Pre-Analysis Plan for Experimental Auctions with Securities

Zachary Breig* Allan Hernández-Chanto† Declan Hunt

March 29, 2022

1 Introduction

Security-bid auctions refer to a class of auctions in which the seller can use diverse financial instruments, other than cash, to secure the payment from the winning bidder. These auctions are used in the allocation of the rights over large-scale projects and complex financial assets, e.g., sales of oil, gas and logging leases; corporate takeovers; venture capital financing; and class-action suits, among many others. The key feature of these auctions is that the revenue of the project (asset) being auctioned is verifiable, and, thus, contractible. Furthermore, because the final payment is contingent on the revenue realization of the project (asset), it creates linkage to the bidder's true valuation, which gives the seller higher expected revenues than a standard cash auction.

In a fundamental paper, DeMarzo et al. (2005) established the framework to study general securities within a class of symmetric mechanisms. In a setting with a monopolistic seller and risk-neutral buyers, they establish results about bidding behavior, allocative efficiency, and revenue across different types of securities and different auction formats. Furthermore, the authors make a distinction between formal and informal auctions. In the former, the seller commits to a predefined auction format and security design, so that he disregards any bid that does not belong to the chosen family. For instance, if a seller commits to run the auction using equities, he will not consider any bid in debt or call option. Meanwhile, in informal auctions, bidders choose which securities to use to express their bids and the seller chooses the most-profitable bid ex post according to his beliefs. In this sense, bidders and seller engage in a signaling game.

Fioriti and Hernandez-Chanto (2021) extend the results in DeMarzo et al. (2005) by introducing risk-averse bidders. They show that when bidders are risk averse, different security designs offer different levels of insurance, affecting bidding behavior, and the allocative and Pareto efficiency of the auction.

*Lecturer, School of Economics, University of Queensland. Address: The School of Economics, Level 6 Colin Clark Building, The University of Queensland, St. Lucia, QLD, 4072, Australia. Email: z.breig@uq.edu.au.

†Lecturer, School of Economics, University of Queensland. Address: The School of Economics, Level 6 Colin Clark Building, The University of Queensland, St. Lucia, QLD, 4072, Australia. Email: a.hernandezchanto@uq.edu.au.

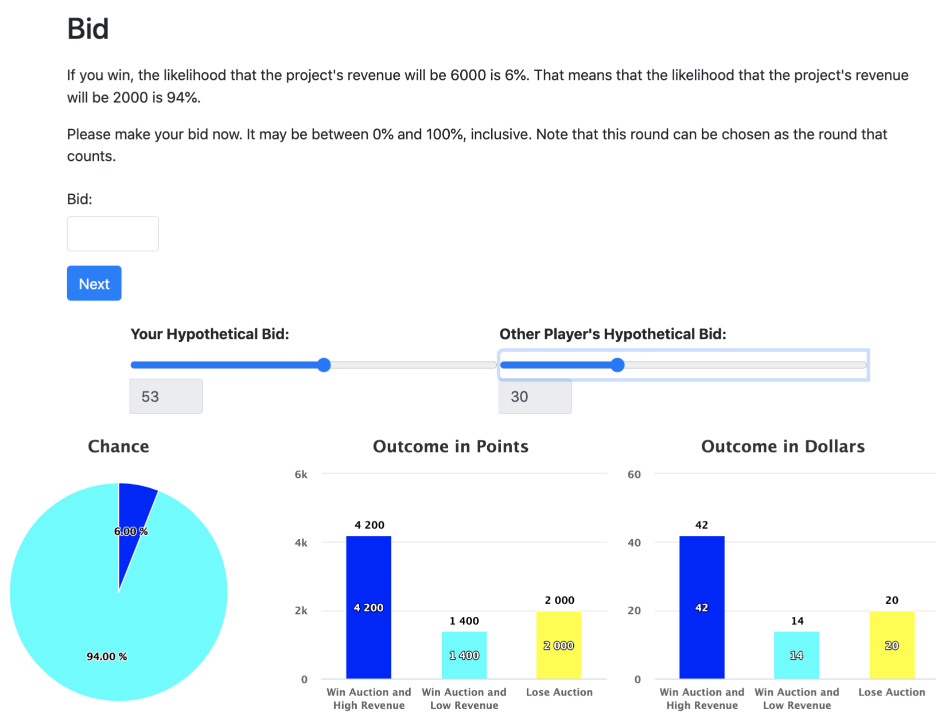
In this experiment, we will carry out an experimental evaluation of securities auctions. We will focus on equities and debt in first-price, second price, and informal auctions.

2 Experimental Design

Our laboratory experiment is primarily a between design, with 5 main treatments corresponding to different types of auctions: (1) first-price equities auctions, (2) second-price equities auctions, (3) first-price debt auctions, (4) second-price debt auctions, and (5) informal auctions.

Subjects participate in a single treatment. In each auction, bidders are endowed with 2000 points. They receive a signal corresponding to the likelihood of receiving "high revenue" that is uniformly distributed between 0% and 100% and is their private information. Subjects are told that if they win the auction, they must invest their endowment of 2000 points but that they will receive a return of the high revenue of 6000 points or the low revenue of 2000 points. Their payment to the auctioneer depends on their treatment and whether they received the high revenue. If they lose the auction they retain their endowment.

Figure 1: Auction interface for a second-price auction in equities

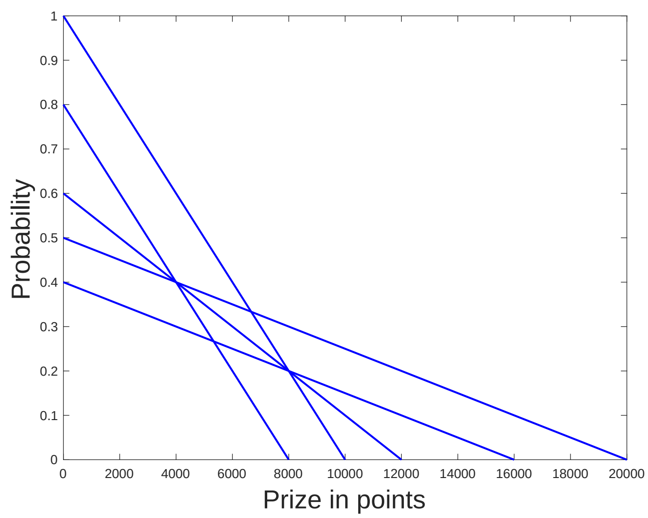


In the formal auctions, each subject is randomly paired with a single other subject. After receiving their likelihood, they make a bid using the security corresponding to the treatment they are in. The winner of the auction is the bidder that made a higher bid, and the price is either their bid (in first-price auctions) or the other subject's bid (in second-price auctions). The winner of an equities auctions pays a percentage of the revenue of the project equal to the price, while the winner of a debt auction pays either the price or their revenue, whichever is lower. Subjects are informed of who won the auction and the price, but are not informed of the other bidder's signal or whether the winner received the high revenue.

In the informal auctions, each subject is randomly paired with two other subjects. One of these subjects is assigned to the role of the seller, and the other two are bidders. The bidders first choose what type of security they will bid with (either equities or debt) and then choose their bid. The seller observes the bids (but not the associated signals) and chooses a winner. Informal auctions are always first-price by definition.

In all treatments, subjects first participate in 20 rounds of auctions. They then make 10 choices from the Andreoni-Harbaugh risk elicitation task, which allows subjects to choose from linear budgets over a prize and the likelihood of receiving that prize (Andreoni and Harbaugh, 2009). Each subject make two choices from each of five unique budgets.

Figure 2: Andreoni-Harbaugh Budgets



After completing all choice tasks, subjects complete a short demographic survey and a cognitive reflection test.

2.1 Data Collected

In addition to choice data from the auctions and risk tasks, we collect the decision time for each choice. We also collect standard demographic data including gender, age, college major, etc. We supplement these data with a short cognitive reflection test.

3 Empirical Analysis

3.1 Primary Questions: Efficiency and Revenue

The primary focus of the study is the effect of auction features on efficiency and revenue. For both of these cases, we study the ex-interim values. That is, we study the efficiency and expected revenue *after* the project's ownership has been allocated, but before the projects revenue has been realized. This is the appropriate measure because conditional on which buyer is allocated the project, surplus generated in the project depends only on the signal received by the winning bidder about how good the project is.

In the experiments that we focus on, we define efficiency as the ex-interim expected surplus. Letting p_W represent the likelihood of high revenue for the winning bidder, this is given by

$$ES_{a,t} = 2000(1 - p_W) + 6000p_W - 2000$$

which is the expected value of the winner's revenue minus the investment cost. Thus, to compare the effect of auction format, we will estimate the model

$$ES_{a,t} = \beta_0 + \beta_1 \text{Debt}_{a,t} + \beta_2 \text{Second}_{a,t} + \beta_3 \text{Debt} \times \text{Second}_{a,t} + \beta_4 \text{Informal}_{a,t} + TS_{a,t} + \alpha_t + \varepsilon_{a,t} \tag{1}$$

where $TS_{a,t}$ is the total surplus available in the auction and α_t is a round fixed effect.

The definition of ex-interim expected revenue is straightforward. If the winning bid was in debt, then revenue is

$$R_{a,t} = \begin{cases} \text{Price}_{a,t} \text{ if } \text{Price}_{a,t} < 2000 \\ 2000(1 - p_W) + \text{Price}_{a,t} p_W \text{ otherwise} \end{cases} .$$

If, on the other hand, the winning bid is in equities, then expected revenue is

$$R_{a,t} = 2000\text{Price}_{a,t}(1 - p_W) + 6000\text{Price}_{a,t} p_W.$$

Thus, to compare the effect of auction format, we will estimate the model

$$R_{a,t} = \beta_0 + \beta_1 \text{Debt}_{a,t} + \beta_2 \text{Second}_{a,t} + \beta_3 \text{Debt} \times \text{Second}_{a,t} + \beta_4 \text{Informal}_{a,t} + TS_{a,t} + \alpha_t + \varepsilon_{a,t} \tag{2}$$

where $TS_{a,t}$ is the total surplus available in the auction and α_t is a round fixed effect.

3.2 Secondary Questions

While the primary focus of our analysis is the effect of auction design on efficiency and surplus, there are several other empirical questions that our design will allow us to address.

1. We will test whether the average realized bidding functions in both first and second price auctions are equal to the theoretically predicted bidding functions from the risk-neutral Nash Equilibrium. Specifically, we take the difference between any bid and the predicted bid, then regress this difference on dummies for various ranges of signals (e.g. a dummy for the signal being between 0 and 0.05, between 0.06 and 0.1, etc.).

2. We will study how risk aversion is related to bidding behaviour by first splitting the sample into more- and less-risk loving subjects based on their choices in the Andreoni-Harbaugh task. We will then take the difference between average bids for various ranges of signals

(e.g. between 0 and 0.05, between 0.06 and 0.1, etc.) and conduct t-tests for differences in mean bids.

3.3 Power Analysis

The informal auctions experimental treatment was carried out between August and October of 2021. This gave a total of 380 auctions. The realized average total surplus in this treatment was 2269 (standard deviation 1109) while the realized average revenue was 1399 (standard deviation 964).

We focus our power analysis on achieving an 80% likelihood of rejecting our null hypotheses regarding revenue and efficiency. To compute power, we carry out the following bootstrapping exercise. We define N as the number of auctions observations that will be carried out for each treatment (giving a total of $5N$ auctions over the entire experiment). Using the 380 observations from the informal treatment, we randomly draw a sample of N observations of ex-interim expected surplus and ex-interim expected revenue with replacement for each treatment.

The theoretical prediction from DeMarzo et al. (2005) is that all auction formats achieve full efficiency. On the other hand, Fioriti and Hernandez-Chanto (2021) demonstrate that when bidders may be risk averse, the bidder with the higher signal is more likely to win the auction under equities. Thus, the natural hypothesis is to compare the ex-interim expected surplus of equities auctions to debt auctions. Because theory does not give an exact prediction for what the efficiency of the two types of auctions should be, we focus our power analysis on detecting differences in efficiency if debt auctions achieve less than 95% of the efficiency of equities auctions. As such, we multiply the randomly drawn ex-interim expected surplus for the debt treatments by 0.95, then estimate equation (1) 200 times. For each of these regressions we test the null hypothesis that $\beta_1 = \beta_3 = 0$, and we find that we have 80% power to reject the null hypothesis at the 5% level when $N > 320$

The theoretical prediction for revenue arising from both first- and second-price equities auctions with our design is that average revenue is equal to approximately 1723. The predicted revenue for second-price debt is approximately 1394 and the predicted revenue for both first price debt and informal auctions is approximately 1333. Because the effect of security choice (debt vs. equities) is expected to be much larger than the effect of pricing rules (first-price vs. second-price) we focus on two hypotheses: first that security choice has no effect on revenue ($\beta_1 = \beta_3 = 0$) and second that the overall auction format has no effect on revenue ($\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5$). Thus, we multiply the randomly drawn ex-interim expected revenue by the ratio of the theoretical prediction to the observed average in the informal treatment (i.e. by 1723/1399 in the equities treatments, 1393/1399 in the second-price debt treatment, and 1333/1399 in the first price debt and informal auction treatments). We estimate equation (2) 200 times and test the hypotheses above, finding that both tests have statistical power greater than 80% for $N > 200$.

Based on these results, we expect to have a final sample size of 350-400 auctions for each treatment.

References

Andreoni, J. and W. Harbaugh (2009). Unexpected utility: Five experimental tests of preferences for risk. *Unpublished Manuscript*.

DeMarzo, P. M., I. Kremer, and A. Skrzypacz (2005). Bidding with securities: Auctions and security design. *American economic review 95*(4), 936–959.

Fioriti, A. and A. Hernandez-Chanto (2021). Leveling the playing field for risk-averse agents in security-bid auctions. *Management Science*.

A Screen-shots/Instructions

The full set of instructions for the second-price equities auctions treatment appears below. Instructions for the other auctions have minor differences reflecting the different setting.

Instructions

PLEASE READ CAREFULLY AND DO NOT PRESS NEXT UNTIL INSTRUCTED TO DO SO.

Thank you for participating in this study. This study is about decision-making. It should take about 120 minutes, and you will be paid based on your earnings from the experiment. The money you earn will be paid either in cash at the end of the study or electronically within a few days of the end of the study.

Please do not use any electronic devices or talk with other participants during this study.

There will be no deception in this study. Every game or decision you make will be carried out exactly as they are described in the instructions. Anything else would violate the human ethics protocol under which we run the study (UQ Human Research Ethics Approval 2021/HE000019).

The study will have two parts. In each part, you will make decisions which will affect the amount of money you earn. Part 1 of the study consists of games that you will play with other randomly selected players. The players that you are paired with in a round are independent of who you play with in any other round. In Part 2, you will make decisions individually and no other participant can affect your earnings.

If you have questions at any point, please raise your hand and we will answer your questions privately.

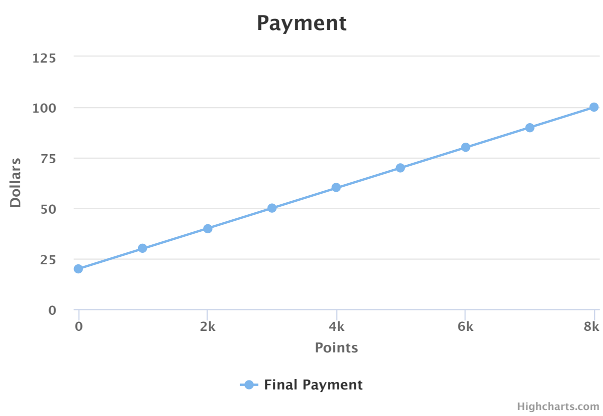
Next

Instructions

PLEASE READ CAREFULLY AND DO NOT PRESS NEXT UNTIL INSTRUCTED TO DO SO.

In this study, you will receive points based on the choices you and other participants make. Your dollar earnings at the end of the study will depend on how many points you receive. **You will receive $20 for completing the experiment. You will be paid $2 for each question about the instructions you answer correctly. You will be paid an additional $1 for each 100 points you receive.**

At the end of the study, we will select **one** round at random to be the one that counts. Your points will be determined based on the outcome of that round. Each round is equally likely to be chosen. Because each round may be the one that counts, it is in your best interest to make each choice as if it were going to be implemented.



Important: The amount of points you receive determines how much you are paid at the end of the experiment. It is in your best interest to maximise the number of points you receive in each task.

Next

Instructions

PLEASE READ CAREFULLY AND DO NOT PRESS NEXT UNTIL INSTRUCTED TO DO SO.

In this part of the experiment, you will participate in 20 rounds of auctions. Each auction begins with the computer randomly pairing you with another participant. The player that you are paired with in a round is selected independently of who you play with in any other round. You will not know the player you are paired with.

Before each round, you will be provided with 2000 points.

In each auction you will bid for the opportunity to make a risky investment. The cost of making the investment is the 2000 points that you are provided with at the beginning of the round. However, this investment generates revenue. The revenue of the investment is either 2000 points or 6000 points. Each bidder has a different likelihood of the investment having a revenue of 6000 points, and the likelihoods are uniformly distributed between 0 out of 100 and 100 out of 100. If you do not win the auction, you will keep the 2000 points you were initially provided with.

Important: The bids in this auction will be slightly different to auctions you may have seen before. Both players will make their bids in terms of **percentages** . The winner will be the player with the highest bid, and the "price" will be equal to the loser's bid. However, the amount the winner pays may depend on the revenue that the investment generates. **The winner pays a percentage of their revenue equal to the price.** If both players make the same bid, the winner is chosen randomly and the price is equal to their bid.

For instance, suppose that Player 1 bids 20% while Player 2 bids 45%. Then Player 1 loses the auction and keeps the 2000 points they were provided with. Player 2 invests their 2000 points, but receives (1 - 0.2) × 6000 = 4800 points if the revenue is high and (1 - 0.2) × 2000 = 1600 points if the revenue is low.

The next page contains a few more examples to familiarize you with how this works. Take your time and make sure you understand how it works. After the examples, there will be a short quiz about the rules of this game. You will earn $2 for each question you answer correctly.

Next

Examples

Example 1: Alice and Bob participate in this type of auction. Alice finds out that her project has a 53% chance of generating a high revenue, while Bob finds out that his project has an 81% chance of generating the high revenue.
Alice bids 30% and Bob bids 43%. Then Alice loses the auction and is guaranteed a payoff of 2000 points.
Bob wins the auction and has an 81% chance of receiving (1 - 0.3) × 4200 = 3420 points and a 19% chance of receiving (1 - 0.3) × 2000 = 1400 points.

Example 2: Carmen and Daron participate in this type of auction. Carmen finds out that her project has a 42% chance of generating a high revenue, while Daron finds out that his project has an 55% chance of generating the high revenue.
Carmen bids 27% and Daron bids 22%. Then Daron loses the auction and is guaranteed a payoff of 2000 points.
Carmen wins the auction and has a 42% chance of receiving (1 - 0.22) × 6000 = 4680 points and a 58% chance of receiving (1 - 0.22) × 2000 = 1560 points.

Compare bids: The interactive figure below will help show you what your payoffs will be conditional on your and your and the other player's bids. Once you move a slider, the diagram will show you the likelihood of winning the auction with high revenue, the likelihood of winning the auction with low revenue, and the likelihood of losing the auction. It will also show you the number of points and the final dollar outcomes associated with each of these outcomes. Try out different bids to make sure you understand the consequences of your choices.

For instance, suppose that if you win, the likelihood that the project's revenue will be 6000 is 70%. That means that the likelihood that the project's revenue will be 2000 is 30%.

Your Bid: 50

Other Player's bid: 50

When you are ready to continue, press next and you will begin the quiz.

Next

Quiz

You will now be given a series of questions to check your understanding of the instructions and examples. You will be paid $2 for each answer you get correct.

How is the auction winner decided?

- ○ Another player chooses the winner.
- ○ The computer randomly chooses the winner from all bidders.
- ○ The computer randomly chooses the winner from the highest bidders.

What will each player know about the chance of high revenue?

- ○ Each player only knows their own chance.
- ○ Each player knows their chance and the other player's chance.
- ○ Each player knows their chance and learns the other player's chance after the auction.
- ○ Neither player knows either player's chance.

How will the auction's price be set?

- ○ The price is equal to the highest bid.
- ○ The price is equal to the second highest bid.
- ○ The price is randomly selected from the two bids.
- ○ The price is a randomly selected value between the two bids.

How is the price used when computing payoffs?

- ○ The auction's winner pays a percentage of their revenue equal to the price.
- ○ The auction's winner receives a percentage of their revenue equal to the price.
- ○ The auction's loser pays a percentage of their revenue equal to the price
- ○ The auction's loser receives a percentage of their revenue equal to the price.

Suppose that the other player bids 20% and you bid 10%. How many points will each player receive?

- ○ You will receive 2000 points. The other player will receive 1600 points if the revenue is low and 4800 points if the revenue is high.
- ○ You will receive 2000 points. The other player will receive 1800 points if the revenue is low and 5400 points if the revenue is high.
- ○ You will receive 1600 points if the revenue is low and 4800 points if the revenue is high. The other player will receive 2000 points.
- ○ You will receive 1800 points if the revenue is low and 5400 points if the revenue is high. The other player will receive 2000 points.

Suppose that the other player bids 20% and you bid 80%. How many points will each player receive?

- ○ You will receive 2000 points. The other player will receive 1600 points if the revenue is low and 4800 points if the revenue is high.
- ○ You will receive 2000 points. The other player will receive 400 points if the revenue is low and 1200 points if the revenue is high.
- ○ You will receive 1600 points if the revenue is low and 4800 points if the revenue is high. The other player will receive 2000 points.
- ○ You will receive 400 points if the revenue is low and 1200 points if the revenue is high. The other player will receive 2000 points.

Suppose that the other player bids 70% and you bid 10%. How many points will each player receive?

- ○ You will receive 2000 points. The other player will receive 600 points if the revenue is low and 1800 points if the revenue is high.
- ○ You will receive 2000 points. The other player will receive 1800 points if the revenue is low and 5400 points if the revenue is high.

- ○ You will receive 600 points if the revenue is low and 1800 points if the revenue is high. The other player will receive 2000 points.
- ○ You will receive 1800 points if the revenue is low and 5400 points if the revenue is high. The other player will receive 2000 points.

Suppose that the other player bids 70% and you bid 80%. How many points will each player receive?

- ○ You will receive 2000 points. The other player will receive 600 points if the revenue is low and 1800 points if the revenue is high.
- ○ You will receive 2000 points. The other player will receive 400 points if the revenue is low and 1200 points if the revenue is high.
- ○ You will receive 600 points if the revenue is low and 1800 points if the revenue is high. The other player will receive 2000 points.
- ○ You will receive 400 points if the revenue is low and 1200 points if the revenue is high. The other player will receive 2000 points.

When you believe you have answered all questions correctly, press next to check your answers.

Next

Quiz Answers

The answers for the quiz are given below. Please review the answers and note any mistakes you have made.

Question 1: How is the auction winner decided?
Correct Answer: The computer randomly chooses the winner from the highest bidders.
Your Answer: Another player chooses the winner.

Question 2: What will each player know about the chance of high revenue?
Correct Answer: Each player only knows their own chance.
Your Answer: Each player only knows their own chance.

Question 3: How will the auction's price be set?
Correct Answer: The price is equal to the second highest bid.
Your Answer: The price is equal to the highest bid.

Question 4: How is the price used when computing payoffs?
Correct Answer: The auction's winner pays a percentage of their revenue equal to the price.
Your Answer: The auction's winner pays a percentage of their revenue equal to the price.

Question 5: Suppose that the other player bids 20% and you bid 10%. How many points will each player receive?
Correct Answer: You will receive 2000 points. The other player will receive 1800 points if the revenue is low and 5400 points if the revenue is high.
Your Answer: You will receive 2000 points. The other player will receive 1600 points if the revenue is low and 4800 points if the revenue is high.

Question 6: Suppose that the other player bids 20% and you bid 80%. How many points will each player receive?
Correct Answer: You will receive 1600 points if the revenue is low and 4800 points if the revenue is high. The other player will receive 2000 points.
Your Answer: You will receive 2000 points. The other player will receive 1600 points if the revenue is low and 4800 points if the revenue is high.

Question 7: Suppose that the other player bids 70% and you bid 10%. How many points will each player receive?
Correct Answer: You will receive 2000 points. The other player will receive 1800 points if the revenue is low and 5400 points if the revenue is high.
Your Answer: You will receive 2000 points. The other player will receive 600 points if the revenue is low and 1800 points if the revenue is high.

Question 8: Suppose that the other player bids 70% and you bid 80%. How many points will each player receive?
Correct Answer: You will receive 600 points if the revenue is low and 1800 points if the revenue is high. The other player will receive 2000 points.
Your Answer: You will receive 2000 points. The other player will receive 600 points if the revenue is low and 1800 points if the revenue is high.

You earned $4.0 from your correct answers. Please review any questions you answered incorrectly. When you are ready to begin the auction, click the next button.

Next

Bid

If you win, the likelihood that the project's revenue will be 6000 is 91%. That means that the likelihood that the project's revenue will be 2000 is 9%.

Please make your bid now. It may be between 0% and 100%, inclusive. Note that this round can be chosen as the round that counts.

Bid:

Next

Your Hypothetical Bid:

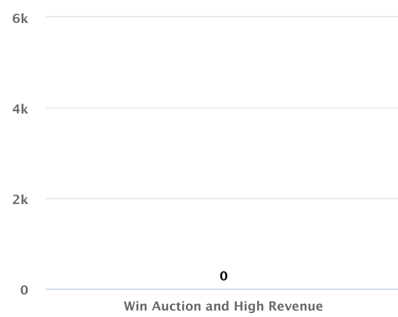
50

Other Player's Hypothetical Bid:

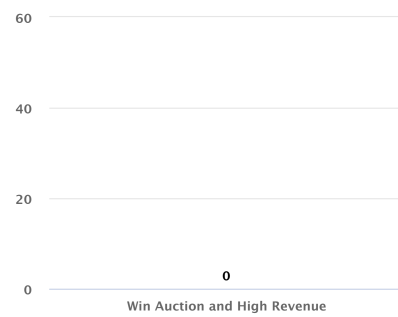
50

Chance

Outcome in Points



Outcome in Dollars



Results

You won the auction! Your bid was 30% while the second highest bid was 5%. That means that if this round is chosen for payment, you will have a 42% chance of receiving $57 and a 58% chance of receiving $19. The other player will receive $20.

Next

Results

You did not win the auction. Your bid was 1% while the winning bid was 15%. That means that if this round is chosen for payment, you will receive $20. The other player will receive either $59.4 or $19.8.

Next

Instructions:

PLEASE READ CAREFULLY AND DO NOT PRESS NEXT UNTIL INSTRUCTED TO DO SO.

In this part of the experiment, you will complete 10 rounds of an individual choice task. Every task has an interactive visual aid to assist with picking your preferred choice. In this part of the study, your payoffs will depend only on your choices, and not any other participants' choices.

In every task, you must choose among different options. Your choice will determine a monetary prize and its chance. All of your choices will involve some chance of a monetary prize, otherwise you will get the show-up fee of $20. As you move the slider to the right, the monetary prize will decrease but the chance you will receive the prize will increase. For each task you will have to determine your preferred combination of a positive prize and its chance. The size of the potential outcomes and how their chance changes with the slider will be different for different tasks.

Most choices involve some risk. For example, a choice could be between a 25 in 100 chance of 3000 points, and the corresponding 75 in 100 chance of 0 points. To aid with your choice, there will be a changing display for every possible choice. Therefore, for any choice you will always be able to see the chance of receiving a positive amount.

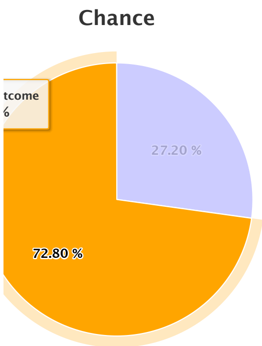
The next page contains an example to familiarize you with how this works. Take your time and make sure you understand how it works. We will not begin until everybody completes this example.

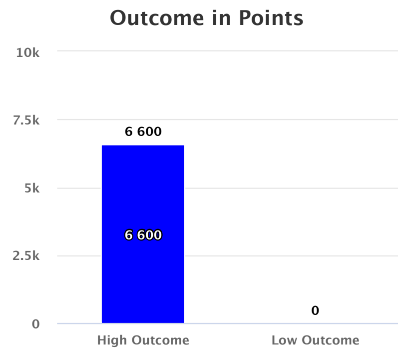
Very Important: For each task, the slider is a tool to help you decide the choice you like the best. Therefore, it is in your best interest to move it around to help you determine which choice you like better.

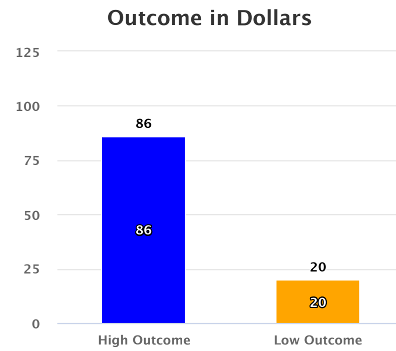
Next

Example

Maximum gain is 10000 points and maximum chance is 80 in 100.







Choice example:

34

Verify example:

Please select your preferred chance and outcome. Note that this task is an example and cannot be chosen as the round that counts.

Important: Remember you must manually select a spot on the slider for this task to count.

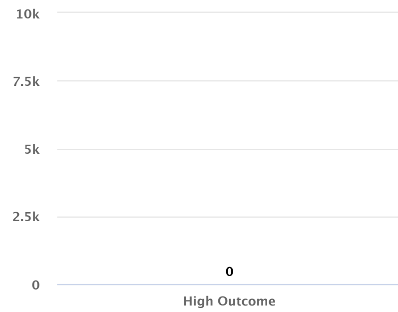
Next

Round 1

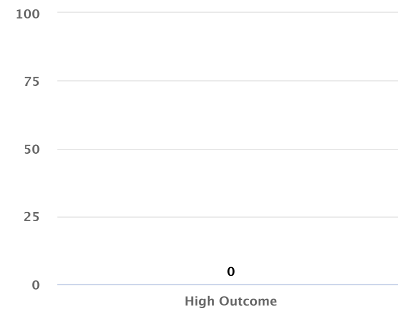
Maximum gain is 8000 points and maximum chance is 80 in 100.

Chance

Outcome in Points



Outcome in Dollars



Choice:

50

Verify:

Please select your preferred chance and outcome. Note that this round can be chosen as the round that counts.

Important: Remember you must manually select a spot on the slider for this task to count.

Next

Survey

Please answer the following questions. Your answers to these questions do not affect how much money you will earn.

What is your age?

What gender do you identify with the most?

- ○ Female
- ○ Male
- ○ Other/Prefer Not to Say

Is English your first language?

- ○ Yes
- ○ No

Are you completing or have you completed an economics degree at UQ?

- ○ Yes
- ○ No

On a scale of 1 to 10, with 10 being the highest score, how well did you feel you understood the objective of today's tasks?

Briefly describe your strategy in today's auctions, and any influences on your strategy.

Next

Survey

Please answer the following questions. Your answers to these questions do not affect how much money you will earn.

A bat and a ball cost 22 dollars in total. The bat costs 20 dollars more than the ball. How many dollars does the ball cost?

"If it takes 5 machines 5 minutes to make 5 widgets, how many minutes would it take 100 machines to make 100 widgets?" :

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how many days would it take for the patch to cover half of the lake? :

Next

Results

The round that has been randomly selected for payment is Round 4 of the security-bid auction. You lost the auction. You will receive 2000 points with certainty. Continue to see your final payoff in points and dollars.

Next

Results

You received 2000 points. This means that including your show-up fee of $20 and quiz payment of $4.0, you will receive $44.0.

Next