DEAL OR NO DEAL: AN ANALYSIS OF DECISION MAKING AND RISK

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INTRODUCTION

Deal or No Deal has become a popular game show on network television. Stir crazy contestants go on the show for a chance to beat the bank and walk away with a lot of money. But how many contestants are really making the best deals possible? As soon as they get onto the show, contestants let emotion get in the way of the real task at hand: to make the most money possible. Instead of making rational decisions with a cool head, contestants get too wrapped up in the theatricalities of the game itself when they should be really thinking about how they are going to effectively walk away a little heavier in the pockets.

Through our research and analysis we believe that we may effectively provide guidelines in which contestants can follow to make better decisions. Through an understanding of the game and the risk associated with it, we may develop potential ways in which a contestant may become more attune to the game at hand. Therefore, walking in there a little more confident and perhaps walking out a little bit richer. One of the main focuses of our analysis in regards to Deal or No Deal involves EMV or expected monetary value (which shall be explained later on). Using EMV for decision making, we are able to dissect each round of the game and walk one through it piece by piece, showing the potential decisions needed to be made at a certain point in time.

Our group has looked at secondary sources as a means to establish the foundation to our own research. In understanding what other scholars have done in regards to game shows or Deal or No Deal in particular, we may build off of their work and truly make it our own. Analyzing secondary sources will provide us with a better understanding of the technical aspects of the game, such as statistics, along with a general feel towards how game shows really play out.

One article, Deal or No Deal? Decision making under risk in a large-payoff game show raises several other dimensions to the game that had not been considered by our group prior. The authors of this article collected their data by observing 151 contestants from three different countries; 51 from Netherlands, 47 from Germany, and 53 from United States. They used these three countries because it is a very similar game format. With their observation data, they used the Expected Utility Theory and Prospect Theory to analyze the choices the contestants made. They also performed three experiments in which college students played the game.

In their observation of the 151 contestant, they found that depending on what cases are opened in the first round, it affects their attitude for the rest of the game. If a person chooses high-valued briefcases, their expectations are shattered which causes a decreases in their risk aversion. If a person chooses low-valued briefcases, their expectations are suppressed which also decreases risk aversion. The contestant will perform differently depending on their stress levels. If they are stressed, they will tend to be more risk averse. If they are not stressed, they will tend to be risk lovers. In the later rounds, they considered the analysis more difficult due to the family and friends that are there talking to them. Instead of it being an observation of an individual, it was a couple or group that they had to observe.

There are several conclusions that may be drawn from this article. Most people are moderate levels of risk aversion. Offers the contestants accept depend on the type of person. Contestants change their view due to a change in their expectation (opening of prior cases).
This article does not give our group sufficient data about the Expected Monetary Value, which is the basis of our presentation. However, it does add another dimension that the group has to take into account: risk aversion. Even with the computed EMV, it does not give a clear cut answer on how much a contestant is getting. It is simply just an estimate. This is why it depends on the person who is making the decision, whether or not the EMV is in front of him/her. The EMV serves as a guideline while the person themselves add another dimension to the game.

Another article that brings out other dimensions of risk and decision making is *Decision Making under Uncertainty When the Stakes Are High: Evidence from a Lottery Game Show*. The authors first explain the methodology of attaining their contestants, while then stating the rules. Despite the game being different from *Deal or No Deal, Instant Riches* has the same basic concept, to walk away with the best amount possible. The authors formed their data by using Expected Utility Theory to compare the choices contestants are given.

The authors found that depending on what type of contestant they are dealing with, the wagers given may be accepted or not. Some conclusions that the article draws are: all contestants have a tough decision to whether be risk averse or risk lover. Since they get their contestants from their “scratch and win” lottery tickets, they may not be generalizing their information for the public at large. This may provide knowledge to the lottery playing segment of the population.

Granted, Deal or No Deal is a game like any other type of show like it on television. We recognize this and feel that it is important to acknowledge. There are certain dimensions to the game that make every contestant and every situation unique, for example: contestant personality. Therefore, our research applies more to generalities and may be used to make individuals more knowledgeable by providing them with potential tools to be successful on these types of shows, Deal or No Deal in particular. By no means is our research fool proof in that it is the end all be all. We only dare to explore possibilities to make better decisions so people may be more successful on a show that many know and love.

**DESCRIPTION OF THE GAME SHOW**

Deal or No Deal is a television game show that is shown in several variations throughout the world. A Dutch production company, Endemol, produced the first show that was launched in 2001. Although a Dutch company produced it, the first Deal or No Deal show aired in Australia.

The show is currently televised in sixty countries. Several of the countries include: The United Kingdom, The United States, France, Mexico, Spain, Italy, Germany, Brazil, Chile, Argentina, Poland, Russia, Portugal, The Netherlands, India, South Africa, Lebanon, Morocco, The Philippines, and Australia. Each country conducts the show in their own unique way, so there are several variations to the game throughout the world.

Therefore, in our research, we will focus on The United States version of Deal or No Deal, as we and are audiences are most familiar with it.

Being one of the last countries to produce the show, Deal or No Deal premiered in the United States on December 19, 2005. The show, hosted by actor & comedian Howie Mandel, can be viewed on NBC live on Monday nights at 9 pm and Thursday nights at 8 pm.

The United States version is very similar to the international format and is based on a contestant selecting one briefcase out of 26, each containing a cash value from $0.01 to $1,000,000. Over the course of the game, the contestant eliminates the other cases in the game, periodically being presented with a "deal" from "The Banker" for a cash amount to bow out of the game. Should the contestant refuse every deal, they win the value of the case selected by him or her at the start.

The show has been a success for NBC, typically averaging from 10 to 16 million viewers each episode. It has lead to the creation of online, card, and video games for American families. Its huge success
has captured the attention of all America, so our research is quite relatable to something that many are so very aware.

RULES AND GAME PLAY

One contestant stands in front of a stage with 26 models holding 26 suitcases. Each suitcase holds within it a designated cash dollar value. Each suitcase has unique dollar values. No suitcase holds the same dollar value. The suitcases have been randomly assigned cash values by a neutral third party prior to the game so there is no question in regards to randomness of the suitcase allocations.

A board is displayed within the studio displaying these cash values for the contestant, the audience, and everyone at home. As each cash value is eliminated from the game (details explained later on) the board will display these results and the possible values that are still “in play” or in which the contestant may potentially win. The following dollar values designate the possible cash values within each suitcase.

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The object of the game is for the contestant to win the most money by making the best possible deal made to them by “The Banker” or playing out the game to the very end.

There are nine rounds in each complete game. A contestant does not necessarily have to complete all nine rounds as he or she may opt to quit before the game is fully complete, depending on when he or she makes a deal. A contestant chooses one briefcase out of the 26 in which he or she believes contains the million dollars. This briefcase remains next to the contestant, unopened, throughout the course of the game. In each round the contestant chooses a certain number of briefcases, the number depend on what round he or she is in. The briefcases are opened and the dollar values revealed to everyone. Those dollar values are taken out of play and are stricken from the board of possible cash values remaining. After each round the host relays an offer to the contestant via the “Banker” who watches the game from the control room. The identity of the “Banker” is undisclosed. The contestant listens to the proposed offer. Then the contestant has the choice of either accepting the deal made by the banker or rejecting the deal and continuing to play another round. If the contestant rejects the offer made by the banker, he or she will not receive another offer until opening the required number of suitcase for that next round.

Each round plays out as follows:

ROUND 1: 6 cases are opened. The Bank makes an offer based on the remaining 20 closed cases. The Finalist decides whether to accept or reject the offer - Deal or No Deal.

ROUND 2: 5 cases are opened. The Bank makes an offer based on the remaining 15 closed cases. The Finalist decides Deal or No Deal.
ROUND 3: 4 cases are opened. The Bank makes an offer based on the remaining 11 closed cases. The Finalist decides Deal or No Deal.

ROUND 4: 3 cases are opened. The Bank makes an offer based on the remaining 8 closed cases. The Finalist decides Deal or No Deal.

ROUND 5: 2 cases are opened. The Bank makes an offer based on the remaining 6 closed cases. The Finalist decides Deal or No Deal.

The subsequent rounds play out where a case is opened one at a time and an offer is made to the contestant after each opened case. When the contestant reaches the final two briefcases, one on stage and the one next to him or her, he or she has the choice of keeping the briefcase besides them or trading it out for the one on stage. The briefcase besides him or her, the original or new one, is then opened to reveal what the contestant won. Note: this is only if the contestant chooses to reject all of the banker’s offers and play the game out until the last two briefcases. If the contestant decides to take a deal made by the banker earlier on in the game, the game plays out in terms of showing what the contestant could have won if he or she decided to have continued to play the game. Other dimensions to the game that need to be considered are: after a certain number of rounds, the contestant’s family is introduced to the audience. The contestant then has the ability to consult with his or her family in regards to whether or not the offer made by the banker should have been accepted or rejected. Each contestant has a certain amount of time to decide whether or not to take a deal made by the banker. This time allotment is at the discretion of the producers.

DESCRIPTION OF DATA

As the show currently airs on television, live and in the form of re-runs, we are able to actually obtain our own first hand data by watching the show. Initially, we have viewed three contestants completely play out the game; we have collected the data for each contestant for each round along with the overall outcome, and even have one complete game recorded onto DVD, which we intend to have a record for every contestant we analyze. We have at 10 episodes with a contestant playing out the game fully to their deal, the rest of the show time permitting. This would generate 10 results for our group to analyze and compare. We predict that our initial ten contestants serve as good indicators of what trends will come to follow by other contestants, but more contestant data is necessary to validate these initial assumptions. Right now, these ten contestants can be fully analyzed and their outcomes compared to our further data collection. Attached within Table 1 is the result for the 10 contestants in terms of: the deals the contestants were offered each round and how far each contestant actually progressed in the game until finally making a deal. From this initial data collection we are confident in the direction our research has headed so far.

METHODOLOGY

The game Deal or No Deal is not simply about getting lucky and choosing the million dollar case, but also using your statistics and the Expected Monetary Value (EMV) which provides a rational means for selecting the best course of action. In this situation the EMV can influence a player’s decision of whether to take the bankers offer or continue playing the game based on the cases that are in play. The EMV is a statistical concept that figures out the weighted average using the probabilities as weights. In other words it is the sum of all possible values for a random variable, and each variable is multiplied by its probability of occurrence. In each round of Deal or No Deal the EMV is found by taking the sum of all the cases that are left in play after multiplying the specific amount of each case by the probability of the case’s occurrence. In each round of the game the banker makes an offer to the player based on the cases that are in play in hopes to get them to accept the deal and leave with as little amount of money as possible. In the situation of having to choose between the bankers offer or continuing to play, the EMV is used to give the player an idea of what the future possibilities are and decide whether to take the bankers offer or risk it and continue the game.

In one of the many situations from Deal or No Deal a player was in his 5th round of the game with six more cases left in play and a bank offer of $107,000. The six cases left in play include the amounts of...
$10, $300, $500, $1,000, $100,000, $1,000,000 with a probability for each case to occur being 1 out of 6. Therefore, to help make a decision, a player can determine EMV and compare it to the banker’s offer to make a more reasonable decision.

\[
EMV = \text{SUM of (Amount in each case left in play} \times \text{Probability that each case can occur)}
\]

\[
10 \times \left(\frac{1}{6}\right) = 1.7 \\
300 \times \left(\frac{1}{6}\right) = 50 \\
500 \times \left(\frac{1}{6}\right) = 83 \\
1000 \times \left(\frac{1}{6}\right) = 167 \\
100000 \times \left(\frac{1}{6}\right) = 16667 \\
1000000 \times \left(\frac{1}{6}\right) = 166667 \\
EMV = 183,635 \\
\]

Bankers Offer $107,000

In this case the difference between the bankers offer and the possible future EMV is $76,635 and the player ended up taking the bankers offer of $107,000 instead of taking the risk and continuing with the game. In the first few rounds of the game it is easier for the player to turn down the banker’s offer especially when the cases with high amounts are still in play. However, as the game winds down and there are fewer cases left in play, the EMV will help the player make the best decision under each round with its unique situations.

Attached in Table 2 is the spreadsheet for the first contestant in regards to the calculated expected monetary value for each round, the order of the cases picked, a comparison of the EMV compared to the banker offer for each round, and how much more money a contestant could have potentially won if they had made decisions based on EMV and progressed farther into the game. This table serves as a represented table for the other nine contestants in terms of content and format.

RESULTS

The process of our preliminary analysis, based on the ten contestants’ recorded data, has proved very interesting. By taking a simple concept that we have learned from Operations Management, such as EMV, our group was able to apply it to a real life situation. Not only has it reinforced the concept, but it has fueled our desire to learn and interact with the outside environment.

Preliminary analysis has allowed us to look at each individual contestant and see where they made their deal in relation to where EMV showed that they should have made the deal. Both Contestants 1 and 2 could have gone further along in the game if they understood this simple concept of EMV. Table 3 shows the decisions that the first contestant should have made for each round on the basis of EMV and where was his optimal stop compared to where he stopped. For each round, all contestants must decide whether or not to take the deal made by the banker or reject it and continue on to the next round. Based on EMV, within each round, if the offer made to the contestant by the banker was smaller than the EMV of the remaining cases, that person should have rejected the offer and continued on playing the game. When the banker’s offer is greater than the EMV, only then, should the contestant accept the banker’s offer.

EMV analysis shows that Contestant 1 should have only accepted the deal in round 8. Instead he made a deal in round 5. Therefore, he missed out on the chance of winning an additional $239,000! Contestant 2 made a deal in round 8, but if she understood EMV, she should have waited until round 9 to accept the deal. She could have won an additional $70,000! Contestant 3 was an interesting scenario. He made a deal in round 8 for $36,000. Based on EMV this would have been the right time to make the deal also. Most likely, this contestant did not understand EMV. The correlation between his decision and a decision based on EMV should be attributed to mere coincidence or dumb luck. Based on contestant 3, it is determined that other dimensions to the game also need to be taken in to consideration in regards to decision making. The rest of the data, for the other contestants, falls into suit.
First and foremost, this is a game so luck definitely plays a significant role in managing decisions from round to round. A person may just be picking the briefcases with the highest values. Therefore, this is a small amount of money that he or she could still potentially win. This will affect not only what the banker offers to the contestant, but also how high or low is the EMV. On the other side of things, the contestant may never eliminate the million dollar briefcase from the podium. Therefore, there is a good chance that this contestant could win this amount as he or she gets closer and closer to the final rounds of the game. The existence of the million dollar case still in play also drastically changes the course of the game and greatly effects EMV calculations. If the contestant truly thinks that he or she has the million dollar case sitting right next to him or her, then she will most likely disregard EMV completely and play it out to the very end, no matter how tempting the offer made by the banker, so that the million dollar case is revealed. This actually was the scenario for Contestant 1. He had the million dollar case sitting beside him the entire game, so he should have played it out to the very end if he was confident enough. However, his lack of confidence made him accept a deal that did not even compare to the million dollars. This introduces another dimension that needs to be further examined later on at some point in time: risk. If a person is a risk lover, he or she will tend to disregard reason and play things out to the very end as if the million dollar case was right there beside him or her. On the other hand, if the person was risk adverse, he or she would probably make a deal as soon as a hefty sum was offered.

CONCLUSIONS

Deal or No Deal is one of the most popular game shows currently on television. It looks so easy yet every time one watches it; the contestants fail to come out as the big winner. Why cannot these contestants win big if the game appears to be so simple? Much of it has to do with the individual and the way they irrationally act to the game. There are those people jumping up and down like maniacs, joking around with the camera, when in fact they need to be thinking logically about the game at hand. Through our research and primary analysis about real time episodes, we have begun to better understand and appreciate the show. By applying concepts that we have learned in our Operations Management class, our group is able to apply this to a real life application in Deal or No Deal. Primarily, through the use of EMV for decision making, and some understanding of an individual’s association with risk, we are able to better educate readers so not only can they see how logical the thought processes are when it comes to these sorts of game shows, but perhaps even on the slight chance, they may use this to if they ever actually get on Deal or No Deal. So if you are ever thinking about going on to one of these shows, just remember to relax, clear your head, and make good decisions. And if you ever win big, do not be afraid to throw some of those winnings our way.

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**Bank Offer to Deal**

When Game Stopped?
Player should've played till
Extra potential gain: $239,000

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*3rd Annual Siena College Student Conference in Business*

*April 18, 2008*
Table 3

Contestant 1

Offer: $42,000
EMV: $129,380.80

Offer: $35,000
EMV: $122,496

Offer: $60,000
EMV: $125,185.45

Offer: $91,000
EMV: $162,726.88

Offer: $107,000
EMV: $183,635

Offer: $187,000
EMV: $220,262

Offer: $231,000
EMV: $250,327.50

Offer: $346,000
EMV: $333,436.66

Offer: $453,000
EMV: $500,150

Optimal Stop

Continued from previous slide

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