Appendix A: Instructions (Online Working Paper)

A.1. Risk Preferences

Choices Over Risky Prospects

This is a task where you will choose between prospects with varying prizes and chances of winning. You will be presented with a series of pairs of prospects where you will choose one of them. For each pair of prospects, you should choose the prospect you prefer to play. You will actually get the chance to play **one** of the prospects you choose, and you will be paid according to the outcome of that prospect, so you should think carefully about which prospect you prefer.

Here is an example of what the computer display of such a pair of prospects might look like.

The outcome of the prospects will be determined by the draw of a random number between 1 and 100. Each number between, and including, 1 and 100 is equally likely to occur. In fact, you will be able to draw the number yourself using two 10-sided dice.

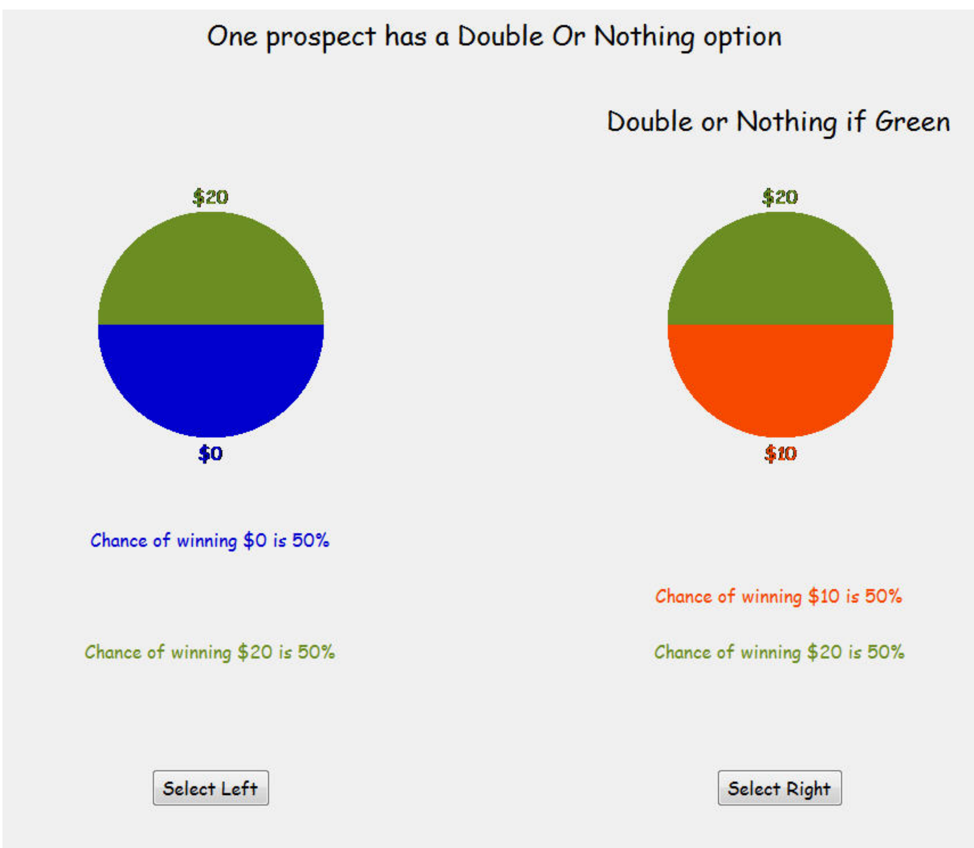
Although not shown in this example, in the top left corner of your computer screen you can see how many choices you will be asked to make today.

In this example the left prospect pays five dollars ($5) if the number drawn is between 1 and 40, and pays fifteen dollars ($15) if the number is between 41 and 100. The blue color in the pie chart corresponds to 40% of the area and illustrates the chances that the number drawn will be between 1 and 40 and your prize will be $5. The orange area in the pie chart corresponds to 60% of the area and illustrates the chances that the number drawn will be between 41 and 100 and your prize will be $15.

Now look at the pie in the chart on the right. It pays five dollars ($5) if the number drawn is between 1 and 50, ten dollars ($10) if the number is between 51 and 90, and fifteen dollars ($15) if the number is between 91 and 100. As with the prospect on the left, the pie slices represent the fraction of the possible numbers which yield each payoff. For example, the size of the $15 pie slice is 10% of the total pie.

Each pair of prospects is shown on a separate screen on the computer. On each screen, you should indicate which prospect you prefer to play by clicking on one of the buttons beneath the prospects.

You could also get a pair of prospects in which one of the prospects will give you the chance to play "Double or Nothing." For instance, the right prospect in the next screen image pays "Double or Nothing" if the Green area is selected, which happens if the number drawn is between 51 and 100. The right pie chart indicates that if the number is between 1 and 50 you get $10. However, if the number is between 51 and 100 a coin will be tossed to determine if you get double the amount. If it comes up Heads you get $40, otherwise you get nothing. The prizes listed underneath each pie refer to the amounts <u>before</u> any "Double or Nothing" coin toss.

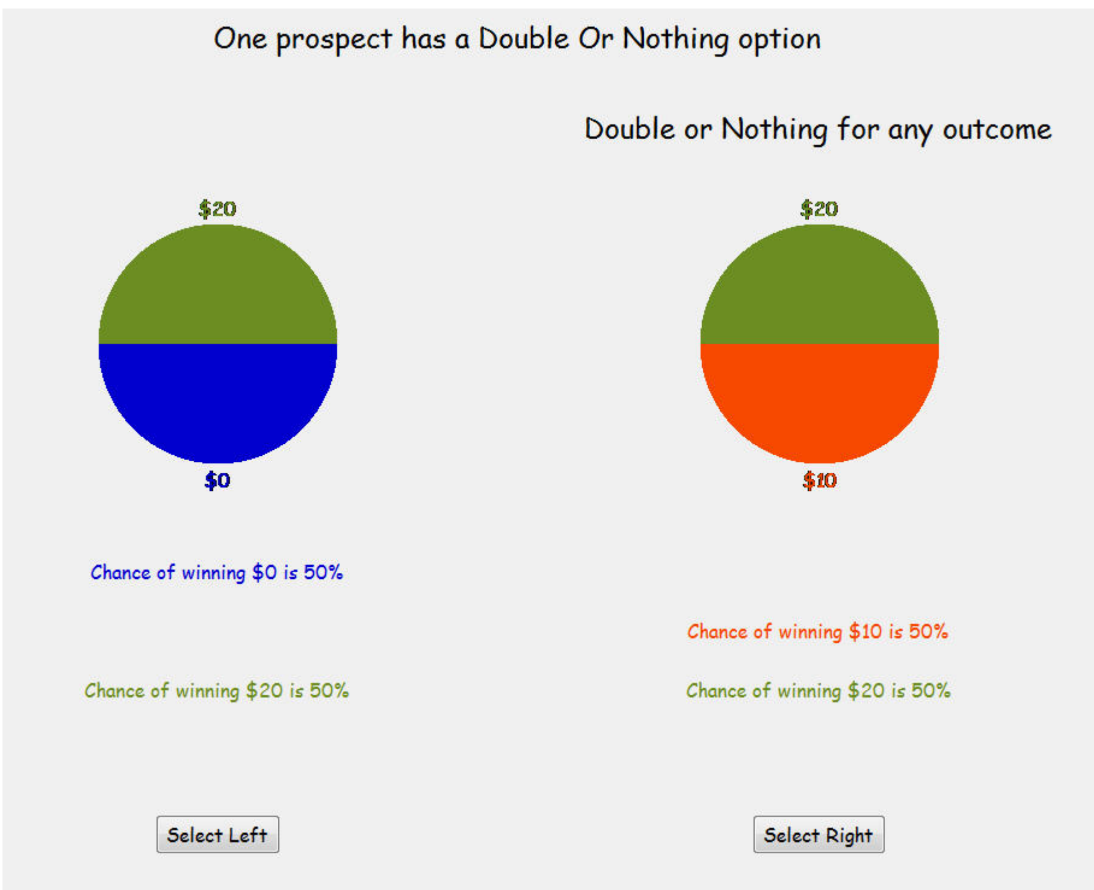


After you have worked through all of the pairs of prospects, raise your hand and an experimenter will come over. You will then roll two 10-sided dice until a number comes up to determine which pair of prospects will be played out. If there are 40 pairs we will roll the dice until a number between 1 and 40 comes up, if there are 80 pairs we will roll until a number between 1 and 80 comes up, and so on. Since there is a chance that any of your choices could be played out for real, you should approach each pair of prospects as if it is the one that you will play out. Finally, you will roll the two ten-sided dice to determine the outcome of the prospect you chose, and if necessary you will then toss a coin to determine if you get "Double or Nothing."

For instance, suppose you picked the prospect on the left in the last example. If the random number was 37, you would win $0; if it was 93, you would get $20.

If you picked the prospect on the right and drew the number 37, you would get $10; if it was 93, you would have to toss a coin to determine if you get "Double or Nothing." If the coin comes up Heads then you get $40. However, if it comes up Tails you get nothing from your chosen prospect.

It is also possible that you will be given a prospect in which there is a "Double or Nothing" option no matter what the outcome of the random number. This screen image illustrates this possibility.



Therefore, your payoff is determined by four things:

- by which prospect you selected, the left or the right, for each of these pairs;
- by which prospect pair is chosen to be played out in the series of pairs using the two 10-sided dice;
- by the outcome of that prospect when you roll the two 10-sided dice; and
- by the outcome of a coin toss if the chosen prospect outcome is of the "Double or Nothing" type.

Which prospects you prefer is a matter of personal taste. The people next to you may be presented with different prospects, and may have different preferences, so their responses should not matter to you. Please work silently, and make your choices by thinking carefully about each prospect.

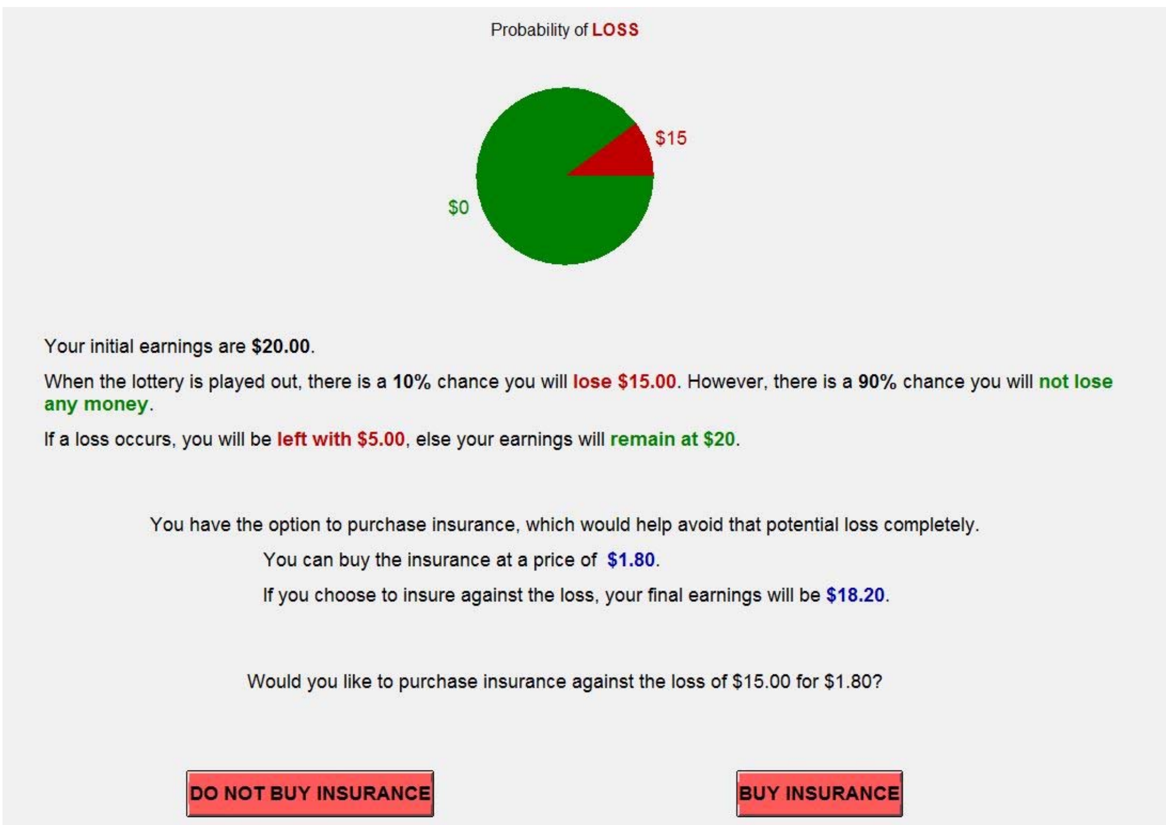
All payoffs are in cash, and are in addition to the show-up fee that you receive just for being here.

A.2. Control Treatment for Insurance Choices

Choices Over Insurance Prospects

In this task you will be asked to make a series of insurance decisions. For each decision, you will start off with an initial amount of money. You will then be presented with the probability and value of a potential loss, as well as the price of the insurance you could purchase to avoid that loss. You have to decide if you want to purchase the insurance that would protect you if that loss should occur. There are 16 decisions to be made in this task. After all the decisions have been made, you will actually get the chance to play out one of the insurance decisions you make. You will be paid according to the outcome of that event, so you should think carefully about how much the insurance is worth to you.

Here is an example of what your decision would look like on the computer screen.



In this lottery, there is a 10% chance you will experience a loss of fifteen dollars ($15) that corresponds with the red portion of the pie, and a 90% chance you will experience no loss ($0) that corresponds with the green portion of the pie. Since you start out with $20, this means there is a 90% chance your earnings remain at $20, but there is a 10% chance you will lose $15, which would leave you with $5.

You are given the option to buy insurance to protect yourself against the potential loss in this lottery. You should decide if you want the insurance before you know if a loss will occur. In this example, the insurance will cost you $1.80. This is full insurance: if you purchase the insurance and a loss should occur, the insurance will cover the full loss and your net earnings will be your initial earnings of $20 less the price paid for the insurance, $1.80, which is $18.20. If you choose to purchase insurance and there was no loss you would still need to pay for the $1.80 insurance, and your net earnings will be $18.20.

Each decision you have to make is shown on a separate screen on the computer. For each decision, you should indicate your choice to purchase, or not purchase the insurance, by clicking on your preferred option.

We will use die rolls to determine the outcome of the lottery. After everyone has worked through all of the insurance decisions, please raise your hand and wait in your seat, and an experimenter will come to you.

You will then roll a 20-sided die to determine which insurance decision will be played out. Since there are only 16 decisions, you will keep rolling the die until a number between 1 and 16 comes up. There is an equal chance that any of your 16 choices could be selected, so you should approach each decision as if it is the one that you will actually play out to determine your payoff.

Once the decision to play out is selected, you will roll the 10-sided die to determine the outcome of the lottery. In this example the probability of experiencing a loss is 10%. If a 0 is rolled on the die, a loss event has occurred. If a number 1 to 9 is rolled, then there is no loss. If the probability of experiencing a loss is 20%, then a loss event has occurred if the die roll is a 0 or 1, and no loss has occurred if the die roll is from 2 to 9, and so on.

In the example, if you had chosen **not to purchase insurance** and you rolled a 7 on the die, you would receive $20. If you had rolled a 0, you would receive $5.

If you had **chosen to purchase insurance**, you would receive $18.20.

Therefore, your payoff is determined by three factors:

- whether or not you chose to buy insurance for each of the 16 decisions;
- the decision selected to actually be played out using a 20-sided die; and
- whether or not there is a loss based on the die roll from a 10-sided die.

Whether or not you prefer to buy the insurance is a matter of personal taste. You may choose to buy insurance on some or all of your 16 choices, or none of the choices. The people next to you may be presented with different choices, and may have different preferences, so their responses should not matter to you. Please work silently, and make your choices by thinking carefully about each prospect.

All payoffs are in cash, and are in addition to the show-up fee that you receive just for being here, as well as any other earnings in other tasks.

Are there any questions?

A.3. Non-performance Treatment for Insurance Choices

Choices Over Insurance Prospects

In this task you will be asked to make a series of insurance decisions. For each decision, you will start off with an initial amount of money. You will then be presented with the probability and value of a potential loss, as well as the price and payout of the insurance you could purchase to avoid that loss. You have to decide if you want to purchase the insurance that would protect you if that loss should occur. There are 32 decisions to be made in this task. After all the decisions have been made, you will actually get the chance to play out one of the insurance decisions you make. You will be paid according to the outcome of that event, so you should think carefully about how much the insurance is worth to you.

Here is an example of what your decision would look like on the computer screen.

In this lottery, there is a 10% chance you will experience a loss of fifteen dollars ($15). The possible outcomes for you correspond with the possible outcomes in the red and green pie. In this example the red portion of the pie represents the 10% chance that you will experience a $15 loss and be left with $5, and the green portion of the pie corresponds to the 90% chance that you will experience no loss ($0) and your earnings will remain at $20.

You are given the option to buy insurance to protect yourself against the potential loss in this lottery. You should decide if you want the insurance before you know if a loss will occur. In this example, the insurance will cost you $1.80 and will fully cover the loss. Regardless of the loss outcome, your net earnings will be your initial earnings of $20 less the price paid for the insurance, \$1.80, which is \$18.20. There is a chance, however, that the insurance company may go bankrupt. If that happens, the insurance company will not be able to fully compensate for the loss if a loss occurs. In this example if the insurance company goes bankrupt it will only pay out 40% of the loss should a loss occur, which is \$6 (40% × \$15 = \$6). If you experience a loss and the insurance company goes bankrupt your final earnings will be your initial earnings less the premium paid less the loss and adding back any payout received from the insurance company, which is \$9.20 in this example (\$20 - \$1.80 - \$15 + \$6 = \$9.20).

The blue pie shows the bankruptcy probabilities of the insurance company. In this example the light blue portion of the pie represents the 20% chance that the insurance company goes bankrupt. If there is a loss, the company can only pay out 40% of the losses and you will be left with \$9.20. The dark blue portion of the pie corresponds to the 80% chance that the insurance company does not go bankrupt. If there is a loss, the insurance company will fully compensate for the \$15 loss and your earnings will be your initial earnings of \$20 less the premium of \$1.80, which is \$18.20. If there is no loss, your earnings will remain at \$18.20 regardless of the outcome of the bankruptcy. The bankruptcy event is independent of the loss. The probability of bankruptcy is not affected by the probability of loss and *vice versa*.

Each decision you have to make is shown on a separate screen on the computer. For each decision, you should indicate your choice to purchase, or not purchase the insurance, by clicking on your preferred option.

We will use die rolls to determine the outcome of the lottery. After everyone has worked through all of the insurance decisions, please raise your hand and wait in your seat, and an experimenter will come to you.

You will then roll two 10-sided dice to determine which insurance decision will be played out. Since there are only 32 decisions, you will keep rolling the dice until a number between 1 and 32 comes up. There is an equal chance that any of your 32 choices could be selected, so you should approach each decision as if it is the one that you will actually play out to determine your payoff.

Once the decision to play out is selected, you will roll the 10-sided die to determine the loss outcome. In this example the probability of experiencing a loss is 10%. If a 0 is rolled on the die, a loss event has occurred. If a number 1 to 9 is rolled, then there is no loss. If the probability of experiencing a loss is 20%, then a loss has occurred if the die roll is a 0 or 1, and no loss has occurred if the die roll is from 2 to 9, and so on.

If you have chosen to purchase insurance and a loss event has occurred, you will roll the 10-sided die to determine the bankruptcy outcome. In this example the probability of bankruptcy is 20%. If a 0 or 1 is rolled on the die, the insurance company has experienced bankruptcy. If a number 2 to 9 is rolled, then the insurance company has not experienced bankruptcy.

Suppose you had chosen **not to purchase insurance** in the example. If you rolled a 7 on the die, for instance, you would receive $20; if you rolled a 0, you would receive $5.

If you had **chosen to purchase insurance** and rolled a 7, you would receive $18.20; if you rolled a 0, you would have to roll the die a second time to determine the bankruptcy outcome. If you had rolled a 6 for instance for the second roll you would receive $18.20; if you had rolled a 1 you would receive $9.20.

Therefore, your payoff is determined by four factors:

- whether or not you chose to buy insurance for each of the 32 decisions;
- the decision selected to actually be played out using two 10-sided dice;
- whether or not there is a loss based on the die roll from a 10-sided dice; and
- whether or not there is bankruptcy based on the die roll from a 10-sided die.

Whether or not you prefer to buy the insurance is a matter of personal taste. You may choose to buy insurance on some or all of your 32 choices, or none of the choices. The people next to you may be presented with different choices, and may have different preferences, so their responses should not matter to you. Please work silently, and make your choices by thinking carefully about each prospect.

All payoffs are in cash, and are in addition to the show-up fee that you receive just for being here, as well as any other earnings in other tasks.

Are there any questions?

A4. Subjective Beliefs Instructions (see Appendix D)

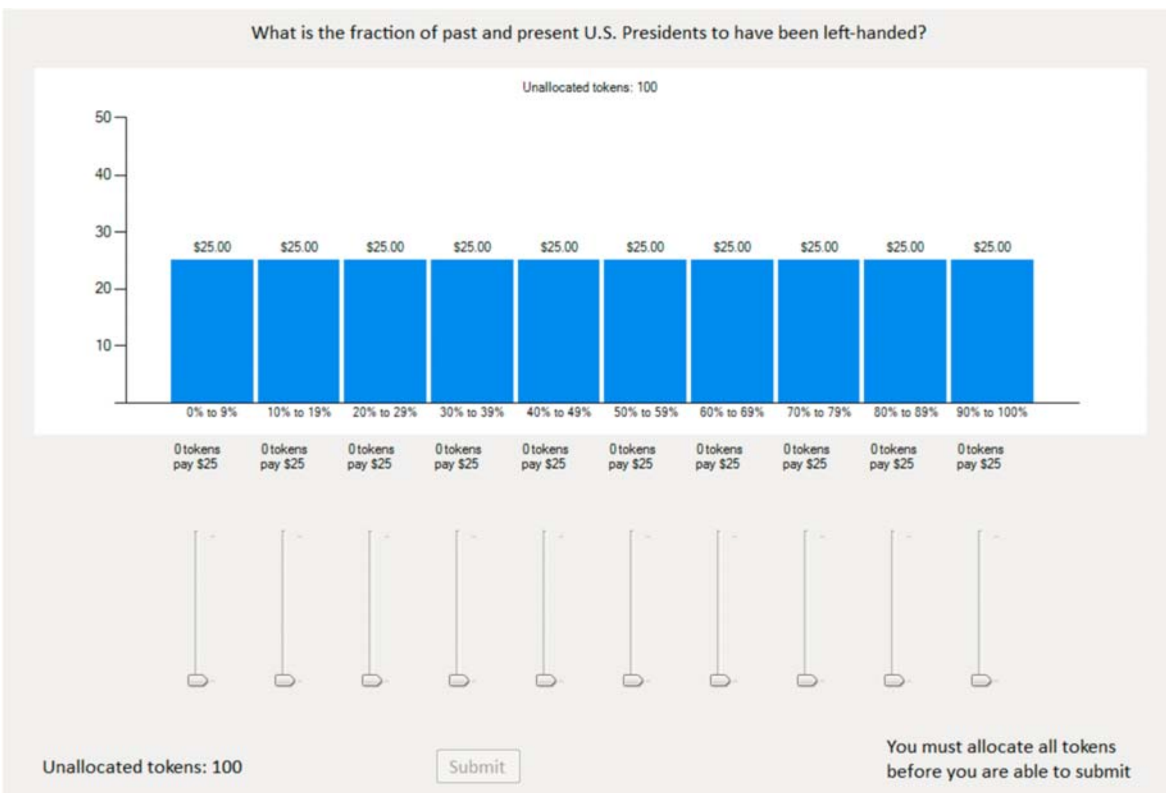
Instructions

This section of the experiment is made up of two tasks that are related. The first task is asking you how accurate your beliefs are about certain things, and the second task is asking you about your preferences for purchasing insurance. You will receive a payout from each stage, so make your choices for each stage carefully. It is important that you understand all instructions before making your choices in this experiment.

The general instructions for the first task are as follows.

This is a task where you will be paid according to how accurate your beliefs are about certain things. You will be presented with some questions and asked to place some bets on your beliefs about the answers to each question. You will be rewarded for your answer to one of these questions, so you should think carefully about your answer to each question. The question that is chosen for payment will be determined after you have made all decisions, and that process is explained below.

Here is an example of what the computer display of a question might look like. We pick a question that is not going to be asked of you, just for illustration.

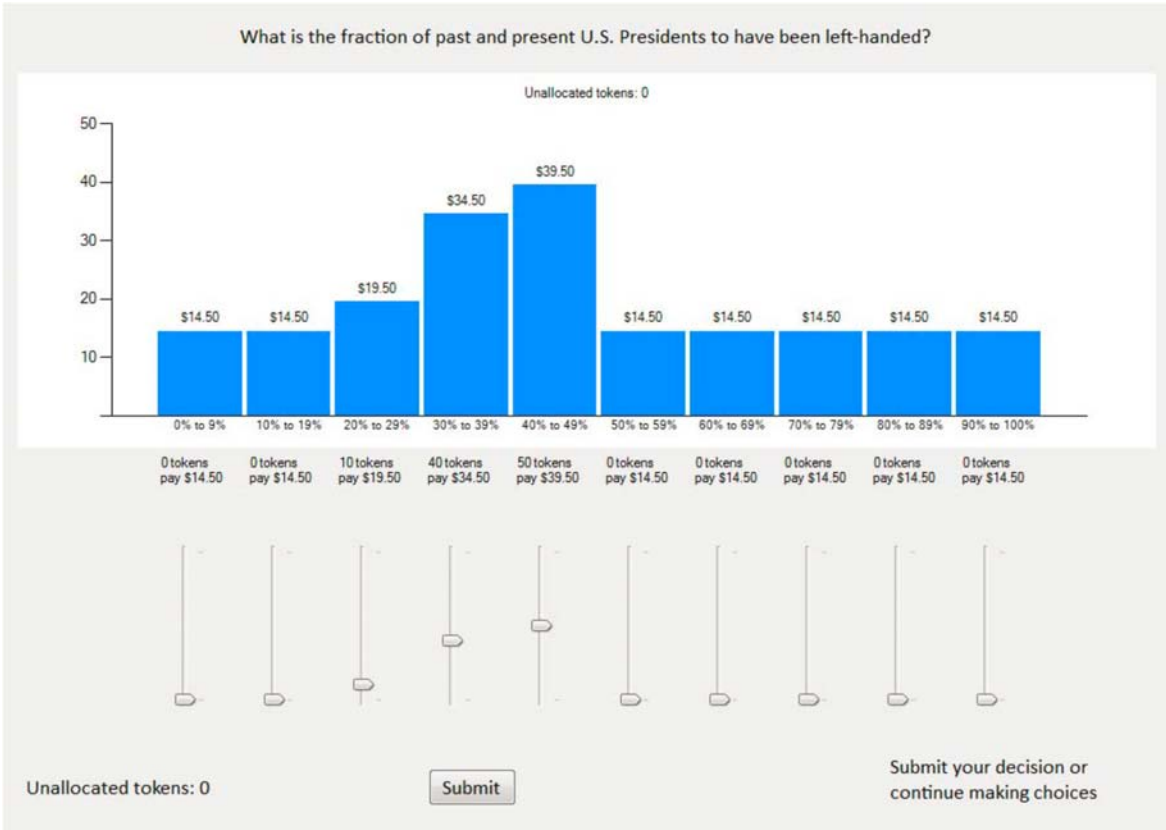


The display on your computer will be larger and easier to read. You have 10 sliders to adjust, shown at the bottom of the screen, and you have 100 tokens to allocate across the sliders. Each slider allows you to allocate tokens to reflect your belief about the answer to this question. You must allocate all 100 tokens, and in this example we start with 0 tokens allocated to each slider. As you allocate tokens, by adjusting sliders, the payoffs displayed on the screen will change. Your earnings are based on the payoffs that are displayed after you have allocated all 100 tokens.

You can earn up to $50 in this task.

Where you position each slider depends on your beliefs about the correct answer to the question. Note that the bars above each slider correspond to that particular slider. In our example, the tokens you allocate to each bar will naturally reflect your beliefs about the proportion of left-handed Presidents. The first bar corresponds to your belief that the proportion is between 0% and 9%. The second bar corresponds to your belief that the proportion is between 10% and 19%, and so on. Each bar shows the amount of money you could earn if the true proportion is in the interval shown under the bar.

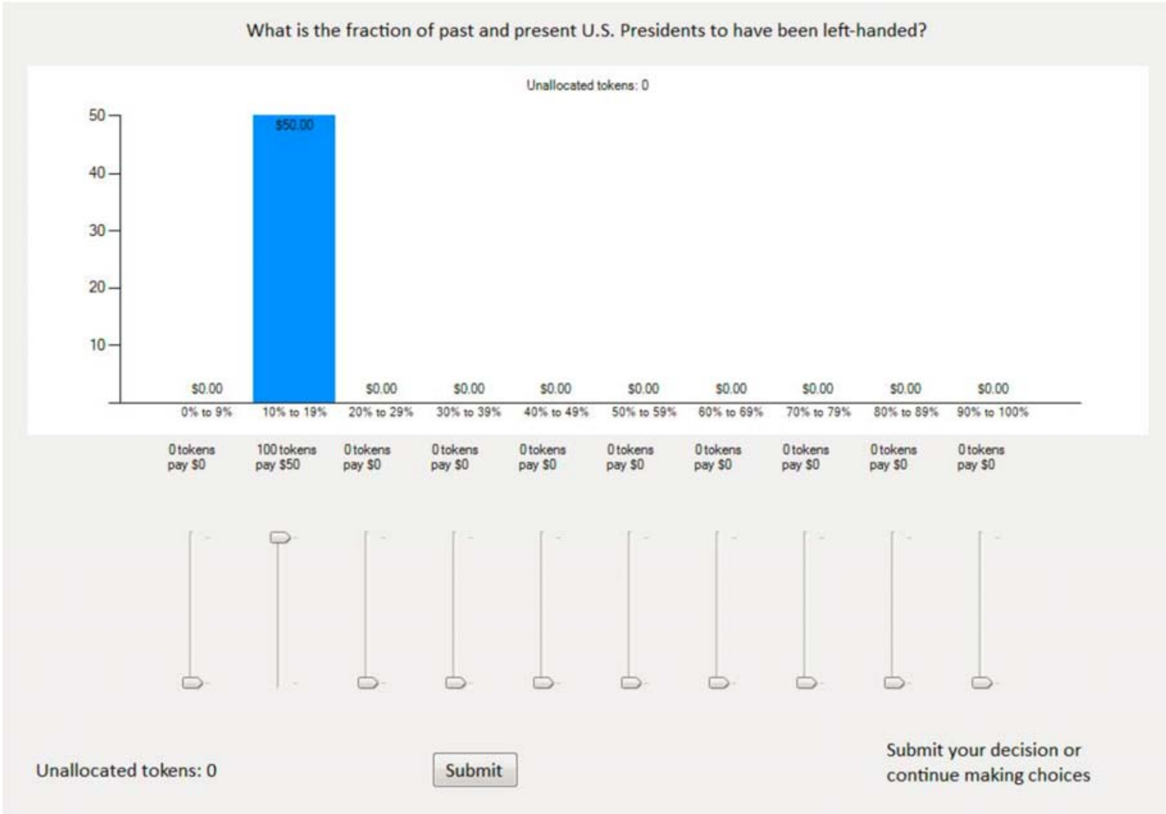
To illustrate how you use these sliders, suppose you think there is a fair chance the true answer is just under 50%. Then you might allocate the 100 tokens in the following way: 50 tokens to the interval 40% to 49%, 40 tokens to the interval 30% to 39%, and 10 tokens to the interval 20% to 29%. So you can see in this picture that if indeed the proportion of left-handed Presidents is between 40% and 49% you would earn $39.50. You would earn less than $39.50 for any other outcome. You would earn $34.50 if the proportion of left-handed Presidents is between 30% and 39%, $19.50 if it is between 20% and 29%, and for any other proportion you would earn $14.50.



You can adjust the allocation as much as you want to best reflect your personal beliefs about the proportion of left-handed Presidents.

Your earnings depend on your reported beliefs and, of course, the true answer. For instance, suppose you allocated your tokens as just shown. The true answer is that there are 8 left-handed Presidents out of 44, so the true proportion is 18.2%, and we would round that to 18%. So if you had reported these beliefs, you would have earned $14.50.

Suppose you had put all of your eggs in one basket, and allocated all 100 tokens to the interval corresponding to a proportion between 10% and 19%. Then you would have faced the earnings outcomes shown here:



Note the "good news" and "bad news" here. Since the proportion of left-handed Presidents is indeed between 10% and 19%, you earn the maximum payoff, shown here as $50. But if the true proportion had been 20%, you would have earned nothing in this task.

It is up to you to balance the strength of your personal beliefs with the possibility of them being wrong. There are three important points for you to keep in mind when making your decisions:

- **First, your belief about the correct answer to each question is a personal judgment that depends on the information you have about the topic of the question.**
- **Second, depending on your choices and the correct answer you can earn up to $50.**
- **Third, your choices might also depend on your willingness to take risks or to gamble.**

The decisions you make are a matter of personal choice. Please work silently, and make your choices by thinking carefully about the questions you are presented with.

When you are satisfied with your decisions, you should click on the **Submit** button and confirm your choices. When you are finished we will roll dice to determine which question will be played out. The experimenter will record your earnings according to the correct answer and the choices you made.

All payoffs are in cash, and are in addition to the show-up fee that you receive just for being here, as well as any other earnings in the session today.

We will now have a video demonstration of how you make decisions in this task, using the same hypothetical example. You can then raise your hand if you need more explanation, or replay these instructions. The actual questions we will ask you to state your beliefs about will be presented after we explain the next task. Here is the video demonstration...

The question we will be asking concerns your beliefs on the composition of colored balls in an urn. You will be presented with 2 urns, urn A and urn B. Each urn contains 100 ping-pong balls which are either red or white. The mixture of colored balls in each urn will remain constant throughout all the tasks. The exact mix of red and white balls in each urn will be unknown to you, but you will receive information about the mixture.

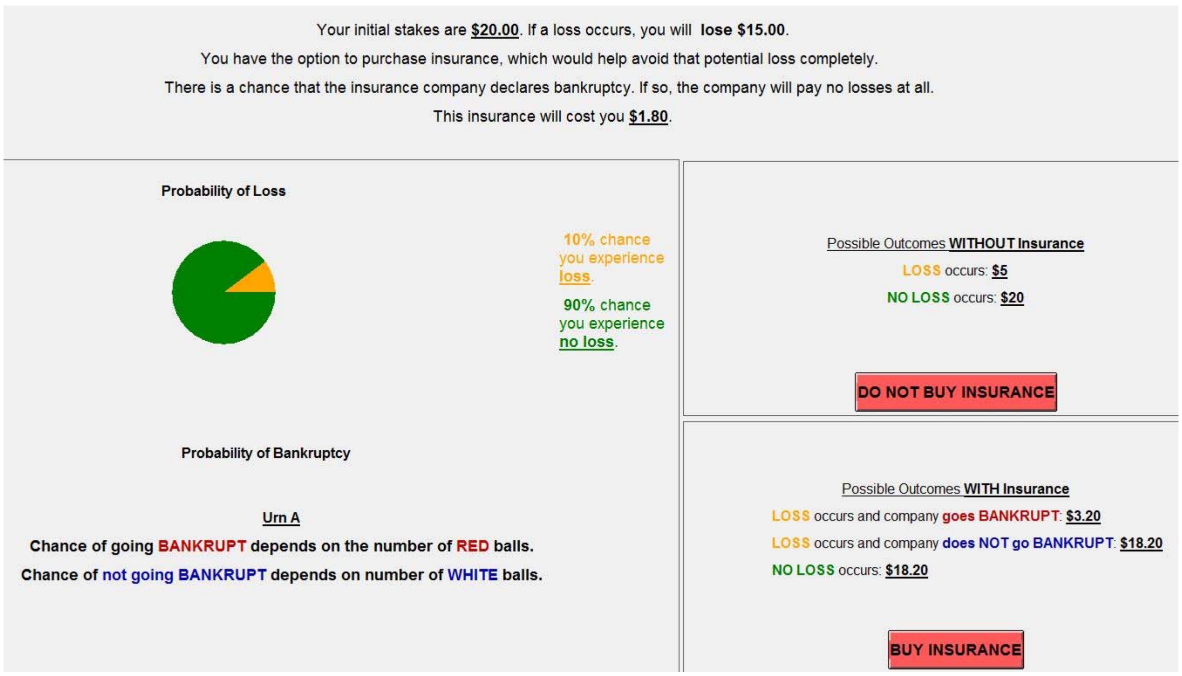
At the end of these two tasks, we will draw 9 balls from each urn. The question you will answer by using the sliders to allocate tokens is "Out of 9 balls drawn from the urn in the final draw, how many balls will be red?" The number of red balls in this **final draw** will determine your earnings in each of the two tasks. There will be 2 rounds of these tasks. Each round will be essentially the same.

In the first round we will draw 9 balls each from urn A and urn B and announce the number of red balls and white balls drawn from each urn. This sample information is the only information you will receive in the first round on the composition of balls in each urn. You will then get the chance to allocate your tokens across the sliders for each urn to reflect your belief about the number of red balls that will be drawn in a final draw. This sample draw is not the **final draw** that will determine your earnings.

After everyone has completed the first task, you will use your beliefs of the composition of balls in urns A and B to help you make a series of decisions to purchase insurance or not in the second task.

In this second task you will be asked to make a series of insurance decisions, just like the ones shown here. For each decision, you will start off with $20. You will then be presented with the probability and value of a potential loss, as well as the price and payout of the insurance you could purchase to avoid that loss. You have to decide if you want to purchase the insurance that would protect you if that loss should occur. After all the decisions have been made, you will actually get the chance to play out one of the insurance decisions you make. You will be paid according to the outcome of that event, so you should think carefully about how much the insurance is worth to you.

This is an example of what your decision would look like on the computer screen, using urn A as an example.



In this lottery, there is a 10% chance you will experience a loss of fifteen dollars ($15). The possible outcomes for you correspond with the possible outcomes in the yellow and green pie. In this example the yellow portion of the pie represents the 10% chance that you will experience a $15 loss and be left with $5, and the green portion of the pie corresponds to the 90% chance that you will experience no loss ($0) and your earnings will remain at $20.

You are given the option to buy insurance to protect yourself against the potential loss in this lottery. You should decide if you want the insurance before you know if a loss will occur. In this example, the insurance will cost you $1.80 and will fully cover the loss. Regardless of the loss outcome, your net earnings will be your initial earnings of $20 less the price paid for the insurance, $1.80, which is $18.20. There is a chance, however, that the insurance company may go bankrupt. If that happens, the insurance company will not compensate for the loss if a loss occurs. If you experience a loss and the insurance company goes bankrupt your final earnings will be your initial earnings less the premium paid less the loss, which is $3.20 in this example ($20 - $1.80 - $15 = $3.20).

The probability of the insurance company going bankrupt depends on the distribution of the **9 final balls** drawn from either urn A or urn B. In this example the balls will be drawn from urn A. The probability of the insurance company going bankrupt is represented by the number of **red** balls among the 9 balls drawn from urn A in the **final draw**. If there is a loss, the insurance company does not compensate for the $15 loss and you will be left with $3.20. The probability of the insurance company **not** going bankrupt is represented by the number of **white** balls among the 9 balls drawn from urn A in the **final draw**. If there is a loss, the insurance company will fully compensate for the $15 loss and your earnings will be your initial earnings of $20 less the premium of $1.80, which is $18.20.

If there is no loss, your earnings will remain at $18.20 regardless of the outcome of the bankruptcy. The bankruptcy event is independent of the loss. The probability of bankruptcy is not affected by the probability of loss and *vice versa*.

Each decision you have to make is shown on a separate screen on the computer. For each decision, you should indicate your choice to purchase, or not purchase the insurance, by clicking on your preferred option.

We will conduct 2 rounds of both tasks. The second round will be just like the first. We will replace the first round sample of 9 balls in each urn, and then draw a new sample of 9 balls. We will again tell you the mix of red and white balls in this new sample draw. You will then again report your beliefs about the number of red balls in the **final** draw, which will occur at the end of the second round. You will also make another series of insurance decisions.

Once both rounds are completed we will conduct the final draw of 9 balls from urns A and B to determine the number of red balls drawn from each urn. We will then use die rolls to select a choice from each task that we will actually play out to determine your payoffs. After all the stages are completed, you will then roll dice to determine which insurance decision will be played out for this stage. There is an equal chance that any of your choices could be selected, so you should approach each decision as if it is the one that you will actually play out to determine your payoff.

Once the decision to play out for this stage is selected, you will roll the 10-sided die to determine the loss outcome. In this example the probability of experiencing a loss is 10%. If a 0 is rolled on the die, a loss event has occurred. If a number 1 to 9 is rolled, then there is no loss. If the probability of experiencing a loss is 20%, then a loss has occurred if the die roll is a 0 or 1, and no loss has occurred if the die roll is from 2 to 9, and so on.

If you have **chosen to purchase insurance** and a loss event has occurred, you will roll the 10-sided die to determine the bankruptcy outcome. The probability of bankruptcy is determined by the number of red balls out of the 9 balls drawn in the **final draw**. In this example the 9 balls drawn from urn A will be used. If the die roll is less than the number of red balls drawn, the insurance company has experienced bankruptcy. If a number larger than or equal to the number of red balls is rolled, then the insurance company has not experienced bankruptcy.

This table lists the bankruptcy outcomes for the die rolls, depending on the number of red balls drawn from the urn.

Number of Red Balls Drawn from Urn	**Percentage Chance of Bankruptcy**	**Die Rolls for Bankruptcy**	**Die Rolls for No Bankruptcy**
0	0%	-	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
1	10%	0	1, 2, 3, 4, 5, 6, 7, 8, 9
2	20%	0, 1	2, 3, 4, 5, 6, 7, 8, 9
3	30%	0, 1, 2	3, 4, 5, 6, 7, 8, 9
4	40%	0, 1, 2, 3	4, 5, 6, 7, 8, 9
5	50%	0, 1, 2, 3, 4	5, 6, 7, 8, 9
6	60%	0, 1, 2, 3, 4, 5	6, 7, 8, 9
7	70%	0, 1, 2, 3, 4, 5, 6,	7, 8, 9
8	80%	0, 1, 2, 3, 4, 5, 6, 7	8, 9
9	90%	0, 1, 2, 3, 4, 5, 6, 7, 8	9

Suppose you had chosen **not to purchase insurance** in the example. If you rolled a 7 on the die, for instance, you would receive $20; if you rolled a 0, you would receive $5.

If you had **chosen to purchase insurance** and rolled a 7, you would receive $18.20; if you rolled a 0, you would have to roll the die a second time to determine the bankruptcy outcome. If there were 4 red balls out of the 9 balls drawn from urn A and you rolled a 9 you would receive $18.20; if you rolled a 2 you would receive $3.20.

Therefore, your payoff is determined by five factors:

- whether or not you chose to buy insurance for each of the decisions;
- the decision selected to actually be played out using dice;
- whether or not there is a loss based on the die roll from a 10-sided die;
- the probability of bankruptcy based on the number of red balls out of the 9 balls drawn from the urn; and
- whether or not there is bankruptcy based on the die roll from a 10-sided die compared to the number of red balls.

Whether or not you prefer to buy the insurance is a matter of personal taste. You may choose to buy insurance on some or all of your choices, or none of the choices. The people next to you may be presented with different choices, and may have different preferences, so their responses should not matter to you. Please work silently, and make your choices by thinking carefully about each prospect.

All payoffs are in cash, and are in addition to the show-up fee that you receive just for being here, as well as any other earnings in other tasks.

Are there any questions?

A.5. Demographics Survey

Q1. What is your AGE?

- ❍ 16 (1)
- ❍ 17 (2)
- ❍ 18 (3)
- ❍ 19 (4)
- ❍ 20 (5)
- ❍ 21 (6)
- ❍ 22 (7)
- ❍ 23 (8)
- ❍ 24 (9)
- ❍ 25 (10)
- ❍ 26 (11)
- ❍ 27 (12)
- ❍ 28 (13)
- ❍ 29 (14)
- ❍ 30 (15)
- ❍ 31 (16)
- ❍ 32 (17)
- ❍ 33 (18)
- ❍ 34 (19)
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- 60 (45)
- 61 (46)
- 62 (47)
- 63 (48)
- 64 (49)
- 65 (50)
- 66 (51)
- 67 (52)
- 68 (53)
- 69 (54)
- 70 (55)
- 71 (56)
- 72 (57)
- 73 (58)
- 74 (59)
- 75 (60)
- 76 (61)
- 77 (62)
- 78 (63)
- 79 (64)
- 80 (65)
- 81 (66)
- 82 (67)
- 83 (68)
- 84 (69)
- 85 (70)
- 86 (71)
- 87 (72)
- 88 (73)
- 89 (74)
- 90 (75)
- 91 (76)
- 92 (77)
- 93 (78)
- 94 (79)
- 95 (80)
- 96 (81)
- 97 (82)
- 98 (83)
- 99 (84)

Q2. What is your sex?

- Male (1)
- Female (2)
- Other (please specify) (3) ________________

Q2_TEXT. What is your sex?
[Text Entry for: Other (please specify)]

Q3. Which of the following categories best describes you?

- ❍ White (1)
- ❍ African-American (2)
- ❍ African (3)
- ❍ Asian-American (4)
- ❍ Asian (5)
- ❍ Hispanic-American (6)
- ❍ Hispanic (7)
- ❍ Mixed Race (8)
- ❍ Other (9) ____________________

Q3_TEXT. Which of the following categories best describes you?
[Text Entry for: Other (please specify)]

Q4_1. What is your major? (select all that apply)
1 = Accounting

Q4_2. What is your major? (select all that apply)
1 = Economics

Q4_3. What is your major? (select all that apply)
1 = Finance

Q4_4. What is your major? (select all that apply)
1 = Business Administration, other than Accounting, Economics, or Finance

Q4_5. What is your major? (select all that apply)
1 = Education

Q4_6. What is your major? (select all that apply)
1 = Engineering

Q4_7. What is your major? (select all that apply)
1 = Health Professions

Q4_8. What is your major? (select all that apply)
1 = Public Affairs or Social Services

Q4_9. What is your major? (select all that apply)
1 = Biological Sciences

Q4_10. What is your major? (select all that apply)
1 = Math, Computer Sciences, or Physical Sciences

Q4_11. What is your major? (select all that apply)
1 = Social Sciences or History

Q4_12. What is your major? (select all that apply)
1 = Humanities

Q4_13. What is your major? (select all that apply)
1 = Psychology

Q4_14. What is your major? (select all that apply)
1 = Other Fields (please elaborate)

Q4_14_TEXT. What is your major? (select all that apply)
[Text entry for: Other Fields (please elaborate)]

Q4_15. What is your major? (select all that apply)
1 = Does not apply

Q5. What is your class standing?
- Freshman (1)
- Sophomore (2)
- Junior (3)
- Senior (4)
- Masters (5)
- Doctoral (6)
- Does not apply (7)

Q6. What is the highest level of education you expect to complete?
- Bachelor's Degree (1)
- Master's Degree (2)
- Doctoral Degree (3)
- First Professional Degree (4)
- High School Diploma or GED (5)
- Less than High School (6)

Q7. What was the highest level of education that your father (or male guardian) completed?
- Less than High School (1)
- GED or High School Equivalency (2)
- High School (3)
- Vocational or Trade School (4)
- College or University (5)
- Don't Know (6)

Q8. What was the highest level of education that your mother (or female guardian) completed?
- ❍ Less than High School (1)
- ❍ GED or High School Equivalency (2)
- ❍ High School (3)
- ❍ Vocational or Trade School (4)
- ❍ College or University (5)
- ❍ Don't Know (6)

Q9. What is your citizenship status in the United States?
- ❍ U.S. Citizen (1)
- ❍ Resident Alien (2)
- ❍ Non-Resident Alien (3)
- ❍ Other Status (please elaborate) (4) ____________________

Q9_TEXT. What is your citizenship status in the United States?
[Text entry for: Other Status (please elaborate)]

Q10. Are you a foreign student on a Student Visa?
- ❍ Yes (1)
- ❍ No (2)

Q11. Are you currently...?
- ❍ Single and never married? (1)
- ❍ Married? (2)
- ❍ Separated, divorced, or widowed? (3)

Q12. On a 4-point scale, what is your current GPA if you are doing a Bachelor's degree, or what was it when you did a Bachelor's degree? This GPA should refer to all of your coursework, not just the current year. (please select one)
- ❍ Between 3.75 and 4.0 GPA (mostly A's) (1)
- ❍ Between 3.25 and 3.74 GPA (about half A's and half B's) (2)
- ❍ Between 2.75 and 3.24 GPA (mostly B's) (3)
- ❍ Between 2.25 and 2.74 GPA (about half B's and half C's) (4)
- ❍ Between 1.75 and 2.24 GPA (mostly C's) (5)
- ❍ Between 1.25 and 1.74 GPA (about half C's and half D's) (6)
- ❍ Less than 1.25 GPA (mostly D's or below) (7)
- ❍ Have not taken course for which grades are given (8)

Q13_1. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = The Global Economy (ECON 2100)

Q13_2. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = Principles of Macroeconomics (ECON 2105)

Q13_3. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = Principles of Microeconomics (ECON 2106)

Q13_4. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = Macroeconomics - CTW (ECON 3900)

Q13_5. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = Microeconomics (ECON 3910)

Q13_6. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = Other (please elaborate)

Q13_6_TEXT. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
[Text entry for: Other (please elaborate)]

Q13_7. We are interested in knowing what kind of background you have in Economics. From the following choices, please select all of the Economics courses that you have taken. (select all that apply)
1 = None

Q14. Where do you live now? That is, where do you stay most often?
- ❍ Your own place (apartment, house, condo, etc.) (1)
- ❍ Parent or Guardian's home (2)
- ❍ Another's home (non-parental relative's or non-related adult's home) (3)
- ❍ Group living arrangement (dormitory, barracks, group home, etc.) (4)
- ❍ Homeless (no regular place to stay) (5)
- ❍ Other (please elaborate) (6) ____________________

Q14_TEXT. Where do you live now? That is, where do you stay most often?
[Text entry for: Other (please elaborate)]

Q15. How many people live in your household? Include yourself, your spouse, and any dependents. Do not include your parents or roommates unless you claim them as dependents. (regardless of your living situation, always include yourself as "1")

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)
- ❍ 6 (6)
- ❍ 7 (7)
- ❍ 8 (8)
- ❍ 9 (9)
- ❍ 10 (10)
- ❍ 11 (11)
- ❍ 12 (12)
- ❍ 13 (13)
- ❍ 14 (14)
- ❍ 15 (15)
- ❍ 16 (16)
- ❍ 17 (17)
- ❍ 18 (18)
- ❍ 19 (19)
- ❍ 20 (20)

Q16. Please select the category below that best describes the total amount of INCOME earned last year by the people in YOUR HOUSEHOLD (as "household" is defined in the previous question). Consider all forms of income, including salaries, tips, interest and dividend payments, scholarship support, student loans, parental support, social security, alimony, child support, and others.

- ❍ $15,000 or under (1)
- ❍ $15,001 - $25,000 (2)
- ❍ $25,001 - $35,000 (3)
- ❍ $35,001 - $50,000 (4)
- ❍ $50,001 - $65,000 (5)
- ❍ $65,001 - $80,000 (6)
- ❍ $80,001 - $100,000 (7)
- ❍ $100,001 - $150,000 (8)
- ❍ Over $150,000 (9)
- ❍ Prefer to not answer (10)
- ❍ Don't Know (11)

Q17. Please select the category below that best describes the total amount of INCOME earned last year by YOUR PARENTS. Again, consider all forms of income, including salaries, tips, interest and dividend payments, scholarship support, student loans, parental support, social security, alimony, child support, and others.

- ❍ $15,000 or under (1)
- ❍ $15,001 - $25,000 (2)
- ❍ $25,001 - $35,000 (3)
- ❍ $35,001 - $50,000 (4)
- ❍ $50,001 - $65,000 (5)
- ❍ $65,001 - $80,000 (6)
- ❍ $80,001 - $100,000 (7)
- ❍ $100,001 - $150,000 (8)
- ❍ Over $150,000 (9)
- ❍ Prefer to not answer (10)
- ❍ Don't Know (11)

Q18. Do you work for pay part-time, full-time, or neither?

- ❍ Part-time (1)
- ❍ Full-time (2)
- ❍ Neither (3)

Q19. How much money do you typically spend each day using cash and your debit card (in dollars)?

[Text entry]

Q20 Do you currently smoke cigarettes?

- ❍ Yes (1)
- ❍ No (2)

Q21. <u>Answered if: *Yes* was selected on Q20.</u> If you do smoke cigarettes, approximately how many cigarettes do you smoke per day?

[Text entry]

Q22_1. How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please select and option on the scale, where 0 means: 'not at all willing to take risks' and the value 10 means: 'very willing to take risks'.

	0 (1)	1 (2)	2 (3)	3 (4)	4 (5)	5 (6)	6 (7)	7 (8)	8 (9)	9 (10)	10 (11)	
Not at all willing to take risks	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Very willing to take risks

Q23. How would you characterize your religious beliefs? Please select the option that best describes your beliefs.
- Atheism (1)
- Buddhism (2)
- Christianity - Baptist (3)
- Christianity - Catholic (4)
- Christianity - Lutheran (5)
- Christianity - Methodist (6)
- Christianity - Other (7)
- Hinduism (8)
- Islam (9)
- Judaism (10)
- Nonreligious or Agnostic (11)
- Prefer to not answer (12)
- Other (please elaborate) (13) ____________________

Q23_TEXT. How would you characterize your religious beliefs? Please select the option that best describes your beliefs.

[Text entry for: Other (please elaborate)]

Q24. Have you recently purchased renters' insurance?
- Yes (1)
- No (2)

Q25. Have you recently purchased homeowners' insurance?
- Yes (1)
- No (2)

Q26. Have you recently purchased auto insurance?
- Yes (1)
- No (2)

Q27. Have you recently purchased health insurance?
- Yes (1)
- No (2)

Q28. Have you recently purchased an extended warranty on any electronics?
- Yes (1)
- No (2)

Appendix B: Risk Lottery Choices (NOT FOR PUBLICATION)

Table B1: Parameters for Double or Nothing Lotteries

Also see text for the Lotteries in Table B2

	Left Lottery						Right Lottery					
Lottery ID	Prize 1	Probability 1	Prize 2	Probability 2	Prize 3	Probability 3	Prize 1	Probability 1	Prize 2	Probability 2	Prize 3	Probability 3
rdon1	$0	0.5	$10	0.5	$20	0	$0	0.5	$10	0.5	$20	0
rdon2	$0	0	$10	1	$20	0	$0	0.5	$10	0.5	$20	0
rdon3	$0	0	$10	1	$35	0	$0	0	$5	0.5	$18	0.5
rdon4	$0	0.25	$10	0.75	$70	0	$0	0	$35	1	$70	0
rdon5	$0	0	$10	1	$70	0	$0	0	$35	1	$70	0
rdon6	$0	0	$20	1	$35	0	$0	0	$10	0.5	$35	0.5
rdon7	$0	0	$20	0.5	$70	0.5	$0	0	$35	0.5	$70	0.5
rdon8	$0	0	$35	1	$70	0	$0	0	$35	0.5	$70	0.5
rdon9	$0	0	$20	0.5	$35	0.5	$0	0.5	$20	0	$70	0.5
rdon10	$0	0	$35	0.75	$70	0.25	$0	0	$35	1	$70	0
rdon11	$0	0	$20	1	$70	0	$0	0	$20	0.5	$35	0.5
rdon12	$0	0	$35	0.75	$70	0.25	$0	0	$35	0.5	$70	0.5
rdon13	$0	0.25	$10	0.75	$35	0	$0	0.5	$18	0.5	$35	0
rdon14	$0	0	$20	0.75	$35	0.25	$0	0	$18	0.5	$35	0.5
rdon15	$0	0	$20	0.75	$70	0.25	$0	0	$35	0.5	$70	0.5

Table B2: Text for Double or Nothing Lotteries

Also see parameters for the Lotteries in Table B1

Lottery ID	Double or Nothing Text
rdon1	Double or Nothing if outcome 2 in right lottery
rdon2	Double or Nothing if outcome 2 in right lottery
rdon3	Double or Nothing for any outcome in right lottery
rdon4	Double or Nothing for any outcome in right lottery
rdon5	Double or Nothing for any outcome in right lottery
rdon6	Double or Nothing if outcome 2 in right lottery
rdon7	Double or Nothing if outcome 2 in right lottery
rdon8	Double or Nothing if outcome 2 in right lottery
rdon9	Double or Nothing if outcome 3 in left lottery
rdon10	Double or Nothing for any outcome in right lottery
rdon11	Double or Nothing if outcome 3 in right lottery
rdon12	Double or Nothing if outcome 2 in right lottery
rdon13	Double or Nothing if outcome 2 in right lottery
rdon14	Double or Nothing if outcome 2 in right lottery
rdon15	Double or Nothing if outcome 2 in right lottery

Table B3: Parameters for Actuarially-Equivalent Lotteries

	Left Lottery						Right Lottery					
Lottery ID	Prize 1	Probability 1	Prize 2	Probability 2	Prize 3	Probability 3	Prize 1	Probability 1	Prize 2	Probability 2	Prize 3	Probability 3
rae1	$0	0.5	$10	0.5	$20	0	$0	0.75	$10	0	$20	0.25
rae2	$0	0	$10	1	$20	0	$0	0.75	$10	0	$20	0.25
rae3	$0	0	$10	1	$35	0	$0	0.5	$10	0.25	$35	0.25
rae4	$0	0.25	$10	0.75	$70	0	$0	0.5	$10	0	$70	0.5
rae5	$0	0	$10	1	$70	0	$0	0.5	$10	0	$70	0.5
rae6	$0	0	$20	1	$35	0	$0	0.25	$20	0.25	$35	0.5
rae7	$0	0	$20	0.5	$70	0.5	$0	0.25	$20	0	$70	0.75
rae8	$0	0	$35	1	$70	0	$0	0.25	$35	0	$70	0.75
rae9	$0	0.25	$20	0.5	$70	0.25	$0	0.5	$20	0	$70	0.5
rae10	$0	0	$35	0.75	$70	0.25	$0	0.5	$35	0	$70	0.5
rae11	$0	0	$20	1	$70	0	$0	0.25	$20	0.5	$70	0.25
rae12	$0	0	$35	0.75	$70	0.25	$0	0.25	$35	0	$70	0.75
rae13	$0	0.25	$10	0.75	$35	0	$0	0.75	$10	0	$35	0.25
rae14	$0	0	$20	0.75	$35	0.25	$0	0.25	$20	0	$35	0.75
rae15	$0	0	$20	0.75	$70	0.25	$0	0.25	$20	0	$70	0.75
ls2_lr	$10	0.3	$30	0	$50	0.7	$10	0.15	$30	0.25	$50	0.6
ls6_lr	$10	0.6	$30	0	$50	0.4	$10	0	$30	1	$50	0
ls7_lr	$10	0.6	$30	0	$50	0.4	$10	0.15	$30	0.75	$50	0.1
ls10_lr	$10	0.5	$30	0	$50	0.5	$10	0.1	$30	0.8	$50	0.1
ls13_rl	$10	0.5	$30	0.4	$50	0.1	$10	0.7	$30	0	$50	0.3
ls15_rl	$10	0.4	$30	0.6	$50	0	$10	0.5	$30	0.4	$50	0.1
ls17_lr	$10	0.1	$30	0	$50	0.9	$10	0	$30	0.25	$50	0.75
ls18_rl	$10	0.1	$30	0.75	$50	0.15	$10	0.4	$30	0	$50	0.6

Table B4: Parameters for the Lotteries Based on Loomes and Sugden [1998]

	Left Lottery						Right Lottery					
Lottery ID	Prize 1	Probability 1	Prize 2	Probability 2	Prize 3	Probability 3	Prize 1	Probability 1	Prize 2	Probability 2	Prize 3	Probability 3
ls2_lr	$10	0.3	$30	0	$50	0.7	$10	0.15	$30	0.25	$50	0.6
ls6_lr	$10	0.6	$30	0	$50	0.4	$10	0	$30	1	$50	0
ls7_lr	$10	0.6	$30	0	$50	0.4	$10	0.15	$30	0.75	$50	0.1
ls10_lr	$10	0.5	$30	0	$50	0.5	$10	0.1	$30	0.8	$50	0.1
ls13_rl	$10	0.5	$30	0.4	$50	0.1	$10	0.7	$30	0	$50	0.3
ls15_rl	$10	0.4	$30	0.6	$50	0	$10	0.5	$30	0.4	$50	0.1
ls17_lr	$10	0.1	$30	0	$50	0.9	$10	0	$30	0.25	$50	0.75
ls18_rl	$10	0.1	$30	0.75	$50	0.15	$10	0.4	$30	0	$50	0.6
ls21_lr	$10	0.7	$30	0	$50	0.3	$10	0.6	$30	0.25	$50	0.15
ls26_rl	$10	0.2	$30	0.6	$50	0.2	$10	0.4	$30	0	$50	0.6
ls29_rl	$10	0.5	$30	0.3	$50	0.2	$10	0.6	$30	0	$50	0.4
ls32_rl	$10	0.7	$30	0.3	$50	0	$10	0.8	$30	0	$50	0.2
ls34_rl	$10	0.1	$30	0.6	$50	0.3	$10	0.25	$30	0	$50	0.75
ls35_rl	$10	0	$30	1	$50	0	$10	0.25	$30	0	$50	0.75
ls39_rl	$10	0.5	$30	0.2	$50	0.3	$10	0.55	$30	0	$50	0.45
ls1i_lr	$10	0.12	$30	0.05	$50	0.83	$10	0.03	$30	0.2	$50	0.77
ls3i_lr	$10	0.27	$30	0.05	$50	0.68	$10	0.03	$30	0.45	$50	0.52
ls7i_lr	$10	0.54	$30	0.1	$50	0.36	$10	0.18	$30	0.7	$50	0.12
ls9i_lr	$10	0.08	$30	0.04	$50	0.88	$10	0.05	$30	0.1	$50	0.85
ls13i_lr	$10	0.65	$30	0.1	$50	0.25	$10	0.55	$30	0.3	$50	0.15
ls16i_lr	$10	0.88	$30	0.04	$50	0.08	$10	0.83	$30	0.14	$50	0.03
ls17i_rl	$10	0.04	$30	0.15	$50	0.81	$10	0.08	$30	0.05	$50	0.87
ls18i_rl	$10	0.14	$30	0.65	$50	0.21	$10	0.38	$30	0.05	$50	0.57
ls22i_lr	$10	0.66	$30	0.1	$50	0.24	$10	0.54	$30	0.4	$50	0.06
ls28i_rl	$10	0.12	$30	0.84	$50	0.04	$10	0.18	$30	0.66	$50	0.16
ls30i_rl	$10	0.45	$30	0.45	$50	0.1	$10	0.55	$30	0.15	$50	0.3
ls31i_lr	$10	0.48	$30	0.36	$50	0.16	$10	0.42	$30	0.54	$50	0.04
ls35i_lr	$10	0.2	$30	0.2	$50	0.6	$10	0.1	$30	0.6	$50	0.3
ls36i_rl	$10	0.02	$30	0.92	$50	0.06	$10	0.08	$30	0.68	$50	0.24
ls37i_lr	$10	0.48	$30	0.28	$50	0.24	$10.0	0.44	$30.0	0.44	$50.0	0.12

Appendix C: Additional Figures (NOT FOR PUBLICATION)

Figure C1: Proportion of Actual Take-Up to Predicted Choices (NP)

Fisher Exact Test 2-sided p-value < 0.001

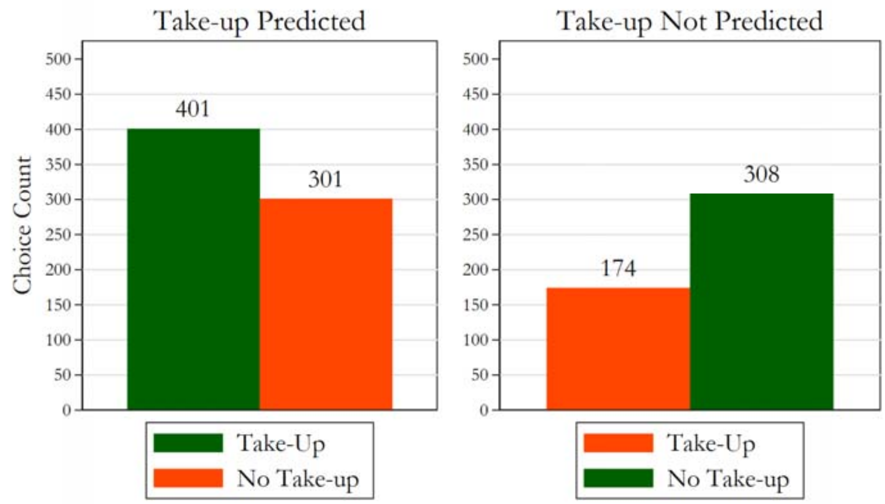


Figure C2: Proportion of Actual Take-Up to Predicted Choices (Control)

Fisher Exact Test 2-sided p-value < 0.001

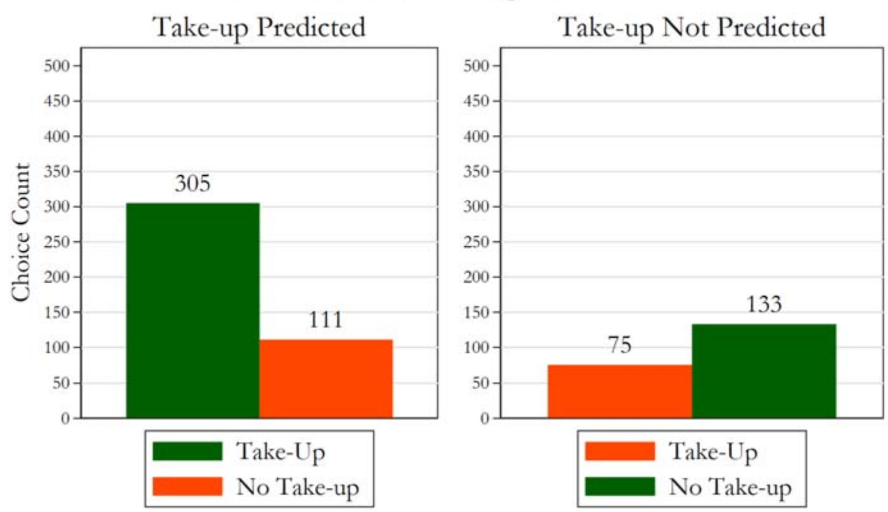


Figure C3: Proportion of Actual Take-Up
to Bootstrapped Predicted Choices for NP Treatment

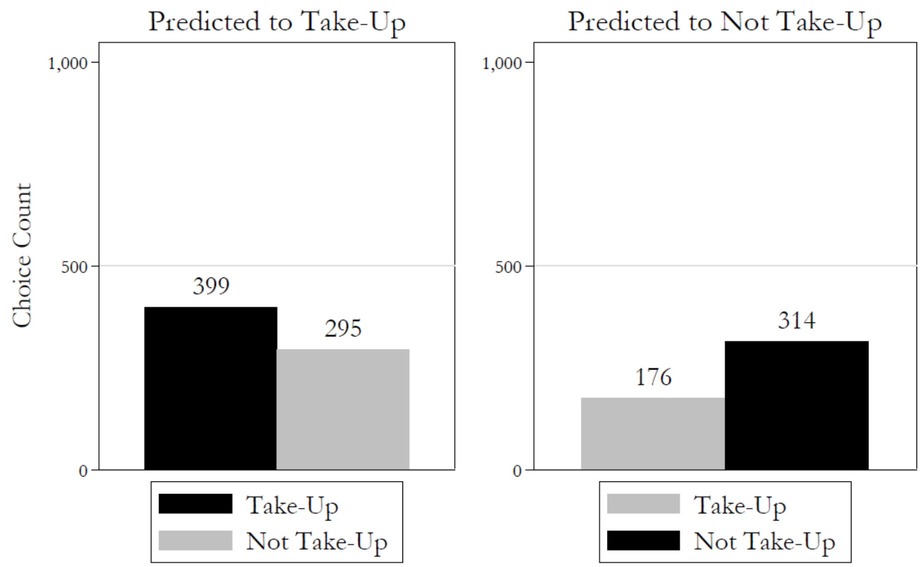
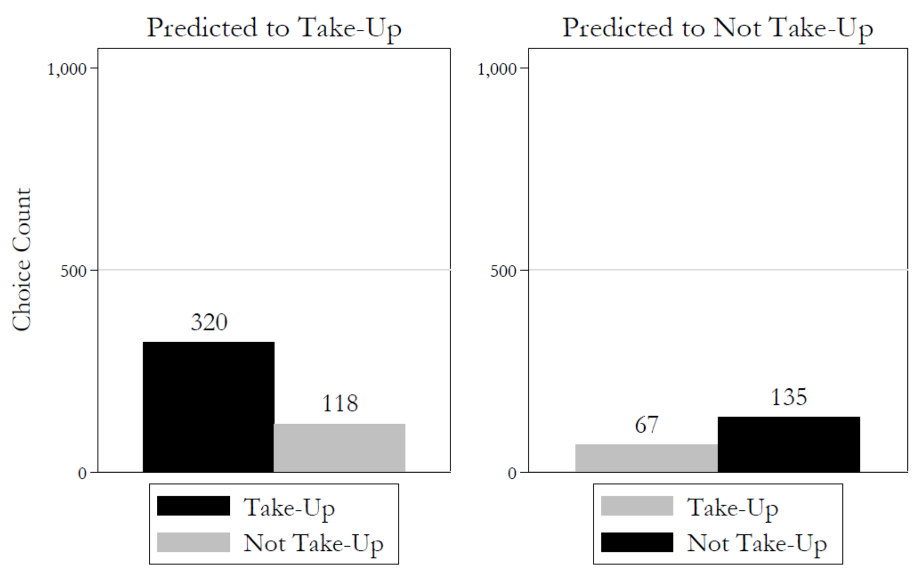


Figure C4: Proportion of Actual Take-Up
to Bootstrapped Predicted Choices for Control



Appendix D: A Subjective Beliefs Treatment

Biener, Landmann and Santana [2017] and Liu and Myers [2016] suggest that perceived non-performance risk significantly decreases microinsurance take-up. We extend our current model, following Cummins and Mahul [2003], to allow the insurance company and buyers of insurance to have divergent subjective probabilities about the non-performance risk.[1] We further allow non-performance risk to be a probability distribution, *potentially* allowing agents to exhibit uncertainty aversion by taking into account the confidence with which they subjectively perceive that risk. Following Harrison [2011; §4], we define uncertainty aversion as occurring when agents "boil down" probability distributions using some aspect of the distribution other than the weighted average: in effect, when agents do *not* apply ROCL with respect to that distribution. Cummins and Mahul [2003] note that if this weighted average of the distribution of the probability of non-performance is less (greater) than the objective non-performance probability, we would expect the expected welfare gain from the insurance to decrease (increase). If agents employ ROCL then they evaluate such distributions as if they are a well-defined point-mass distribution exactly equal to that weighted average. We assume that ROCL applies, that there is no uncertainty aversion, and that agents behave as if they use the weighted average of their subjective beliefs to make decisions about purchasing insurance.

Theory of Belief Elicitation

Let the decision maker report his subjective beliefs in a discrete version of a QSR for continuous distributions (Matheson and Winkler [1976]).[2] We consider the QSR since it is the most popular scoring rule in use, but show that all theoretical results generalize to any proper scoring rule, which is any rule for which truthful reporting generates the highest expected payoff.[3]

Partition the domain into K intervals, and denote as r_k the report of the likelihood that the event falls in interval $k = 1, ..., K$. Assume for the moment that the decision maker is risk neutral, and that the full report consists of a series of reports for each interval, $\{ r_1, r_2, ..., r_k, ..., r_K \}$ such that $r_k \geq 0\ \forall k$ and $\sum_{i=1...K} (r_i) = 1$.

If k is the interval in which the actual value lies, then the payoff score is defined by Matheson and Winkler [1976; p.1088, equation (6)]: $S = (2 \times r_k) - \sum_{i=1...K} (r_i)^2$. The reward in the score is a doubling of the report allocated to the true interval, and the penalty in the score depends on how these reports are distributed across the K intervals. The subject is rewarded for accuracy, but if that accuracy misses the true interval the punishment is severe. The punishment includes all

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[1] Contrary to Cummins and Mahul [2003; p.121] this assumption does not require that the risks be uncertain. It could just be that the two groups have different priors or data, leading to different (posterior) subjective probabilities even if both apply Bayes rule.

[2] Our experimental set-up only requires that our intervals are discrete integers between 0 and 9, but that is just a specific form of this set-up. Hence the derivations here apply to our experimental set-up.

[3] For instance, Andersen, Fountain, Harrison and Rutström [2014] show that behavior under a Linear Scoring Rule and QSR are behaviorally identical when applied to elicit subjective probabilities for binary events, after one undertakes calibration for the different effects of risk aversion and probability weighting on behavior under the two types of scoring rules.

possible reports.[4]

To ensure complete generality, and avoid any decision maker facing losses, allow some endowment, α, and scaling of the score, β. We then get the following scoring rule from the report { $r_1, r_2, ..., r_k ,..., r_K$ } when the true event is in interval k: $\alpha + \beta\, [\, (2 \times r_k) - \sum_{i=1...K} (r_i)^2\,]$, where we initially assumed α=0 and β=1. We can assume α>0 and β>0 to get the payoffs to any positive level and units we want.

We restate Lemma 2 from Harrison and Ulm [2016], which allows one to recover the latent subjective beliefs by accounting for EUT or RDU risk preferences:

Lemma 2: Let p_k represent the underlying subjective probability of an individual for outcome k and let r_k represent the reported probability for outcome k in a given scoring rule. Let $\theta(k) = \alpha + \beta 2 r_k - \beta \sum_{i=1...K} (r_i)^2$ be the scoring rule that determines earnings θ if state k occurs. Assume that the individual uses some probability weighting function $\omega(\cdot)$, leading to decision weights $w(\cdot)$ defined in the standard decumulative fashion of $w_j = \omega(p_j + ... + p_J) - \omega(p_{j+1} + ... + p_J)$ for j=1,... , J-1, and $w_j = \omega(p_j)$ for j=J, with the subscript j ranking outcomes from worst to best. Assume that the individual behaves consistently with RDU, applied to subjective probabilities. If the individual has a utility function $u(\cdot)$ that is continuous, twice differentiable, increasing and concave and maximizes rank-dependent utility over weighted subjective probabilities, the actual and reported probabilities must obey the following system of equations:

$$w(p_k) \times \partial u/\partial\theta \,|_{\theta = \theta(k)} - \sum_{j=1,K} \{\, w(p_j) \times r_j \times \partial u/\partial\theta \,|_{\theta=\theta(j)} \,\} = 0, \forall\, k = 1,..., K$$

The implication of Lemma 2 is that we must estimate the risk preferences of an individual, allowing those to be RDU if that is appropriate. Since EUT is nested in RDU, Lemma 2 covers the case in which the subject does not, as an empirically significant matter, probability weight. Lemma 2 then allows one to recover the latent subjective belief distribution implied by the QSR reports and the estimated risk preferences.

Experimental Implementation

In the subjective beliefs (SB) treatment an additional task is added to elicit subjective beliefs on the non-performance risk for a different sample of subjects. The subjective belief elicitation task is developed by Harrison, Martínez-Correa, Swarthout and Ulm [2017]. The instructions are provided in Appendix A of Harrison and Ng [2017].

[4] Take some examples, assuming $K = 4$. What if the subject has very tight subjective beliefs and allocates all of the weight to the correct interval? Then the score is $S = (2 \times 1) - (1^2 + 0^2 + 0^2 + 0^2) = 2 - 1 = 1$, and this is positive. But if the subject has tight subjective beliefs that are wrong, the score is $S = (2 \times 0) - (1^2 + 0^2 + 0^2 + 0^2) = 0 - 1 = -1$, and the score is negative. So we see that this score would have to include some additional "endowment" to ensure that the earnings are positive; this is a point of practical behavioral significance, but is not important for the immediate theory. Assuming that the subject has very diffuse subjective beliefs and allocates 25% of the weight to each interval, the score is less than 1: $S = (2 \times ¼) - ((¼)^2 + (¼)^2 + (¼)^2 + (¼)^2) = ½ - ¼ = ¼ < 1$. So the tradeoff from the last case is that one can always ensure a score of ¼, but there is an incentive to provide less diffuse reports, and that incentive is the possibility of a score of 1.

The non-performance risk in the SB treatment is provided as an uncertain distribution in order to elicit the subjective beliefs of each subject for the probability of the insurance company not paying out in the event of a loss. The probability of non-performance is represented by the proportion of red balls in an urn filled with red and white balls, as shown in the SB insurance task interface in Figure D1.

We present subjects with two urns, one with 20 red balls and 80 white balls and the other with 50 red balls and 50 white balls, to represent the solvency probabilities of 0.8 and 0.5 respectively. The urns are covered, and subjects are not given the distribution of balls in each urn. Prior to each belief elicitation, we draw 9 balls from each urn and reveal to subjects the sample distribution of 9 balls drawn from each urn. This is the only information subjects receive regarding the distribution of balls in each urn, prior to the initial belief elicitation. The number of red balls drawn out of 9 balls drawn represents the probability of non-performance of the insurance company, and we ask subjects for their beliefs on the number of red balls drawn out of the 9 balls drawn for each urn. Subjects allocate their tokens into 10 bins according to their beliefs on the distribution of the number of red balls drawn, where each bin represents the number of red balls drawn ranging from 0 to 9. A sample of the interface used is shown in Figure D2. Payouts for each bin are calculated using the QSR described above, with $\alpha = \beta = 25$. Earnings for this task range from \$0 to \$50.

The beliefs task was presented to the subjects before the insurance task. There were two rounds of the beliefs task and insurance task conducted in the SB treatment, to allow for updating of beliefs. In the SB treatment we vary the loss probability, non-performance risk and premium in a 2×2×8 framework for a total of 32 choices, displayed in Table D1. The loss probabilities and premium match those used in the control treatment, and the solvency probabilities used to elicit subjective beliefs were based on the solvency probabilities used in the NP treatment. The repayment proportion was set at 0 across all insurance choices in the SB treatment. The 32 choices in the insurance task were split into half. Choices 1 to 16 were presented in the first half in a randomized order, and choices 17 to 32 were presented in the second half in a randomized order to allow for an even spread of premium variability between the two halves.

Results: Solvency Probabilities

When we allow for non-performance risk to be measured by subjects' beliefs on the distribution of balls drawn from a cage, the risk of contract non-performance is represented by the weighted average of the number of red balls the subject believes that will be drawn from the cage. Solvency risk is then simply 1 less the default risk. Using the weighted average of balls based on the subjective beliefs requires that we assume ROCL. The subject's beliefs also depend on their risk preferences. It is known from Winkler and Murphy [1970] that risk aversion can affect the incentives to correctly report true subjective probability. We account for this by using the risk preferences, probability weighting parameters and winning decision-making model estimated for each subject in the risk task to infer the latent probability distribution in the beliefs task (Harrison and Ulm [2016]). We do not consider uncertainty aversion in our analysis, since we do not consider the spread of subjects' beliefs, but that can be an immediate extension of our analysis.

The solvency probability may also be measured as the probability inferred from the distribution of balls in the sample draws of balls from the urns during the experiment. If we assume that the probabilities are updated in the second draw perfectly using Bayes rule, there is a solvency probability that is objective across all subjects that represents the information the subjects were provided with. We assume that all subjects start out with a diffuse prior, and update their beliefs based on the results of each sample draw using Bayes rule. Since we are asking for beliefs on the number of red balls when we draw 9 balls from an urn without replacement, the likelihood follows a hypergeometric distribution, which means the conjugate prior follows a beta-binomial distribution. Hence we use the mean for a beta-binomial distribution to calculate the solvency probability from the sample draws of balls from the urns. The actual draws for each urn for both sample draws in both sessions conducted can be found in Table D2.

Finally, the solvency probability can also be measured by the non-performance risks that determined the composition of red and white balls in each urn. Urn A was filled with 20 red balls and 80 white balls, which represents a solvency probability of 0.8; and urn be was filled with 50 red balls and 50 white balls, which represents a solvency probability of 0.5. These population solvency probabilities correspond to the objective solvency probabilities used in the NP treatment, where the probabilities were just given to the subjects and treated as known.

Table D3 shows the distribution of the three different ways of measuring solvency probability. The subjective solvency probability here is the average subjective probability across all subjects. The probabilities from the actual draws did not stray too far from the population probabilities. The largest deviation is for Urn B in the second draw in the second session, which is 15% higher than the population probability. The subjective probabilities for urn B following that draw were accordingly higher. The average subjective solvency probabilities for Urn A are higher than the subjective solvency probabilities for Urn B, but the difference is not as great as the difference in solvency probabilities from the sample draws. The subjective probabilities are also closer to 0.5: uncertain subjects will want to spread out their tokens more, which would bring the weighted average of their beliefs closer to 0.5.

Although we are for now only considering the weighted average in our subjective beliefs analysis, we also look at the percentage of subjects that allocated tokens in each bin for each belief elicitation question. Each bin represents a number of red balls out of nine balls that could have been drawn from the urn, as per the sample display shown in Figure D2. The detailed allocation to each bin is displayed in Table D4, and shows that the beliefs of the subjects were quite spread out across the bins. Generally the modal allocation in Urn B was higher than the modal allocation in Urn A, which is qualitatively consistent with the distribution of balls in each urn.

Results: Varying Solvency Probabilities in SB Treatment

We consider the impact of using different methods to represent solvency probability on the expected welfare gain of subjects' insurance choices in the SB treatment. The three solvency probabilities are the population solvency probability, which is either 0.8 or 0.5; the posterior probabilities based on the actual sample draw of balls from the urns assuming perfect application of Bayes rule; and the subjective beliefs on solvency estimated for each individual which is represented by the weighted average of the distribution of their latent beliefs on the outcome.

Figure D3 compares the distribution of efficiency of the insurance choices, calculated using the population probabilities, to the distribution of efficiency of the insurance choices calculated using the posterior probabilities based on the sample draws from the urn. This allows us to see the effect that the uncertain draws had on our predicted results. Figure D4 compares the efficiency distribution when the posterior probabilities from the sample draws are used to the efficiency distribution when the subjective beliefs based on subjects' token allocations are used. This allows us to see the impact of each subject's behavior, where "behavior" here refers to the process each subject used to update their prior beliefs, which might not have followed Bayes' rule.

Figures D3 and D4 show that neither the use of uncertain draws to represent solvency probability nor the impact of subjective beliefs on solvency probability, have a statistically significant impact on the distribution of the estimated efficiency of subjects' insurance choices. This shows that although the solvency probabilities differ, the use of different solvency probabilities to estimate expected welfare gain from insurance is not the cause of difference in expected welfare gain observed across treatments. As discussed below, the regression analysis shows that differences between the subjective solvency probabilities and the solvency probabilities based on the urn draws do not significantly impact efficiency.

Results: Impact on Expected Welfare Gain between Treatments

Figure D5 shows the distribution of decision-making models based on the risk preferences elicited in the risk task in the SB treatment, and is similar to the distribution for subjects in the NP treatment.

Figure D6 shows the distribution of the actual insurance choices made in the SB treatment compared to the predicted choices based on the CS calculated from their estimated risk preferences and subjective solvency probabilities. There is a larger proportion of insurance choices in the SB treatment where subjects are predicted not to take-up insurance, as compared to the control treatment of the NP treatment. This is due to the factors of insurance choices in the SB treatment that contain both the higher premiums used in the control treatment and the non-performance risk used in the NP treatment.

The focus of Figure D6, however, should be on the proportion of "correct" and "incorrect" choices. The overall proportion of choices in the SB treatment that are "correct" is 59%: insurance was purchased when it was predicted to be purchased, and insurance was not purchased when it was predicted to not be purchased. Conditional on take-up predicted, the proportion of choices in the SB treatment that are "correct" is 57%. These proportions are very similar to the proportions in the NP treatment, which were 60% and 57% respectively. These proportions still hold even if we only compared the insurance choices with actuarial parameters that are common across all three treatments.

Figure D7 compares the distribution of CS of insurance choices in the SB treatment to the distribution of CS of insurance choices in the NP treatment. Although the average CS in the SB treatment is not statistically significantly different from the average CS in the NP treatment, the distribution of CS in the SB treatment is more dispersed than the distribution of CS in the NP treatment. A significantly different distribution of CS in the SB treatment indicates that using subjective beliefs results in significantly different welfare estimated for purchasing choices on insurance than assuming the population solvency risks.

The distribution of efficiency shows similar results, shown in Figure D8. Although a *t*-test shows that the average efficiency of each subject's insurance choices is not significantly different between the NP and SB treatments, Figure D8 shows that the efficiency distribution for the SB treatment is more dispersed.[5] Again the results hold when we only compare the insurance choices that are common across both treatments.

Table D5 shows the results of a regression analysis on insurance choices in the SB treatment. In addition to the factors considered in the control and NP treatments, there are other factors unique to the SB treatment that are also considered. The coefficient on the covariate "Urn B" shows that whether the solvency probabilities were from draws from Urn A or Urn B does not have a significant effect on welfare and take-up, and the coefficient on the covariate "Second Draw" shows that insurance choices made in the second round of drawing balls from the urn have an expected welfare gain that is weakly significantly higher compared to choices made in the first round.

Allowing for subjective solvency probabilities does impact welfare. The difference between the subjective solvency probability for each insurance choice and the Bayesian probability for that choice increases CS, with strong statistical significance. This means that when subjects are optimistic, and their beliefs on solvency probability are higher than the solvency probability calculated from the actual draws from the urn assuming perfect Bayesian updating, they make insurance choices which imply a higher CS. Conversely pessimistic subjects make choices which imply a lower CS. This optimism does not significantly impact efficiency. Although we are not formally taking into account uncertainty aversion when estimating the subjective solvency probabilities, the coefficient on a covariate for the standard deviation of subjects' beliefs of solvency probability, "Solvency Probability Spread," shows us that dispersed beliefs do not significantly impact take-up or welfare of insurance choices.

The demographic factors that significantly impact take-up are different from the factors that significantly impact welfare in the NP treatment. ROCL violation is not a significant factor for welfare measures, which is consistent with us requiring the ROCL assumption to represent the subjective solvency probability by the weighted averages of subjects' beliefs. Being Christian is no longer statistically significant, however subjects who have prior experience with insurance, freshmen, and females make choices that have significantly higher CS.

[5] A Kolmogorov-Smirnov test has a p-value < 0.001, and a Wilcoxon-Mann-Whitney test is weakly significant for the two treatments having different distributions (p-value $= 0.021$).

Figure D1: Interface for Insurance Choice With Subjective Beliefs on Non-Performance

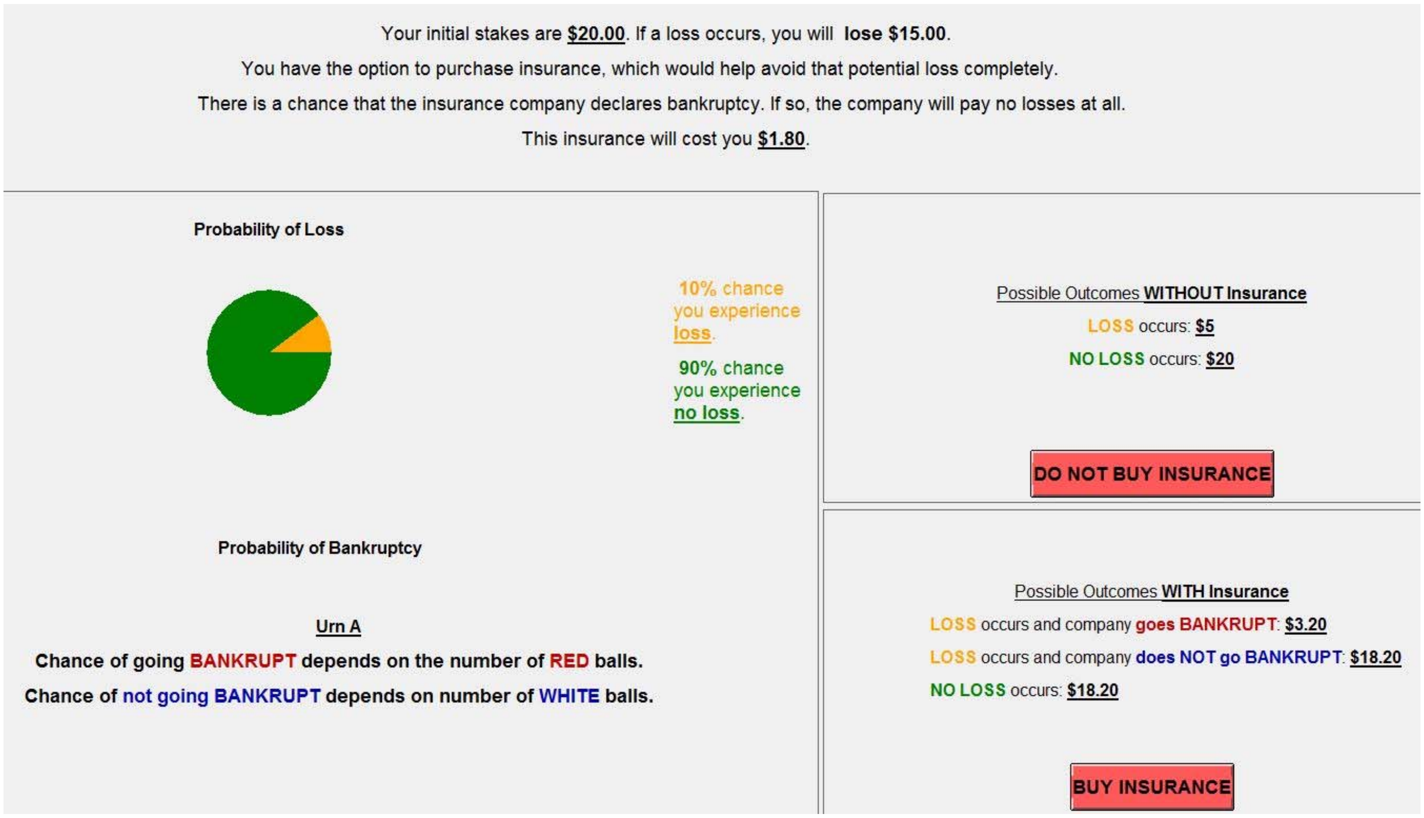

Figure D2: Interface for Elicitation of Subjective Beliefs of Non-Performance

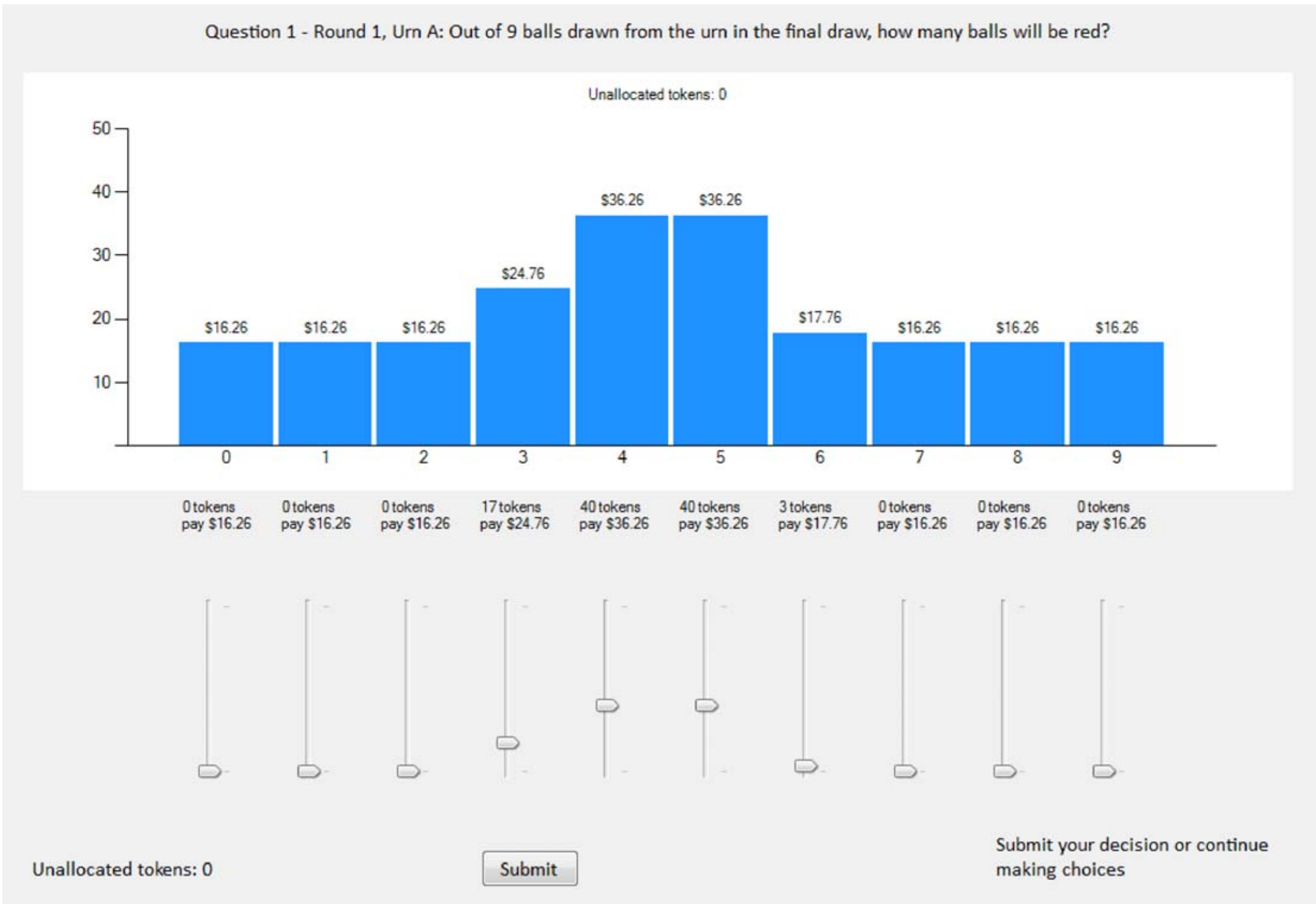

Table D1. Insurance Contracts and Parameters in the Subjective Beliefs Treatment

Choice	Urn for Solvency Probability	Objective Solvency Probability	Premium ($)	Loss Probability	Initial Endowment ($)	Loss ($)	Actuarially Fair Premium ($)
1	A	0.8	0.50	0.1	20	15	1.20
2	B	0.5	0.50	0.1	20	15	0.75
3	A	0.8	0.50	0.2	20	15	2.40
4	B	0.5	0.50	0.2	20	15	1.50
5	A	0.8	1.80	0.1	20	15	1.20
6	B	0.5	1.80	0.1	20	15	0.75
7	A	0.8	1.80	0.2	20	15	2.40
8	B	0.5	1.80	0.2	20	15	1.50
9	A	0.8	2.90	0.1	20	15	1.20
10	B	0.5	2.90	0.1	20	15	0.75
11	A	0.8	2.90	0.2	20	15	2.40
12	B	0.5	2.90	0.2	20	15	1.50
13	A	0.8	4.10	0.1	20	15	1.20
14	B	0.5	4.10	0.1	20	15	0.75
15	A	0.8	4.10	0.2	20	15	2.40
16	B	0.5	4.10	0.2	20	15	1.50
17	A	0.8	1.20	0.1	20	15	1.20
18	B	0.5	1.20	0.1	20	15	0.75
19	A	0.8	1.20	0.2	20	15	2.40
20	B	0.5	1.20	0.2	20	15	1.50
21	A	0.8	2.30	0.1	20	15	1.20
22	B	0.5	2.30	0.1	20	15	0.75
23	A	0.8	2.30	0.2	20	15	2.40
24	B	0.5	2.30	0.2	20	15	1.50
25	A	0.8	3.50	0.1	20	15	1.20
26	B	0.5	3.50	0.1	20	15	0.75
27	A	0.8	3.50	0.2	20	15	2.40
28	B	0.5	3.50	0.2	20	15	1.50
29	A	0.8	4.70	0.1	20	15	1.20
30	B	0.5	4.70	0.1	20	15	0.75
31	A	0.8	4.70	0.2	20	15	2.40
32	B	0.5	4.70	0.2	20	15	1.50

Table D2: Actual Number of Red Balls drawn from Urns during Experiment

Session 1

Urn	Sample Draws Round 1	Sample Draws Round 2	Bayesian Update Round 1	Bayesian Update Round 2	Population
A	3	2	3	2.5	2
B	6	4	6	5	5

Session 2

Urn	Sample Draws Round 1	Sample Draws Round 2	Bayesian Update Round 1	Bayesian Update Round 2	Population
A	1	2	1	1.5	2
B	4	3	4	3.5	5

Table D3. Summary of Solvency Probabilities

Session 1

	Urn A				**Urn B**			
Draw	Population	Sample	Subjects' Beliefs (Ave)	Subjects' Beliefs (SD)	Population	Sample	Subjects' Beliefs (Ave)	Subjects' Beliefs (SD)
1	0.8	0.7	0.63	0.11	0.5	0.4	0.5	0.1
2	0.8	0.75	0.66	0.11	0.5	0.5	0.55	0.09

Session 2

	Urn A				**Urn B**			
Draw	Population	Sample	Subjects' Beliefs (Ave)	Subjects' Beliefs (SD)	Population	Sample	Subjects' Beliefs (Ave)	Subjects' Beliefs (SD)
1	0.8	0.9	0.69	0.14	0.5	0.6	0.58	0.07
2	0.8	0.85	0.68	0.14	0.5	0.65	0.62	0.09

Table D4: Percentage of Subjects that Allocated Tokens in Each Bin

	Session 1				Session 2			
	Draw 1		Draw 2		Draw 1		Draw 2	
Bin	Urn A	Urn B	Urn A	Urn B	Urn A	Urn B	Urn A	Urn B
1	10.8%	5.4%	5.4%	16.2%	51.4%	29.7%	32.4%	18.9%
2	54.1%	21.6%	56.8%	24.3%	89.2%	54.1%	81.1%	56.8%
3	75.7%	32.4%	89.2%	45.9%	**91.9%**	73.0%	**89.2%**	83.8%
4	**91.9%**	70.3%	**91.9%**	83.8%	83.8%	86.5%	91.9%	**94.6%**
5	**91.9%**	86.5%	89.2%	91.9%	70.3%	**89.2%**	73.0%	89.2%
6	75.7%	**94.6%**	64.9%	**97.3%**	64.9%	**89.2%**	56.8%	83.8%
7	51.4%	83.8%	35.1%	73.0%	51.4%	70.3%	45.9%	56.8%
8	29.7%	70.3%	24.3%	59.5%	51.4%	59.5%	43.2%	43.2%
9	16.2%	32.4%	16.2%	24.3%	29.7%	21.6%	24.3%	29.7%
10	10.8%	8.1%	5.4%	10.8%	24.3%	21.6%	18.9%	32.4%

Figure D3: Comparison of Efficiency Distribution for Population and Sample Solvency Risks

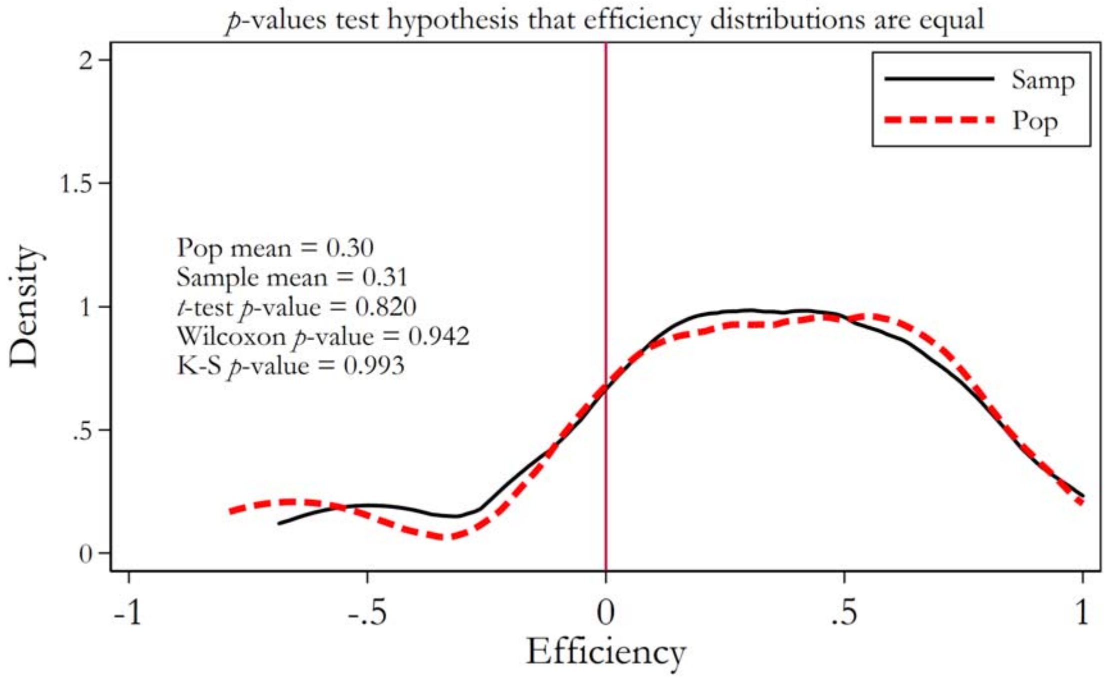

Figure D4: Comparison of Efficiency Distribution for Subjective and Sample Solvency Risks

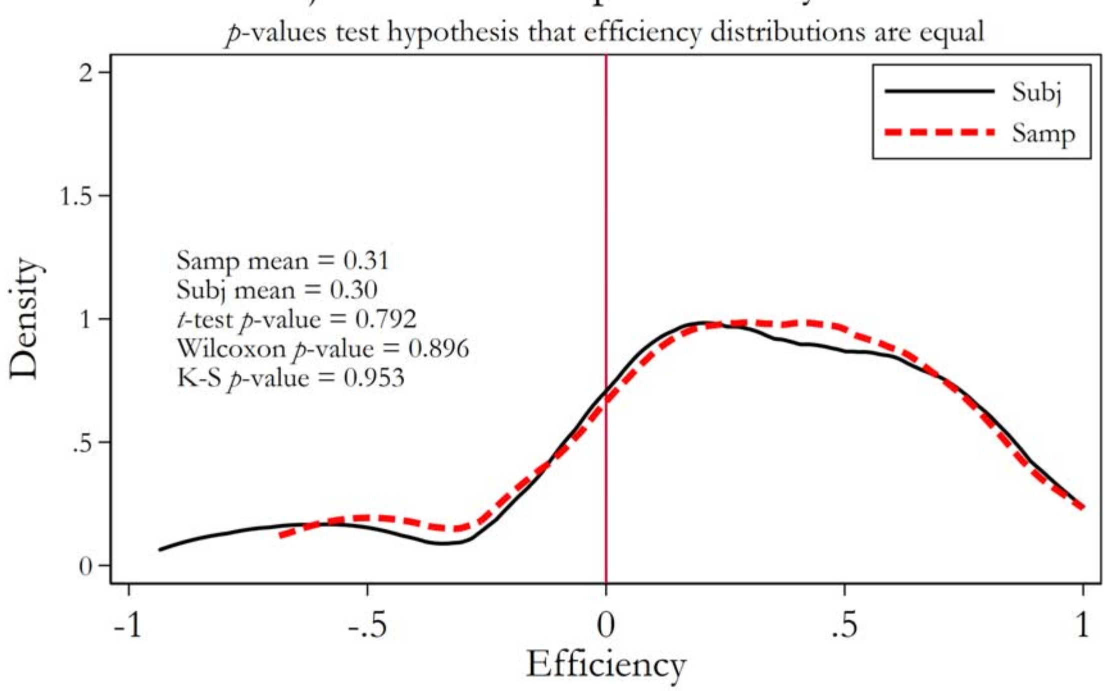

Figure D5: Classifying SB Subjects as EUT or RDU

N=74, one *p*-value per individual
Estimates for each individual of EUT and RDU specifications

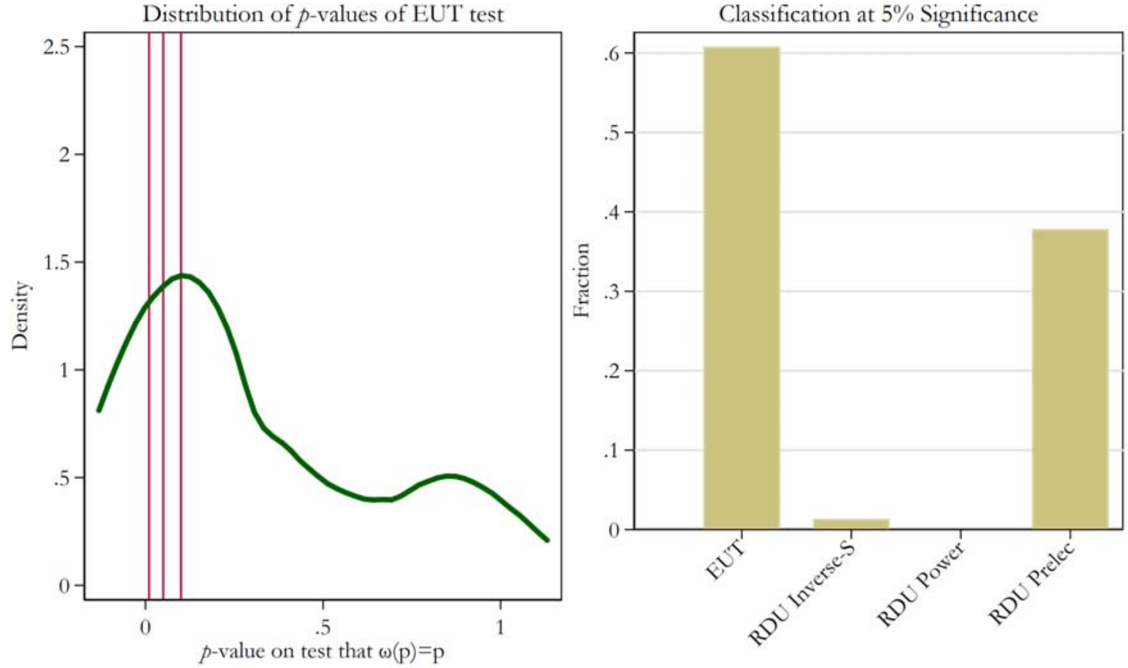

Figure D6: Proportion of Actual Take-Up to Predicted Choices (SB)

Fisher Exact Test 2-sided *p*-value < 0.001

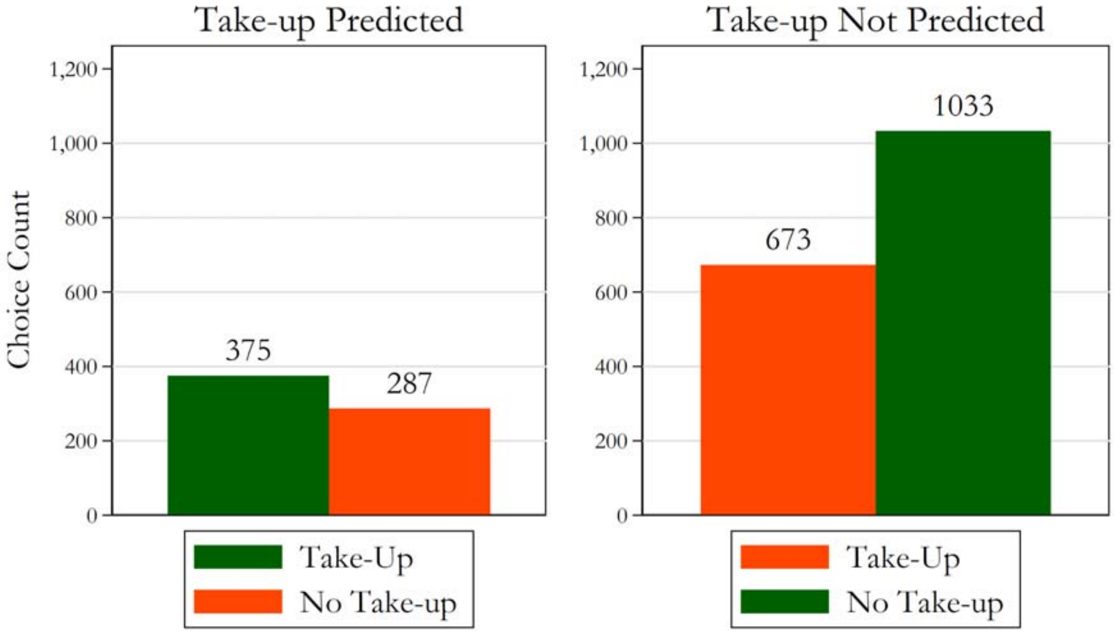

Figure D7: Comparison of Consumer Surplus Distribution for NP and SB Treatments

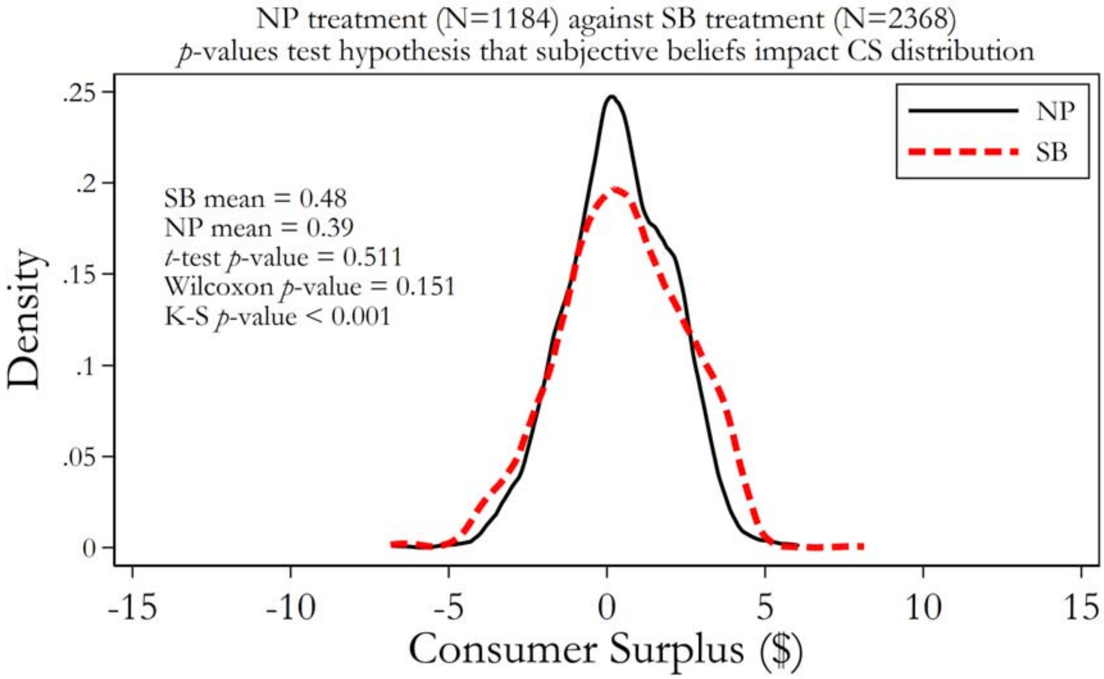

Figure D8: Comparison of Efficiency Distribution for NP and SB Treatments

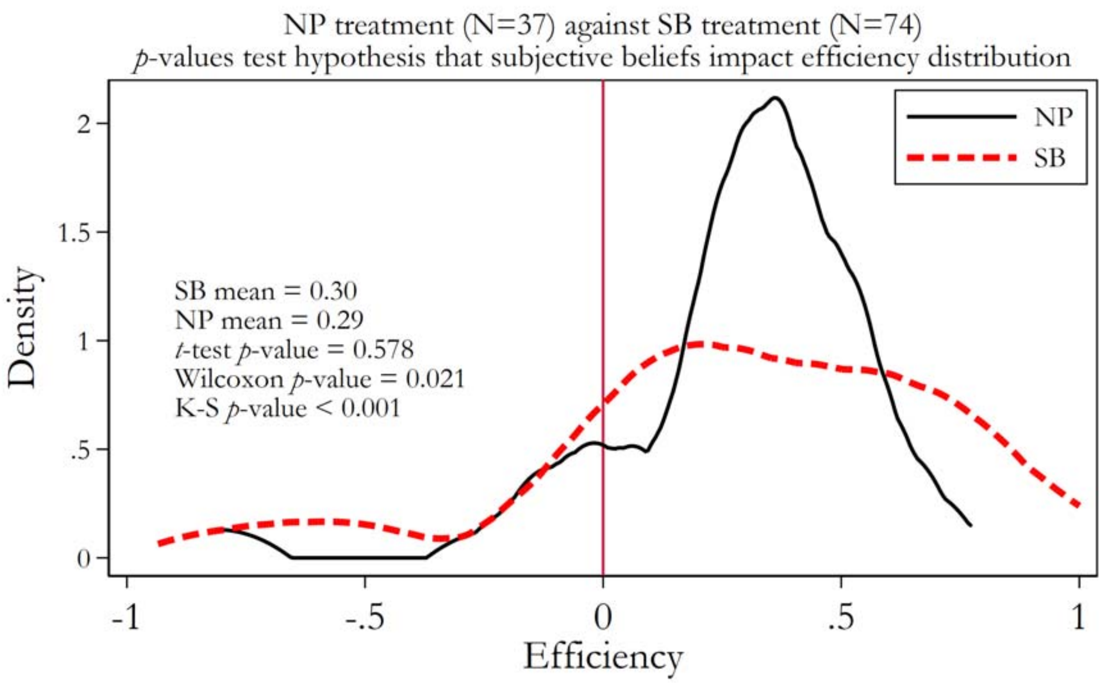

Table D5. Factors Affecting Welfare With Subjective Non-Performance Risk

	Average marginal effects of appropriate regression models			
	Take-up	**Choice**	**CS**	**Efficiency**
Risk Aversion	0.0931	-0.0182	-0.106	-0.0626
	(0.061)	(0.616)	(0.269)	(0.135)
(Risk Aversion)^2	0.0114*	-0.00297	-0.0153	-0.00785
	(0.037)	(0.460)	(0.157)	(0.122)
Difference between Subjective	-0.384	0.482*	2.689***	0.116
and Drawn Probabilities	(0.065)	(0.014)	(<0.001)	(0.686)
Solvency Probability Spread	0.0376	0.0138	0.0553	0.388
	(0.879)	(0.954)	(0.924)	(0.485)
Solvency Probability	0.0838	0.136	-0.357	
	(0.439)	(0.177)	(0.468)	
Urn B	-0.0290	0.0190	-0.000805	
	(0.192)	(0.326)	(0.996)	
Premium	-0.0646***	0.0417**	0.325***	
	(<0.001)	(0.002)	(<0.001)	
Loss Probability	1.478***	-0.930***	-5.795***	
	(<0.001)	(<0.001)	(<0.001)	
Second Draw	0.0771***	0.0489**	0.131	
	(<0.001)	(0.005)	(0.411)	
ROCL Violation Count	-0.00642	0.00156	0.0110	0.00265
	(0.689)	(0.846)	(0.501)	(0.819)
Female	-0.163**	0.0853*	0.288**	0.0948*
	(0.007)	(0.032)	(0.002)	(0.047)
Black	0.0188	-0.0469	-0.192	-0.0363
	(0.846)	(0.420)	(0.055)	(0.599)
Asian	-0.0555	-0.0105	-0.0412	-0.000167
	(0.639)	(0.866)	(0.724)	(0.998)
Business Major	0.0500	-0.0266	-0.0921	-0.0194
	(0.511)	(0.536)	(0.200)	(0.736)
Freshman	-0.0144	0.0514	0.322***	0.0674
	(0.857)	(0.288)	(<0.001)	(0.224)
Senior	0.0485	0.00642	0.106	0.0336
	(0.549)	(0.888)	(0.353)	(0.611)
High GPA	0.0820	-0.0692	-0.212*	-0.0683
	(0.215)	(0.079)	(0.013)	(0.147)
Christian	-0.0409	-0.00943	0.155	0.0314
	(0.582)	(0.835)	(0.169)	(0.567)
Insured	-0.0487	0.0688	0.303***	0.0896
	(0.461)	(0.075)	(<0.001)	(0.070)

p-values in parentheses
* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

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