

Brosig-Koch, Jeannette; Keldenich, Klemens

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The More You Know? – Consumption Behavior and the Communication of Economic Information

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Jeannette Brosig-Koch
Klemens Keldenich

The More You Know? – Consumption Behavior and the Communication of Economic Information



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Technische Universität Dortmund, Department of Economic and Social Sciences
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Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
Technische Universität Dortmund, Department of Economic and Social Sciences
Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, email: W.Leininger@wiso.uni-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
International Economics
Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Christoph M. Schmidt
RWI, Phone: +49 (0) 201/81 49-227, e-mail: christoph.schmidt@rwi-essen.de

Editorial Office

Joachim Schmidt
RWI, Phone: +49 (0) 201/81 49-292, e-mail: joachim.schmidt@rwi-essen.de

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Jeannette Brosig-Koch and Klemens Keldenich¹

The More You Know? – Consumption Behavior and the Communication of Economic Information

Abstract

This paper uses a laboratory experiment to analyze the impact of different types of information on consumption and savings behavior. Based on a buffer stock savings model, three treatment dimensions are used: The amount of information subjects receive about the likelihood of income shocks, whether subjects are informed about other people's beliefs about these shocks, and the framing of shocks. The results reveal that – even with little information about the random term determining the income shock – consumption decisions are surprisingly close to the optimal consumption path. If at all, more information rather worsens than improves consumption behavior. Nevertheless, in line with the theoretical prediction, observed behavior is robust to the framing and other people's beliefs about income shocks. Given that actual decisions are significantly correlated with the optimal consumption amount (and not with easier accessible variables like cash-on-hand) suggests that subjects do not simply use naive heuristics to determine their consumption.

JEL Classification: C91

Keywords: Consumption; framing; beliefs

December 2012

¹ Jeannette Brosig-Koch, University of Duisburg-Essen; Klemens Keldenich, University of Duisburg-Essen, RGS Econ. – All correspondence to Klemens Keldenich, RGS Econ, c/o Chair for Economic Policy: University of Duisburg-Essen, Faculty of Economics, Universitätsstr. 12, 45117 Essen, Germany, E-Mail: klemens.keldenich@ibes.uni-due.de.

1 Introduction

Saving money for the future is among the most central economic decisions private households have to make. Therefore, the decision how to split available income between saving and consumption has always been of major interest in economic research. Accordingly, there is a large literature both theoretical and empirical trying to explain the savings behavior of economic agents (see e.g. Schunk, 2009 for an introduction). Given the complexity of the saving decision, research focuses on disentangling the importance of certain factors that influence saving behavior. These include a great number of economic, psychological, sociological, and institutional factors. Browning and Lusardi (1996) provide a very comprehensive survey on consumption and saving. They list a total of nine possible motives why people save, including the precautionary, the life-cycle, the intertemporal substitution, and the enterprise motives. Disentangling the importance of one single motive is extremely difficult. However, it is agreed that the uncertainty surrounding income (and expenditures) is one of the main determinants.

The early theoretical work on consumption and savings faced the problem that a realistic representation of the savings decision (based on realistic preferences and/or stochastic income, among others) is very difficult to solve analytically. One way to deal with this is to introduce a more tractable utility function. Following this approach and using quadratic utility functions, the Certainty Equivalent model was developed (Deaton, 1992). However, the results obtained with this model are not able to explain several empirical observations regarding savings (see for example Carroll, 2001). Thus, the second way taken to model consumption behavior was to solve the complicated model numerically and not analytically. This approach resulted in the Buffer Stock Savings Model (Deaton, 1991; Zeldes, 1989) which predicts that consumers should build up a “buffer stock” of savings to prepare themselves for future negative income shocks. This model forms the theoretical base for the paper at hand.

Besides empirical research (see for example Carroll, 1997), the latter model also motivated a number of laboratory experiments. Such experiments allow a high degree of control over the decision environment and, thus, are particularly useful for testing the predictions of this model. More specifically, uncertainty can more easily be disentangled from other determinants of saving behavior. In a pioneering experiment, Hey and Dardanoni (1987) found that subjects were unable to consume and save optimally as predicted by economic theory, but that the comparative static predictions of the theory hold nevertheless. This result was confirmed by Carbone and Hey (2004) who also report significant over-reactions to changes in risk. The experimental analysis by Brown et al. (2009) introduces the possibility of learning how to save optimally. They find that both “social learning” (by seeing the decisions of other participants) and individual learning (by repeating the sequence of decisions seven times) improve the quality of decision making.

This paper builds on the experimental design by Brown et al. (2009) and aims to investigate what kinds of information exactly influence the agents' decision. What should people know about the random process affecting future incomes in order to make optimal decisions? Do other people's beliefs about the future income already affect behavior positively - or do subjects need to be informed about others' choice to improve their consumption decisions as found by Brown et al. (2009)? Furthermore, since the future income is affected by various economic events (like unemployment or changes in tax policy), subject's connotation of these events might also affect their consumption. Accordingly, we test whether the framing of the source of the income shock has an influence on behavior.

2 Model

The model used for the paper at hand is a Buffer Stock Saving Model and largely follows Brown et al. (2009), who in turn base their parameters on empirical evidence reported by Carroll et al. (2000). Consumers live for 30 periods. In each of these periods, subjects earn a stochastic income and have to decide how to allocate their cash-on-hand between saving and consumption. The utility function is a CRRA (constant relative risk aversion) one and incorporates a habit stock into the calculation:

$$U(C_s, H_{s-1}) = \frac{\left(\frac{C_s}{H_{s-1}}\right)^{1-\rho}}{1-\rho} \quad (1)$$

The following table gives the variables used in the model:

X_s	- Total cash / funds available in Period s (denoted "cash-on-hand")
S_s	- Savings in period s (Share of X_s not used for consumption)
C_s	- Consumption in period X_s
R	- Gross interest rate in each period
H_{s-1}	- Habit stock from period $s - 1$
$U(C_s, H_{s-1})$	- Utility in period s
Y_s	- Actual income in period s
P_s	- Fixed income in period s
g_s	- Growth rate of fixed income in period s
G_s	- $1 + g_s$, indicates the development of the fixed income: $P_{s+1} = P_s G_{s+1}$
η_s	- Stochastic income shock in period s
ρ	- Coefficient of relative risk aversion
γ	- Parameter to indicate the importance of the habit stock variable

The inclusion of a habit stock (H_t) into the calculation of course makes early consumption less attractive as it decreases the utility of future consumption. As a consequence, early saving becomes more attractive even above the need to insure oneself against future negative income shocks. The consumer maximizes his expected lifetime utility, leading to the following maximization problem:

$$\max E_t[\sum_{s=t}^T U(C_s, H_{s-1})] \quad (2)$$

In order to keep the experimental task manageable, the time preference factor is assumed to be 1 and is therefore omitted. The habit stock develops according to the subjects' consumption: $H_t = (1 - \sigma)H_{t-1} + C_t$, where σ is the habit stock's depreciation rate. This rate indicates how persistent the habit stock is. The higher σ , the slower the habit stock decreases back to zero and the more important is to incorporate it into one's calculation. In this model, no borrowing is allowed (i.e. $S_t \geq 0$). To simplify computation, it is convenient to divide all variables by fixed income P_s , thereby eliminating the fixed income variable. Lower case variables denote variables where this division has taken place. A recursive specification of current and future utility can now be written as a function of only two variables, namely h_{t-1} and x_t . The optimal value function is then

$$\bar{V}_t(x_t, h_{t-1}) = \max u(c_t, h_{t-1}) + E_t[\bar{V}_{t+1}(\frac{R}{G}[x_t - c_t] + \eta_{t+1}, \frac{\sigma}{G}h_{t+1} + \frac{1}{G}c_t)] \quad (3)$$

Subject to constraints

$$s_t = x_t - c_t \quad (4)$$

$$x_{t+1} = \frac{R}{G}s_t + \eta_{t+1} \quad (5)$$

$$h_t = \frac{\sigma}{G}h_{t+1} + \frac{1}{G}c_t \quad (6)$$

Note that the first constraint implies that there is no borrowing; subjects can only spend their available cash-on-hand which is dependent on past savings and current income.

Following the parameter specification used by Brown et al. (2009), the utility function is adapted to include some scaling parameters, and parameters were chosen such that $\rho = 3$ and $\gamma = 0.6$. The following utility function was therefore used in the experiment:

$$U(C_t, H_{t-1}) = 40 + 750 \frac{\left(\frac{C_t + 2.7}{H_{t-1}^{0.6}}\right)^{1-3}}{1-3} \quad (7)$$

Furthermore, the stochastic income shock has to be specified. The income shock η is chosen to be lognormally distributed with a standard deviation of $\sigma^2 = 1$: $\log \eta \sim N(-0.5, 1)$. This results in a mean income shock of $E[\eta] = 1$. The growth rate of the fixed income is set to be constant at 5% per period. The habit stock's depreciation rate σ is 0.3 which signifies a slow decrease of the habit stock over time. The starting habit H_0 is set to 10.

3 Experimental design

At the beginning of the experiment, subjects receive detailed instructions and have to answer eight comprehension questions about the decision task.¹ In total, subjects played thirty periods. The first period only starts after all subjects have correctly answered all questions. During the experiment, possible questions asked by participants are always answered in private by the same experimenter. In the description of the decision task, technical terms from economics are avoided (thus the income shock is called “adjustment factor” and the habit stock “lifestyle index”). The money in the experiment is given in “Experimental currency” (EW from the German “Experimentalwahrung”) units. The amount of EW they choose to spend in a period is converted to actual Eurocents. Participants are given a large table in the instructions showing possible results from different spending decisions. In addition, they also receive the formula and a table indicating the development of the habit stock. In each period, participants are informed about the current income, their available cash-on-hand, and their habit stock. They further receive the information that their income is subject to a random adjustment factor and that this adjustment factor is drawn independently in each period. To illustrate this, subjects are given three example draws of the income shock over all 30 periods. To test what a certain amount of spending would mean in terms of Euro payoff, subjects could use a Euro calculator which was implemented in the decision screen. The use of this calculator is recorded for future analysis. Before each decision, subjects have to state a belief about this period's adjustment factor. Figure 1 shows a screenshot of the decision screen.

In total, we varied three treatment dimensions: The specifics of information subjects receive about the random process determining their income (Info treatments), the availability of other subjects' beliefs about the current period's adjustment factor (Belief treatment), and the framing of the source of income shocks, i.e., the framing of the random adjustment factor (Frame treatments).

We implemented four Info treatments in addition to the baseline treatment (Base) described above. In treatment LowInfo, subjects do not receive any example draws of the income shock. Treatments

¹See the Appendix for a full set of instructions.

PointInfo and IntervallInfo add a point estimate and an interval estimate of the random variable to the three example draws, respectively. The HighInfo treatment implements the most detailed information concerning the income shock and adds the density function of the random variable, a statement that the income shock is always larger than 0 but will be smaller than 1 most of the time, and the 90% confidence interval for the random variable.

Round 8 of 30
Remaining time (This time only serves for your guidance): 44

Euro calculator

Here you can test how many Eurocents you would receive for a certain amount of EW.

Your spending in EW:

Spending in EW	Savings in EW	Possible Eurocent	Lifestyle Index (next round)
60.00	296.87	52.83	148.79
70.00	286.87	105.90	158.79
80.00	276.87	140.92	168.79

Current round

Round	Fixed income	Adjustment factor	Available cash	Lifestyle index
8	140.71	0.863	356.67	126.84

Your decision

How many EWs do you want to spend in this round?

Your decision:

Past rounds

Round	Fixed income	Adjustment factor	Available cash	Lifestyle index	Chosen spending	Eurocent
1	100.00	1.247	124.67	10.00	15.00	138.68
2	105.00	0.469	158.91	22.00	20.00	66.89
3	110.25	0.138	154.17	35.40	25.00	30.50
4	115.76	0.742	215.05	49.75	30.00	12.08
5	121.55	1.073	315.48	64.85	40.00	60.31
6	127.63	0.304	320.62	85.39	50.00	77.60
7	134.01	0.111	285.48	109.77	50.00	13.44

FIGURE 1: Screenshot of the decision screen

The second treatment dimension varies the framing of the random process generating subjects' income. The three framings identify changes in tax policy (TaxFrame), unemployment (JobFrame), or the general economic development (EconFrame) as the source of income shocks.

Finally, the communication of other subjects' beliefs about the income shock is used as a treatment variable. In treatment Belief, subjects are randomly assigned to groups each consisting of five subjects; this assignment is kept throughout the experiment. Before each of the 30 periods, subjects are informed about the beliefs of their fellow four group members.

The experiment was conducted computer-based and took place at the "Essen laboratory for experimental economics" (elfe) at the University of Duisburg-Essen, Germany, in October and November 2011.

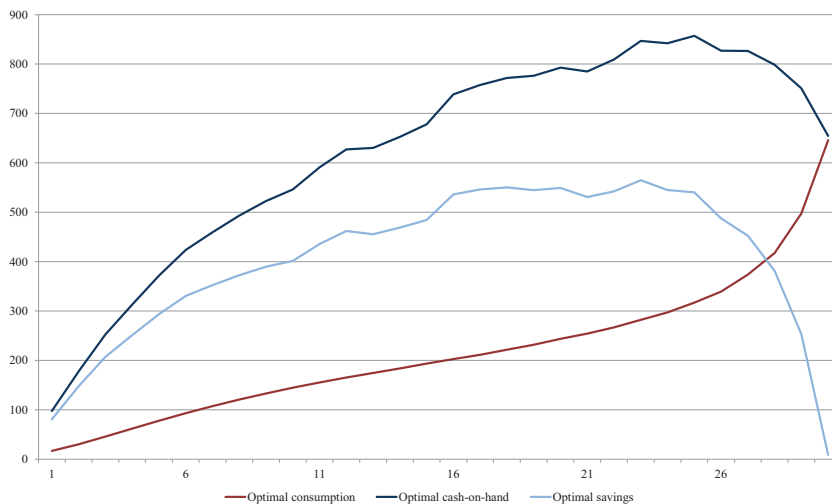
Participants were recruited via the program ORSEE (Greiner, 2004) and the attached subject pool. To program the experiment, the software z-Tree (Fischbacher, 2007) was used. In total, 11 sessions with up to 24 subjects each were conducted, leading to a total of 206 participants². All participants were students from the University of Duisburg-Essen. The experiment lasted about 150 minutes and average payoff including the show-up fee of EUR 5.00 was EUR 27.39 (minimum EUR 0.10, maximum EUR 40.12).³ Subjects were paid out one after the other to preserve anonymity.

4 Results

4.1 General picture

To get a general overview how the ex ante optimal solution looks like, Figure 2 illustrates the optimal consumption, cash-on-hand, and savings that are predicted for 30 periods. The stylized description of this is to save a lot (proportionately) in the early periods to build up a buffer stock of cash-on-hand. This way, consumption can be smoothed and no immediate reaction to bad draws in the future is necessary. At the very end, all savings are of course consumed.

FIGURE 2: Ex ante optimal consumption, cash-on-hand, and savings

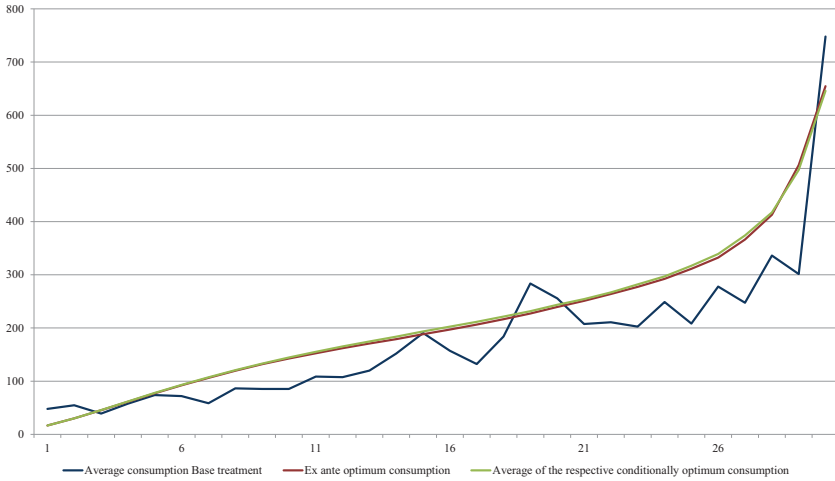


The subjects in our experiment came surprisingly close to this prediction. Figure 3 shows the average of the subjects' actual consumption paths, the ex-ante optimal consumption, and the average of the respective conditionally optimal consumptions. Again, some stylized observations can be made: In the

²Of those, 4 subjects experienced technical problems and therefore are excluded from the analysis.

³If decisions by the participant would have led to negative payoffs which exceeded the show-up fee, the participant was warned by a pop-up screen and could change her decision.

FIGURE 3: Average of actual consumption paths and conditional optima



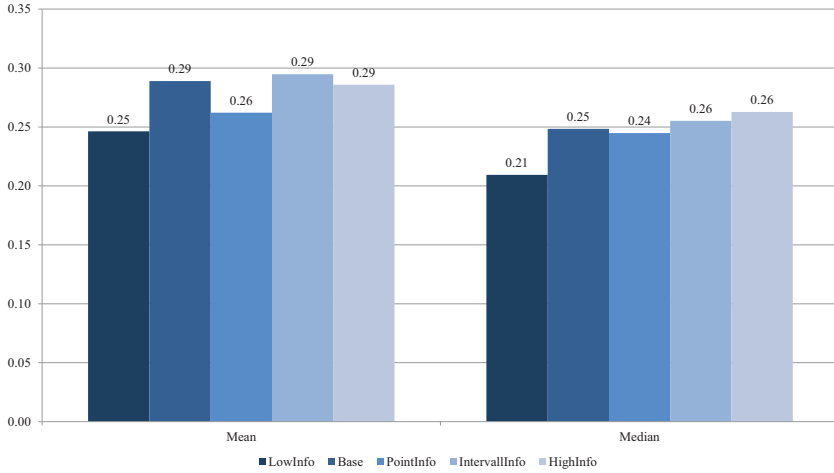
very first periods, overconsumption can be seen. A special case of this are some periods where the optimal consumption would have been 0 (recall that the negative utility one can incur is bounded from below) but the actual consumption is positive. In later rounds, the main difference is the overreaction to high income shocks. This way, the consumption smoothing is not as good as it would be in the conditional optimum. However, overall the actual consumption is surprisingly close to the actual chosen consumption. Still, the average deviation from the conditional optimum is significantly different from 0 in most rounds (only in rounds 14, 20, and 26 no significant difference can be found using a one sample t-test for each round).

4.2 The effect of information

Given that subjects' consumption decisions are surprisingly close to the optimum, we test, whether different amounts of information about the stochastic income have an influence on this behavior. Figure 4 shows the average absolute deviation from the conditional optimum for each Info treatment and the Base treatment as a share of the fixed income.

Using pairwise exact Mann-Whitney U tests to compare behavior between treatments reveals significant differences only between the LowInfo treatment and the HighInfo treatment ($p = 0.045$). But, instead of improving consumption decisions, more information leads to larger deviations from the conditional optimum, if at all. This observation is not consistent over all rounds: The treatment effect is (at least weakly) significant in rounds 2, 11, 12, 13, 18, and 21 ($p < 0.094$). It seems that very detailed information about the random process make subjects somewhat overconfident in their ability to determine the optimal consumption amount and, therefore, they tend to consume too much and save

FIGURE 4: Average absolute deviation from conditional optimum, Info and Base treatments



too little respectively.⁴ Accordingly, the problem of undersaving (see above) is more sincere with more instead of less information. Figure 5 illustrates the actual consumption decisions, the cash-on-hand and the deviation from the conditional optimum observed in the two treatments for all 30 periods.

The previous results suggest that very detailed information rather produces a feeling of better understanding instead of being really understood by subjects. The question is then whether the framing of the random process and, thus, own experiences with income shocks triggered by this framing, do affect undersaving. We particularly focus on framings that (currently) have rather negative connotations and, accordingly, might induce subjects to consume more carefully and reduce undersaving. Figure 6 includes the average absolute deviation from the conditional optimum for each Frame treatment and the Base treatment as a fraction of fixed income. But neither the unemployment frame, nor the taxation frame, nor the general economic development frame of the random process significantly affects behavior ($p > 0.841$). Obviously the observed undersaving in our experiment is rather robust to experiences with income shocks made outside the laboratory.

⁴Overconfidence is a very robust finding (Among others, Kirchler and Maciejovsky 2002 provide an overview of several examples) and can broadly be classified into three different areas: miscalibration (an underestimation of the variance of random variables), unrealistically positive self-evaluations, and illusion of control (overestimation of personal success probability). For more details about these three areas see, e.g., Glaser et al. (2007, 2012). Menkoff et al. (2010) show that expert subjects - who usually have more information - exhibit a higher degree of overconfidence than laypeople, leading to worse decisions. Here, the higher amount of information available might also lead to more overconfidence and thus cause worse decisions.

FIGURE 5: Consumption, cash-on-hand, and deviation from optimum

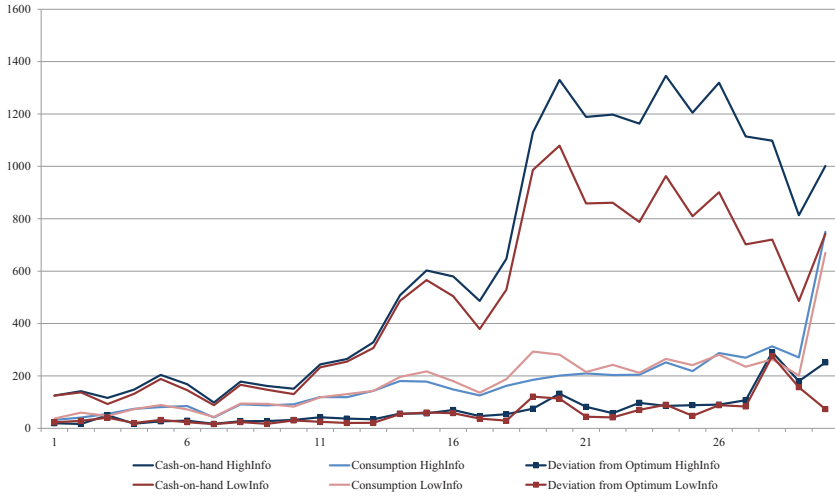
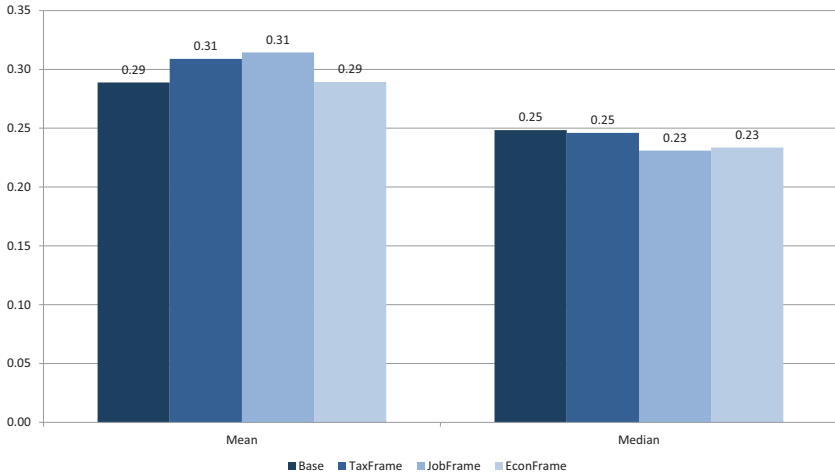
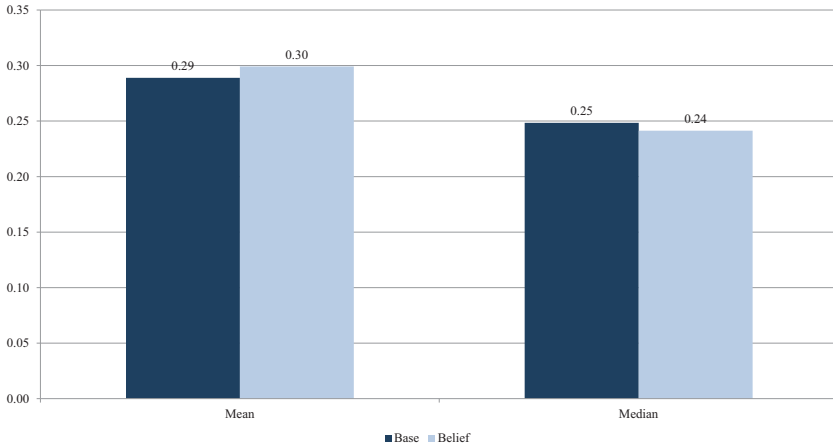


FIGURE 6: Average absolute deviation from conditional optimum, framing treatments



Brown et al. (2009) reported that social learning in the form of seeing other subjects' decision improves consumption behavior. Our belief treatment tests whether social learning can be already induced by seeing other subjects' beliefs about the next income shock. Figure 7 illustrates the aggregate data observed in the Belief and in the Base treatment. However, no significant difference between the Belief and the Base treatment can be observed ($p = 0.575$). In contrast to seeing others' decisions, subjects do not benefit when they are given access to the beliefs about future shocks.

FIGURE 7: Average absolute deviation from conditional optimum, belief treatment



4.3 Panel estimation

In order to control for confounding influences, a Random Effects panel estimation is conducted, using the log of absolute deviation from the conditional optimum as the dependent variable. An additional clustering at the group level is used for the participants in the Belief treatment who were informed about their group members' beliefs. Table 1 shows three different model specifications which add further explaining variables. The first specification includes only the treatment dummies with the baseline treatment as the reference treatment. The second one adds demographic variables (sex, age, a dummy for being an economics student, number of semesters, high school GPA), the number of test entries, and the subject's own belief. In addition, risk attitude, patience, and impulse control are included.⁵ The third and final specification also adds the period and the squared period to look for changes during the course of the experiment.

In all specifications, the treatment dummies are not significant (the Base treatment is used as a baseline). However, in specifications 2 and 3 a subject's belief, and number of test entries and in the full specification also the period and period squared, have a significant influence on behavior. The development of deviations over the thirty periods mirrors the results by Brown et al. (2009) as the decisions by the subjects actually get worse instead of better. This is in parts driven by the fact that the absolute scale of deviations just gets bigger as participants have a higher fixed income and more cash-on-hand. However, using the deviation as a share of fixed income instead yields the same qualitative results: deviations get larger in later rounds.

Looking at a subject's belief about the random adjustment factor in this round shows that a significant,

⁵These variables are evaluated on a 11-point scale with questions taken from the German Socio-Economic Panel (GSOEP).

TABLE 1: Random effects estimation results

Dependent variable:			
Log of deviation	Specification 1	Specification 2	Specification 3
(Constant)	3.312*** (0.000)	3.636*** (0.000)	2.219*** (0.000)
Treatment 1	-0.166 (0.883)	-0.124 (0.364)	-0.127 (0.356)
Treatment 3	-0.140 (0.313)	-0.114 (0.399)	-0.122 (0.366)
Treatment 4	-0.004 (0.972)	0.003 (0.982)	-0.000 (0.998)
Treatment 5	0.033 (0.797)	0.064 (0.539)	0.063 (0.597)
Treatment 6	0.000 (1.000)	-0.016 (0.912)	-0.026 (0.862)
Treatment 7	0.070 (0.601)	0.104 (0.431)	0.103 (0.438)
Treatment 8	-0.052 (0.698)	-0.028 (0.836)	-0.028 (0.832)
Treatment 9	-0.039 (0.718)	-0.021 (839)	-0.027 (0.801)
Own belief	-	-0.001** (0.032)	-0.001** (0.011)
Male dummy	-	-0.052 (0.507)	-0.050 (0.518)
Age	-	-0.011 (0.167)	-0.011 (0.143)
Semester	-	0.005 (0.585)	0.005 (0.593)
Economics student dummy	-	0.003 (0.110)	0.021 (0.100)
High school GPA	-	0.066 (0.261)	0.060 (0.271)
Patience	-	-0.011 (0.497)	-0.011 (0.494)
Impulse control	-	-0.022 (0.146)	-0.022 (0.138)
Risk attitude	-	0.030 (0.201)	0.030 (0.208)
Number of test entries	-	-0.043*** (0.007)	-0.051*** (0.000)
Period	-	-	0.216*** (0.000)
Period squared	-	-	-0.006*** (0.000)

Notes: Treatment 2 is the baseline for the treatment dummies. P-values in parentheses. Additional clustering at group level.

Significance levels: *10% **5% ***1%

Source: Own calculations.

slightly negative relation between the belief and the deviation exists. The existence of a relationship is somewhat puzzling, as the true adjustment factor for each round is drawn and shown to the subjects before they make their decision. Possibly, a subject's belief is an indicator for the anticipated general future development of the adjustment factor and, as such, influences behavior. Adding the beliefs of the other group members as explaining variables shows that none of the other beliefs has a significant influence on a subjects' behavior. Thus, subjects seem to realize that all group members have the same information about the random adjustment factor and there is no need to take others' beliefs into account for their own consumption decision.

The effect of the number of test entries goes in the expected direction: The more entries in the Euro calculator a subject makes, the smaller is her deviation from the conditional optimum. However, the effect is pretty small in economic terms. Of course, one has to be careful in interpreting this significance, as it does not indicate a causal effect from number of test entries to quality of the decision. Instead, participants who simply think about the problem for a longer time might use both more test entries and make better decisions.

4.4 Heuristics

In general, our results reveal that even with little information, consumption decisions are quite close to the optimum. Given that more information, if at all, rather increases deviations to the optimum level raises some doubts that subjects calculate the optimal solution. Instead, it might be that they rather use a naïve heuristic basing their consumption decision on easier accessible variables like cash-on-hand or fixed income. To identify such simple decision rules, we run a regression (pooling all subjects) which explains the actual consumption decision by the predicted consumption, the available cash-on-hand, and the fixed income. Table 2 shows the results from this regression.

TABLE 2: OLS estimation results for actual consumption

Dependent variable:	
Consumption	
(Constant)	63.868 (0.335)
Conditional Optimum	0.273* (0.059)
Cash-on-hand	0.045 (0.247)
Fixed Income	-0.419 (0.460)

Notes: P-values in parentheses.
 Significance levels: *10% **5% ***1%
 Source: Own calculations.

The regression results indicate that subjects do not consistently align their consumption to their

cash-on-hand or their fixed income. Instead, the optimal consumption is weakly significantly correlated to their consumption decision. This observation suggests that subjects at least try to calculate the optimal decision though they are not able to account for all information necessary to determine this optimum.

5 Conclusion and discussion

The paper at hand uses a laboratory experiment to analyze the effect of different information conditions on consumption and savings behavior. The main results are twofold: First, the consumptions are - given the complex environment - pretty close to optimal decisions. Second, differing information conditions hardly affect the quality of the decisions. Especially the second result is somewhat surprising: The Info treatments tested here vary substantially from giving subjects almost no information at all about the random element of their future income to giving a full specification of the random term including example draws and the density function. Instead, if at all, more information seems to increase the deviation from the optimum. This suggests that subjects do not really use this information in the way assumed by standard models (i.e. thinking about their expected future utility) but instead employ some other way of dealing with the difficult decision situation. However, we can exclude simple decision rules that base the decision on easier accessible variables as a possible explanation. The observation that a considerable number of subjects use the Euro calculator (87% percent of the subjects use it in more than 25 periods) rather suggests that subjects at least try to calculate the optimum. Moreover, the fact that testing different consumption levels has a positive influence on decision quality implies that subjects may benefit even more from "learning by doing" than from thinking the model through right from the start. This mirrors the results by Brown et al. (2009), who repeat the "lifetime" of a subject seven times and find that decisions continually improve. It is also in line with our finding, that subjects do not benefit from just seeing the others' beliefs about income shocks - which still requires some calculation to determine own consumption, but rather need to see the decisions made by others to improve consumption behavior (as reported by Brown et al., 2009). Still, the exact method people use to arrive at their actual spending decisions is not clear. Future research might try to open the "black box" of the consumption decision and analyze how consumers are able to consistently make good decisions.

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Appendix

Instructions¹

Welcome to the experiment!

You are participating at a study of decision making behavior in the context of experimental economics. During the study you and the other participants will be asked to make decisions. You can earn money with this study. How much money you earn is dependent on the course of the experiment. You will receive detailed instructions about this in the following. All participants are paid in cash directly after the experiment one by one. To assure this, please remain seated after the experiment until your cabin number is called.

Should you have any questions before the start of the experiment, please ask an employee of the laboratory. He will come to your place and help you. **Any communication with the other participants during the experiment is only allowed when explicitly prompted; breaking this rule will lead to an immediate exclusion from the experiment.**

¹These instructions are translated from the original, German instructions.

Instructions

The experiment consists of **thirty rounds**. In each of these rounds you have to decide how to split your available money between **saving** and **spending**. The current round is displayed at the top of the screen. Your money is denoted in the unit **experimental currency (EW)**.

Available money

Your **available money** consists of two parts: Your **savings** from earlier rounds and your **current income**. It is denoted in EW.

$$\text{Available money} = \text{Savings} + \text{current income}$$

Current income

In each round, you receive a **current income**. This current income also consists of two parts: a **fixed income** and a **variable adjustment factor**.

$$\text{Current income} = \text{Fixed income} \times \text{variable adjustment factor}$$

The fixed income is 100 EW in the first round and increases by 5% in each round afterwards. In the second round your fixed income is therefore 105 EW, in the third round 110.25 EW etc.

Variable adjustment factor

The adjustment factor is variable, because in each round there is a chance to become **unemployed**. A low adjustment factor - and the resulting low current income - therefore represents high unemployment.

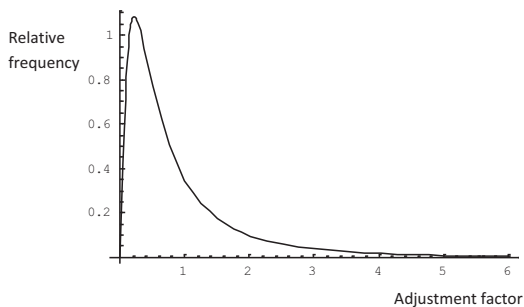
The adjustment factor is variable, because the **overall economic situation** is taken into account in each round. A low adjustment factor - and the resulting low current income - therefore represents a bad economic situation.

The adjustment factor is variable, because in each round the **tax policy** can be changed. A low adjustment factor - and the resulting low current income - therefore represents tax policy which puts high taxes on income.

The adjustment factor is determined using a probability distribution, therefore it is determined **ran-**

domly. The adjustment factors are determined independently in each round. A certain round's adjustment factor therefore has no influence on the next round's adjustment factor.

The probability distribution is represented by the following density function:



The x-axis shows all possible adjustment factors; the y-axis shows the relative frequency of each value. The adjustment factor is therefore always larger than 0, but will be smaller than 1 in most cases. In about 10% of all cases the adjustment factor will be smaller than 0.168. In about 10% of all cases it will be larger than 2.185. In ca. 80% of all cases the adjustment factor will be between 0.168 and 2.185.

The following table shows three possible sequences of adjustment factors, which have been generated with this probability distribution. These possible courses are not used in the experiment and only serve as examples.

	Sequence A	Sequence B	Sequence C
Round	Adjustment factor	Adjustment factor	Adjustment factor
1	1.364	0.845	0.624
2	0.461	2.464	2.660
3	0.498	0.403	2.643
4	0.223	0.199	1.298
5	0.323	0.413	0.840
6	0.108	0.296	0.389
7	0.283	0.199	0.530
8	0.588	0.926	2.592
9	4.793	1.989	0.599
10	0.780	1.601	1.246
11	2.721	0.230	0.674
12	0.334	1.270	0.159
13	2.203	0.715	1.586
14	1.363	0.404	0.129
15	0.289	0.100	0.471
16	0.194	0.170	0.309
17	0.369	0.426	0.364
18	1.296	0.604	0.703
19	0.256	0.248	1.120
20	0.308	1.033	0.219
21	0.767	1.441	0.780
22	0.671	0.910	0.049
23	0.578	0.198	0.486
24	0.956	1.665	0.446
25	2.000	1.636	0.265
26	1.782	0.174	0.549
27	0.140	0.482	0.276
28	0.384	0.342	0.406
29	0.087	0.929	0.457
30	1.692	1.625	0.367

The expected value of the adjustment factor is 1. When many adjustment factors are determined randomly, the average of their values will be 1.

The expected value of the adjustment factor is 1. When many adjustment factors are determined randomly, the average of their values will be 1. In addition, in about 10% of all cases the adjustment factor will be smaller than 0.168. In about 10% of all cases it will be larger than 2.185. In ca. 80% of all cases the adjustment factor will be between 0.168 and 2.185.

Your estimation of the adjustment factor

Before your decision about saving and spending you have to estimate in every round, which adjustment factor will be **determined in the current round**. Please enter your estimation in the field "Estimation" on the screen.

Before your decision you are informed about the estimations about the adjustment factor which have been made by four other participants. These four participants are assigned randomly to you and stay the same for all 30 rounds.

Information after each round

In each round, a table shows savings, fixed income, adjustment factor, and the resulting available money. The values of the past rounds are also displayed in the table.

Your decision

Please enter your **decision** how much of your available money you want to spend in the current round (and with it indirectly how much you want to save) in the field "Your decision".

The amount of EW which you **spend** in each round is converted to **Eurocent**.

The lifestyle index

For **testing purposes**, you can check how many Eurocents you receive for a certain amount of EW with

the Euro calculator on the screen.

The conversion from EW to Eurocents is influenced by your **lifestyle index**. The **higher** the lifestyle index, **the less** Eurocent you receive for a certain amount of EW you spend.

The appendix of these instructions contains a **Eurocent conversion table (Table 1)** which shows how spending is converted to Eurocent. The following table is an excerpt of this conversion table:

		Lifestyle index							
		10	20	50	100	150	200	250	300
Spending (in EW)	5	-391.57	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00
	10	20.48	-290.27	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00
	20	185.03	87.76	-257.20	-400.00	-400.00	-400.00	-400.00	-400.00
	40	238.81	211.32	113.83	-75.81	-286.26	-400.00	-400.00	-400.00
	60	250.17	237.42	192.21	104.26	6.65	-97.80	-207.67	-322.04
	80	254.35	247.02	221.03	170.48	114.37	54.33	-8.82	-74.56
	100	256.34	251.59	234.73	201.95	165.57	126.64	85.69	43.06
	120	257.43	254.10	242.30	219.33	193.84	166.57	137.88	108.01
	140	258.10	255.64	246.91	229.93	211.09	190.92	169.71	147.63
	160	258.54	256.65	249.93	236.87	222.37	206.86	190.55	173.56
	180	258.84	257.34	252.02	241.66	230.16	217.86	204.92	191.45
	200	259.06	257.84	253.51	245.10	235.76	225.76	215.25	204.31
	220	259.22	258.21	254.63	247.65	239.92	231.64	222.93	213.86
	240	259.34	258.49	255.48	249.61	243.09	236.12	228.79	221.15
260	259.44	258.71	256.14	251.13	245.57	239.62	233.36	226.84	

For example, if you decide to spend 100 EW in a round, you will receive 256.34 Eurocent if your lifestyle-index is 10, but only 201.95 Eurocent if your lifestyle-index is 100.

Development of the lifestyle index

In each round, the lifestyle index is calculated as follows:

$$\text{Lifestyle index (current round)} = 0.7 \times \text{lifestyle index (last round)} + \text{Spending (last round)}$$

Therefore, the **more** you spend in each round, the **higher** the lifestyle index gets. At the end of these instructions you find a **lifestyle table (Table 2)** which shows the development of the lifestyle index for a number of spending amounts. The following table is an excerpt of this table:

If for example you choose to spend an amount of 60 EW with a lifestyle index of 10, your lifestyle index in the **next round** will be 67.

		Lifestyle index, current round						
		10	20	50	100	150	200	250
Spending, current round (in EW)	10	17	24	45	80	115	150	185
	20	27	34	55	90	125	160	195
	40	47	54	75	110	145	180	215
	60	67	74	95	130	165	200	235
	80	87	94	115	150	185	220	255
	100	107	114	135	170	205	240	275
	120	127	134	155	190	225	260	295
	140	147	154	175	210	245	280	315
	160	167	174	195	230	265	300	335
	180	187	194	215	250	285	320	355
	200	207	214	235	270	305	340	375
	220	227	234	255	290	325	360	395
	240	247	254	275	310	345	380	415
	260	267	274	295	330	365	400	435
	280	287	294	315	350	385	420	455
	300	307	314	335	370	405	440	475
320	327	334	355	390	425	460	495	

Round 1 of 30 Remaining time (This time only serves for your guidance) 50

Euro calculator
Here you can test how many Eurocents you would receive for a certain amount of EW.

Your spending in EW:

Spending in EW	Savings in EW	Possible Eurocent	Lifestyle index (next round)

Current round

Round	Fixed income	Adjustment factor	Available cash	Lifestyle index
1	100.00			10.00

Your decision
How many EWs do you want to spend in this round?
Your decision:

The lifestyle index in the **first round is 10**.

Course of the rounds

As already described, you have to decide in each of the 30 rounds how to split your available money between spending and saving. Once you have decided upon a split and left the round, you **cannot change** this decision any more. I.e. you cannot return to past rounds. The following picture shows the your decision screen in the experiment.

Your payoff

After the 30 rounds, **all Eurocents** which you received through your spending are **added up**. You are paid this **sum** in cash at the end of the experiment.

In addition, you receive a **show-up fee of EUR 5** for your participation at the experiment.

Comprehension questions

Before the experiment starts, you answer some comprehension questions on the screen. The experiment will only start, when you have answered all questions correctly. These questions do not influence your payoff. **If you have questions regarding the instructions, please raise your hand.** An employee of the laboratory will come to you and answer your questions.

Eurocent conversion table (Table 1)

	Lifestyle index													
	10	20	50	100	150	200	250	300	350	400	500	600	700	...
5	-391.57	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	...
10	20.48	-290.27	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	...
20	185.03	87.76	-257.20	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	...
40	238.81	211.32	113.83	-75.81	-286.26	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	-400.00	...
60	250.17	237.42	192.21	104.26	6.65	-97.80	-207.62	-322.04	-400.00	-400.00	-400.00	-400.00	-400.00	...
80	254.35	247.02	221.03	170.48	114.37	54.33	-8.82	-74.56	-142.55	-212.50	-357.59	-400.00	-400.00	...
100	256.34	251.59	234.73	201.93	165.57	126.64	85.69	43.06	-1.03	-46.39	-140.47	-238.41	-339.68	...
120	257.43	254.10	242.30	219.33	193.84	166.57	137.88	108.01	77.13	45.35	-20.56	-89.17	-160.12	...
140	258.10	255.64	246.91	229.93	211.09	190.92	169.71	147.63	124.80	101.30	52.58	1.85	-50.61	...
160	258.54	256.65	249.93	236.87	222.37	206.86	190.55	173.56	156.00	137.92	100.44	61.41	21.06	...
180	258.84	257.34	252.02	241.66	230.16	217.86	204.92	191.45	177.52	163.19	133.46	102.51	70.51	...
200	259.06	257.84	253.51	245.10	235.76	225.76	215.25	204.31	192.99	181.35	157.20	132.06	106.06	...
220	259.22	258.21	254.63	247.65	239.92	231.64	222.93	213.86	204.49	194.84	174.83	154.00	132.47	...
240	259.34	258.49	255.48	249.61	243.09	236.12	228.79	221.15	213.26	205.14	188.29	170.75	152.62	...
260	259.44	258.71	256.14	251.13	245.57	239.62	233.36	226.84	220.11	213.17	198.79	183.83	168.35	...
280	259.52	258.89	256.67	252.34	247.54	242.40	237.00	231.37	225.55	219.56	207.15	194.22	180.86	...
300	259.58	259.03	257.09	253.32	249.13	244.65	239.93	235.03	229.95	224.73	213.90	202.63	190.97	...
325	259.64	259.17	257.52	254.30	250.73	246.90	242.88	238.69	234.36	229.91	220.67	211.05	201.10	...
350	259.69	259.29	257.86	255.08	251.99	248.69	245.22	241.91	237.87	234.02	226.05	217.74	209.15	...
375	259.73	259.38	258.13	255.71	253.02	250.14	247.11	243.96	240.70	237.35	230.39	223.15	215.66	...
400	259.76	259.45	258.36	256.22	253.86	251.33	248.66	245.89	243.02	240.07	233.95	227.58	221.00	...
425	259.79	259.51	258.54	256.65	254.56	252.31	249.95	247.49	244.95	242.33	236.91	231.26	225.42	...
450	259.81	259.57	258.70	257.01	255.14	253.14	251.03	248.83	246.57	244.23	239.39	234.35	229.14	...
475	259.83	259.61	258.83	257.32	255.64	253.84	251.94	249.97	247.94	245.84	241.49	236.96	232.28	...
500	259.85	259.65	258.95	257.58	256.06	254.43	252.72	250.95	249.11	247.21	243.29	239.20	234.92	...
550	259.87	259.71	259.13	258.00	256.74	255.40	253.98	252.51	250.99	249.42	246.17	242.79	239.29	...
600	259.89	259.76	259.27	258.31	257.26	256.13	254.94	253.70	252.42	251.10	248.37	245.53	242.59	...
650	259.91	259.79	259.37	258.56	257.66	256.70	255.68	254.63	253.54	252.41	250.09	247.66	245.15	...
700	259.92	259.82	259.46	258.76	257.98	257.15	256.28	255.37	254.42	253.46	251.45	249.35	247.20	...

Lifestyle table (Table 2)

		Lifestyle index, current round															
		10	20	50	100	150	200	250	300	350	400	500	600	700	800	900	...
Spending amount, current round (in EW)	10	17	24	45	80	115	150	185	220	255	290	360	430	500	570	640	
	20	27	34	55	90	125	160	195	230	265	300	370	440	510	580	650	
	40	47	54	75	110	145	180	215	250	285	320	390	460	530	600	670	
	60	67	74	95	130	165	200	235	270	305	340	410	480	550	620	690	
	80	87	94	115	150	185	220	255	290	325	360	430	500	570	640	710	
	100	107	114	135	170	205	240	275	310	345	380	450	520	590	660	730	
	120	127	134	155	190	225	260	295	330	365	400	470	540	610	680	750	
	140	147	154	175	210	245	280	315	350	385	420	490	560	630	700	770	
	160	167	174	195	230	265	300	335	370	405	440	510	580	650	720	790	
	180	187	194	215	250	285	320	355	390	425	460	530	600	670	740	810	
	200	207	214	235	270	305	340	375	410	445	480	550	620	690	760	830	
	220	227	234	255	290	325	360	395	430	465	500	570	640	710	780	850	
	240	247	254	275	310	345	380	415	450	485	520	590	660	730	800	870	
	260	267	274	295	330	365	400	435	470	505	540	610	680	750	820	890	
	280	287	294	315	350	385	420	455	490	525	560	630	700	770	840	910	...
	300	307	314	335	370	405	440	475	510	545	580	650	720	790	860	930	
	320	327	334	355	390	425	460	495	530	565	600	670	740	810	880	950	
	340	347	354	375	410	445	480	515	550	585	620	690	760	830	900	970	
	360	367	374	395	430	465	500	535	570	605	640	710	780	850	920	990	
	380	387	394	415	450	485	520	555	590	625	660	730	800	870	940	1010	
	400	407	414	435	470	505	540	575	610	645	680	750	820	890	960	1030	
	420	427	434	455	490	525	560	595	630	665	700	770	840	910	980	1050	
	440	447	454	475	510	545	580	615	650	685	720	790	860	930	1000	1070	
	460	467	474	495	530	565	600	635	670	705	740	810	880	950	1020	1090	
	480	487	494	515	550	585	620	655	690	725	760	830	900	970	1040	1110	
	500	507	514	535	570	605	640	675	710	745	780	850	920	990	1060	1130	
520	527	534	555	590	625	660	695	730	765	800	870	940	1010	1080	1150		
540	547	554	575	610	645	680	715	750	785	820	890	960	1030	1100	1170		
560	567	574	595	630	665	700	735	770	805	840	910	980	1050	1120	1190		
580	587	594	615	650	685	720	755	790	825	860	930	1000	1070	1140	1210		
600	607	614	635	670	705	740	775	810	845	880	950	1020	1090	1160	1230		
620	627	634	655	690	725	760	795	830	865	900	970	1040	1110	1180	1250		
⋮																⋮	