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A Idealized Welfare Analysis

A.1 Proof of Theorem 1

To reflect the dependence of WTAs on α, we will define $x^V(z,\theta,\alpha)$, $x_0^V(z,\alpha)$, $x^U(z,\theta,\alpha)$, and $x_0^U(z,\alpha)$ as the solutions to the following equations, which generalize equations (1) through (4):

$$\begin{aligned}
V_1\left(x^V(z,\theta,\alpha)\right) &= \int V_2(\alpha y)dG_z(y,\theta) \\
V_1\left(x_0^V(z,\alpha)\right) &= \int V_2(\alpha y)dF_z(y) \\
U_1\left(x^U(z,\theta,\alpha)\right) &= \int U_2(\alpha y)dG_z(y,\theta) \\
U_1\left(x_0^U(z,\alpha)\right) &= \int U_2(\alpha y)dF_z(y)
\end{aligned}$$

Under our assumptions, these values are unique and differentiable in α.

It is straightforward to verify that the numerator and denominator of the ratio in the theorem both converge to 0 along with α. Accordingly, we apply L'Hospital's rule. Implicitly differentiating the previous four equations, we obtain:

$$\begin{aligned}
\frac{dx^V(z,\theta,\alpha)}{d\alpha} &= \frac{\int yV_2'(\alpha y)dG_z(y,\theta)}{V_1'\left(x^V(z,\theta,\alpha)\right)}, \\
\frac{dx_0^V(z,\alpha)}{d\alpha} &= \frac{\int yV_2'(\alpha y)dF_z(y)}{V_1'\left(x^V(z,\theta,\alpha)\right)}, \\
\frac{dx^U(z,\theta,\alpha)}{d\alpha} &= \frac{\int yU_2'(\alpha y)dG_z(y,\theta)}{U_1'\left(x^V(z,\theta,\alpha)\right)},
\end{aligned}$$

and

$$\frac{dx_0^U(z,\alpha)}{d\alpha} = \frac{\int yU_2'(\alpha y)dF_z(y)}{U_1'\left(x^V(z,\theta,\alpha)\right)}.$$

Accordingly,

$$\begin{aligned}
\lim_{\alpha\to 0}\left[\frac{x^U(z,\theta,\alpha)-x_0^U(z,\alpha)}{x^V(z,\theta,\alpha)-x_0^V(z,\alpha)}\right] &= \lim_{\alpha\to 0}\left[\frac{\dfrac{dx^U(z,\theta,\alpha)}{d\alpha}-\dfrac{dx_0^U(z,\alpha)}{d\alpha}}{\dfrac{dx^V(z,\theta,\alpha)}{d\alpha}-\dfrac{dx_0^V(z,\alpha)}{d\alpha}}\right] \\
&= \lim_{\alpha\to 0}\left[\frac{\dfrac{\int yU_2'(\alpha y)dG_z(y,\theta)}{U_1'\left(x^V(z,\theta,\alpha)\right)}-\dfrac{\int yU_2'(\alpha y)dF_z(y)}{U_1'\left(x^V(z,\theta,\alpha)\right)}}{\dfrac{\int yV_2'(\alpha y)dG_z(y,\theta)}{V_1'\left(x^V(z,\theta,\alpha)\right)}-\dfrac{\int yV_2'(\alpha y)dF_z(y)}{V_1'\left(x^V(z,\theta,\alpha)\right)}}\right] \\
&= \frac{\frac{U_2'(0)}{U_1'(0)}\int y[dG_z(y,\theta)-dF_z(y)]}{\frac{V_2'(0)}{V_1'(0)}\int y[dG_z(y,\theta)-dF_z(y)]} \\
&= \frac{U_2'(0)V_1'(0)}{U_1'(0)V_2'(0)} \\
&\equiv K,
\end{aligned}$$

where the third equality follows from continuity of x^U, x_0^U, x^V, and x_0^V, and continuous differentiability of U_t and V_t.

A.2 Generalization to Non-Expected Utility

If consumers are expected utility (EU) maximizers, then they become risk neutral as $\alpha \to 0$, which raises questions about the applicability of the theorem to settings where risk preferences play a central role, particularly when the pertinent choice data exhibit small-scale risk aversion. Our formulation already admits a departure from expected utility in the following sense: because x is riskless, the differences between V_1 and V_2, and between U_1 and U_2, may reflect a certainty effect (Andreoni and Sprenger, 2012b), rather than or in addition to a timing effect. Accordingly, the formulation is technically consistent with WTA data that display small-scale risk aversion. Also, we have not assumed that these indirect utility functions are derived from primitives compatible with expected utility defined over consumption bundles (although that possibility is obviously subsumed). As we explain below, our theorem is in fact robust with respect to more general violations of EU, which ensures its broad applicability.

First notice that proof works without modification if we replace $dG_z(y,\theta)$ and $dF_z(y)$ with $\omega(y, G_z, \theta)$ and $\omega(y, F_z)$, where ω is a weighting function. Accordingly, the theorem extends immediately to settings with probability weighting, whether state-by-state (as in Kahneman and Tversky (1979)) or

cumulative (as in Tversky and Kahneman (1992)).

Second, one can also modify the proof to accommodate loss aversion. Suppose in particular that $V_2^{'-}(0) = (1+\lambda)V_2^{'+}(0)$, where $V_2^{'-}$ and $V_2^{'+}$ are left-hand and right-hand derivatives, respectively, and similarly for U_2. Then one simply reinterprets $V_2'(0)$ and $U_2'(0)$ as $V_2^{'+}(0)$ and $U_2^{'+}(0)$, respectively, and replaces $\int y[dG_z(y,\theta) - dF_z(y)]$ with $\int y\big(1+\lambda I(y<0)\big)[dG_z(y,\theta) - dF_z(y)]$, where $I(y<0)$ takes on a value of 1 when $y<0$ and 0 otherwise.

The result is therefore robust, accommodating (for example) all the elements of Prospect Theory and Cumulative Prospect Theory. One important qualification is in order, however. The preceding arguments presuppose that the probability weighting function, loss aversion parameter, and reference point are the same for V_2 and U_2. In other words, the generalization to non-EU preferences assumes that these elements of risk preferences are normatively valid, and that errors and biases are confined to V_1 and V_2. We acknowledge that this assumption is potentially controversial.

B Experiment Implementation: Details

In this section we detail the implementation of the experiment. Screenshots of the instructions and the experimental interface are in Appendix E.

Amazon Mechanical Turk Workers log on to AMT through an interface that displays a list of *Human Intelligence Tasks* (HITs), each with a title, an estimated duration, and an estimated remuneration rate. Other HITs include taking surveys, categorizing images, writing product descriptions, and identifying performers on music recordings.

To ensure that subjects were *technically* able to view the videos, we told them at the outset of the study that access to youtube.com was required. We also asked them to reproduce the last word spoken in the welcome video, and the last word of the title slide of whichever treatment video they viewed. Subjects who were not able to complete these tasks correctly were not allowed to continue with the study. The videos were embedded in the survey so that subjects could not find the other treatment videos used in this study.

We ensured that each subject participated in our study only once using the unique identifying numbers assigned by AMT.[52] A subject can only receive payment for participation in the study if she correctly provides this information, and hence has no incentive for misrepresentation.

Initial Financial Literacy Before participating in the main stages of the experiment, subjects completed the unincentivized financial literacy test in Table B.1. This test of financial literacy origi-

[52] Nonetheless, one subject managed to participate in our study twice. Both times, this subject exhibited multiple switching points, and hence is excluded from all analyses.

nated with Lusardi and Mitchell (2009) and van Rooij, Lusardi and Alessie (2011), and has been used in many other studies (Lusardi and Mitchell, 2014).

Attention to the Video Before subjects watched the treatment video, we informed them that, with 25% probability, their earnings would be entirely determined by their performance on a test,[53] and that 'to be able to answer the questions in the test, you need to both understand and know the contents of the video.' We also explained that the video could help them make better decisions both during the experiment and in real life, inasmuch as it was made by 'internationally recognized academic experts on financial decision making.' Finally, we disabled the *continue* button for the duration of the video.

Iterated Multiple Price List Each line of each price list was a binary choice between the future reward and a specified dollar amount to be received no more than two days after completion of the experiment. For the first price list, the immediate payment varied from \$0 to \$20 in increments of \$2. For the second price list, it varied from $\$x$ to $\$(x + 1.8)$ in increments of \$0.20, where $x + 2$ is the smallest amount chosen over the future reward in the first list. (See appendix E for screenshots of the computer interface.) If a subjects' payment was determined according to a price list, the randomization over lines proceeded as follows. A line was randomly selected from the first price list. If that line did not correspond to x (defined above), it was implemented. Otherwise, a random line from the second price list was selected, and the decision for that line was implemented. With this procedure, truthful revelation of preferences is optimal.

Our measure of response time in section 6 is the number of seconds a subject took to complete the first of the two price lists for each task.

Questionnaire Questions concerning decision strategies employed the following wording. Use of the rule of 72 in complexly framed problems: "Sometimes in this experiment, you were given a choice such as 'We will invest \$10 in an account with 1% interest per week. Interest is compounded weekly. We will pay you the proceeds in 72 days.' When deciding about this choice, did you use the rule of 72?"[54] Use of the rule of 72 in simply framed problems: "Sometimes in this experiment, you were given a choice such as 'We will pay you \$20 in 36 days.' When deciding about such a choice, did you use the rule of 72?" In both cases, subjects answered either "Yes", "No", or "I don't know the rule of 72." Number of problems for which the future reward was calculated explicitly: "In total, you were given 10 rounds in which one of the options was something like 'we will invest \$... in an

[53] Hastings et al. (2013) criticize most existing studies that use such test scores as outcome measures on the grounds that the tests are unincentivized. One of the few exceptions is Levy and Tasoff (2016).

[54] The survey question incorrectly described the interest rate as pertaining to a week rather than a day. We believe the meaning of the question was nevertheless clear despite this typo.

account with ...% interest per day. Interest is compounded daily. We will pay you the proceeds in... days.' Out of these 10 rounds, how many times did you explicitly calculate the money amount that this investment would yield within the specified time?" Subjects responded by selecting an integer between 0 and 10. Use of external help on the test: "When you completed the test about the video on financial investing, did you use external resources (such as other websites, books, etc.) to find the right answers?" Subjects answered either "Yes" or "No."

We also asked subjects how much attention they had paid to their choices, how much attention they had paid to the video, whether they had any suggestions about the study, and whether they had experienced any technical difficulties. The overwhelming majority of subjects reported the highest level of attention in answer to both questions—a finding we interpret with caution.

FL1. Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow?
More than $102 (92.86%), Exactly $102 (3.37%), Less than $102 (1.98%), Do not know (1.79%)

FL2. Suppose you had $100 in a savings account and the interest rate is 20 percent per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?
More than $200 (72.62%), Exactly $200 (22.62%), Less than $200 (2.98%), Do not know (1.79%)

FL3. Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, how much would you be able to buy with the money in this account?
More than today (8.33%), exactly the same (6.94%), less than today (1.15%), do not know (3.57%)

FL4. Assume a friend inherits $10,000 today and his sibling inherits $10,000 3 years from now. Who is richer because of the inheritance?
My friend (55.36%), his sibling (9.13%), they are equally rich (29.37%), do not know (6.15%)

FL5. Suppose that in the year 2015, your income has doubled and prices of all goods have doubled too. In 2015, how much will you be able to buy with your income?
More than today (4.76%), the same (89.29%), less than today (4.76%), do not know (1.19%)

Table B.1: Financial Literacy questionnaire. This questionnaire was administered to subjects at the beginning of the survey. Numbers in brackets indicate the percentage of subjects who chose a given answer.

C Demographics

C.1 Summary statistics

Table C.1 presents detailed demographics of our subject pool by treatment, as well as their initial financial literacy.[55] Column 5 lists data for the representative US citizen. Demographic variables are

[55]These statistics only include subjects who did not exhibit multiple switching points in any of the price lists.

taken from the 2010 US Census. Employment variables are for April 2014, and come from the Bureau of Labor Statistics. Financial literacy scores are from Lusardi (2011), and from Bricker et al. (2012) for stock holdings. (Representative data on financial literacy only exist for questions FL1 and FL3.) For empty cells, no representative data are available. Column 6 reports, for each variable, the p-value of an F-test for differences across treatments. The number of significant differences is well within the range we would expect given the number of tests performed.

As reported in section 4, our sample is poorer, better educated, and more likely to live in larger households than the average US citizen. While the incidence of full-time employment in our sample mirrors that of the general population, the fraction of respondents who classify themselves as employed part-time is double that of the general population. Our subjects are also disproportionately male and white, younger, slightly more urban, and more likely to have never been married than the representative US citizen.

C.2 Measures of financial decision-making by demographics

We investigate how our measure of financial competence varies with (self-reported) demographic characteristics of the respondents. We compare this to how financial literacy (as measured by the unincentivized questions in Table B.1) varies with these characteristics, and explore how much of the demographic variation in financial competence remains once we control for financial literacy.[56] Because our dataset is not representative of the general U.S. population, these results should be interpreted with caution.[57]

We measure financial literacy as the number of questions FL1 - FL5 of table B.1 answered correctly, and use only data from subjects in the Control treatment, so that our measures of financial competence are not affected by our treatment interventions.

Column 1 of table C.2 shows how financial literacy relates to demographics in our subject pool. Perhaps due to the relatively small number of subjects, we find only one demographic variable that is significantly related to financial literacy—on average, Hispanics answer one fewer question correctly.

Column 2 shows that several demographic variables are significantly related to the average framing distortion, $d_{j,r,t}$. The bias is attenuated for males, for higher income individuals, and for African Americans. Moreover, the bias is exacerbated for subjects in 2-person households. Of these variables, only income is significantly related to financial competence, C_e (see column 3). Notably, the smaller exponential growth biases among males and African Americans do not translate into higher welfare.

[56] The demographic variables we use here are slightly coarser than those listed in table C.1. This is to ensure that each subgroup is adequately populated.

[57] We also note that financial literacy scores are based on five unincentivized questions whereas measures of financial competence represent 20 incentivized decisions. Thus, we would expect our measure of financial competence to exhibit a larger number of significant correlations with demographics than financial literacy scores.

The demographic patterns we observe partly align with those for financial knowledge that have been noted in the literature (see Lusardi and Mitchell, 2014). In particular, the literature finds that both males and the more highly educated perform better on tests of financial knowledge, while African-Americans, Hispanics, and people residing in rural areas perform worse. It is unclear why in our experiment the smaller exponential growth bias for the more highly educated translates into welfare gains whereas the smaller exponential growth bias for men does not. In contrast to the literature, we fail to find any relation to age. This might be an artifact of the limited age range observed in our sample.[58]

We also investigate how financial literacy relates to financial competence, and how controlling for financial literacy changes the relationships between demographics, framing distortions, and competence. The results are in columns 4 and 5. We first note that financial literacy is significantly positively related to the framing distortion $d_{j,r,t}$, perhaps because the average individual is subject to exponential growth bias, and this bias is attenuated for subjects with higher financial literacy scores. Moreover, the relationship between financial literacy and competence is positive and significant, which shows that these variables tend to measure related attributes. Controlling for financial literacy, however, does not substantially affect the relationships between demographics and either the average framing distortion or competence.

[58] 84.2% of our subjects are between 20 and 40 years of age. The literature finds a hump-shaped relation between financial literacy and age. Age variables remain insignificant in all of the specifications in table C.2 even when we add a quadratic term.

Treatment	(1) Control	(2) Full	(3) Substance only	(4) Rhetoric only	(5) US	(6) p-value
FL1	91.7	93.4	92.2	94.6	65	0.81
FL2	73.4	81.1	73.4	70.5	-	0.27
FL3	81.7	82.1	82.8	84.8	64	0.92
FL4	64.2	57.5	50	58.9	-	0.17
FL5	89.9	96.2	86.7	91.1	-	0.03**
All questions FL1 - FL3 correct	63.3	70.8	61.7	61.6	-	0.41
All questions FL1 - FL5 correct	45	47.2	34.4	40.2	-	0.19
Male	56.9	56.6	60.9	50	49.2	0.40
Age (median)	32	28	29	29	37.2	0.05**
Household Income (median)[a]	35,000	45,000	45,000	45,000	53,046	0.69
Race						
African-american	5.5	7.5	7.8	4.5	13.1	0.66
Asian	11	7.5	12.5	5.4	5.1	0.18
Caucasian	72.5	81.1	71.9	76.8	63.0	0.31
Hispanic	7.3	2.8	3.1	9.8	16.9	0.08*
Other	3.7	.9	4.7	3.6	1.9	0.19
Education						
Less than high school	0	.9	0	0	13.7	-
High school	11.9	13.2	14.8	14.3	31.0	0.92
Vocational / technical	8.3	7.5	7.8	2.7	8.6	0.11
Some college	36.7	34.9	32.8	43.8	19.3	0.35
College	36.7	38.7	37.5	33.9	18.0	0.09*
Graduate degree	6.4	4.7	7	5.4	9.3	0.88
Employment						
Full time employed	49.5	50	47.7	42.9	48.2[b]	0.66
Part time employed	22.9	20.8	25.8	26.8	10.6[c]	0.74
Marital Status[d]						
Never married	65.1	64.2	64.1	64.3	26.9	0.99
Married	30.3	28.3	32	29.5	56.4	0.45
Widowed	0	0	0	0	6.3	-
Divorced	4.6	6.6	3.9	4.5	10.4	0.86
Urban / Rural						
Urban and suburban	83.5	83	89.1	83	80.7	0.38
Rural	16.5	17	10.9	17	19.3	0.38
Household size						
1	12.8	17.9	10.9	18.8	21.7	0.27
2	23.9	21.7	25	24.1	36.3	0.8
3	19.3	14.2	17.2	22.3	16.5	0.59
4 or more	44	46.2	46.9	34.8	25.6	0.24
Owns stocks	22.9	16	20.3	23.2	15.1	0.62
N	109	106	128	112	-	-

Table C.1: Demographics and financial literacy. The sample includes all subjects who completed the study and did not exhibit multiple switching points in any of the treatments. Column 5 presents comparison values for the representative US citizen, whenever they are available. See text for data sources.

[a] In our survey, household income is interval coded. The values stated are the midpoints of the median intervals.
[b] Percentage of civilian noninstitutional population that is full-time employed.
[c] Percentage of civilian noninstitutional population that is part-time employed.
[d] Our questionnaire included the option "Prefer not to say". The three subjects who chose this response are not accounted for in this table.

VARIABLES	(1) Financial literacy	(2) $100 \times d_{j,r,t}$	(3) $-100 \times C_e$	(4) $100 \times d_{j,r,t}$	(5) $-100 \times C_e$
Male	0.193	11.54**	1.242	10.79**	0.900
	(0.247)	(4.610)	(2.743)	(4.588)	(2.751)
Age	0.0124	-0.0982	-0.0143	-0.146	-0.0362
	(0.0148)	(0.248)	(0.142)	(0.245)	(0.141)
Income (in $1000)	0.00406	0.172**	0.126***	0.156**	0.119***
	(0.00452)	(0.0832)	(0.0438)	(0.0776)	(0.0420)
Rural	-0.120	-4.643	-0.849	-4.182	-0.637
	(0.329)	(5.948)	(3.323)	(5.745)	(3.375)
Race					
African American	-0.450	25.17***	-4.240	26.90***	-3.444
	(0.526)	(7.860)	(8.834)	(8.078)	(8.825)
Asian	-0.577	-3.533	-4.270	-1.308	-3.247
	(0.363)	(7.777)	(4.787)	(7.777)	(4.821)
Hispanic	-1.060**	1.021	-4.582	5.106	-2.704
	(0.435)	(7.832)	(3.086)	(8.439)	(3.132)
Other	-0.723	-7.762	-9.009	-4.975	-7.727
	(0.646)	(16.49)	(8.644)	(15.82)	(8.320)
Education					
High school or less	-0.356	11.00*	-2.613	12.37**	-1.982
	(0.583)	(6.082)	(4.988)	(6.202)	(4.948)
Vocational school or some college	0.227	-5.463	-3.500	-6.339	-3.902
	(0.507)	(5.421)	(3.463)	(5.626)	(3.394)
College degree	0.198	-3.947	-0.707	-4.710	-1.057
	(0.492)	(4.183)	(3.065)	(4.319)	(2.942)
Employment					
Full time employed	-0.0122	1.501	-0.0667	1.548	-0.0450
	(0.294)	(5.383)	(3.125)	(5.087)	(3.053)
Part time employed	0.0504	5.271	5.109*	5.077	5.020*
	(0.333)	(6.118)	(2.998)	(5.763)	(2.846)
Marital status					
Widowed or divorced	0.129	8.723	8.797*	8.226	8.569*
	(0.601)	(7.729)	(4.831)	(7.737)	(4.867)
Never married	-0.0696	9.968*	7.631**	10.24*	7.755**
	(0.307)	(5.709)	(3.205)	(5.692)	(3.182)
Household size					
2	0.287	-12.80**	-4.908	-13.91**	-5.416*
	(0.322)	(5.851)	(3.322)	(5.422)	(3.165)
3 to 5	-0.604	12.04	1.899	14.36**	2.969
	(0.460)	(7.345)	(4.518)	(7.206)	(4.521)
6 or more	-0.293	4.533	-1.605	5.663	-1.085
	(0.423)	(6.549)	(4.254)	(6.754)	(4.371)
Owns stocks	-0.0531	-2.362	-1.844	-2.158	-1.750
	(0.325)	(4.483)	(2.901)	(4.285)	(2.773)
Financial literacy score				3.854**	1.772*
				(1.738)	(0.970)
Constant	3.435***	-24.49*	-22.26***	-37.73**	-28.35***
	(0.800)	(13.80)	(7.815)	(15.28)	(8.895)
Observations	109	1,090	1,090	1,090	1,090
Subjects	109	109	109	109	109

Table C.2: Financial literacy, framing distortion, and financial competence by demographics. Excluded categories are *married*, *caucasian*, *urban or suburban*, *graduate degree*, *unemployed* and *single person household*. Only data from subjects in the Control treatment shown. Standard errors clustered by subject. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

D Robustness Checks

In this section we demonstrate the robustness of our results.

First, we report results of the incentivized test on compound interest separately for each question. Notably, the Full intervention significantly increases the fraction of correct responses on the question that is most closely related to our valuation problems at the 5% level, and the Substance-Only intervention does so at the 10% level, but the estimated effect of the Rhetoric-Only intervention is smaller and statistically insignificant.

Second, we demonstrate that our main results (in Table 4) are not attributable either to special features of particular experimental tasks such as the time horizon, or to special subgroups of subjects defined by demographic characteristics, initial levels of financial literacy, degree of responsiveness to variation in experimental stimuli, or degree to which a subject's implied rate of time preference is stable across simply framed tasks.

Third, we adapt our analysis to allow for the possibility that subjects' valuations may be 'fuzzy.' Here we employ two distinct analytic strategies. One is to assume that 'true' valuations are well-defined, and that the fuzziness reflects noisy elicitation, which could in principle mask improvements in welfare. The other strategy is to proceed according to the Bernheim-Rangel welfare framework, treating fuzzy valuations as implying normative ambiguity. Both strategies leave our qualitative conclusions unchanged.

D.1 Effects on individual test questions

We analyze the effect of the treatments on answers to individual test questions in table D.1. The test questions differ by how closely they follow the material in the education intervention, and by how easily they are answered without knowledge of the rule of 72.

Q1 is the only question for which the answer was explicitly given in the education video for the Full and Substance-Only treatments. These treatments also discussed an example that is similar, but not identical, to Q2.[59]

The remaining questions required more flexible thinking. Q3 and Q4 can easily be answered with the rule of 72. Knowledge of this rule, however, is not necessary to answer these questions correctly. Q3 can be answered by iteratively multiplying a starting value with 1.07, and counting the number of iterations required for the amount to increase to the desired value. Likewise, Q4 can be answered by calculating the factor by which an investment grows within 8 years at 9 percent interest (either iteratively, or using the compound interest formula), and then dividing 500 by this number. Q5 is a

[59] The example is: "To double your money in 10 years, what rate of return do you need? The answer: 10 times $X = 72$, so $X = 7.2$ percent."

standard compound interest calculation, and parallels the calculations that need to be made in the complexly framed decision problems.

Table D.1 displays the treatment effects on the success rates for each of these questions. The significant effect of the Full and Substance-Only treatments on the total score appears to derive from questions Q1, Q2, and Q5. The fact that performance in Q5 increased in these treatments is reassuring, as it demonstrates that the increase in test scores is at least partly due to subjects' increased ability to analyze previously unseen problems properly. The increase in test scores for the Rhetoric-Only treatment seems to be due to Q2 and Q4.

Question	Q1	Q2	Q3	Q4	Q5
Level in Control	0.330***	0.220***	0.514***	0.422***	0.477***
	(0.0380)	(0.0402)	(0.0478)	(0.0478)	(0.0474)
Treatment effects					
Full	0.566***	0.619***	0.0617	0.0214	0.174**
	(0.0541)	(0.0573)	(0.0681)	(0.0680)	(0.0674)
Substance-Only	0.584***	0.592***	-0.0372	0.0233	0.109*
	(0.0517)	(0.0548)	(0.0650)	(0.0650)	(0.0644)
Rhetoric-Only	0.0715	0.191***	0.0666	0.114*	0.0497
	(0.0534)	(0.0565)	(0.0671)	(0.0671)	(0.0665)
P(joint insignificance)	0	0	0.313	0.330	0.0587
$P(\beta_{Substance}=\beta_{Rhetoric})$	0	0	0.109	0.162	0.356
$P(\beta_{Full}=\beta_{Rhetoric})$	0	0	0.942	0.173	0.0645
$P(\beta_{Substance}=\beta_{Full})$	0.732	0.623	0.132	0.977	0.317
Observations	455	455	455	455	455

Table D.1: Effects of the education interventions on individual test questions. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

D.2 Alternative specifications and analysis on select subsamples

Demographic control variables We replicate Table 4 with the addition of a vector of demographic control variables. Table D.2 shows that our results are robust to this change.

Timeframes Our main analyses average over choices made in two different investment timeframes. Table D.3 shows that our results obtain within each timeframe, and hence are not driven by a single one of them.

Initial Financial Literacy At the beginning of the survey all subjects answered the questions in table B.1. Of the five questions, the first three are closely related to interest compounding. We classify a subject as highly financially literate if they answer all of the first three questions correctly.

Table D.4 displays our main results separately for subjects with high and low financial literacy, respectively. We find that the effect of the Rhetoric-only intervention on the simply framed choices only applies to subjects with high, but not to those with low financial literacy. This seems to be the reason for the apparently beneficial effect of the Rhetoric-only treatment on financial competence. No such effect is observed for the subsample of subjects with low financial literacy. All other conclusions remain unchanged.

Responsiveness to variation in experimental stimuli Subjects who do not pay close attention to the experiment may fail to vary their responses appropriately in response to changing stimuli. Indeed, in each of our treatments, we found a single subject with no variation in switching points whatsoever. We therefore investigated the possible implications of inertia for our results.

The normalized valuation of a subject who is not sufficiently responsive to variations across the decision problems should be smaller the higher the reward amount. Hence, we estimate each subject's responsiveness by running the following regression, using data on the ten simply framed decision problems (recall that r is a dollar amount to be received in the future):

$$\delta^s_{j,r,t} = \beta^j_0 + \beta^j_1 r + \epsilon_{j,r,t} \tag{7}$$

Note that for a rational utility-maximizing agent with a linear rate of time preference, $\beta^j_1 = 0$. In contrast, $\beta^j_1 < 0$ for any subject whose valuations $V_{j,r,t}$ are constant across all decision problems. We find that $\beta^j_1 \geq 0$ for 57.4% of our subjects. We separately investigate all treatment effects for those subjects who are sufficiently or overly responsive ($\beta^j_1 \geq 0$), and for those who are under-responsive ($\beta^j_1 < 0$).

Table D.5 displays the results separately for the subsamples of insufficiently and sufficiently or overly responsive subjects. Our results are directionally similar for both subsamples. Unsurprisingly, perhaps, treatment effects tend to be smaller for the less responsive subjects, and they are often insignificant (but note that the subsample of insufficiently responsive subjects is smaller).

Stability of implied rate of time preference across decision tasks If valuations are elicited with noise, treatment effects could be masked. To investigate this hypothesis, we classify subjects as *low noise* and *high noise*, as follows. For each simply framed decision we calculate the rate of time preference implied by the subject's choice. For each timeframe, we then calculate the subject-

level standard deviation of these rates of time preference, and average over timeframes. The average standard deviation is 8.14 percentage points amongst all subjects, and 4.25 percentage points amongst low noise subjects.[60] Noisiness displays a modest but statistically significant correlation with financial literacy; the correlation coefficient is 0.17 ($p < 0.001$).

Table D.6 displays our main regressions separately for high-noise and low-noise subjects. The treatment effects on all dependent variables are similar across the two subsamples. Perhaps surprisingly, the high-noise subpopulation has a less severe mean framing distortion than the low-noise subpopulation.

VARIABLES	(1) Test score	(2) $100 \times \delta^c$	(3) $100 \times \delta^s$	(4) $100 \times d$	(5) $100 \times C_e$	(6) $100 \times C_m$
Level in Control	1.379***	58.986***	69.664***	-10.678	14.765***	27.611***
	(0.422)	(8.823)	(7.324)	(7.279)	(3.947)	(4.939)
Treatment effects						
Full	1.386***	13.139***	0.182	12.957***	0.305	-1.258
	(0.181)	(3.462)	(2.921)	(3.248)	(1.969)	(2.296)
Substance-Only	1.205***	4.218	0.471	3.746	-1.186	-1.826
	(0.176)	(3.321)	(2.809)	(2.873)	(1.653)	(2.108)
Rhetoric-Only	0.558***	18.260***	5.244*	13.017***	-2.742*	-4.994**
	(0.184)	(3.561)	(2.979)	(2.879)	(1.610)	(2.047)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0	0.110	0	0.320	0.110
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.170	0.0900	0.990	0.110	0.090
$P(\beta_{Substance} = \beta_{Full})$	0.300	0.0100	0.920	0	0.430	0.790
P(joint insignificance)	0	0	0.00200	0	0.001	0
Observations	455	4,550	4,550	4,550	4,550	4,550
Number of Subjects	455	455	455	455	455	455

Table D.2: Replication of Table 4 with demographic controls. Controls variables are age, gender, race dummies (African-American, Asian, Caucasian, Hispanic, Other), household income, marital status dummies (married, was married, has never been married), education dummies (high school degree or less, vocational degree or some college, college degree), rural dummy, employment dummies (full time, part time, unemployed), household size (two or fewer, 3 to 5, 6 or more), owns stocks dummy. All control variables are self-reported. Standard errors clustered by subject. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

D.3 Welfare analysis adjusting for stochasticity in choice

Here we check the robustness of our results on welfare effects with respect to procedures that explicitly account for stochasticity in choice.

[60] In comparison, a pilot experiment with 38 Stanford undergraduates yielded a standard deviation in implied discount rates for the simply framed rewards of 5.22 percentage points.

VARIABLES	(1) Test score	(2) $100 \times \delta^c$	(3) $100 \times \delta^s$	(4) $100 \times d$	(5) $100 \times C_e$	(6) $100 \times C_m$
A. 36 days timeframe						
Level in Control	1.963***	61.496***	75.874***	-14.378***	11.822***	24.820***
	(0.139)	(2.371)	(2.013)	(2.283)	(1.245)	(1.682)
Treatment effects						
Full	1.442***	14.398***	-0.073	14.470***	0.171	-2.050
	(0.193)	(3.532)	(2.890)	(3.489)	(2.325)	(2.527)
Substance-Only	1.271***	4.213	-0.698	4.910	-0.848	-2.052
	(0.186)	(3.403)	(2.821)	(3.185)	(1.800)	(2.336)
Rhetoric-Only	0.492**	17.639***	4.308	13.331***	-3.055*	-5.417**
	(0.202)	(3.675)	(2.843)	(3.075)	(1.745)	(2.258)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0	0.0800	0.0100	0.220	0.130
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.400	0.130	0.730	0.160	0.160
$P(\beta_{Substance} = \beta_{Full})$	0.350	0	0.830	0.0100	0.670	1
P(joint insignificance)	0	0	0.268	0	0.287	0.109
Observations	455	2,275	2,275	2,275	2,275	2,275
Number of subjects	455	455	455	455	455	455
B. 72 days timeframe						
Level in Control	1.963***	56.401***	68.637***	-12.235***	11.564***	24.076***
	(0.139)	(2.333)	(2.244)	(2.334)	(1.375)	(1.744)
Treatment effects						
Full	1.442***	14.227***	0.876	13.351***	0.139	-1.117
	(0.193)	(3.580)	(3.186)	(3.487)	(2.099)	(2.506)
Substance-Only	1.271***	3.829	0.734	3.095	-2.074	-2.819
	(0.186)	(3.369)	(3.115)	(2.984)	(1.766)	(2.250)
Rhetoric-Only	0.492**	19.541***	6.428**	13.112***	-2.037	-3.885*
	(0.202)	(3.682)	(3.198)	(3.063)	(1.860)	(2.273)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0	0.0700	0	0.980	0.600
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.180	0.0800	0.940	0.280	0.230
$P(\beta_{Substance} = \beta_{Full})$	0.350	0	0.960	0	0.250	0.460
P(joint insignificance)	0	0	0.162	0	0.469	0.325
Observations	455	2,275	2,275	2,275	2,275	2,275
Number of subjects	455	455	455	455	455	455

Table D.3: Panels A and B replicate Table 4 for the subsample of valuation tasks with a 36 days and 72 days timeframe, respectively. Standard errors clustered by subject. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

VARIABLES	(1) Test score	(2) $100 \times \delta^c$	(3) $100 \times \delta^s$	(4) $100 \times d$	(5) $100 \times C_e$	(6) $100 \times C_m$
A. High initial financial literacy						
Level in Control	2.290***	63.115***	75.081***	-11.966***	9.816***	21.648***
	(0.172)	(2.471)	(2.155)	(2.404)	(1.298)	(1.819)
Treatment effects						
Full	1.403***	10.458***	-2.224	12.682***	-0.119	-2.009
	(0.224)	(3.762)	(3.246)	(3.688)	(2.359)	(2.749)
Substance-Only	1.368***	-1.366	-4.670	3.304	-2.056	-3.586
	(0.225)	(3.736)	(3.401)	(3.208)	(1.868)	(2.512)
Rhetoric-Only	0.449*	20.060***	8.483***	11.577***	-3.402**	-5.827**
	(0.248)	(3.845)	(3.021)	(3.132)	(1.680)	(2.395)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0	0	0	0.430	0.340
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.0200	0	0.750	0.140	0.140
$P(\beta_{Substance} = \beta_{Full})$	0.860	0	0.500	0.0100	0.420	0.560
P(joint insignificance)	0	0	0	0	0.179	0.0990
Observations	292	2,920	2,920	2,920	2,920	2,920
Number of subjects	292	292	292	292	292	292
B. Low initial financial literacy						
Level in Control	1.400***	51.761***	67.380***	-15.619***	14.931***	29.278***
	(0.209)	(4.272)	(4.214)	(4.401)	(2.425)	(3.016)
Treatment effects						
Full	1.310***	20.744***	4.792	15.952**	2.120	1.390
	(0.334)	(6.951)	(6.076)	(6.774)	(3.564)	(4.115)
Substance-Only	1.151***	13.175**	7.895	5.279	-0.714	-0.897
	(0.277)	(6.021)	(5.261)	(5.819)	(3.054)	(3.739)
Rhetoric-Only	0.600*	16.732**	0.710	16.022***	-1.398	-3.101
	(0.314)	(6.754)	(5.773)	(5.892)	(3.400)	(3.842)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0.0600	0.600	0.160	0.0500	0.820	0.500
$P(\beta_{Full} = \beta_{Rhetoric})$	0.0400	0.600	0.490	0.990	0.320	0.220
$P(\beta_{Substance} = \beta_{Full})$	0.620	0.280	0.570	0.100	0.380	0.520
P(joint insignificance)	0	0.0120	0.371	0.0190	0.771	0.657
Observations	163	1,630	1,630	1,630	1,630	1,630
Number of subjects	163	163	163	163	163	163

Table D.4: Panels A and B replicate Table 4 for the subsample of subjects with high and low initial financial literacy, respectively. Standard errors clustered by subject. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

VARIABLES	(1) Test score	(2) $100 \times \delta^c$	(3) $100 \times \delta^s$	(4) $100 \times d$	(5) $100 \times C_e$	(6) $100 \times C_m$
A. Inert subjects						
Level in Control	1.979***	56.152***	65.730***	-9.578***	11.009***	23.554***
	(0.195)	(3.781)	(3.540)	(3.420)	(1.864)	(2.385)
Treatment effects						
Full	1.235***	10.166*	-1.323	11.488*	3.960	3.711
	(0.296)	(5.635)	(4.935)	(5.917)	(3.740)	(3.996)
Substance-Only	0.880***	1.563	-0.906	2.469	-0.191	0.178
	(0.274)	(4.910)	(4.743)	(4.494)	(2.440)	(3.031)
Rhetoric-Only	0.042	12.447**	6.511	5.936	-3.001	-4.355
	(0.277)	(6.191)	(5.298)	(4.447)	(2.368)	(3.103)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0.0600	0.140	0.400	0.190	0.100
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.720	0.140	0.320	0.0500	0.0300
$P(\beta_{Substance} = \beta_{Full})$	0.230	0.100	0.930	0.110	0.250	0.340
P(joint insignificance)	0	0.0840	0.423	0.215	0.194	0.138
Observations	194	1,940	1,940	1,940	1,940	1,940
Number of subjects	194	194	194	194	194	194
B. Non-inert subjects						
Level in Control	1.951***	61.149***	77.389***	-16.240***	12.231***	25.151***
	(0.196)	(2.740)	(2.288)	(2.870)	(1.642)	(2.235)
Treatment effects						
Full	1.580***	16.668***	0.681	15.987***	-2.432	-5.176*
	(0.257)	(4.156)	(3.401)	(3.892)	(2.287)	(2.928)
Substance-Only	1.584***	6.039	0.864	5.174	-2.470	-4.519
	(0.247)	(4.354)	(3.333)	(3.893)	(2.285)	(3.061)
Rhetoric-Only	0.818***	22.853***	4.126	18.728***	-2.260	-4.922*
	(0.279)	(4.062)	(3.150)	(3.876)	(2.375)	(2.969)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0	0.320	0	0.930	0.890
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.150	0.300	0.460	0.940	0.930
$P(\beta_{Substance} = \beta_{Full})$	0.990	0.0200	0.960	0	0.990	0.820
P(joint insignificance)	0	0	0.558	0	0.658	0.279
Observations	261	2,610	2,610	2,610	2,610	2,610
Number of subjects	261	261	261	261	261	261

Table D.5: Panels A and B replicate Table 4 for the subsample of more and less inert subjects, respectively. Inertia is defined as follows. For each subject, we regress the implied rate of time preference on the amount of money to be received in the simply framed valuation problems. We define a subject as inert if the slope parameter from this estimation is negative. Note that for a rational agent with linear preferences the slope parameter is 0. Standard errors clustered by Subject. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

VARIABLES	(1) Test score	(2) $100 \times \delta^c$	(3) $100 \times \delta^s$	(4) $100 \times d$	(5) $100 \times C_e$	(6) $100 \times C_m$
A. Noisier half of subjects						
Level in Control	1.825***	58.171***	69.182***	-11.011***	12.942***	27.060***
	(0.178)	(3.127)	(2.584)	(3.237)	(1.709)	(2.049)
Treatment effects						
Full	1.152***	11.424**	-3.663	15.087***	3.910	1.978
	(0.285)	(5.387)	(3.938)	(5.774)	(3.782)	(3.726)
Substance-Only	1.052***	-1.697	-5.383	3.685	-2.295	-3.621
	(0.240)	(4.085)	(3.426)	(4.176)	(2.232)	(2.675)
Rhetoric-Only	0.466*	11.667**	-0.872	12.539***	-3.386	-6.189**
	(0.271)	(5.309)	(4.161)	(4.134)	(2.445)	(2.724)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0.0300	0.0100	0.260	0.0200	0.630	0.300
$P(\beta_{Full} = \beta_{Rhetoric})$	0.0200	0.970	0.530	0.640	0.0600	0.0200
$P(\beta_{Substance} = \beta_{Full})$	0.720	0.0100	0.640	0.0400	0.0900	0.120
P(joint insignificance)	0	0.00900	0.405	0.00400	0.189	0.0490
Observations	228	2,280	2,280	2,280	2,280	2,280
Number of subjects	228	228	228	228	228	228
B. Less noisy half of subjects						
Level in Control	2.115***	59.801***	75.623***	-15.822***	10.324***	21.585***
	(0.216)	(3.313)	(3.284)	(2.987)	(1.763)	(2.530)
Treatment effects						
Full	1.583***	15.962***	1.905	14.057***	-1.892	-2.935
	(0.267)	(4.523)	(4.328)	(3.945)	(2.191)	(3.129)
Substance-Only	1.594***	11.790**	7.897*	3.893	-0.643	-1.465
	(0.275)	(5.196)	(4.495)	(4.155)	(2.520)	(3.497)
Rhetoric-Only	0.499*	25.168***	10.986***	14.182***	-1.571	-2.824
	(0.299)	(4.679)	(3.919)	(4.161)	(2.359)	(3.319)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0	0.0100	0.410	0.0100	0.700	0.670
$P(\beta_{Full} = \beta_{Rhetoric})$	0	0.0400	0.0100	0.970	0.880	0.970
$P(\beta_{Substance} = \beta_{Full})$	0.960	0.410	0.150	0.0100	0.570	0.630
P(joint insignificance)	0	0	0.0120	0	0.826	0.783
Observations	227	2,270	2,270	2,270	2,270	2,270
Number of subjects	227	227	227	227	227	227

Table D.6: Panels A and B replicate Table 4 for the subsample of more and less noisy halves of subjects, respectively. Noisiness is defined as the variance of implied rates of time preference over the simply framed valuation task, separately for each timeframe, and averaged. Standard errors clustered by subject. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

We first examine the consistency exponential growth bias across the ten choice pairs for each individual. If the individual heterogeneity we observe is merely an artifact of noisy decision making, such consistency should be absent. We calculate, separately for each treatment, the Cronbach-α of $d_{j,r,t}$. This statistic is 0.92, 0.92, 0.94, and 0.95 for the Control, Full, Substance-Only and Rhetoric-Only treatments, respectively. These values compare favorably with the standard benchmark of 0.8, indicating a high level of individual consistency.[61] This suggests that the variation in measured framing distortions reflects individual heterogeneity, and consequently that the absence of measurable welfare effects in our setting is not merely due to noisy elicitation.[62]

To explicitly account for stochasticity in choice, we implement two separate procedures. For the first, we impute the expected welfare loss each subject would incur if her choices in the complexly framed problems were just as noisy as those in the simply framed problems. Formally, we calculate the mean and standard deviation of each subject j's normalized valuation for each timeframe t. For each choice pair, we then replace the complexly framed choice with a draw from a normal distribution with the mean and standard deviation estimated for subject j in timeframe t, and calculate the quadratic and absolute deviations. We repeat this calculation 5,000 times, and thus obtain a Monte Carlo estimate of the welfare loss that one would calculate for a complexly framed problem simply as a consequence of the decision noise present in the equivalent simply framed problem. We denote this expected welfare loss by $l^e_{j,t}$ and $l^m_{j,t}$ depending on whether the square or the absolute value is used as distance measure. We then estimate the effects of our interventions on $\tilde{C}_e = C_e - l^e_{j,t}$ and $\tilde{C}_m = C_m - l^m_{j,t}$. (These variables represent the *incremental* welfare loss associated with complex framing.) The results are reported in columns 1 and 2 of table D.7. Our conclusions are qualitatively unchanged, with the exception that the Rhetoric treatment no longer has a significant beneficial effect.

Now we turn to the second procedure through which we account for decision noise. First we calculate each subject's mean normalized valuation in the simply and complexly framed problems, $\bar{\delta}^s_j$ and $\bar{\delta}^c_j$, respectively. Decision noise thereby largely averages out. Our measures of welfare are then given by $\bar{C}_e = (\bar{\delta}^s_j - \bar{\delta}^c_j)^2$ and $\bar{C}_m = |\bar{\delta}^s_j - \bar{\delta}^c_j|$. Columns 3 and 4 of Table D.7 display the results for these alternative measures. Our conclusions are qualitatively unchanged.

[61] For a vector $(X_1, \ldots, X_n)$ of random variables, Cronbach's alpha is defined as $\alpha(X_1, \ldots, X_n) = \frac{n}{n-1}\left[1 - \frac{\sum_i \text{var}(X_i)}{\text{var}(\sum_i X_i)}\right]$. Higher values signify higher internal consistency. The reference level of 0.8 is suggested in Kline (1999).

[62] Consistent with this interpretation, Levy and Tasoff (2016) also find substantial consistency in individual-level exponential growth bias.

VARIABLES	(1) $\tilde{C}_e$	(2) $\tilde{C}_m$	(3) $\bar{C}_e$	(4) $\bar{C}_m$
Level in Control	8.998***	14.639***	7.134***	1.934***
	(1.194)	(1.681)	(1.054)	(0.168)
Treatment effects				
Full	0.778	-0.484	-0.610	-0.172
	(2.004)	(2.388)	(1.501)	(0.240)
Substance-Only	-1.253	-2.255	-1.375	-0.318
	(1.598)	(2.194)	(1.434)	(0.229)
Rhetoric-Only	-1.802	-3.307	-2.913**	-0.542**
	(1.570)	(2.157)	(1.480)	(0.236)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0.710	0.590	0.280	0.330
$P(\beta_{Full} = \beta_{Rhetoric})$	0.180	0.190	0.120	0.120
$P(\beta_{Substance} = \beta_{Full})$	0.290	0.420	0.600	0.530
P(joint insignificance)	0.468	0.379	0.229	0.130
Observations	4,550	4,550	455	455
Number of subjects	455	455	455	455

Table D.7: Welfare analysis adjusting for accounting for stochasticity in choice. Standard errors clustered by subject. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

D.4 Welfare analysis allowing for normative ambiguity

An alternative to treating "fuzzy" valuations as reflecting stochastic expressions of 'true preference' is to interpret them as implying normative ambiguity within the Bernheim and Rangel (2009) framework. The observed variation in discounting is then attributed to subtle differences in framing within the welfare-relevant domain. Here we show how to apply the concept of financial competence in this case. That is, we treat all normalized valuations for a given horizon as normatively valid when analyzing any choice made with the same horizon, and live with the remaining ambiguity.

We let $\underline{\delta}_{j,t} = \min_r\{\delta^s_{j,r,t}\}$ and $\bar{\delta}_{j,t} = \max_r\{\delta^s_{j,r,t}\}$. We assume that, for any given simply framed choice with horizon t, subject j could manifest any $\delta \in [\underline{\delta}_{j,t}, \bar{\delta}_{j,t}]$, depending on framing. A subject's welfare loss from making a complexly framed choice with normalized valuation $\delta^c_{j,r,t}$ is then bounded from above by $C^e_H = \max\{(\delta^c_{j,r,t} - \underline{\delta}_{j,t})^2, (\delta^c_{j,r,t} - \bar{\delta}_{j,t})^2\}$, and bounded from below by $C^e_L = \min\left\{(\delta^c_{j,r,t} - \delta)^2 : \delta \in [\underline{\delta}_{j,t}, \bar{\delta}_{j,t}]\right\}$. Notice that if $\delta^c_{j,r,t} \in [\underline{\delta}_{j,t}, \bar{\delta}_{j,t}]$, then $C^e_L = 0$; otherwise, $C^e_L = \min\{(\delta^c_{j,r,t} - \underline{\delta}_{j,t})^2, (\delta^c_{j,r,t} - \bar{\delta}_{j,t})^2\}$. We similarly define C^m_H and C^m_L by replacing the square with the absolute value in the foregoing.

Table D.8 presents the effects of our treatments on each of these bounds. Again, only the Rhetoric-Only treatment significantly improves welfare (at the 5% level).

VARIABLES	(1) C_L^e	(2) C_H^e	(3) C_L^m	(4) C_H^m
Level in Control	12.148***	14.360***	24.435***	28.524***
	(2.077)	(1.397)	(1.783)	(1.825)
Treatment effects				
Full	1.579	-2.813	0.894	-4.856*
	(2.886)	(1.987)	(2.620)	(2.474)
Substance-Only	-2.729	-1.466	-2.949	-2.859
	(2.373)	(2.077)	(2.242)	(2.492)
Rhetoric-Only	-1.803	-4.561***	-2.957	-6.827***
	(2.538)	(1.748)	(2.342)	(2.335)
$P(\beta_{Substance} = \beta_{Rhetoric})$	0.620	0.100	1	0.0800
$P(\beta_{Full} = \beta_{Rhetoric})$	0.170	0.320	0.120	0.370
$P(\beta_{Substance} = \beta_{Full})$	0.0600	0.520	0.100	0.400
P(joint insignificance)	0.255	0.0590	0.236	0.0270
Observations	4,550	4,550	4,550	4,550
Number of subjects	455	455	455	455

Table D.8: Welfare analysis without WARP. Standard errors clustered by subject. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

E Instructions

This is a research study run by the department of economics at Stanford University.

IMPORTANT

This study may take up to ONE AND A HALF HOURS to complete. Please start this study only if you do have that much time in a single session.

If you do not complete the study, or if the HIT times out on you, we will not be able to pay you. (The HIT is set to time out in 3 hours.)

You will earn $10 just for completing this study. In addition, you will receive up to $20, depending on the decisions you make in this study.

Do not start this study if you do not have access to youtube.com. Some browsers will block embedded videos. Please make sure your browser will display them, as you may otherwise not be able to complete this study.

Click here to start the study: https://stanforduniversity.qualtrics.com/SE/?SID=SV_0GPXNo1f9TX5YIR

Provide the survey code here:

WELCOME

This is a research study run by the department of economics at Stanford University.

IMPORTANT

This study may take up to ONE AND A HALF HOURS to complete. Please start this study only if you do have that much time in a single session.

If you do not complete the study, or if the HIT times out on you, we will not be able to pay you. (The HIT is set to time out in 3 hours.)

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Do not start this study if you do not have access to youtube.com. Some browsers will block embedded videos. Please make sure your browser will display them.

By clicking the button below, you consent to participating in this research study.

Questions, Concerns, or Complaints: If you have any questions, concerns or complaints about this research study, its procedures, risks and benefits, you should ask the Protocol Director, Sandro Ambuehl, sambuehl@stanford.edu

Independent contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Stanford Institutional Review Board (IRB) to speak to someone independent of the research team at (650)-723-2480 or toll free at 1-866-680-2906. You can also write to the Stanford IRB, Stanford University, Stanford, CA 94305-5401

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[There should be a video here. If if does not load, please click here]

Links to researchers' personal homepages

Professor B. Douglas Bernheim

Sandro Ambuehl

To continue, please enter the LAST word that Doug Bernheim said in this video. A continue button will appear after the duration of the video.

>>

Before we start this study, we would like to ask you a few questions about yourself. Please answer these questions truthfully. Your answers will not affect your payment from this experiment.

What is your gender?

- male
- female

What is your age?

What is your ethinicity?

- African-American
- Asian
- Caucasian
- Hispanic
- Other

Please indicate the highest level of education you completed.

- Elementary School
- Middle School
- High School or equivalent
- Vocational/Technical School (2 year)
- Some College
- College Graduate (4 year)
- Master's Degree (MS)
- Doctoral Degree (PhD)
- Professional Degree (MD, JD, etc.)

What is your current marital status?

- Divorced
- Living with another
- Married
- Separated
- Single
- Widowed
- Prefer not to say

Which of the following best describes the area you live in?

- ◯ Urban
- ◯ Suburban
- ◯ Rural

Please indicate your current household income in U.S. dollars

- ◯ Under $10,000
- ◯ $10,000 - $19,999
- ◯ $20,000 - $29,999
- ◯ $30,000 - $39,999
- ◯ $40,000 - $49,999
- ◯ $50,000 - $74,999
- ◯ $75,000 - $99,999
- ◯ $100,000 - $150,000
- ◯ Over $150,000
- ◯ Prefer not to say

Please choose the option that describes your situation best

- ◯ I am unemployed
- ◯ I am employed part-time
- ◯ I am employed full-time

How many people other than you live in your household?

Do you own stocks or bonds?

- ◯ Yes
- ◯ No

>>

Please answer the following questions as well as you can. Your answers to these questions will not affect your payment from this study.

Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, how much would you be able to buy with the money in this account?

- More than today
- Exactly the same
- Less than today
- Do not know

Suppose you had $100 in a savings account and the interest rate is 20 percent per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?

- More than $200
- Exactly $200
- Less than $200
- Do not know

Assume a friend inherits $10,000 today and his sibling inherits $10,000 3 years from now. Who is richer because of the inheritance?

- My friend
- His sibling
- They are equally rich
- Do not know

Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

- More than $102
- Exactly $102
- Less than $102
- Do not know

Suppose that in the year 2015, your income has doubled and prices of all goods have doubled too. In 2015, how much will you be able to buy with your income?

- More than today
- The same
- Less than today
- Do not know

>>

You will now watch a

12-MINUTE VIDEO ABOUT FINANCIAL INVESTING.

Please follow this video carefully.

Please watch the ENTIRE video.

(a "continue" button will appear after 12 minutes.)

Doing so will be useful to you for three reasons:

1. *TEST with PAYMENT FOR CORRECT ANSWERS.*

Your earnings from this experiment may be entirely determined by a test on this video. **The final part of this experiment is a test about the contents of this video. There is a one in four chance that your earnings from this experiment are wholly determined by your performance in this test. The test has 10 questions. For each question you answer correctly, you will receive $1 within at most two days from today. For each question you answer incorrectly, you will receive $0. To be able to answer the questions in the test, you need to both *understand* and *know* the contents of the video. You may scroll back to watch parts of the video multiple times if you wish.**

2. *REMAINDER OF THIS STUDY.*

The video may help you with your decisions in the remainder of this experiment.

In each remaining part of this experiment, you will make financial investment decisions. There is a three in four chance that one of these decisions wholly determines your earnings from this experiment.

3. REAL LIFE

The video may help you with your decisions in real life.

This video was made by internationally recognized academic experts on financial decision making (Burton G. Malkiel, Charles D. Ellis, and B. Douglas Bernheim). This video may help you make financial decisions in your life in general.

>>

PLEASE FOLLOW THIS VIDEO CAREFULLY

PLEASE WATCH THE ENTIRE VIDEO

[Some browsers will ask you whether you want to display this content. Please click "display all content".]

[There should be a video here. If it does not load, please click here.]

To continue, enter the FOURTH word of the FIRST slide of this video. A continue button will appear after the duration of the video.

>>

PLEASE READ THESE INSTRUCTIONS CAREFULLY

The remainder of this experiment consists of 20 rounds of decision making.

Your payment may be determined entirely by ONE RANDOMLY CHOSEN decision you make in this part of the experiment.

This will happen with a three in four chance. Otherwise, your payment is determined by your performance in the test about the video you just watched.

Hence, you should make every decision as if it is the one that counts, because it might be!

>>

PLEASE READ THESE INSTRUCTIONS CAREFULLY

In each round, you will be presented with two lists. The first list will be like the following:

	you will get the specified dollar amount within two days from today	Option X
$20	○	○
$18	○	○
$16	○	○
$14	○	○
$12	○	○
$10	○	○
$8	○	○
$6	○	○
$4	○	○
$2	○	○
$0	○	○

Option X will vary from round to round. For instance, option X may be "get $15 in 8 weeks".

YOUR TASK:
Decide, on each line, whether you prefer the option on the left, or the option on the right.

Most people begin a decision list by preferring the option on the left, and then switch to the option on the right, for instance like this:

	you will get the specified dollar amount within two days from today	Option X
$20	◉	○
$18	◉	○
$16	◉	○
$14	◉	○
$12	◉	○
$10	◉	○
$8	◉	○
$6	○	◉
$4	○	◉
$2	○	◉
$0	○	◉

After you have filled in the first list, you will be shown the second list. This list will have *different payment amounts*, for instance like this:

	you will get the specified dollar amount within two days from today	Option X
$ 7.80	○	○
$ 7.60	○	○
$ 7.40	○	○
$ 7.20	○	○
$ 7	○	○
$ 6.80	○	○
$ 6.60	○	○
$ 6.40	○	○
$ 6.20	○	○
$ 6	○	○

Again, your task is to decide, on each line, whether you prefer the option on the left, or the option on the right.

Read this paragraph if you want to know how the options on the second list are determined.

The options on the second list are determined by the point at which you switched from the left option to the right option in the first list. The second list will display payment amounts that lie between the two amounts at which you switched in the first list. In the above example, you switched between the amounts $6 and $8. Hence, the second list shows amounts between $6 and $8.

>>

PLEASE READ THESE INSTRUCTIONS CAREFULLY

Our payment procedure is designed such that it is in your best interest to choose, on each line of each decision list, the option you genuinely prefer.

Here's why: You'll get exactly what you chose, for one randomly drawn decision.

Read this paragraph if you want to know more details.

Question: When will I be paid according to the first decision list, and when will I be paid according to the second decision list in a round?

Answer: Suppose you filled in the *first* decision list of a round as follows:

	you will get the specified dollar amount within two days from today	Option X
$20	◉	○
$18	◉	○
$16	◉	○
$14	◉	○
$12	◉	○
$10	◉	○
$8	◉	○
$6	○	◉
$4	○	◉
$2	○	◉
$0	○	◉

If the line randomly selected on the *first* list is NOT the line corresponding to $6, you will be paid according to the *first* decision list. Otherwise, you will be paid according to the *second* decision list.

That is, you are paid according to the FIRST decision list whenever the line randomly selected on that list is NOT the first line at which you chose the option on the right. Otherwise, you are paid according to the SECOND decision list.

>>

YOU WILL NOW MAKE YOUR DECISIONS

It is in your best interest to choose as you genuinely prefer. Please think about your choices carefully.

There are no right or wrong choices!

>>

Please choose, on each line, the option you genuinely prefer.

If you pick the option on the LEFT,

you will get the specified dollar amount within two days from today.

If you pick the option on the RIGHT,

we will invest $4.50 in an account with 2% interest per day. Interest is compounded daily. We will pay you the proceeds in 72 days.

You may switch from left to right at most once.

This is the
first
decision list for these options.

	you will get the specified dollar amount within two days from today	we will invest $4.50 in an account with 2% interest per day. Interest is compounded daily. We will pay you the proceeds in 72 days.
$20	○	○
$18	○	○
$16	○	○
$14	○	○
$12	○	○
$10	○	○
$8	○	○
$6	○	○
$4	○	○
$2	○	○
$0	○	○

>>

Please choose, on each line, the option you genuinely prefer.

If you pick the option on the LEFT,

you will get the specified dollar amount within two days from today.

If you pick the option on the RIGHT,

we will invest $4.50 in an account with 2% interest per day. Interest is compounded daily. We will pay you the proceeds in 72 days.

You may switch from left to right at most once.

This is the
second
decision list for these options.

	you will get the specified dollar amount within two days from today	we will invest $4.50 in an account with 2% interest per day. Interest is compounded daily. We will pay you the proceeds in 72 days.
$ 9.8	○	○
$ 9.6	○	○
$ 9.4	○	○
$ 9.2	○	○
$ 9	○	○
$ 8.8	○	○
$ 8.6	○	○
$ 8.4	○	○
$ 8.2	○	○
$ 8	○	○

>>

TEST

You will now participate in a test about the video you have watched at the beginning of the experiment. The test has 10 questions.

There is a one in four chance that your earnings from this study are entirely determined by your performance in this test.

IF you are randomly chosen to be paid according to this test, THEN: For each question you answer correctly, you will earn $1. For each question you answer incorrectly, you will earn $0. You will be paid within at most two days from today.

>>

What is an "indexing" investment strategy?

- Buying index funds, which hold assets that have been indexed as particularly profitable by financial experts
- Buying index funds, which hold stocks of companies that provide information about the stock market as a whole (stock market indices)
- Buying index funds, which hold the market portfolio
- Buying index funds, which hold optimally diversified, custom tailored portfolios

Paul had invested his money into an account which paid 9% interest per year (interest is compounded yearly). After 8 years, he had $500. How big was the investment that Paul had made 8 years ago?

- $200
- $210
- $220
- $230
- $240
- $250
- $260
- $270
- $280
- $290
- $300
- $310
- $320
- $330
- $340
- $350
- $360
- $370
- $380
- $390
- $400

if the interest rate is 10% per year (interest is compounded yearly), how many years does it take until an investment doubles?

- 7 years
- 7.2 years
- 7.4 years
- 7.8 years
- 8 years

If an investment grows at 8 percent per year (interest is compounded yearly), by how much has it grown after 4 years?

- by 30%
- by 31%
- by 32%
- by 33%
- by 34%
- by 35%
- by 36%
- by 37%
- by 38%
- by 39%
- by 40%

Which of the following quotes is attributed to Benjamin Franklin?

- Compound interest is the most powerful force in the universe
- Youth is wasted on the young
- Money makes money. And the money that money makes, makes money

What percentage of mutual funds tends to be outperformed by the market (S&P 500 Index) each year?

- between 10 and 30%
- between 30 and 50%
- between 50 and 70%
- between 70 and 90%

If the interest rate is 7% per year (interest is compounded yearly), about how long does it take until an investment has grown by a factor of four (i.e. is four times as large as it was originally)?

- about 5 years
- about 10 years
- about 15 years
- about 20 years
- about 25 years
- about 30 years
- about 25 years
- about 30 years
- about 35 years
- about 40 years

Which quote is attributed to the author Upton Sinclair

- Only liars manage always to be out of the market during bad times and in during good times.
- It is difficult to get a man to understand something when his salary depends upon his not understanding it.
- There are three classes of people who do not believe that markets work: the Cubans, the North Koreans, and active managers.
- Nobody knows more than the market

If somebody tells you an investment should double in four years, what rate of return (per year) is he promising?

- 15%
- 16%
- 17%
- 18%
- 19%
- 20%

Professional investors as a whole are responsible for what percentage of stock market trading?

- 30%
- 50%
- 70%
- 90%

>>

Please answer the following questions truthfully. Your answers to these questions DO NOT AFFECT YOUR PAYMENT for this study.

How much attention did you pay to your choices?

- ◯ I paid quite a bit of attention for all of my choices.
- ◯ For some choices I paid attention, for others I didn't pay much attention
- ◯ I clicked through most of the choices without paying much attention.

At the beginning of the experiment, we asked you to watch a video about financial investing. Please indicate which of the following describes your situation best

- ◯ I watched the entire video, and paid close attention
- ◯ I watched the entire video, but sometimes didn't pay attention
- ◯ I skipped parts of the video, because I already knew the material
- ◯ I skipped parts of the video, because it was boring (but I did not already know the material)
- ◯ I did not watch the video.

Sometimes in this experiment, you were given a choice such as "We will invest $10 in an account with 1% interest per day. Interest is compounded weekly. We will pay you the proceeds in 72 days." When deciding about this choice, did you use the rule of 72?

- ◯ Yes
- ◯ No
- ◯ I don't know the rule of 72

Sometimes in this experiment, you were given a choice such as "We will pay you $20 in 36 days." When deciding about such a choice, did you use the rule of 72?

- ◯ Yes
- ◯ No
- ◯ I don't know the rule of 72

In total, you were given 10 rounds in which one of the options was something like "we will invest $... in an account with ...% interest per week. Interest is compounded weekly. We will pay you the proceeds in … days". Out of these 10 rounds, how many times did you explicitly calculate the money amount that this investment would yield within the specified time?

When you completed the test about the video on financial investing, did you use external resources (such as other websites, books, etc.) to find the right answers?

- ◯ Yes
- ◯ No

Do you have any suggestions for us about this experiment?

Did you experience any technical difficulties with this study?

>>

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