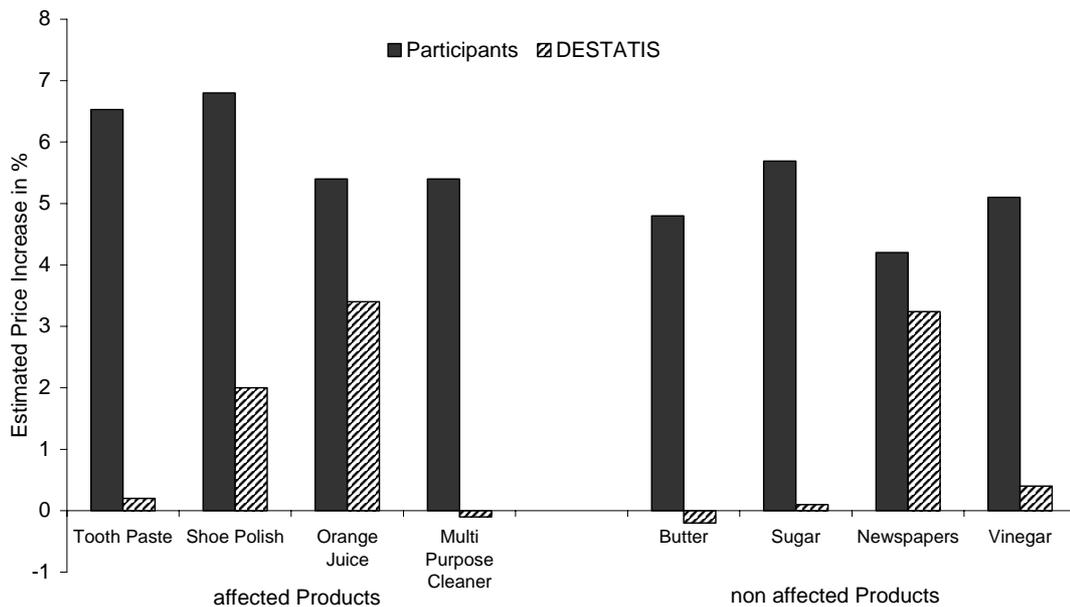
Figure 5: Factual Price Increases as measured by the German Federal Statistical Office (DESTATIS) compared to the Perceived Price Increases by the Participants

Figure 5 contrasts these different measurements for the eight products. It attracts attention that only slight differences between the various experienced price increases by the participants are observable. On the other hand, for example the remarkable difference between orange juice and the other products in the measurements provided by the German Federal Statistical Office are not reflected in the price increase estimations by the participants. Hence, when comparing the estimated price increase for orange juice (*M* = 5.35%, *SD* = 8.97) to the price increase for butter (*M* = 5.10%, *SD* = 9.77), no significant difference was observed, *t*(279) = 0.41. Here the official

statistical data by the German Federal Statistical Office tell a different story. Whereas the prices for butter even decreased in the time from October 2006 to February 2007 by -0.2%, the prices for orange juice were increased by 3.4%. The fact that the participants do not seem to know much about the factual price development is also shown in a nonsignificant negative correlation between the experienced and factual price development for the eight products (r = -.19). To sum up, the real price development seemingly did not play a crucial role for the perceived price increases of the participants. But where did they then derive their price increase judgements from?

According to the theoretical considerations on the top-down approach of the confirmation bias it was expected that the price increase expectation before the value-added tax increase should contribute to experienced price increases after the value added tax increase. In the first survey, the general price increase expectation was measured on a 6-point scale (0 = no price increases, 5 = strong price increases). Because the ratings were unequally distributed, this variable was trichotomized, yielding a low expectation group for the values 0, 1 and 2 (n = 102), a medium expectation group vor the value 3 (n = 133) and a high expectation group for the values 4 and 5 (n = 72). An analysis of variance in fact revealed a significant effect of the trichotomized expectations on the experienced price increases, $F(2, 304)$ = 8.01, p < .01, η^2 = .05. Figure 6 shows that the experienced price increases were lowest for the low expectation group (M = 3.43%, SD = 5.20), higher for the medium expectation group (M = 5.49%, SD = 6.96) and highest for the high expectation group (M = 7.48%, SD = 7.70). A subsequent LSD post-hoc test revealed a significant difference for all paired comparisons, p_S < .05.
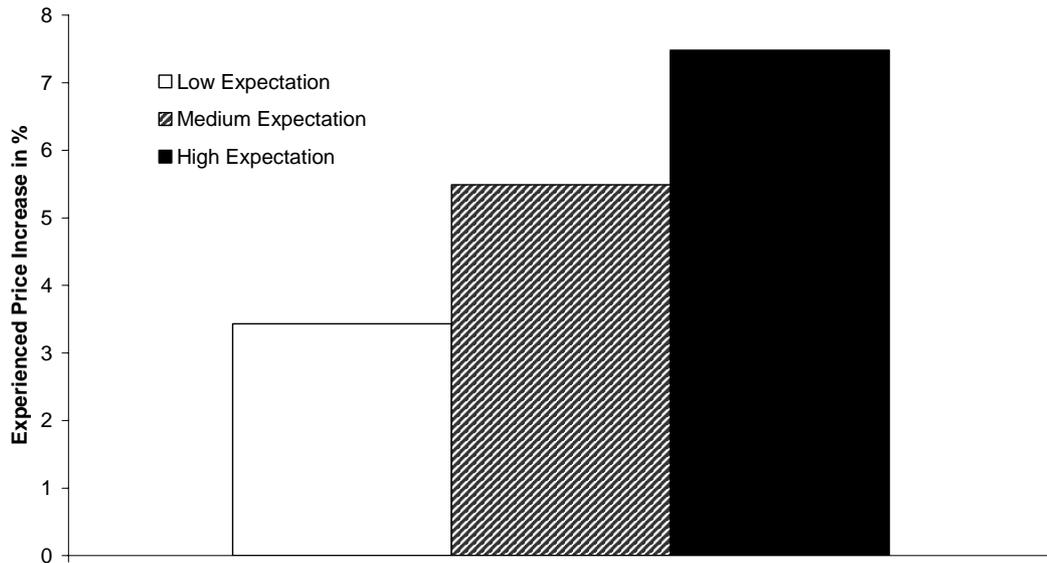
Figure 6: Experienced Price Increases after the Value-Added Tax Increase depending on the General Price Increase Expectations before the Value-Added Tax Increase

The anticipated price increases (API) were another measurement in the first survey to capture the expected price increases due to the value-added tax increase. Using a procedure very similar to the section above, the API were also trichotomized, yielding a low price increase group (n = 109), medium price increase group (n = 100) and high price increase group (n = 98). An analysis of variance revealed a significant effect of the trichotomized API on the experienced price increases, $F(2, 304)$ = 28.36, p < .01, η^2 = .16. Figure 7 shows that the experienced price increases were lowest for the low price increase group (M = 2.51%, SD = 3.72), higher for the medium price increase group (M = 4.67%, SD = 5.87) and highest for the high expectation group (M = 8.97%, SD = 8.45). A subsequent LSD post-hoc test revealed a significant difference for all paired comparisons, p_S < .05.
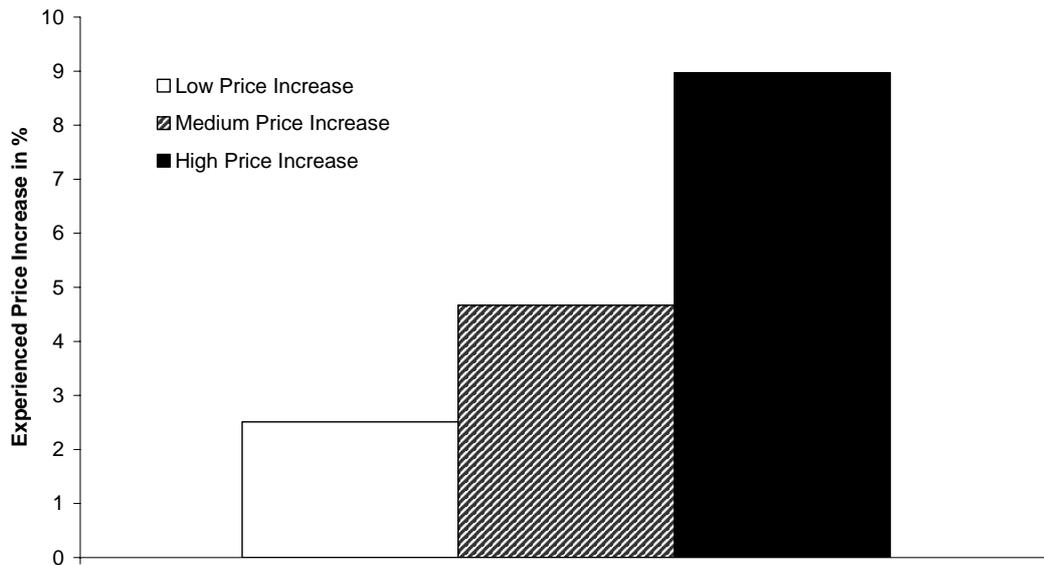
Figure 7: Experienced Price Increases depending on the Mean Anticipated Price Increases

To sum up, an influence of the price increase expectations – measured directly with an explicit judgement of the expectation and indirectly by considering the difference between current and future prices – on the experienced price increases after the value-added tax increase was observed. It is therefore concluded that the experienced price increases in the second survey were little influenced by the real price development, but mainly by the expectations before the value added tax increase.

4.3. Discussion

This study aimed at examining the confirmation bias in a real-world context, using the example of a value-added tax increase in Germany. It was found that in fact a confirmation bias concerning the belief "the value-added tax increase will lead to noticeable price increases" appeared. Furthermore, the results indicated that this confirmation bias was based on a top-down process, because the estimated price

increases were practically not correlated with the objective price development measured by the German Federal Statistical Office.

First it was found that in the end of 2006 virtually all participants were convinced that the value added tax increase will lead to noticeable price increases. By that an important requirement for the appearance of a confirmation bias was fulfilled, because a conformation bias requires established beliefs (Oswald & Grosjean, 2004). A possible explanation for this widespread belief could be rooted in the introduction of the euro in 2002 and the subsequent perception of noticeable price increases, which objectively did not exist (e. g. Traut-Mattausch et al., 2004). It appears possible that people transferred their decision routine "the introduction of the Euro lead to significant price increases" to another context, the value-added tax increase. This is in accordance with studies which did show that if people have established a decision routine in one task and are expected to test this procedure in another context, they tend to maintain this routine (Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2000). The possibility that people transfer certain decision routines into other contexts could give the top-down approach of the confirmation bias an even more far-reaching meaning than the one discussed in this study. Hence, it appears possible that the confirmation bias is not only based on expectations, which have such a strong impact that objective evidence is ignored. It appears possible that a confirmation bias results from superior belief-systems, which are applied in different contexts. This could be explored in further studies, controlling for such belief systems.

Another requirement for the appearance of the confirmation bias was the lack of an objective standard (Traut-Mattausch et al., 2004). Interestingly, such an objective standard exists – if one takes the measurements by the German Federal Statistical Office for granted. Contrasting the experienced price increases for the various products with the factual price increases revealed that his objective standard

did not seem to play a crucial role for the price increase judgements after the value-added tax increase. Nonetheless it has to be conceded that the experienced price increases were clearly lower than the anticipated price increases. Research dealing with motivated reasoning coined the term reality constraints (Kunda, 1990) to indicate limits of biased cognition. According to our findings it appears that these reality constraints are quite stretchable in real-world settings, but only within certain boundaries. One possible theoretical explanation is found in the anchoring and adjustment heuristic (Tversky & Kahneman, 1974). Accordingly, the remarkable anticipated price increases served as anchor, which was adjusted by the daily experience that the real consequences of the value-added tax increase were at least not as bad as expected.

The two requirements discussed in the sections above – established beliefs and the lack of an objective standard – argue in favour of ubiquity of the confirmation bias within the field of (economic) policy, because political measures in general are accompanied by high complexity and ambiguity. Because lay people require clear-cut beliefs to find their way in a complex and obscure economic world, it appears most likely that many such beliefs exist which are a foundation for a subsequent confirmation bias. The fact that top-down processes (as observed in this study) – which more or less ignore real developments – may contribute to the hardening of such beliefs implicates that it is almost impossible to find consent for unpopular political measures. This leads over into the practical implications of this study.

The findings implicate that on the whole the real consequences of the value-added tax increase in Germany were insufficiently communicated. Hence, the knowledge that many convenience goods were not at all affected by this value-added tax increase might have contributed to a higher acceptance. As a consequence of this inadequate communication, people first expected non-existent price

increases. Due to the confirmation bias, these non-existent but expeted price increases were finally perceived. This in turn could lead to consumer reticence with the corresponding negative cyclical consequences.

5. General Discussion

In the previous chapters, various phenomena surrounding lay perceptions of economic phenomena and belief persistence were investigated and discussed. The aims of this final general discussion are threefold. The first aim is to consider the theoretical implications of the previous chapters and in doing so integrate the central findings into a broader theoretical context. The second aim is to address the practical implications of the central findings presented in the previous chapters. In this context, various recommendations for both economists and political decision makers are discussed. Finally, the third aim is to consider implications for future research.

5.1. Theoretical Implications

In the previous chapters, a variety of results as well as theoretical and practical implications were presented. From a bird's eye view, two central phenomena and their interplay were examined. First, the phenomenon that lay perceptions of future economic phenomena are often biased and inaccurate, and second, that it is extremely difficult to modify beliefs on the economy, since they appear - even in the face of clearly contradictory evidence - to be stable over time. The interplay of these phenomena can be described as follows: Biased and inaccurate beliefs on future economic events are first formed and then remain stable, even when the holders of these beliefs are presented with clear evidence to the contrary.

5.1.1. Lay perceptions of future economic phenomena are often biased and inaccurate

Chapter 2 presented a series of four experiments which demonstrated that participants strongly tended to underestimate long-term economic growth. This also applied to participants with high expertise in estimating exponential effects. A similar, albeit opposite

mechanism was observed in Chapter 4. Here, participants clearly tended to overestimate future price increases in connection with an increase in value added tax. It was thus shown that people have enormous difficulties anticipating the development of central macro-economic variables such as economic growth and inflation.

This underestimation of exponential effects is not only restricted to the domain of economic growth. In three surveys with residents of New Zealand and Germany, Kemp (1984; 1987; 1991) also found that past prices were systematically overestimated. The reverse case of the systematical underestimation of exponential effects found in the context of economic growth can thus also be observed. Accordingly, the exponential growth of prices due to inflation is systematically underestimated, resulting in an inflation of recollected past prices. It would therefore appear that two central macroeconomic variables are subject to a tendency to strongly underestimate the impact of exponential effects. According to these findings, economic theory could improve the predictive quality of corresponding models by introducing individual discount rates for the anticipation of future growth or the perception of past prices.

However, although it has been shown that future and past perceptions of these central macro-economic variables are extremely biased and therefore highly likely to affect macro-economic modeling; these considerations have yet to be integrated into macro-economic theory. Interestingly, integration does appear to have occurred within micro-economic theory. Here, the similar phenomena of time discounting and time preference (Frederick, Loewenstein, & O'Donoghue, 2002) already find consideration in the field of behavioral economics. While time discounting encompasses all reasons for caring less about future consequences, time preference refers to preferring immediate utility to delayed utility. Corresponding research indicates that the classical Discounted Utility Model (P. Samuelson, 1937), which suggests that all possible motives

underlying intertemporal choice can be condensed into the single parameter of a subjective discount rate, has little empirical support, despite its continued use by many economists. The most established anomaly is termed hyperbolic discounting and refers to a declining discount rate. It shows that when asked to compare a smaller-sooner to a larger-later reward, subjects' implicit discount rate is lower over longer than over short time horizons (Thaler, 1981). Discounted utility has thus been subject to modification in order to account for this and various other intertemporal choice anomalies (Frederick et al., 2002). In order to develop descriptively adequate models, the same approach may be adopted when modeling inflation, economic growth or related topics by considering that people tend to underestimate future growth and overestimate future inflation.

A major consequence of biased perceptions of future economic phenomena, in particular the tendency to underestimate the long-term effects of cumulative growth, is found in the so-called fixed pie assumption (Bazerman, Moore, & Gillespie, 1999; Fetchenhauer & Haferkamp, 2007). According to this assumption, the economy is understood as a fixed pie, that is, the future wealth of a nation is perceived as stable and invariant. When it comes to distributing this wealth, people are convinced that the gain of one group can only occur at the loss of another group. Examples of beliefs embodying this assumption are manifold, for example, wealthy nations are wealthy at the expense of poor nations, or unemployment exists because foreign workers have stolen domestic jobs (Fetchenhauer & Haferkamp, 2007). All of these considerations, however, tend to ignore the fact that the economy is a dynamical system rather than a fixed pie. The central question of economic policy is not how to distribute the current pie, but rather how to enlarge the future pie. In addressing this question, economic growth plays a crucial role. Given that people are very poor in estimating long-term economic growth, however, it is not surprising that political measures which aim to stimulate the economy find little support and that people are more

interested in distributing the fixed pie. A biased perception of cumulative growth in the future may therefore also help to explain the fixed pie assumption.

A further example of the consequences of biased perceptions of future economic phenomena is to be found in people's tendency to underestimate the advantages resulting from foreign trade (J. Baron & Kemp, 2004; Caplan, 2007; Fetchenhauer & Haferkamp, 2007). Future benefits of foreign trade tend to be totally disregarded or significantly underestimated. People also tend to interpret trade volume as a fixed pie, so that everything which is exported is considered lost. Again, people fail to consider the positive long-term consequences of foreign trade, focusing instead on the present and adopting a static perspective which ignores dynamic processes and positive future consequences for the domestic country.

Biased perceptions of future economic phenomena are also to be found when examining the interrelation between technological progress and its consequences for employment. Again, humans tend to adopt a static perspective and assume that there is a fixed amount of employment and capital which also includes the employment of machines (Fetchenhauer & Haferkamp, 2007). As a result of this point of view, which again can be traced back to the fixed pie assumption, each form of technological progress (new machines) is assumed to contribute to a loss of jobs, with machines replacing manpower. The idea that new technologies are able to create new jobs and that humans are adaptive and able to further themselves is completely ignored. From this perspective, it is not surprising that people see the creation and maintenance of employment as a central task for economic policy, while the question concerning the productivity of employment is for the most part neglected (Caplan, 2007). It is therefore extremely difficult to convince people that employment in outdated industries is inefficient. This is an important

reason, why, for example, people tend to oppose the cutback of coal subsidies.

5.1.2. Lay beliefs on the economy remain stable over time, even in the light of contradictory evidence

Chapter 3 examined the reactions of economic laypeople when their beliefs were contradicted by an expert. A variety of reactions were observed which can be considered typical for the "freezing" tendency due to a strong need for cognitive closure and which could explain why lay beliefs on the economy remain stable, even in the face of contradictory evidence. Freezing on prior beliefs was also observed in Chapter 4; perceived price increases following a value added tax increase were strongly influenced by price increase expectations prior to the increase and hardly influenced by actual price development.

The general tendency to overvalue favorable evidence and undervalue unfavorable evidence serves an adaptive function for the human psyche. Many humans would presumably not be able to cope with the imponderabilities of everyday life without such a system of psychological immunity. The same applies to belief persistence due to reasons of cognitive relief. Nonetheless, it is generally assumed that reality constraints exist (Kunda, 1990). In other words, it is not possible to generally conclude what one wants to conclude regardless of real-life circumstances. Why then, do lay beliefs remain stable over time, despite clear evidence to the contrary?

One possible answer is that knowledge on the economy is characterized by a certain level of elasticity (Hsee, 1995); economic reality for laypeople is ambiguous and neither obvious nor clear cut. It is therefore always possible to find evidence to support any prevalent belief. This is true of one's own experiences as well as of the experiences or knowledge of others. Using perceived inflation as an example, it is always possible to identify single items for which price increases occurred and to generalize this experience to the majority of products. The same logic can be applied to all kinds of lay beliefs on

the economy. It is always possible to find arguments (whether these arguments are good is another question, though it usually suffices that these arguments are perceived as convincing) which support a certain lay belief on the economy. This phenomenon has also been referred to as *my-side bias* (J. Baron, 1998), reflecting the selection and excessive consideration of favorable and the rejection of unfavorable evidence.

A further explanation is found when examining the way in which knowledge on the economy and politics is usually communicated. While economic theory generally aims to model the economy with mathematical precision, it would appear questionable that economics as a science is unambiguously able to explain how the economy works (Fetchenhauer & Haferkamp, 2007). This may result in conflicting views. Additionally, expert information is by and large communicated via the mass media. Since it is a common procedure to invite and cite experts with extreme views, it is a logical consequence that the public is exposed to these extreme stances. This in turn may result in an availability of evidence provided by experts in favor of certain lay beliefs, evidence which does not necessarily reflect the opinion of the scientific mainstream. Referring to the issues dealt with in Chapters 3 and 4, it must be noted that both the introduction of the euro and the value added tax increase was also accompanied by media coverage of (alleged) experts, who stated that these political measures would lead to noticeable price increases; an opinion which was not in line with the scientific mainstream. This helps to explain why and how a biased research evaluation (Kunda, 1990) can contribute to stability of lay beliefs on the economy, despite clearly contradictory evidence.

A further explanation for the persistence of such beliefs may be that experts are generally not perceived to be credible sources of information. While this hypothesis is not supported by findings from previous research (Petty, Cacioppo, & Goldman, 1981) which has

reported an "experts can be trusted" heuristic, recent research suggests that this explanation may in fact hold true (Förg, Jonas, Traut-Mattausch, Heinemann, & Frey, 2007). According to this more recent study, experts advocating certain economic and political reform measures induce rejection and resistance. This effect was mediated by reactance and low perceived similarity to one's own point of view. These results may be due to a loss of reputation on the part of the experts, which is assumed to result from an increasing instrumentalization of experts by lobbies. This would explain why expert information is not necessarily effective in changing lay beliefs and why these beliefs remain stable despite contradictory evidence provided by experts.

A further particularity of lay beliefs – at least for those which were formed without excessive weighting of evidence in favour of and against the accuracy of this belief – is a heightended subjective confidence in the accuracy of this belief. Hence, if people are less aware of competing viewpoints, they may be more confident that their selected belief is true (Kruglanski, 2004). Ironically, this a fortiori increases the stability of beliefs, since the high level of confidence provides one with a sense of security that a certain belief is right. This may also explain why lay beliefs remain stable and are even strengthened over time.

A central consequence of stable lay beliefs is a general preference for the perpetuation of current states, a phenomenon which is referred to as the *status quo bias* (W. Samuelson & Zeckhauser, 2005). The status quo is considered good. Accordingly, the burden of proof lies with those who want to make changes, while those who want to maintain the status quo do not require arguments to do so (J. Baron, 1998). Even if there are good arguments in favor of changing the status quo, a general tendency to weight evidence in favor of the status quo in a biased manner is likely to come into play. This has been termed functionalism (Furnham, 1988). By emphasizing the

positive functions of the status quo, functionalism may provide a further explanation for the status quo effect.

5.1.3. The interplay of biased perceptions of future economic phenomena and the persistence of resulting beliefs

Chapter 4 examined the interplay between biased perceptions of economic phenomena and mechanisms of belief perseverance by examining the so-called *confirmation bias* in a real-world context, using the example of a value added tax increase in Germany. The belief that "the value added tax increase will lead to noticeable price increases" was indeed found to result in a confirmation bias. Global expectations that the value added tax increase would lead to noticeable price increases were thus formed prior to the tax increase. These global expectations were subsequently confirmed, despite official statistics from the German Federal Statistical Office indicating that no price increases were realized for many products. Results thus revealed that estimated and perceived price increases were practically not correlated with actual price development as measured by the German Federal Statistical Office.

It was, however, further found that perceived price increases after the value added tax increase were lower than expected price increases before the tax increase. Since there was almost no correlation between perceived price increases and actual price development as measured by the German Federal Statistical Office, participants do not appear to have considered real price development when judging price increases due to the value added tax increase and rather modified their judgments prior to the tax increase. Why then were perceived price increases lower than expected price increases? While the anchoring and adjustment heuristic may account for these findings, as suggested in the discussion of Chapter 4, the question remains as to why an adjustment occurred following the value added tax increase. Various explanations could account for this finding.

First, it seems possible that a general positivity bias exists when retrospectively judging unpleasant events. According to this interpretation, unpleasant events are more unpleasant before than after they occur. From the perspective of cognitive psychology, this is a proximate interpretation, with unpleasant events in the future appearing likely to trigger cognitive dissonance (Festinger, 1957). In turn, the general tendency to reduce cognitive dissonance should contribute to the tendency to play down the unpleasant event. According to this explanation, the lower perceived price increases found after the value added tax increase may have been the result of dissonance reduction. Based on more recent research, a further theoretical explanation may be found in biases associated with affective forecasting and the tendency to overestimate the duration of affective reactions to negative events (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998). This in turn may have contributed to an overestimation of the negative consequences of the value added tax increase before and to more appropriate judgments after the value added tax increase.

Second, it would also seem possible that judgments on unpleasant events are considerably influenced by media coverage and how frequently and controversially these topics are discussed. According to this explanation, changes in media coverage (less coverage in general on the value added tax increase, moderate reports on its consequences, etc.) may have contributed to lower perceived price increases following the value added tax increase. How is this interpretation compatible with the finding in Chapter 3, that lay beliefs on the economy are stable over time? In order to answer this question, it should be noted that stability is stronger for beliefs which are meaningful to the individual (e.g., Kruglanski, 1989). It would, however, at least seem questionable whether all lay beliefs on the economy are really meaningful to their holder. Given a lack of personal significance, some lay beliefs may thus be less stable than the belief that the euro introduction lead to significant price

increases, which was observed in Chapter 3. In line with this argument, the stability of the belief that the introduction of the euro was inflationary may have been fostered by the fact that the Deutschmark had served as a symbol of national pride and identity and had therefore been meaningful to many Germans (Müller-Peters, 1998). In displacing an important symbol of national identity and pride, the introduction of the euro and associated beliefs may thus have carried great significance for many individuals. This personal significance may in turn have contributed to the stability observed in Chapter 3. What consequences can be drawn from the insight that non-stable lay beliefs may also exist? These beliefs might prove highly susceptible to the influence of media coverage. Consequently, unpleasant events may be retrospectively judged differently given changes in media coverage. According to this explanation, the lower perceived price increases after the value added tax increase may have been the result of a decrease in controversial media coverage on this topic, as a consequence, for example, of the importance and explosiveness of other issues. This in turn may have contributed to the general belief that the consequences of the value added tax increase had not been as unpleasant as expected – which finally lead to lower perceived price increases.

In order to gain a deeper understanding of the reasons underlying the lower perceived price increases after the value added tax increase, an additional study was conducted. This study basically replicated the study design presented in Chapter 4 and also used the same products. The first part of this study was conducted in early November 2007, approximately three months after the German dairy industry announced that prices for dairy products would increase by up to 50%. This increase was primarily explained by the rising demand of the world market (Focus-Money, 2007). Following this announcement, participants were expected to anticipate future price increases – if at all – for butter. Since there had been no general announcements suggesting significant price increases for the

remaining seven products of the study, participants were expected to anticipate no or at the most modest price increases for the remaining seven products.

Participants

Participants were 53 students of various courses of study who participated in a course in advertising psychology.

Procedure

The first survey was conducted in November 2007. At the beginning of the course, participants received a questionnaire and were asked to estimate the current and future prices (in two months) of the eight products used in Chapter 4 – toothpaste, orange juice, shoe polish, multi-purpose cleaner, butter, newspapers, sugar and vinegar. They were additionally informed that the survey did not represent a knowledge test in any form and that they were required to judge intuitively. Each participant was assigned a password in order to enable correct allocation of the data from the second survey.

This second survey was conducted in January 2008, two months after the first survey. Participants were asked to estimate the current and past prices (two months previous) of the eight products discussed in the section above. At the end of the survey, participants were debriefed and informed about the objectives of the investigation.

Results and Discussion

A closer look at the actual price development between November 2007 and January 2008 for the eight products revealed that only the prices for orange juice (+2.5%), vinegar (+1.7%), and newspapers (+1.2%) significantly increased by more than 1%, while a strong price decrease was observed for butter (–17.7%). It should, however, be noted that the price for butter had in fact increased by 45% between July 2007 and November 2007. The prices for the remaining products sugar (+0.6%), shoe polish (+0.2%), multi-purpose cleaner (+1.0%) and toothpaste (–0.5) remained more or less stable.

How accurate were the estimates of the participants? An examination of Figure 8 reveals relatively accurate estimates for all products except for butter. These were, however, the products for which no dramatic price changes occurred. The actual price decrease of 17.7% for butter went unnoticed by the participants, who instead perceived a price increase of 12.05%. One-sample t-tests revealed significant differences between official statistics from the German Federal Statistical Office and participants' perceived price increases for the products toothpaste, orange juice, butter, and vinegar, $p_S < .05$. It is noticeable that for three of these four products, actual price changes beyond a range of +/-1% had occurred. Differences between participants' perceptions and official statistics for the remaining products (sugar, newspapers, multi-purpose cleaner and shoe polish) were not significant.
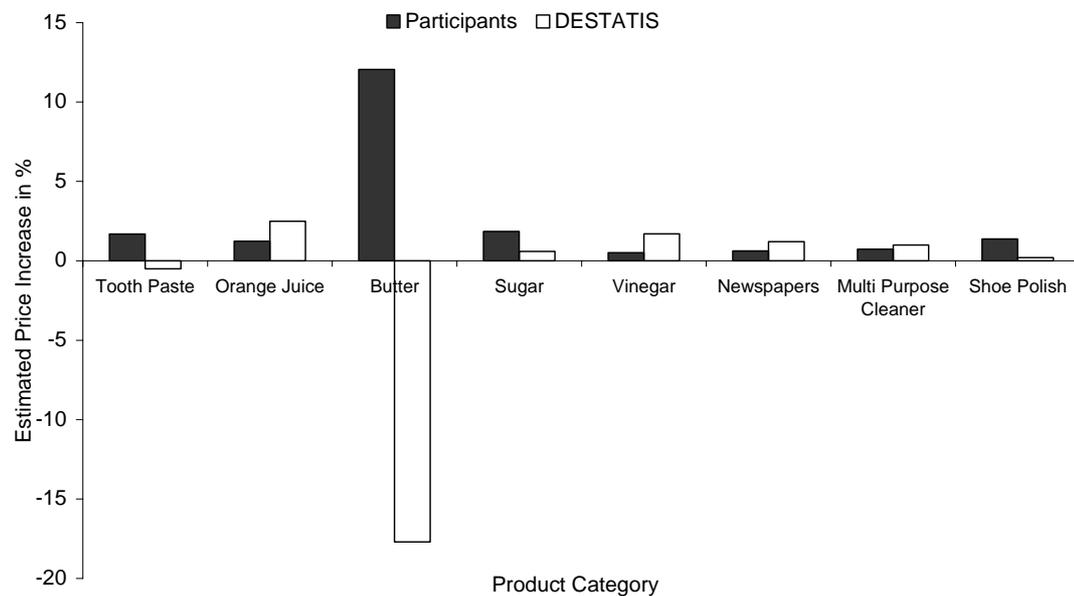
**Figure 8: Mean Price Increase Estimations by Participants and DESTATIS**

A subsequent question of interest was the extent to which participants' perceived price increases were influenced by their expected price increase estimates two months earlier. On the whole, a remarkable correlation of $r(53)= .39, p < .01$ was observed between the mean expected price increases in the first survey and the mean

perceived price increases in the second survey. This indicates that the perceived price increases in the second survey were strongly influenced by the expected price increases in the first survey. This is also confirmed when looking at the correlations between the expected and perceived price increases for the separate products. Correlation coefficients range from $r(53)= .18$ (not significant) for orange juice to $r(53)= .73$, $p < .01$ for toothpaste and indicate that the expected price increases two months earlier played an important role in the perceived price increases two months later.

On the whole, the results obtained so far confirm the findings of Chapter 4 that expected future price increases play an important role in the subsequent perception of price increases. Furthermore, it would appear that real price development plays only a subordinate role in determining the perception of price changes. This study, however, also aimed to address the question as to whether a general positivity bias exists, according to which unpleasant events are more positively judged after they have happened.

A closer look at the expected price increases from the first survey reveals that noticeable price increases were expected for only two products; a remarkable price increase of 8.49% (SD = 10.30) for butter, and a noticeable price increase of 3.92% (SD = 10.36) for sugar. A general positivity bias should contribute to more positive and therefore lower price increase judgments in the second survey – in particular in the case of butter, since a remarkable price increase of 8.49% may in fact be characterized as an unpleasant event. However, no such effect was observed. The mean perceived price increase of 12.05% (SD = 16.59) for butter in the second survey did not significantly differ from the expected price increases of 8.49%, $t(52) = 1.55$, $d = .26$ in the first survey. On the contrary, while this difference was not significant, the perceived price increase was tendentially even higher than the expected price increase. A further non-significant result was observed for sugar; the mean perceived

price increase of 1.84% (SD = 5.43) for sugar in the second survey did not significantly differ from the expected price increase of 3.92%, t(52) = 1.50, d = .25 in the first survey. Here, however, the perceived price increase was tendentially lower than the expected price increase, thus confirming the results of Chapter 4.

In sum, the results therefore indicate that no general positivity bias exists to explain the finding that perceived price increases after the value added tax increase were lower than the expected price increases before the tax increase as observed in Chapter 4. This is insofar a remarkable finding, as the price increases of up to 50% announced by the German dairy industry also appear to constitute a threatening event, if not even more threatening than a value added tax increase from 16% to 19%. If this event was indeed perceived as more threatening, it should have triggered greater cognitive dissonance and in turn greater dissonance reduction.

If no general positivity bias exists, however, the question arises as to how far the results from the present study and the study discussed in Chapter 4 can be explained by the influence of media coverage and the frequency and controversy of the corresponding discussion. Unfortunately, this question extends beyond the scope of the present dissertation and would require a closer examination of media coverage during the realization of the studies. The correlation between media coverage and perceived price increases may represent a fruitful topic of study for future research.

A further explanation for the discrepant findings between the study described above (equal perceived price increases in the second survey) and that in Chapter 4 (lower perceived price increases in the second survey) may be found in the period between the two surveys in each study. While the study discussed in the sections above was designed to replicate the survey design found in Chapter 4, it must critically be noted that the period between the two surveys in the study above was only two months as compared to four months in the

study in Chapter 4. It is possible that the shorter interval between the two surveys in the study described above lead to a greater salience of the expectations from the first survey, as a result of which these expectations exerted a stronger influence on the perceived price increases in the second survey. This may be explained by brain effects, for example by the phenomenon of interference (Woodworth & Schlosberg, 1955). Accordingly, oblivion is often the consequence of acquiring new and similar information. A longer period of time between the two surveys increases the probability that new information is acquired, which in turn may contribute to the replacement of recollected prices with other, more recent prices – which may also be fictitious. Nonetheless, this explanation does not explain with which new information recollected prices were replaced; the results of Chapter 4 indicate that there was practically no correlation between real price development and perceived price increases.

5.2. Practical Recommendations

The previous section showed that lay perceptions of the economy are often biased; that lay beliefs remain stable, even in the light of contradictory evidence; and that there is interplay between biased perceptions and the perseverance of lay beliefs. However, none of the above-described mechanisms necessarily imply that de-biasing or changing lay beliefs is impossible. This section addresses practical recommendations which might contribute to de-biasing and changing erroneous lay beliefs. Some of the ideas presented are derived solely on the basis of theoretical considerations and therefore require future empirical investigation. Other ideas are derived from empirical and theoretical research in a variety of domains and may be successfully transferable to the context of lay beliefs on the economy.

5.2.1. Enabling people to think in terms of consequences and dynamics

One of the central reasons for inappropriate lay beliefs is the misperception of the long run consequences of macroeconomic variables, such as economic growth or inflation, and of economic and political measures in general. But how can this shortcoming be explained, given that the human race is able to build space shuttles or map out human chromosomes?

A convincing explanation for the misperception of long-term consequences is provided by evolutionary psychology (Barkow, Cosmides, & Tooby, 1992). According to this perspective, our brains have evolved to solve problems which were prevalent in the environment of evolutionary adaptation. It is generally assumed that relatively little evolution has occurred since the civilization of humans (in approximately the last 10.000 years). Therefore, much of our mental architecture evolved in the context of hunter-gatherer societies, which is why our minds are best adapted to such societies (Rubin, 2002). However, the corresponding period was characterized by small human groups with little social structure, little food storage and little division of labor or specialization. People were not settled and therefore did not encumber themselves with possessions (Kelly, 1995). A consequence of this high level of mobility was that all possessions had to be portable. It therefore logically follows that there was little need for any form of possessions which were fixed in one place, required prolonged manufacture, regular maintenance, or joint work by several people – in terms used by the economist – capital accumulation. There was thus little capital and therefore little value in developing an ability to understand the productivity of capital (Rubin, 2003). Consequently, there was little technological progress in the environment of evolutionary adaptation and therefore little growth. Accordingly, individuals did not observe any growth during their lifetime (Kremer, 1993). From this perspective, it is not surprising that no mechanisms were developed for understanding

growth or dynamical processes, given the lack of incentive for such mechanisms. These evolutionary psychological considerations can help to understand the origins of the general tendency to misperceive the long-term consequences of macroeconomic variables and of economic and political measures.

Nonetheless, the fact that the human race is able to build space shuttles or map out human chromosomes despite these inherent limitations indicates that humans are able to overcome these limitations by learning. A variety of studies have demonstrated that learning improves the ability to deal with and more accurately estimate exponential processes (Dörner et al., 1997; Ebersbach & Wilkening, 2007; Eisenstein & Hoch, 2005; Keren, 1983; Mackinnon & Wearing, 1991). Furthermore, education has been found to be the strongest predictor of whether a non-economist shares the economic beliefs of the average economist (Caplan, 2001; 2002). Students of economics have also been found to display a higher understanding of the mutual gains associated with trade (Frank, Gilovich, & Regan, 1996; Yezer, Goldfarb, & Poppen, 1996). The limitations observed in this dissertation and other biases found when dealing with economic and political phenomena can thus apparently be overcome by learning – at least to a certain extent.

Nonetheless, certain infrastructural specifications must be met in providing education on economics and politics. First, students should receive instruction in economics and politics. However, the teaching of economics currently plays a subordinate role in the curricula of European schools such as those in France or Germany (Theil, 2008). In German schools, for example, economic topics are only considered as one of many other topics in the teaching of social studies. Few schools offer economics as a specialized course for high-school graduates. The teaching of economics therefore does not appear to be attributed the significance which is required in order to help people to

overcome their inherent weaknesses when dealing with economics and politics.

A further problem is found when examining the agents responsible for the teaching of economics at school – the teachers. It is self-evident that competence on economic and political issues represents a central precondition for successful instruction. A recent study revealed, however, that teachers of social studies do not necessarily possess this competence (Haferkamp, Fetchenhauer, Belschak, & Enste, in preparation). The study examined the judgments of economic laypeople and professional economists on economic reform measures. It was found that while economists judge policies favorably that are considered economically efficient (lower unemployment, boost economic growth, etc.), laypeople focused on fairness and justice, following moralistic principles of not causing harm to anyone, creating equality, and maintaining the normatively correct status-quo. Teachers of politics and social studies constituted a sub-sample which unfortunately did not significantly differ from the sample of laypeople, thus indicating that teachers did not think like professional economists. Whether these teachers are able to help future generations gain the deeper understanding of political and economical questions which is required to overcome the biases and limitations discussed in this dissertation is therefore highly questionable.

In summary, people generally appear to be able to learn to think in terms of consequences and to consider cumulative effects – at least to a certain extent. However, as far as the infrastructure for learning is concerned, there would appear to be shortcomings – a current situation, which is nonetheless developable.

5.2.2. Highlighting the irrationality of rational ignorance

Weede (2003) uses the term rational ignorance to describe a phenomenon which may eventually lead to suboptimal political outcomes. Accordingly, people are generally inadequately informed,

as far as political questions are concerned. From the perspective of the individual, two reasons are discerned which may contribute to rational ignorance. First, comprehensively informing oneself on economic and political issues is costly. The psychological costs associated with information processing in connection with complex economic and political issues have already been emphasized in Chapter 3. Second, the votes of the individual do not exert a significant influence on the outcomes of elections. This results in insufficient information processing and unreflected and ignorant voting behavior (Fetchenhauer & Haferkamp, 2007). A further problem is that the resulting errors carry public but no private costs, as a consequence of which no self-correcting mechanism is activated to change this voting behavior (Rubin, 2003).

Various psychological theories on information processing suggest that insufficient information processing can be reduced by increasing the subjective costs of erroneous decisions (e.g., Trope & Liberman, 1996). Within the context of economics and politics, this could be accomplished by stressing the importance of the individual voter for the outcome of elections and the negative consequences of ignorant voting behavior. Nonetheless, the free-rider problem remains and it would appear questionable whether people can be convinced of the irrationality of rational ignorance. In line with this consideration, Chapter 2 showed that incentives were not suitable in contributing to de-biasing, although the costs of information processing in this example were indefinitely high, with participants simply lacking the ability to estimate long-term cumulative growth.

5.2.3. Decreasing the costs of information processing

A further method for changing rational into irrational ignorance may be found in decreasing the costs of information processing. Lower costs of information processing should increase the disposition to process the corresponding information. Rational ignorance would thus be transformed into irrational ignorance, since informing oneself

about economic and political issues would no longer be too costly. In other words, presenting economic and political information in a form which enables people to grasp the basic ideas without troublesome information processing should contribute to deeper understanding and therefore decrease the biases observed in the previous chapters.

The efficacy of presenting information in formats which are easier to process has, for instance, been shown in the context of statistical information (e.g., Hoffrage, Lindsey, Hertwig, & Gigerenzer, 2000). Here, it was found that the accuracy of diagnostic tasks dealing with statistical information was remarkably improved by presenting statistical information in the form of natural frequencies rather than probabilities. For example, information on a cancer screening test presented in the form of natural frequencies:

> Out of every 10.000 people, 30 have colectoral cancer. Of these, 15 will have a positive hemoccult test. Out of the remaining 9970 people without colorectal cancer, 300 will still test positive. How many of those who test positive actually have colorectal cancer (Hoffrage et al., 2000, p. 2262)?

The percentage of correct answers was considerably higher when the question was formed in this manner, than when the test was presented in the form of probabilities:

> The probability of colorectal cancer can be given as 0.3%. If a person has colorectal cancer, the probability that the hemoccult test is positive is 50%. If a person does not have colorectal cancer, the probability that he still tests positive is 3% (Hoffrage et al., 2000, p. 2261).

Results indicate that the understanding of statistical information can be remarkably improved by presenting the information in a form which is easier to comprehend for recipients. It should be added that these results were based on a sample of physicians, who can be considered to be experts on diagnostics. The finding that the presentation format of frequencies plays a central role in the outcome

of judgments was also confirmed in a study in which experienced forensic psychologists and psychiatrists were asked to judge the likelihood that a mental patient would commit an act of violence (Slovic, Monahan, & MacGregor, 2000). Clinicians informed that "20 out of every 100" similar patients would likely commit an act of violence (a frequency frame) were more likely to refuse to discharge the patient than clinicians who were told that the patient had a "20% chance" of committing an act of violence (a percentage frame).

It is, however, not only the understanding of probabilities which depends on the format of presentation. People also appear to have difficulty dealing with percentages. In a study examining how well people understand the percentage daily value for fat on food labels, it was found that people did not know how to use this information and therefore incorrectly judged the fat content of the examined products (Levy, Patterson, Kristal, & Li, 2000). In contrast, people who were presented with the food labels were able to provide quite accurate estimates of the fat content. Participants were thus not able to translate the percentage daily value for fat into the fat content of the products. Nonetheless, they were capable of deducing the fat content of the products from the product labels – presumably because the labels presented the information in a format which could more easily be understood and interpreted by the participants.

It seems that people appear to have general difficulties when dealing with numerical information. The question is therefore whether the magnitude of the underestimations of long-term economic growth which were observed in Chapter 2 would have been at least lower if the question had been presented in a more familiar format. This could have been realized by presenting data in absolute numbers, for example a fictitious amount of national income or changes in national income over the next few years. Furthermore, the use of graphical figures might have contributed to a better understanding of the exponential processes and lead in turn to a lower magnitude of

underestimation. The same idea could also have been applied to the value added tax increase. It would appear plausible that communicating the consequences of the value added tax increase using examples with absolute numbers could result in lower expected price increases, since a translation into absolute price increases would clarify that these were far lower than the expected price increases reported in Chapter 4. It may also be possible to take advantage of the self-reference effect (Rogers, Kuiper, & Kirker, 1977) by highlighting the individual and personal consequences of price increases, by, for example, numeralizing the additional expenses for weekly food purchases, etc.

A further implication for economists in decreasing the costs of information processing for laypeople is that the knowledge base of laypeople should be appropriately considered. For example, in convincing listeners or readers that a particular reform measure is efficient, an economist must first convince them that efficiency differences exist between different reform measures. Economists must thus begin their line of reasoning one step further back than they are used to (Rubin, 2003). As mentioned above, economic laypeople tend to understand the economy as a fixed pie. According to laypeople and using tax policies as an example, different policies serve to allocate a fixed burden among various classes of taxpayer. The central criterion for the distribution of this burden is fairness (Haferkamp & Fetchenhauer, 2007). Economists, on the other hand, would argue that different tax policies have specific implications for employment, saving and investments in the economy and that some policies will lead to larger total incomes than others. If laypeople argue with fairness and economists in terms of efficiency and incentives, laypeople will not understand the arguments provided by the economists. This can perhaps be avoided, however, if economists first convince laypeople that different tax policies have effects which extend beyond fairness and distribution. The implications of different tax policies could then be considered in a second step (Rubin, 2003).

Nonetheless, it must be critically mentioned that this procedure is presumably fruitful, as far as "shapeable" beliefs on the economy are concerned. Chapter 3 demonstrated that it is very difficult to change established beliefs. The successful communication of economic concepts may, however, also help to prevent the formation of erroneous beliefs.

5.2.4. Considering the functional nature of lay beliefs and biases in the perception of the economy

A further promising approach when attempting to change lay beliefs on the economy and biases in the perception of the economy is found in a consideration of the functional nature of lay beliefs. The functions of lay beliefs were discussed back in Chapter 3 and included providing support when it comes to economic decision making. However, this is only one function. Other functions may include bolstering or maintaining self-esteem, ensuring group solidarity, or providing a social or moral framework for the comprehension of new facts (Furnham, 1988). This psychological element of lay beliefs must also be considered when discussing methods to modify these beliefs and to reduce biases in the perception of economic and political phenomena.

A further particularity of lay theories is that they are not always logically consistent (Furnham, 1988; Williamson & Wearing, 1996), with opposed presuppositions being simultaneously held by people who may be unaware of, or simply not concerned by, contradiction. This logical inconsistency is, for example, found in the phenomenon of fiscal illusion, according to which people simultaneously tend to favor lower or unchanged taxes at the same time as a higher level of government services (Winter & Mouritzen, 2001). In other words, laypeople tend to engage in counterfactual thinking (B. Schwartz, 2004) and therefore envisage policies which are unrealistic. This may in turn lead to increased dissatisfaction with policies which stick to the facts. A further implication is that this tendency to hold logically

inconsistent beliefs can make laypeople vulnerable to untrustworthy party platforms which promise things that – at least from an economist's point of view – are not compatible.

What are the implications of the finding that lay beliefs may serve a psychological function while at the same not necessarily be logically consistent? Looking at campaigns aiming at changing lay beliefs, an important consequence is that logical campaigns may be less successful than emotional campaigns. This could also be shown within the context of health education (Furnham, 1988). A further implication is that if the psychological function of a certain lay theory or bias can be determined, this theory or behavior can be replaced by another theory or behavior, which equally or even more effectively would fulfill this psychological function. This could be an effective approach in order to change lay beliefs on the economy and biases associated with the perception of the economy.

Chapter 3 demonstrated a continued belief that the introduction of the euro had lead to significant price increases, even in the light of clearly contradictory evidence. It appears plausible that the perseveration of this conviction was the result of the euro displacing the Deutschmark as a symbol of national pride and identity and therefore as something meaningful to many Germans (Müller-Peters, 1998). Based on these theoretical considerations, an emotional campaign, stressing the pride and identity of a common euro zone and its corresponding significance could contribute to greater acceptance of the euro and possibly to the displacement of the belief that the introduction of the euro lead to significant price increases.

It would appear that a better understanding and consideration of the psychological function of lay beliefs may help to develop more successful campaigns and means of communication which aim to change "wrong" lay beliefs and contribute to the de-biasing of biased perceptions of economic phenomena.

5.2.5. Creating structures within which biases can contribute to rational and foresightful behavior

As discussed in Chapter 2, the general tendency to underestimate the long-term effects of accumulated growth might contribute to the rejection of a funding principle, since peoples' tendency to underestimate accumulated capital in the future may be accompanied by an underestimation of future pensions. While from an economic point of view the funding principle appears to be a necessary measure in anticipation of future problems resulting from demographical changes, biased perceptions may contribute to its rejection. A central problem of biased perceptions of economic phenomena is the considerable difficulty – if not impossibility – of eliminating these biases. So what can be done?

If the mountain won't come to Mohammed, Mohammed must go to the mountain. Transferring this to biases in the perception of economic and political phenomena results in the following: If biases in the perception of the economy cannot be overcome, structures must be created within which these biases do not cause harm, but instead contribute to rational and foresightful behavior.

One such example where implemented structures play a crucial role in shaping the behavior of individuals is related to the default bias (e.g., McKenzie, Liersch, & Finkelstein, 2006). According to this bias, people display a strong tendency to stick with the default. This has been shown in a variety of domains, for example, organ donors (Johnson & Goldstein, 2003), pension savings (Madrian & Shea, 2001), insurance (Johnson, Hershey, Meszaros, & Kunreuther, 1993), and internet pricacy policies (Johnson, Bellmann, & Lohse, 2002).

In a recent study, Johnson and Goldstein (2003) explored the question concerning the extent to which defaults can be used to save lives using the example of organ donors. They conducted an international comparison of effective organ donor consent rates. The countries under investigation required either explicit consent in the form of "opting-in", which meant that residents were required to

actively grant permission by signing donor cards, or presumed consent in the form of "opting-out", which meant that residents were required to actively refuse organ donation. Results were rather impressive, showing dramatic differences in effective consent rates (the percentage of residents willing to donate organs) between countries requiring opting-in and those requiring opting-out. For countries requiring opting-in, such as Denmark, the Netherlands, the United Kingdom and Germany, effective consent rates ranged from 4.25% to 27.5%. In contrast, effective consent rates ranged from 85.9% to 99.98% in countries requiring opting-out, such as Austria, Belgium and France. These results indicate that the directed setting of a default can be used to save lives.

In a further study, Madrian and Shea (2001) examined the influence of the default bias on pension savings based on a large U.S. company which made changes to its retirement-plan default. Under the original default, new employees were only enrolled in a 401(k) plan upon request. After the default change, new employees automatically deposited 3% of their income into a 401(k) account unless they requested otherwise. It was found that the number of new employees who enrolled in the retirement plan more than doubled. Further, most new employees invested 3% (the default), even though investments of up to 15% were possible. It can therefore be concluded that people display a strong tendency to stick with the default and that this default can be set by decision makers in such a way as to encourage rational and foresightful behavior.

The creation of structures within which biases may contribute to rational and foresightful behavior is also discussed in the context of "light paternalism" (Loewenstein & Haisley, in press), which aims to improve decision making without restricting it. One example which takes into account the problem that many employees fail to adequately save for retirement and which also considers loss aversion, hyperbolic time discounting, and the status quo bias is the

so-called *Save More Tomorrow* program developed by Thaler and Bernartzi (2004). Employees are asked whether they would be prepared to increase their 401(k) contribution rate at their next pay rise. Hyperbolic time discounting is accounted for, because contribution rates are increased at some point in the future, thus taking into consideration that people are impatient in the present and want to spend money now. Loss aversion is also accounted for, since increases in contribution rates are not perceived as losses, because despite these increases the employees will have an equal or higher future amount at their disposal. Finally, the status quo bias is also integrated into the program, contributing to the perpetuation of and increase in future savings by requiring people to actively opt-out.

Further examples of light paternalism which are currently subject to debate in the literature focus on the importance of immediate feedback and reinforcement in the context of addictive behavior, for example, smoking (Volpp, Gurmankin, Asch, Berlin, Murphy, Gomez, Sox, Jungsan, & Lerman, 2006). Addictive behavior may be reduced using immediate feedback and reinforcement to counteract hyperbolic time discounting. As shown in a study by Schwartz, Bertrand, Mullainathan, & Shafir (2006), framing effects can also be used to promote rational and foresightful behavior. The authors found that contribution rates to employer-sponsored flexible spending healthcare accounts were higher when the decision was framed as an avoidance of loss ("Stop losing money now") instead of as a gain ("Start saving money now").

Against the backdrop of these considerations, the question arises concerning the extent to which the findings of this dissertation can be embedded into light paternalism. Admittedly, it seems rather difficult to develop ideas similar to those discussed in the previous two sections for the biases under investigation in this dissertation. Nonetheless, a conceivable light paternalistic implication of the general tendency to underestimate cumulative growth in the future is

related to increases in contributions to social or healthcare systems. If, for example, a government realizes that healthcare revenue in 20 years will be considerably lower than associated expenses, one possibility would be to try and implement considerably higher contributions in 20 years time. However, it is likely that this procedure would attract the resentment of future voters, which could result in the voting out of this future government. Alternatively, the government could implement a gradual and continual fixed percentage increase in healthcare contributions over the course of the next 20 years. An increase of one percent every two years would, for instance, generate enough to cover the difference between revenue and expense in 20 years time. A corresponding study could confront participants with both settings and investigate participants' policy preferences. Furthermore, participants could be asked to estimate their additional expenses for healthcare. Given that people tend to underestimate the long-term effect of cumulative growth, it would seem plausible that estimated additional expenses for healthcare would be significantly lower in the latter than in the former setting and that people would therefore prefer this solution.

On the other hand, this effect could be foiled by loss aversion and decreasing sensitivity (Kahneman & Tversky, 1979). Regular increases may be perceived as multiple small losses which are subjectively viewed as causing more harm than one large increase associated with loss in the future. These considerations indicate that perceptions of public sector revenue continue to represent a promising field of research.

A further central finding of this dissertation was that lay beliefs on the economy remain stable, even in the light of clearly contradictory evidence. This raises the question concerning how this finding can be aligned with the idea of light paternalism. Finding an appropriate answer to this question would appear difficult; there is an apparent lack of compliance between the creation of structures encouraging

the formation of lay beliefs on the economy which contribute to rational and foresightful behavior and the requirements of light paternalism, namely guiding human behavior in a more beneficial direction while minimizing coercion, maintaining individual autonomy, and maximizing choice to the greatest extent possible (Loewenstein & Haisley, in press). At this point, I do not want to discuss ethical issues of interventions targeting the formation of lay beliefs on the economy, even though the boundaries between a light and stronger forms of paternalism may not always be clear-cut. Nonetheless, it does seem worthwhile to gain a deeper understanding of how lay beliefs on the economy are formed and to develop guidelines for political communication. These findings could in turn be useful in preventing biased perceptions of future economic phenomena, for example the exorbitant price increase expectations discussed in Chapter 4.

5.3. Implications for future research

Some implications for future research have already been discussed in the previous sections of this dissertation. It may have become clear that relatively little research has thus far been conducted on the topic of lay perceptions of the economy, and that it is a sophisticated and fascinating area of research. The aim of this section is to develop more concrete ideas for future research projects dealing with lay perceptions of the economy.

5.3.1. Perceived Inflation

In light of the fact that Chapters 3 and 4 used the topic of perceived inflation in order to examine lay beliefs on and biased perceptions of the economy, it would appear worthwhile to discuss implications for future research on this topic. While the results of Chapter 4 and the study discussed in Section 5.1.3 indicated that future price increase expectations greatly influence perceived price increases, recent

research also suggests otherwise. Two conceptually very different approaches can be discerned in explaining why perceived inflation is higher than official inflation.

The first explanation emphasizes the role of expectation. In a series of experiments conducted by Traut-Mattausch et al. (2004) examining the role of expectation, participants were asked to compare the prices of dishes presented in restaurant menus, in either German Marks before or in euro after the euro conversion. During conversion, prices either did not change, increased by an average of 15% or decreased by an average of 15%. In the condition of price decrease, participants believed that prices had not increased; in the condition of no change, participants believed that prices had increased; and in the condition of 15% increase, participants believed that prices had increased by more than 15%. In a subsequent study in which expectations were experimentally induced (Greitemeyer et al., 2005) by exposing participants to an online article allegedly taken from the consumer magazine "Stiftung Warentest", these results were replicated. In a recent series of experiments (Schulz-Hardt, Traut-Mattausch, Greitemeyer, & Frey, 2007), these results were also replicated in contexts other than the euro introduction: for the prices of ecological and conventional products, and for the amount of rent charged in different cities. In both contexts, participants had prior expectations with respect to the results of a price comparison. People living in Munich, for example, were convinced that rent in Berlin was noticeably cheaper than rent in Munich. In this study, participants received offers for various apartments in either Berlin or Munich including information on rent prices and size in square meters. Results confirmed an explicit bias in the direction of prior expectations. When rent prices in Munich and Berlin were actually equal, Berlin was judged to be cheaper; when rent prices in Munich were cheaper than in Berlin, prices were judged to be equal; and only when - in line with expectations - Berlin was actually cheaper, were price differences correctly judged. The generalization of this

phenomenon to two further settings and different samples indicates a high robustness of the expectancy-consistent judgment bias in the context of price comparisons.

The effect of expectancy confirmation in the face of clearly disconfirmatory evidence is explained by a selective outcome correction process. Accordingly, a prior belief effect can occur even with unambiguous price information, since outcomes of calculations made when evaluating evidence can be correct or incorrect. Initially, the distribution of incorrect and correct calculation outcomes is non-systematic. Expectations surrounding calculation outcomes can, however, lead to a subsequent bias in judging the correctness of these calculation results. Whereas expectancy-consistent outcomes are accepted at face value, expectancy-inconsistent outcomes are more frequently and thoroughly tested. More errors in expectancy-consistent results thus remain undetected and in turn influence the estimation of overall price trends. Two experiments were able to corroborate this selective outcome correction process. In one experiment, half of the participants were allowed to use a calculator. As expected, these participants showed no overestimation of the price trend, whereas an overestimation was found for those participants who did not use a calculator (Schulz-Hardt et al., 2007). In another experiment (Traut-Mattausch et al., 2004, Experiment 4), it was found that overestimation of price changes substantially decreased with increasing cognitive load. This paradoxical finding that a reduction of cognitive capacity lead to more accurate estimations was explained by the fact that the biased testing of expectancy-consistent and expectancy-inconsistent outcomes was prevented and therefore lead to more accurate outcomes.

A second and conceptually different explanation for the phenomenon that perceived inflation is higher than official inflation centers on prospect theoretical assumptions (Brachinger, in press). These assumptions are integrated into the so-called index of perceived

inflation, which is assumed to reflect perceived inflation. This approach first hypothesizes a preliminary perception phase in which, the price of each good with which the buyer is confronted is encoded as gain or loss using a reference price that is specific to that good and irrespective of other goods. In a second step, loss aversion comes into play. Here, it is assumed that price changes are evaluated according to a value function V, with price increases (losses) being evaluated more highly than price reductions (gains). In a third step, the Weber-Fechner psychophysical law is considered. Accordingly, the perception of a price change is a linear function of the relative price change, that is, price changes are perceived in relation to the prices themselves. Finally, purchase frequency is accounted for. The underlying hypothesis in this step is based on the idea that availability is a crucial factor of inflation perception; the average consumer assesses inflation more highly, the easier it is to retrieve examples of noticeable price increases from memory.

All these hypotheses were tested in a recent experimental study (Jungermann, Brachinger, Belting, Grinberg, & Zacharias, 2007). At an aggregate level, it was found that average perceived inflation was higher for often-purchased goods than for occasionally or never-purchased goods. Further, perceived inflation was significantly higher for goods whose prices had increased than for goods whose prices had decreased, thus reflecting a realistic perception of price changes. Finally perceived inflation was found to be highest for low-price items, lower for medium-price items and lowest for high-price items.

Judgments of inflation were assessed using three different methods, which yielded different results. Only the results obtained using one of these methods, however, were very close to the predictions generated by the so-called index of perceived inflation (Brachinger, in press) - the central assumptions of which were discussed in the section above. This method employed questions such as: "12 months ago, 500 g of coffee cost €3.49. How much does 500 g of coffee cost at

present?" (Jungermann et al., 2007, p. 410). It is noteworthy that this question format closely resembles that used in the study presented in Chapter 4. Interestingly, however, this study yielded other results. It was neither found that perceived inflation was higher for often-purchased as compared with occasionally or never-purchased goods, nor was perceived inflation found to be significantly higher for goods whose prices had increased than for goods whose prices had remained stable. In the study in Chapter 4, one high-price item was included – namely a Volkswagen Golf. When comparing the mean perceived price increase of 4.98% (SD = 5.76) for this high-price item to the mean perceived price increase of 5.33% (SD = 6.62) for the remaining low-price items, however, no significant difference was observed, $t(281)$ = .81. Hence, not even the finding that perceived inflation is higher for low-price items was replicated. Why did the results from the study on the value added tax increase differ from those reported in the study by Jungermann et al. (2007)?

The findings from Chapter 4 indicate that perceived inflation is strongly influenced by expectation. The question therefore arises regarding the degree to which expectations affect perceived inflation in general. A recent series of experiments conducted in Sweden (Gärling & Gamble, in press) suggest that perceived inflation is not generally influenced by expectation. Participants were provided with past and current prices in the national currency, in euros and in fictitious currencies, whereby the percentaged price increases were constant for all products and the participants were required to judge future prices. The finding that the euro in general induces price increase expectations was not replicated – at least for the Swedish participants in these experiments. Furthermore, participants on the whole provided accurate price trend judgments and no effect of currency was observed.

A possible explanation offered by the authors is that Swedes would not expect general price increases in connection with a euro

conversion. This finding and this explanation intermediate between the two conceptually different approaches described above on the one hand and the contradictory results in the study of Jungermann et al. (2007) and the findings of Chapter 4 on the other. According to this intermediate perspective, perceived price increases are influenced by expectations, given that expectations on future price trends exist (as in the case of the euro introduction and the value added tax increase). On the other hand, if no future price increase expectations exist, assumptions from the index of perceived inflation may apply. It therefore remains to be examined whether and how media presentation of inflation rates and future price increases influences perceived inflation, and how information on the general inflation rate (received from the media) and on individual prices and price differences (received while shopping) may interact. This interplay of top-down and bottom-up perception of inflation may represent a fruitful subject of study in future research. Future studies may, for example, include experiments in which participants are confronted with price changes over time and receive additional versus no further information on general price trends.

One interesting assumption of both the expectancy-based explanation and the index of perceived inflation is that individual prices are perceived. According to the selective outcome correction process in the case of the expectancy-based explanation, expectancy congruent mistakes made when calculating price development for individual prices are not detected, whereas expectancy incongruent mistakes are. Likewise, the index of perceived inflation also assumes that individual prices are perceived. This is, however, a bold assumption, given that price knowledge in general is rather low (Evanschitzky et al., 2004). The question concerning which past, present, and future prices people really use when judging on inflation and what influences these prices – if at all prices are used for judgments on inflation - therefore appears justified. It seems that research on perceived inflation could benefit from addressing these

questions in more detail. This should contribute to a deeper understanding of the interplay between perceived or remembered past, present and future prices and in turn provide greater insight into perceived inflation.

Various explanations exist for the retrospection of past prices. One explanation is provided by Helson's (1964) Adjustment Level Theory which describes the formation of internal reference prices. According to this theory, the reference value for the assessment of a new stimulus results from a weighted mean of past stimuli. This suggests that a weighted mean of earlier prices for a respective good serves as a reference price or past price of this good. However, as Brachinger (in press) observes, there are to date no specific studies aimed at elucidating the issue of how far back the periods stretch to which reference prices refer. A further question of interest is how far recollections of past prices are distorted by present prices. As suggested by Kemp (1987), it appears possible that interference effects may contribute to a replacement of past prices with current prices. This should in particular be the case for products with a high purchase frequency, which contradicts the index of perceived inflation assumption that perceived inflation is higher for products with high purchase frequency. A further important theoretical implication for the perception of past prices was presented in Chapter 2; the underestimation of exponential effects should in turn contribute to an overestimation of past prices. Future research should thus address the question concerning how past prices are calculated. There is presently a multitude of different explanations requiring further systematic inquiry.

With regard to the perception of present prices, it appears worthwhile to systematically consider price knowledge in different product segments. A subsequent fruitful area of research may be an examination of the question whether little price knowledge increases the chance that additional contextual information is integrated into

judgments on current prices. This could, for example, include media coverage on fair or unfair prices for various product segments. A further interesting question when considering knowledge on present prices is the time it finally takes to adapt to current price levels. It may be the case that price perception is comparatively accurate, but with a time lag of, for example, two months. People asked to state current prices may thus report prices from two months ago. This would also explain the results obtained in the study in section 5.1.3, in which a 12.05% price increase was perceived for butter, despite an actual price decrease of 17.7%. In the months prior to the investigation, butter had namely been subject to price increases. The perceived price increase of 12.05% may thus have reflected the price increases prior to the survey and may have been the result of a delayed adaptation to current price levels. This hypothesis could be tested in a panel-design study, by asking people to regularly estimate the current prices of various products over a longer period of time and comparing these estimates with official price developments.

With regard to the perception of future prices, one interesting variable appears to have been thus far completely neglected, at least within research on perceived inflation: the perceived fairness of price increases. This is insofar interesting as perceived fairness plays a central role in lay judgments on economic and political reform measures and also leads to confident judgments on the quality of reform measures (Fetchenhauer & Haferkamp, 2006). The same applies to the perceived fairness of price increases. For example, the seller's costs are an important factor in buyers judgments on whether a price or a price increase is acceptable or fair (Bolton, Warlop, & Alba, 2003). When buyers believe that sellers have increased prices in order to take advantage of an increase in demand or a scarcity of supply and without a corresponding increase in costs, they perceive the increased prices as unfair (Kahneman, Knetsch, & Thaler, 1986). In contrast, an unavoidable increase in a firm's costs may make the price increase acceptable. Consumers consider, for example, a price

increase for snow shovels the morning after a snowstorm unfair, but do not view an increase in grocery prices after an equivalent increase in wholesale prices as unfair. The question is thus raised as to how far the perceived fairness of price increases may influence expected future prices. Given that mood influences information processing (Schwarz, Bless, & Bohner, 1991) and that unfair price increases should contribute to stronger negative emotions (Xia, Monroe, & Cox, 2004), a tendency to overestimate unfair price increases and to underestimate fair price increases may exist. In line with these considerations, it has also been demonstrated that negative affect associated with a particular currency may in itself cause prices in this currency to appear more expensive (Przybyszewski & Tyszka, 2007). A further consideration of fairness aspects could yield new and interesting insights into the phenomenon of perceived inflation.

The discussion on perceptions of past, present and future prices underscores the necessity of additional research in order to obtain reliable measurements of these price perceptions. This in turn should contribute to a deeper understanding of the interplay between remembered and perceived prices, which may finally result in more accurate estimations of and additional insight into the origins of perceived inflation.

A subsequent question of interest is how different elements (past, present and future prices of different products, general expectations on future price increases, further effects) are integrated into an overall judgment of perceived inflation. Recent research suggests that enormous difficulties arise in connection with the occurrence of random price changes for single products which are not in line with the general price trend. As a reminder, in a recent study by Gärling and Gamble (in press), participants were confronted with past and present prices of different products and were requested to estimate future prices. Furthermore, various currencies were used. Given equal price development for all products, inflation estimations proved

quite accurate. However, in one experiment (Gärling & Gamble, in press, Experiment 5), product-specific random price changes were included, with the consequence that participants were less able to detect common percentage increases. Furthermore, only in this condition was an influence of currency in terms of a compression effect (e.g., Dahaene, 1992) observed, indicating that expected future prices decreased with increasing currency unit, assumedly because the inflation rate is perceived as higher for a small currency unit (larger numbers) than for a large currency unit (smaller numbers).

It therefore appears that information processing becomes increasingly costly with random price changes; changes which however reflect reality outside of the laboratory, since inflation rarely entails a general trend of price development across different products. It was argued in Chapter 3 that from a psychological perspective, information processing in connection with economic issues is costly for most laypeople. This should more than ever apply for the perception of inflation. The perception of price changes for different products should thus be generally costly. However, if this remarkable costliness is increased by random price changes, this should contribute to an even greater need for cognitive closure (Kruglanski, 2004). This need for closure should in turn contribute to the grasping of evidence, for example previous information on a general price trend and anchor values, but also knowledge structures on price trends – such as the price increase belief in consequence of the euro introduction observed in the studies of Traut-Mattausch et al. (2004) or Greitemeyer et al. (2005) and the belief that the value-added tax increase would contribute to noticeable price increases, as discussed in Chapter 4. One important theoretical implication of these deliberations is that the assumption of a perception of individual prices, which is elementary for the current theoretical framework on the measurement of perceived inflation, is in fact questionable.

A series of experiments may therefore look to explore how price trend expectations are formed under such conditions of costly information processing and what informational cues or knowledge structures are used to solve the corresponding tasks. If consistent and easily processible media coverage is available, as in the case of the euro introduction and the value added tax increase, it is likely that this information strongly influences judgments on future (and past?) price increases. Of further interest is what happens when people want to achieve closure on the topic of perceived inflation and no informational cues are available on general price trends. In this case, the purchase frequency hypothesis from the index of perceived inflation should apply. Accordingly, availability would be expected to play a crucial role in the perception of inflation, with the average consumer assessing inflation more highly, the easier it is for him/her to retrieve examples of noticeable price increases from memory.

In sum, a considerable amount of research on the topic of perceived inflation remains to be conducted and will certainly provide enough material for several more dissertation or habilitation projects.

5.3.2. The formation of lay beliefs

Chapter 3 and Chapter 4 showed that established lay beliefs on the economy remain stable over time, even in the light of clearly disconfirmatory evidence. For this reason, future research should address the epistemic process underlying the formation of lay beliefs and in particular the various factors which may systematically contribute to the formation of biased and inaccurate beliefs.

Both chapters revealed an important role of media coverage in the formation of lay beliefs. It therefore appears obvious that a systematic investigation of the extent to which biases in media coverage influence these beliefs may represent a promising approach in gaining a deeper understanding of the formation of lay beliefs. For example, research on the media bias in the context of election campaigns has demonstrated that editorial slant, defined as the

quantity and tone of candidate coverage provided by a newspaper, influenced candidate evaluations and voters' decisions (Druckman & Parkin, 2005). The question concerning the extent to which biased media coverage contributes to certain lay beliefs on the economy may therefore also be subject to examination in future research, by, for example, analyzing media contents for a certain period of time and contrasting them with recipients' beliefs.

A further form of media bias is the general tendency to cite and invite experts with extreme viewpoints, since such viewpoints attract higher audience rates (Fetchenhauer & Haferkamp, 2007). A common procedure is also to invite experts who hold not only extreme but also opposing positions. This can unfortunately evoke wrong ideas on the general stance of the scientific mainstream. If, for example, there are 99 experts who hold position A and 1 expert who holds position B, economic laypeople will have difficulty determining how representative these two positions are. As a result, people may stop trusting all experts, due to a false impression that experts are clueless. This in turn can contribute to ignorance or openness towards other - eventually untrustworthy - sources of information. An examination of the consequences of this media bias on the formation of lay beliefs could take place in an experimental setting in which participants are confronted with a debate on an economic or political issue involving experts. These experts would hold either shared or different opinions. After having been confronted with this debate, a confederate – an alleged participant – could try to convince the participant of a biased and inaccurate point of view. In the debate condition with different points of view, the disposition to accept the biased and inaccurate view of the other participant should be higher.

Besides the question as to whether and how media coverage contributes to the formation of biased or inaccurate beliefs on the economy, more closely examining the agents which mediate the epistemic process of knowledge formation on the economy also

appears to be a promising approach. In a first step, it would be interesting to determine the degree to which the mindset of these agents resembles that of professional economists. One important group of agents was addressed in the section on the practical implications of the findings of this dissertation – teachers. It was found that when judging various economic reform measures, this group did not significantly differ from economic laypeople, indeed however from professional economists (Haferkamp et al., in preparation). Yet another important group is journalists. Regarding this group, preliminary findings are unclear. A recent study showed that whether journalists think more like professional economists or more like economic lay people depends on the issue at hand (Lotz, 2007). This group of agents thus requires further investigation. A final group of interest is politicians. Given that these individuals carry the final responsibility for deciding on the implementation of economic and political reform measures, it would be particularly interesting to determine the degree to which their way of thinking resembles that of professional economists.

With the exception of the group of teachers, this very question was addressed in a recent study examining knowledge and confidence with respect to climate change among experts, journalists, politicians and laypeople (Sundblad, Biel, & Gärling, in press). Experts were found to possess the highest level of knowledge, followed by journalists, politicians, and laypersons. Furthermore, experts expressed the highest level of confidence in their own knowledge, followed by journalists, politicians, and laypeople. Interestingly, the relation of confidence in own knowledge to actual knowledge was higher among journalists than among experts. A similar study design could be applied in the context of economic and political reforms in order to increase understanding on the knowledge structures of important multipliers of knowledge – teachers, journalists and politicians.

However, not only mass media and the multipliers of economic and political knowledge discussed in the section above represent important sources of information. Individuals and groups are not only to be considered as passive receptors, but also as agents of thought themselves, producing and communicating their own social representations (Moscovici, 1984) – in this context: lay beliefs on the economy. According to this perspective, it may be interesting to examine systematic differences in lay beliefs on economic and political issues between different groups of society. One study revealed that the specific understanding of inflation reflected the specific economic perspective of different economic agents, i. e., people in different positions (Leiser & Drori, 2005). When explaining their concepts of inflation, salaries were found to play a crucial role for teachers, whereas prices were of importance to shopkeepers. One additional question of interest may be the extent to which the structure of lay beliefs depends on self-interest. A study may, for example, examine differences in lay beliefs on old-age insurance between different groups of society, for example between pensioners and adolescents.

When examining the structure of lay beliefs, a consideration of personality differences in addition to socio-demographical variables may also be a promising approach. To date, only few attempts have been made to link psychological variables with beliefs on the economy and biases in the perception of economic phenomena. One such attempt was presented in Chapter 2; people displaying a strong need for cognition were found to be less affected by the tendency to underestimate long-term cumulative growth than people with a low need for cognition. In a study by Chebat and Filitraut (1984), the relation between locus of control and political affiliations in the context of an economic setback was investigated. The findings suggest that those with an internal locus of control are more inclined to accept social and political changes and those with an external locus of control are more affected by economic crisis. The

interrelation between locus of control, the belief in a just world, and individuals' views on the economy was also examined in a more recent study (Bastounis, Leiser, & Roland Levy, 2004). Externality and a low belief in a just world were found to positively correlate with left wing ideologies and economic views; a belief constellation indicating low trust in the business world, protest against the unfair treatment of workers, and support for governmental intervention. In contrast, internality and a strong belief in a just world were positively correlated with a conservative right wing political orientation; a belief constellation characterized by satisfaction with the economy and disapproval of government intervention.

Evidence of an interrelation between the belief in a just world and the perception of economic phenomena was also found in the context of the value added tax increase reported in Chapter 4. Here, participants with a strong personal belief in a just world (Dalbert, 1999) expected and perceived lower price increases following the value added tax increase. These participants additionally indicated feeling less affected by the consequences of the value added tax increase (Christandl & Fetchenhauer, in preparation-b).

Nonetheless, there appear to be more psychological variables requiring further investigation considering lay peoples' perception of economic and political phenomena. Since fairness is an important criterion for laypeople judging the advantages or disadvantages of economic and political reform measures, a consideration of interindividual differences in the perception of justice would seem fitting. An appropriate measure may be the Justice Sensitivity Scale, which assumes consistent and stable interindividual differences in the perception of justice (Schmitt, 1996). Given that many economic and political reform measures deal with problems of redistribution in some form or another, an examination of the degree to which the perception of these measures – and the formation of associated

beliefs – is influenced by interindividual differences on the various dimensions of the Justice Sensitivity Scale may be of interest.

The perception of the economy and economic policies should also depend on individual judgments concerning the extent to which various reform measures facilitate the realization of elementary goals, such as well-being. Whether a particular reform measure is perceived as an adequate means of realizing such elementary goals should depend on regulatory focus (Higgins, 1997). People fundamentally differ with respect to the so-called promotion focus which incorporates aims associated with the realization of one's own wishes and longings, and the so-called prevention focus which emphasizes security and maintaining the status quo. The influence of dispositional differences on regulatory focus has been demonstrated in a variety of domains, for example for negotiations (Galinsky, Leonardelli, Okhuysen, & Mussweiler, 2005) and product perception (Werth & Förster, 2007). Implications of individual differences in regulatory focus may be examined in a broad variety of economic and political contexts, including the acceptance of reform measures, aims to change the status quo, economic views, the understanding and perception of markets, and so forth. On the whole, it appears that personality psychology has yet to fully enter the domain of economic policy and the perception of the economy.

5.3.3. Perception of the economy and economic policy

In the section on practical recommendations, a number of ideas were discussed which could contribute to more accurate perceptions of the economy and more rational and foresightful behavior. In line with the idea of decreasing the costs of information processing, one conceivable goal may be the development of a "language for laypeople". This language should look to anticipate that many issues are better understood when presented in adequate formats. Many economic phenomena deal with percentages and dynamic processes. Future research could address the question as to which formats

could contribute to a less biased perception of economic and political phenomena. It was, for instance, shown that presenting statistical information in the form of natural frequencies instead of probabilities results in considerably greater understanding. The role of format should, for example, also be considered with respect to the presentation of growth or inflation rates, changes in sociodemography, and so forth.

A further question of interest lies in the "design" or "packaging" of economic policies. Frequently, the acceptance or denial of a reform measure is also a question of packaging. In a study by Haferkamp & Fetchenhauer (in preparation), different framings of the same item were found to yield different rates of acceptance. While the item "people with children should pay lower social security contributions than people without children" yielded an acceptance of 73%, the reversed item "people without children should pay higher social security contributions than people with children" yielded an acceptance of only 45%. A similar result was found in a survey of citizens in France, Germany, Italy and Spain regarding their welfare states and various reform options (Boeri, Börsch-Supan, & Tabellini, 2001). In anticipating future changes in the age structure of the population and reducing pension burdens for future generations, one idea is a shift towards the funding principle. According to this principle, current workers are allowed to opt out of the current pay-as-you-go system, as a result of which they pay in lower contributions while working in exchange for agreeing to receive lower benefits in retirement. This should considerably reduce the pension burden for future generations of workers. In the survey, participants were asked how willing they would be to opt out. Willingness to opt out was found to be considerably higher when the question was framed in a slightly modified manner which included some moral persuasion in the form of the phrase: "if it would help the generation of our children and grandchildren not to have to pay contributions which are even higher" (Boeri et al., 2001). It can therefore be

concluded that the acceptance or denial of economic and political reform measures is often just a question of framing.

The idea of using language in such a way as to identify formulations or framings which may contribute to higher acceptance of important and sensible reform measures and in turn to more rational and foresighted behavior is compatible with the idea of light paternalism. An interesting implication for future research may therefore include an integration of considerations on both economic necessities and biases in perception of the economy, with the aim of developing economic and political reform packages which are likely to find the acceptance of the voters and in doing so contribute to more rational and foresightful behavior.

5.3.4. Intercultural aspects

Since culture in itself represents an important variable, future research could also address intercultural aspects of biases in perceptions of the economy and in the structure of lay beliefs. A more detailed investigation of the culture variable appears promising for two reasons.

First, cultures differ in terms of economic conditions. These conditions should in turn influence cultural beliefs on the economy. For example, one study addressing national differences in economic beliefs and their associations with national indicators (Allen, Ng, & Leiser, 2005) found that people in nations with less civil social capital and more governmental social capital (social capital = institutions such as laws etc.) display greater economic self-efficacy and more favorable views of the business world. An interesting question for future research may therefore be how far beliefs on the economy are influenced by national indicators – although the direction of causation may also be reversed with beliefs on the economy influencing the efficacy of economies and in turn national indicators. Of further interest is the degree to which biases in the perception of the economy are influenced by economic conditions. For example,

Keren (1983) found that Israeli participants who had been regularly exposed to higher inflation rates were less subject to the underestimation of exponential effects than Canadian participants who had regularly been faced with lower inflation rates. The authors pointed to a higher level of experience on the part of the Israeli participants in dealing with exponential effects due to a higher inflation rate as an explanation of these findings. However, since participants were solely required to judge future prices, it at least appears possible that the respective inflation rate served as an anchor for participants' judgments. The plausibility of this consideration is strengthened by the fact that target knowledge activated by the anchor is primarily drawn upon when it is perceived as being applicable to the judgment which is to be made (Strack & Mussweiler, 1997). It does not seem far-fetched to consider the inflation rate which is currently applicable when judging future prices. According to this interpretation, Israeli participants thus did not provide better estimates due to more experience, but rather by accident, because they used an anchor value which was higher. This example clarifies that the question concerning how far biases in the perception of macroeconomic variables (e.g., inflation, economic growth etc.) are influenced by intercultural differences could prove fruitful in future research.

Second, cultures not only differ in terms of economic conditions, but also with respect to cultural values (Hofstede, 2001). One question of interest is thus the extent to which differences in the structure of lay beliefs can be observed between individualistic cultures such as the USA and collectivistic cultures such as Japan. Collectivistic cultures would be expected to foster consensus strivings within their members, whereas this should apply to a lesser extent to individualistic cultures (Kruglanski, 2004). This in turn may be reflected in the homogeneity of lay beliefs on the economy. In investigating whether lay beliefs on the economy are more homogeneous in individualistic as compared with collectivistic

cultures, a plausible and particularly relevant hypothesis to be tested would be that economic and political reform measures are easier to enforce in a culture which allows for a broader variety of lay beliefs.

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Ausgewählte Veröffentlichungen und Vorträge:

- Christandl, F. & Fetchenhauer, D. (submitted). The illusion of living in a linear world – How laypeople and experts underestimate the effect of economic growth.
- Christandl, F., Fetchenhauer, D. & Fischer, L. (submitted). "I only believe in statistics that I faked myself" – how laypeople react when their beliefs on the economy are contradicted by experts.
- Christandl, F., Fetchenhauer, D., Haferkamp A. & Gresser, F. (2007). The biggest tax increase all-time! On economic laymen's intuitive judgements on the impact of a value-added tax increase. 32nd IAREP Conference. Ljubljana (Slovenia)
- Fetchenhauer, D. & Christandl, F. (2007). The pitfalls of living in a linear world – How laymen and experts underestimate the effect of economic growth. 32nd IAREP Conference. Ljubljana (Slovenia)
- Haferkamp, A., Fetchenhauer, D., Christandl, F. & Fischer L. (2007). Do „normal" citizens as economic laypersons judge different from economic experts? The acceptance of economic and social reforms and the perception of living conditions in Germany. 32nd IAREP Conference. Ljubljana (Slovenia)
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