# Determinants of Contestant's Risk Behavior Including the Appropriator Effect, the Learning Effect and the Recovery Effect: Evidence from Deal or No Deal

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**ABSTRACT**

In this paper, the Dutch Deal or No Deal TV game show is analyzed to explore contestant's risk preferences and the determinants of their behavior. 93 contestants are risk averse, 1 is risk loving, 1 is not risk averse and 28 cannot be classified. Gender, age, relationship status and the number of children do not influence the decision to deal, but relative income does. An appropriator effect, a concept related to the number of episodes the contestant has been in, and a learning effect, a reference point related to the prizes won by the previous contestants, were not statistically significant, although qualitative research confirms the existence. The recovery effect, related to the maximum offer so far, has a significant influence. The absolute or relative offer is always significant. Model alternations stress the fact that easy to calculate and remember reference points play a major role in the decision process.

In various theoretical frameworks and models there are assumptions about the risk preferences of people. I would like to investigate these assumptions by analyzing how people behave in the context of risk behavior and therefore, I will use the game show Deal or No Deal. One of the advantages of the analysis of a game show is that people are not in an experiment and therefore, act comparable to a real life situation. They make their own decisions and are not subject to a social desirability bias. Another advantage is that the stakes are higher than in most of the experiments performed by researchers. That is why it can be expected that people make their decisions more realistically than when the stakes are too small to be interesting.

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In Deal or No Deal, a contestant plays the game with 20 different prices divided over 20 suitcases. The contestant has his own suitcase with an unknown value and eliminates every round some of the other 19 suitcases. Based on the remaining suitcases, the bank makes an offer to buy the contestant his suitcase. The question the host asks is therefore: "Deal or No Deal?" To analyze the determinants of risk behavior, the Dutch version of Deal or No Deal will be analyzed. The choice for the Dutch version is mainly due to the fact that there are 213 episodes available. Another reason is that in France, Italy, and Spain the banker, who prepares the offer, knows the value which is in the suitcase owned by the contestant. This makes the analysis more complicated. Other reasons will be discussed in the literature review. One important note is that Deal or No Deal should not be confused with another Dutch version of the game, called Miljoenenjacht. In this version the stakes are much higher, there are 25 suitcases instead of 20, and all the contestants are replaced per episode. In the Deal or No Deal version, the contestants are not replaced, and therefore, the number of episodes they have been waiting can be derived.

My main question about the assumptions in theoretical frameworks is: *Are people risk loving, risk neutral or risk averse?* In addition to more common sub questions about demographics, which will be presented in the next paragraph, there are three specific research questions. The first research question is: *What is the influence of the number of episodes a contestant has been in, the so called "appropriator effect"?* I want to test if there is something like the "house-money effect", but than in a slightly different way. The house-money effect is the effect where people make risky bets with money they have recently won (Thaler and Johnson, 1990). I think that some sort of effect is applicable for the contestants in Deal or No Deal. This effect will be called the "appropriator effect". I expect that someone who is just in the show and immediately plays the game, plays the game differently than someone who has been waiting for 25 episodes. I expect that people, who have waited for several episodes, see the money that they can win more as if they deserve it. This is in the sense that the money they *can* win is more perceived as if they own it, than for someone who plays in the first or second episode they are in. The second specific research question is about a new reference point. I assume that a contestant uses the winnings of his fellow contestants as a reference point. It makes sense that the playing style of the contestant is influenced by the winnings of the other contestants during the previous episodes. This reference point is related to episodes that they remember and will be called the "learning effect". The corresponding research question is: *What is the influence of the prizes won by previous contestants, the so*

*called "learning effect"?* The third specific research question is also about a reference point. This concept is comparable with the "break-even effect" introduced by Thaler and Johnson (1990). When a decision maker has a prior loss, the opportunity to break even is very attractive. In the context of Deal or No Deal, I think that when the current offer is much lower than the previous highest offer, the contestant is willing to take a lot of risk to make up his loss. This concept will be called the "recovery effect". The corresponding research question is: *What is the influence of the previous highest offer, the so called "recovery effect"?*

The contribution to the research on game shows is, among other things, the appropriator, the learning and the recovery effect. Other variables which will be investigated are based on literature and, of course, on intuition. The other sub questions are: *Are men more risk seeking than women? Are older people more risk averse then younger people? Does the relationship status of the contestant influence the risk preference of the contestant? Are richer people more risk seeking than poorer people?* and *Does the number of children influences the risk preference of the contestant?*

As mentioned before, episodes of the Dutch version of the game show will be used, where recent papers of Brooks, Faff, Mulino, and Scheelings (2009) and De Roos and Sarafidis (2010) use episodes of the Australian version. In the Australian version there are deviations in the sense that there is a supercase[1] option, a chance[2] option, and a double or nothing[3] option, which again makes the analysis more difficult. Post, Van den Assem, Baltussen, and Thaler (2008) do investigate the Dutch version, but they investigate the Miljoenenjacht version mentioned before. Therefore, it is impossible to investigate the "appropriator effect" and the "learning effect" might be less applicable with the Miljoenenjacht version.

The first section discusses prior research and other relevant literature. In the second section the rules of the games, the selection procedure and the bank behavior are explained. The third section contains the hypotheses, where the fourth section describes the methodology that will be used during the paper. The fifth section gives a description of the data. The sixth

[1] The contestant can swap his accepted offer for a suitcase with an unknown amount of money that can take on 8 different values.
[2] The contestant can "undo" his accepted offer and can open his own suitcase.
[3] The contestant has to pick between two suitcases with the text double or nothing in it. He bets his whole accepted offer. Before the 2007 season, contestant could bet a chosen portion of their accepted offer, making the option less risky.

section contains the analysis and the final section presents the conclusions, the limitations and suggestions for further research.

## I. Literature review

Many game shows have been investigated because of the interesting characteristics discussed in the introduction of not being an experiment with low stakes, but involving real-life choices with interesting stakes. Therefore, this section starts with a brief summary of studies of other game shows, where the second part discusses the studies of Deal or No Deal in more detail. The third part will show some interesting insights from another field of research. This section ends with a short explanation of utility functions and risk preferences.

For the show Card Sharks, Gertner (1993) finds a high coefficient of risk aversion. In Illinois Instant Riches, Hersch and McDougall (1997) find that income is not a significant determinant of risk aversion. In Jeopardy!, Metrick (1995) does not reject risk neutrality, where in Lingo, risk aversion is confirmed by Beetsma and Schotman (2001). Fullenkamp, Tenorio, and Battalio (2003) find that risk aversion differs with stakes, where behavior is risk neutral for smaller stakes for the game show Hoosier Millionaire. If these shows are compared with Deal or No deal, it can be concluded that Card Sharks and Lingo have a disadvantage of lower stakes, where Jeopardy! and Lingo have a disadvantage that the price depends on the skills of the contestant. The game show Hoosier Millonaire is the closest to the topic of my paper. The focus is on Deal or No Deal, so this section continues with the in-depth discussion of studies about Deal or No Deal.

There has been quite some research on several versions of Dear or No Deal recently, partly because of the interesting features of the show. Research done by other authors will be presented to highlight the addition of this paper to the field of behavioral finance and to stress why the Dutch Deal or No Deal show is selected.

In their paper, Brooks, Faff, Mulino, and Scheelings (2009) analyze data from the Australian version of Deal or No Deal to explore risk aversion in a high real stakes setting. To be precise, the Australian version is comparable with the Dutch Miljoenenjacht version in terms of the selection procedure, which is based on the correct answering of trivia questions at the beginning of the show. An attractive feature of this version of the game is that supplementary rounds may occur which switch the decision frame of players. First, Brooks et al. (2009) observe that the degree of risk aversion generally increases with stakes. Second,

they observe considerable heterogeneity in people's willingness to bear risk – even at very high stakes. Third, they find that males are statistically less risk averse than females, while wealth is not a statistically significant determinant of risk aversion. They also state that age is a significant determinant, but this is not confirmed by their presented results. Fourth, they find that the reversal of framing does have a significant impact on people's willingness to bear risk.

To analyze the impact of income on the decisions of the contestant, Brooks et al. (2009) use the postal code as a proxy for individual wealth. They use the average income data from the 2001 Australian Census which makes sense to estimate the wealth of a contestant. However, I can imagine that this procedure does not give an accurate estimate of the individual income and that this could be the reason for income not being a statistically significant explanatory variable. I think that my estimation of a person's income based on his occupation is more accurate.

One of the reasons why I am investigating the Dutch Deal or No Deal version instead of a Miljoenenjacht-type is the selection procedure. For the Australian version, answering the questions correct is a proxy for education, which has, through the corresponding income, an influence on risk. Another reason has to do with the additional Chance and SuperCase rounds. Brooks et al. (2009) do investigate the reversal of framing, and therefore, it makes sense to investigate the Australian version. In the first 9 rounds the contestant only faces choices involving possible gains, because he can swap his right to a lottery for a sure amount of money. On the other hand, in the additional rounds, the contestant faces a reversed framing. He can swap his sure winnings for a gamble, introducing possible losses. Where this setting is ideal for Brooks et al. (2009), I think it has an influence on the behavior of the contestant in the standard rounds, because they are aware of the "compensation rounds" and therefore, an analysis of a Deal or No Deal show without exotic additional rounds is preferred.

Post, Van Den Assem, Baltussen, and Thaler (2008) examine the risky choices of contestants in the episodes of the German and US version and the Dutch Miljoenenjacht version of Deal or No Deal and related classroom experiments. Contrary to the traditional view of expected utility theory, in which the preferences for a given choice problem do not depend on the path travelled before arriving at the choice problem, the choices can be explained in large part by previous outcomes experienced during the game. Risk aversion decreases after earlier expectations have been shattered by unfavorable outcomes or surpassed

by favorable outcomes. The results of Post et al. (2008) point to reference-dependent choice theories such as prospect theory, and suggest that path-dependence is relevant, even when the choice problems are simple and well defined, and when large real monetary amounts are at stake. Age, gender, and education did not have significant explanatory power in their analysis. In their experiments, they find that risk aversion is strongly affected by prior outcomes as well.

The outcome of a reference-dependent and path-dependent decision is of course very interesting. Besides the appropriator effect, new possible reference points will be added to the explanatory variables. Based on intuition and comments from the contestants, a variable is included which refers to a number of prices that are won in previous episodes that the contestant who plays the game has been in, the so called learning effect. Another reference point, which also deals with path-dependency, is the variable which represents the highest offer so far. This concept is called the recovery effect and deals with the attempt of the contestant to make up his "loss". Of course, the contestant has no influence on the expected value of his suitcases at all, but a lot of contestants have a theory about selecting the suitcases. If this "theory" turns out to be a good one, they might think that they control the gamble and therefore, reject serious offers. Both variables will be discussed in depth in the hypothesis section.

De Roos and Sarafidis (2010) analyze the choices of 399 contestants in the Australian version of Deal or No Deal. They calculate risk aversion bounds for each contestant, revealing considerable heterogeneity. They then estimate a structural stochastic choice model which captures the dynamic decision problem faced by contestants. To address individual heterogeneity, they nest the dynamic problem within the settings of both a random effects and a random coefficients probit model. Their structural model produces plausible estimates of risk aversion, confirms the role of individual heterogeneity and suggests that a model of stochastic choice is indeed appropriate. They find mixed evidence of greater risk aversion by females. They also examine generalizations to expected utility theory, finding that the rank-dependent utility model adds non-negligible explanatory power and indicates optimism in probability weighting.

As mentioned before in the analysis of the paper by Brooks et al. (2009), I think that the additional rounds could influence contestant's behavior. De Roos and Sarafidis (2010) do discuss this problem in more detail and therefore, their counterarguments are presented. They

say that based on observations, contestants do not appear to take the option value into account, because they never mention the additional rounds when hypothesizing about bank offers. However, it could be that they are subconscious aware of the possibilities. What De Roos and Sarafidis (2010) also mention is that in the first 140 episodes the SuperCase and Chance features did not exists, and therefore, they can calculate the impact of these rounds. They do not find strong evidence for different parameter estimates for the two subsamples. So, perhaps it is not a problem, but to be sure that the decision is as simple as possible, the Dutch Deal or No Deal version is favored. Another reason for the preference for the Dutch version is that in the French, Italian, and Spanish version the banker, who prepares the offer, knows the value which is in the suitcase, which of course makes the analysis more complicated due to strategic thinking by the contestants.

It is important to note that in the versions which look like the Miljoenenjacht version, the contestant is selected based on the answering of several trivia questions. Therefore, there is some skill involved. In the Deal or No Deal version that is investigated in this paper, there is only one question which should be answered correct. I think that the selection of the final contestant is not influenced by this question, but this will be discussed in depth in subsection 2A.

Conclusions from other fields of interest could be helpful for the development of my hypotheses. Therefore, some relevant results from related research on portfolio management will be discussed.

Ackert, Church, and Englis (2002) find that only age affects the composition of risky assets, with lower equity holdings for older investors. The allocation of total portfolio assets to equity is influenced by gender, home ownership, Value and Lifestyle segment, and net worth. The results indicate that men hold a larger proportion in equity than women and this proportion increases as net worth increases.

Hallahan, Faff, and McKenzie (2004) find that risk tolerance scores are significantly influenced by gender, age, number of dependents, marital status, income, and wealth. Where men are more risk tolerant than women, more dependents leads to less risk tolerance, singles are more risk tolerant, and wealthier people are also more risk tolerant. Besides the age, they also use a quadratic age term. Where the age term is insignificant, the quadratic term is negative and significant, which indicates that risk tolerance declines at an increasing rate as

age increases. They also investigate education, but they draw the conclusion that the level of education reflects the wealth of an individual.

Riley and Chow (1992) analyze relative risk aversion from actual asset allocation. They find that relative risk aversion decreases as one rise above the poverty level and decreases significantly for the very wealthy. It also decreases with age, but only up to a point. After the age of 65, risk aversion increases with age.

The final part of this section briefly explains the working of utility functions. The three types of risk behavior, risk neutrality, risk aversion and risk loving, can easily be depicted by utility functions. The first restriction placed on a utility function is that of nonsatiation. This means that X + 1 euro is always preferred to X euros. Thus, if we want to choose between two certain investments, the one with the larger return is always preferred. The second property of utility functions is about the taste for risk. Three tastes are possible, namely risk aversion, risk neutrality and risk seeking. All the tastes can be defined by using a fair gamble (Elton, Gruber, Brown, Goetzman, 2011). Let us assume that in the final round 5 of an episode of Deal or No Deal the contestant faces two suitcases with amounts of €10k and €20k and receives an offer of the bank of €15k. Risk aversion means that the contestant will reject this fear gamble and accepts the certain amount of €15k. The utility function would look like line 3 in figure 1. Risk neutrality means that a contestant is indifferent between taking and rejecting the fair gamble. This is represented by the second line in figure 1. A risk loving contestant will take a fair gamble, because his average utility of €10k and €20k is higher than that of €15k, which is depicted by line 1 in figure 1.

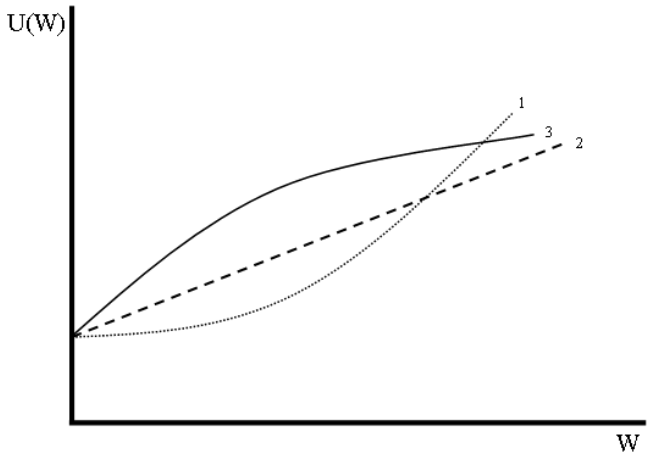


Figure 1: Utility functions for all three risk preferences.

## II. The game

### *A. Game rules*

At the beginning of the game there are 20 participants standing behind their desk. One of them will be selected to play the game and pick the suitcases to be opened. This contestant is the one who answered a multiple-choice[4] question with 3 possibilities as fastest correct. Because of the selection question, it could be possible that you play the game after being in just one, or over thirty episodes.

An issue is that the correct answering of the selection question might be influenced by the education of the contestant. However, I think that being selected is just a matter of luck and not of skills. Answering the question is not really a difficult job. Sometimes, one of the answer possibilities is nonsense. For example, one question about greenhouse gas has the possible answers: "aerobics", "aerosolen", and "aerofonen". Where most people do not know what possibilities two and three are, they know that answer one is nonsense and therefore, the guess probability has increased from 33% to 50%. Several times, Beau, the host of the show, gives some obvious hints for the correct answer. He does this in the form of making up some nonsense answers, by coughing or by saying "it is not what you think it is". He also repeatedly tells the contestants to check www.hier.nu, the web site of the sponsor of the questions. In the autumn 2008 season, Beau repeatedly tells the new contestant what the correct answer is. Furthermore, several episodes he only gives two possible answers. Besides the hints of Beau, you can hear the contestants say the correct answers to their neighbors. You can also see the contestants looking for someone in the audience who signals the correct answer[5]. In Appendix A it is proved that the percentage of people who answer the question correct is significantly higher than the expected guess percentage of 33.33%.

One other aspect of being selected is the speed of selecting the answers. The person who is the fastest of the contestants with the good answer is selected. Beau repeatedly tells that it is about fractions of seconds and that the differences are small. Therefore, I do not expect that skills have an influence on the correct answering of the question and therefore, on the appropriator effect.

[4] The questions in the spring 2009 season and the autumn 2008 season are sponsored by HIER. HIER is a climate campaign, and therefore, all questions are related to topics like climate control and environment.
[5] More examples are available upon request from the author.

The only thing the contestant has to do is to select some suitcases and decide whether to accept or reject a bank offer. Therefore, Beau always calls Deal or No Deal the easiest game on earth. During a 25 minute lasting show the suitcases are selected. In the first round 6 suitcases are selected to be opened. In every following round 3 suitcases are opened. If the contestant keeps refusing the offer, he ends up with 2 suitcases, and so there is a maximum of 5 selection rounds. After every round the bank makes an offer for the suitcase of the contestant. The described sequence is presented in figure 2. The values of the 20 suitcases range from €1 to €250,000. The values are €1, €5, €10, €20, €50, €100, €200, €300, €400, €500, €1k, €5k, €10k, €20k, €30k, €40k, €50k, €100k, €125k, and €250k.

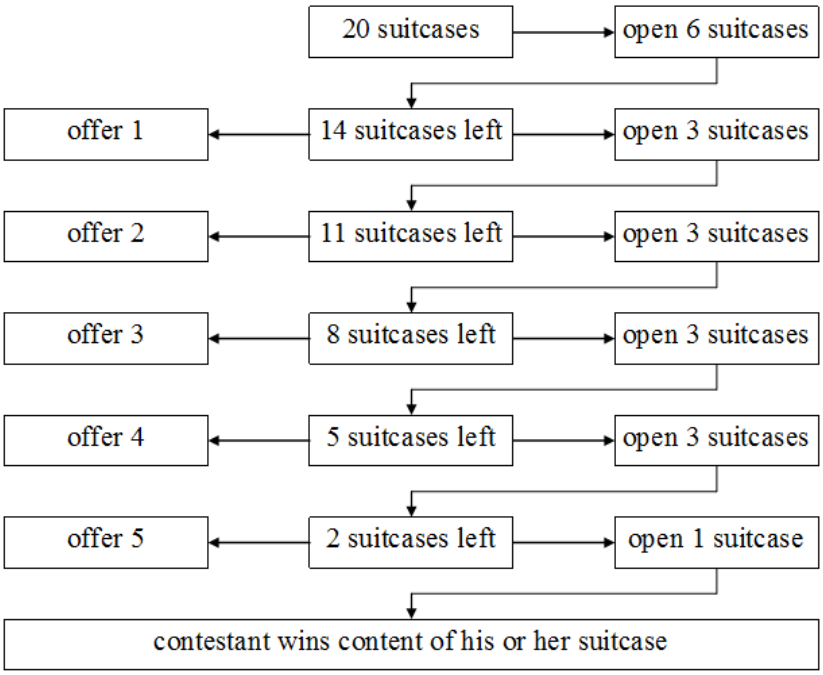


Figure 2: Possible choice paths for a contestant.

*B. Pre-selection procedure*

All the contestants are selected by the editors of the show. During a selection day the potential contestants have to fill in a questionnaire about their hobbies, job, education, etcetera and they have an interview with two editors. After the questions, they will have a chat with each other in a group of five. The editors will watch who takes the lead, who hesitates, and how they respond to each other. What the editors are looking for, are people who can express their feelings and their thoughts, so that the viewers of the show know what the contestant is thinking. The potential contestant will also be subjected to some tests on how they act in front of cameras. After all this, the preliminary selection will be discussed with the

broadcasting agency, which in this case is RTL 5. RTL 5 their target group is the viewer in the age of 20-34 and therefore, the contestants are a bit more outgoing and expressive than the average Dutch person.

### *C. Bank behavior*

It can be seen from table 1, that in a standard episode the bank offers 5% of the value of the remaining suitcases in round 1, 10% in round 2, 20% in round 3, 40% in round 4, and finally the bank ends with an offer with a ratio around 70% in round 5.

**Table 1 Bank behavior measured by the ratio offer / expected value**

| | Round 1° | Round 2 | Round 3 | Round 4 | Round 5 |
|---|---|---|---|---|---|
| Minimum | 0.0248 | 0.0420 | 0.0876 | 0.1735 | 0.4651 |
| Average | 0.0591 | 0.1069 | 0.2187 | 0.4187 | 0.7256 |
| Median | 0.0501 | 0.1053 | 0.2042 | 0.4000 | 0.6923 |
| Maximum | 0.2616 | 0.1563 | 0.4714 | 1.4206°° | 1.1765°°° |
| N | 123 | 123 | 123 | 116 | 61 |

° The numbers are influenced by two extremely high offers. The first episode of the spring 2009 season starts with an offer with a ratio of 26.16% and in episode 33 of the same season there is a high offer with a ratio of 21.40%, because of the bad previous four episodes. If episodes 1 and 33 are excluded the numbers will be 0.0248, 0.0537, 0.0501, and 0.1471.
°° The second highest ratio is 0.8252.
°°° The second, third and fourth highest ratios are 1.0222, 1, and 0.9667.

It can be seen from table 1 that there are only 3 offers which are above the average value of the remaining suitcases, which make the data very useful in determining the risk preferences of the contestants.

## III. Hypotheses

Of course, the research questions are answered with quantitative research, but after seeing many episodes, it makes sense that qualitative research could answer the questions as well. Although, this is not the purpose of my analysis, the hypotheses will be supported with some quotes[6] of the contestants.

$H_1$: A contestant is more likely to accept a deal the higher the offer is.

It is expected that a deal is accepted earlier if the offer is higher. Of course, the size of the offer depends on absolute and relative values. Therefore, to include the bank offer as a predicting variable, two measures will be used. The first measure is the absolute bank offer, where the expectation is that contestants deal earlier when the offer is higher. This hypothesis is supported by the findings of Fullenkamp, Tenorio, and Battalio (2003) that risk aversion differs with stakes, where behavior is risk neutral for smaller stakes. Brooks et al. (2009) draw the same conclusion and state that the degree of risk aversion generally increases with stakes.

$H_2$: A contestant is more likely to accept a deal the higher the ratio of the offer to the expected value is.

As mentioned before, whether an offer is high does not only depend on the absolute value, but also on the relative value, i.e. compared to the expected value (average) of the remaining suitcases. Therefore, it is expected that a contestant deals earlier if the offer compared to the expected value is higher.

$H_3$: Female contestants are more likely to deal.

It is expected that women are more risk averse than men, and thus, deal earlier. This is supported by the evidence of greater risk aversion by females from De Roos and Sarafidis (2010) and Brooks et al. (2009). It is also supported by Ackert, Church, and Englis (2002) and Hallahan, Faff, and McKenzie (2004) their findings on portfolio allocation.

$H_4$: Elder contestants are more likely to deal.

It is expected that the risk aversion increases when age increases, and therefore, older contestants are expected to deal earlier. This hypothesis is based on the relevant literature and

[6] Because the show is in Dutch, the quotes are translated loosely by me and therefore, nothing can be attributed to the contestants themselves.

the fact that elder people need more certainty and safety. Evidence from the field of portfolio management by Ackert, Church, and Englis (2002) supports this hypothesis.

$H_5$: Contestants in a relationship are more likely to deal.

It is expected that people in a relationship are more risk averse than single people. Single people have less responsibility and therefore, are expected to accept an offer later. In their research about portfolio allocation, Hallahan, Faff, and McKenzie (2004) find that singles are more risk tolerant, which supports this hypothesis.

$H_{6a}$: A contestant is more likely to accept a deal the lower the ratio of their salary to the offer is.

The expectation is that the risk aversion decreases when the contastant's income increases and so, contestants with a lower salary are expected to deal earlier. This hypothesis is supported by several contestants their comments. Donna Rahajaan, a saleswoman in a clothing store said: "I must work for many months to earn that (the bank offer) amount of money." Randy Siffels said: "That (the bank offer) is a lot of money for a poor student." Suzanne van Haaster said: "If you have a job in education, it is a lot of money." From the comments it becomes clear that the offer is not worth the same for every contestant. The variable which will be investigated is the salary divided by the offer. So the lower the ratio, the relatively higher the offer is. Therefore, the hypothesis becomes that the lower the ratio is, the earlier the contestant deals. In their research about portfolio allocation, Hallahan, Faff, and McKenzie (2004) and Ackert, Church, and Englis (2002) find that wealthier people are indeed more risk tolerant, which supports this hypothesis.

$H_{6b}$: Contestants with a professional job are less likely to deal.

The risk preferences are expected to differ when the contestant has a different job. Similar to hypothesis $H_{6a}$, contestants with a professional job are expected to deal later.

$H_7$: A contestant is more likely to accept a deal the higher the number of children he has is.

It is expected that the number of children leads to a higher level of risk aversion, because a parent has more responsibilities. The more children the contestant has, the earlier he is expected to deal. This hypothesis is supported by a note of Vita Lie-A-Fo, who has two

children and is pregnant of a third. She commented that in their situation, she should be wise. In their research about portfolio allocation, Hallahan, Faff, and McKenzie (2004) find that more dependents lead to less risk tolerance, which supports this hypothesis.

$H_8$: A contestant is more likely to accept a deal the higher the number of episodes he has been waiting is.

I expect that the risk behavior changes when contestants have been waiting several episodes. I expect contestants to see the money more as their own when they are longer in the game show and therefore, a reversed house-money effect might be applicable. Contestants who have played a lot of episodes play less risky than contestants who have been waiting for only a couple of episodes. Because of the time investment the contestant made, he plays more risk averse because he thinks he should earn at least some money. Therefore, the appropriator effect will have a positive effect on the acceptation of the deal.

$H_9$: The influence of the number of episodes a contestant has been waiting is larger the higher the bank offer is.

Suzanne van Haaster, who played the game in her second episode said: "I have to realize that it is for real." She also said: "€1000 is nice for the time that I have been here." Therefore, it makes sense if there is some sort of turning point depending on the bank offer. I think that contestants who have invested a lot of time accept earlier when offers are high, but that they are, unlike Suzanne, not happy with an amount of €1000 when they have been waiting for 20 episodes. Therefore, an interaction term between the number of episodes and the offer will be included in the regression model presented in the next section. The hypothesis is that the higher the combination of both, the earlier the contestant deals.

$H_{10}$: A contestant is less likely to accept a deal the higher the prizes won by the previous contestants are.

While I was watching all the episodes, I noticed that the contestant use besides their own series of bank offers also another reference point. This reference point is related to episodes which they remember and this is what will be called the learning effect. The average amount of money that is earned during the previous five episodes before an individual plays is used as a reference point. It is expected that the higher this amount is the more risk the contestant takes. This learning effect is supported by some comments of the contestants. Alain

Kersten said: "The recent episodes go through my head," which supports the learning effect. Serena Breidel said: "I have seen it often go so wrong," which underpins the hypothesis.

$H_{11}$: A contestant is more likely to accept a deal the higher the ratio of the offer to the highest offer so far is.

It is known from the literature that people are willing to take a risk to make up their losses, which is known as the break-even effect. Because the contestants have their previous offers as reference points, I expect that the higher the current offer is compared to the previous maximum offer, the earlier they accept the offer. In case of a lower offer they are willing to make up for their loss and take more risk than when the path of bank offers is different. This excessive risk taking is called the recovery effect. The hypothesis is that the higher the ratio of the offer to the previous highest offer is, the earlier the contestant deals. This hypothesis is supported by the findings of Post et al. (2008) that risk aversion decreases after earlier expectations have been shattered by unfavorable outcomes or surpassed by favorable outcomes.

## IV. Methodology

In order to answer the research questions, a logit regression to predict the acceptation or refusal of the offer will be used. A binary logistic regression is run in SPSS with the Generalized Linear Model option. In this case the dependent variable is a dummy which takes the value 1 for the acceptation of the bid and 0 if the offer is rejected.

All the research questions are translated into variables that are shown in the first column of table 2. The second column describes whether the explanatory variable is a dummy variable or a scale variable. The third column gives a short explanation about the calculation of the variable and the fourth column translates the hypotheses into statistical hypotheses.

**Table 2 Variables and statistical hypotheses**

| Variable | Measurement scale | Explanation | Statistical hypothesis |
|---|---|---|---|
| Acceptation | Nominal | This is the variable that will be explained by all the models. It is a dummy variable where No Deal=0 and Deal=1 | |
| Offer | Ratio | The absolute value of the bank offer | $H_0$: $\beta_1 = 0$<br>$H_1$: $\beta_1 > 0$ |
| Offer/EV | Ratio | The relative value of the bank offer, i.e. the offer divided by the expected value of the remaining suitcases | $H_0$: $\beta_2 = 0$<br>$H_2$: $\beta_2 > 0$ |
| Gender | Nominal | Gender is a dummy variable where male=0 and female=1 | $H_0$: $\beta_3 = 0$<br>$H_3$: $\beta_3 > 0$ |
| Age | Ratio | The age of the contestant | $H_0$: $\beta_4 = 0$<br>$H_4$: $\beta_4 > 0$ |
| Relationship | Nominal | Relationship is a dummy variable where single=0 and relation=1 | $H_0$: $\beta_5 = 0$<br>$H_5$: $\beta_5 > 0$ |
| Salary/Offer | Ratio | The salary divided by the offer is used in the first series of models | $H_0$: $\beta_{6a} = 0$<br>$H_{6a}$: $\beta_{6a} < 0$ |
| Job[7] | Nominal | The job of the contestant is used in the second series of models | $H_0$: $\beta_{6b0} = \beta_{6b1} = \beta_{6b2} = \beta_{6b3} = \beta_{6b4} = \beta_{6b5} = \beta_{6b6} = \beta_{6b7} = \beta_{6b8} = \beta_{6b9} = 0$<br>$H_{6b}$: At least one $\beta_{6bi}$ is different |
| #Children | Ratio | The number of children the contestant has | $H_0$: $\beta_7 = 0$<br>$H_7$: $\beta_7 > 0$ |
| #Episodes | Ratio | The number of episodes the contestant has been in | $H_0$: $\beta_8 = 0$<br>$H_8$: $\beta_8 > 0$ |
| #Episodes *Offer | Ratio | The interaction term between the number of episodes and the bank offer | $H_0$: $\beta_9 = 0$<br>$H_9$: $\beta_9 > 0$ |
| Average Winnings | Ratio | The average amount of money that is accepted during the previous 5 episodes | $H_0$: $\beta_{10} = 0$<br>$H_{10}$: $\beta_{10} < 0$ |
| Offer/ PreviousMax | Ratio | The ratio of the offer to the previous highest offer | $H_0$: $\beta_{11} = 0$<br>$H_{11}$: $\beta_{11} > 0$ |

The results of the fourth and the fifth round are pooled to increase the total number of data points. The other rounds are neglected due to the fact that nobody accepted the offer of round 1 and 2, and only 7 out of 123 people accepted the offer of round 3. So, in total there are 116 contestants in round 4 and 61 contestants in round 5, making a total of 177 decisions

[7] The job of a contestant will be classified in one of the ten ISCO classes. To test the null hypothesis, class 0 is redundant in the models and therefore, will be the reference class. Furthermore, when the job is used as a demographic variable it replaces the current Salary/Offer variable in the models.

to be analyzed. Five different models are used to test the different hypotheses. The statistical models for the logistic regression are:

$$\text{Model 1: } \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \cdot Offer + \beta_2 \cdot Offer/EV$$

$$\text{Model 2: } \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \cdot Offer + \beta_2 \cdot Offer/EV + \beta_3 \cdot Gender + \beta_4 \cdot Age + \beta_5 \cdot Relationship + \beta_6 \cdot Salary/Offer + \beta_7 \cdot \#Children$$

$$\text{Model 3: } \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \cdot Offer + \beta_2 \cdot Offer/EV + \beta_3 \cdot Gender + \beta_4 \cdot Age + \beta_5 \cdot Relationship + \beta_6 \cdot Salary/Offer + \beta_7 \cdot \#Children + \beta_8 \cdot \#Episodes + \beta_9 \cdot \#Episodes \cdot Offer$$

$$\text{Model 4: } \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \cdot Offer + \beta_2 \cdot Offer/EV + \beta_3 \cdot Gender + \beta_4 \cdot Age + \beta_5 \cdot Relationship + \beta_6 \cdot Salary/Offer + \beta_7 \cdot \#Children + \beta_{10} \cdot AverageWinnings$$

$$\text{Model 5: } \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \cdot Offer + \beta_2 \cdot Offer/EV + \beta_3 \cdot Gender + \beta_4 \cdot Age + \beta_5 \cdot Relationship + \beta_6 \cdot Salary/Offer + \beta_7 \cdot \#Children + \beta_{11} \cdot Offer/PreviousMax$$

Model 1 is the basic model, which only contains the offer and the ratio of the offer to the expected value (the average) of the remaining suitcases. In the second model, the basic determinants of risk preferences are added. The variables are the gender, age and relative salary of the contestant, a dummy with the value 1 if the contestant is in a relationship, and the number of children the contestant has. In the third model, the appropriator effect is added to model 2. In the fourth model, the learning effect is added to model 2. In the fifth model, the recovery effect is added to model 2. This variable is the ratio of the offer to the highest offer of the previous rounds.

To test the significance of the models, two tests are performed. First, the Omnibus test of model coefficients is used to test whether the complete model is better than a model with an intercept only. The Omnibus test follows a Chi-square distribution. To test whether one model outperforms another model, the likelihood ratio test for multiple parameters is used. In order to perform the test, the two models have to be nested. Nested model tests involve comparison of one model to another model that specifies only a subset of the parameters included in the first model, i.e. model 1 is nested in models 2-5 and model 2 is nested in

models 3-5. Furthermore, the same cases have to be used in both models under comparison. Therefore, if data is missing for a certain variable the sample size is set equal to the lowest sample size of the five models for all the models.

## V. Data

In order to answer all the research questions and test the hypotheses, a self-collected dataset of 123 contestants of the spring 2009 and autumn 2008 season of the Dutch Deal or No Deal version is used. Every 25 minute during episode is watched in full for the offers received from the back, the decisions made by the contestant, information about his demographics and interesting comments from him. An additional 20 minutes is necessary to report the information and transform all the information into variables that could be used for analysis.

The data comes from the website of the Dutch television channel RTL named RTL Gemist[8]. This is a website for episodes of all shows that have been on television[9]. There is data available of four seasons. In every season the occupation is stated on the desk. For the 2007-2008 season the episodes 5-9 are available; for the spring 2008 season the episodes 1-57, 59-74, and 80-84 are available, for the autumn 2008 season the episodes 1-55 are available, and for the spring 2009 season the episodes 1-75 are available.

All the 75 episodes of spring 2009 season are used as input and 48 of the 55 episodes of the autumn 2008 season are used. Not all episodes of the autumn 2008 season are used due to different reasons. Episode 26 and 37 are for unknown reasons not available and therefore, it is impossible to derive the data. Episodes 1 till 5 are also not included, because of the fact that the 20 contestants in those five episodes are different from the contestants in episode 6 of the autumn 2008 season and the last episode of the spring 2008 season. As a sensational opening, the season starts with the 20 contestants of all the previous seasons with the lowest winnings. These episodes are not included, because several hypotheses cannot be tested because of the lack of certain data. So, in total 123 episodes from two seasons are used. The missing of several episodes of the spring 2008 season is the main reason of not including this season in the sample.

[8] http://www.rtl.nl/xl/#/gemist/ (08-09-2011)

[9] Unfortunately, during my research, the episodes could not be found on the website of RTL Gemist anymore. Fortunately, the episodes can be watched via http://www.tvblik.nl/deal-or-no-deal (25-04-2012).

As stated in the methodology section, round 1 till 3 are not taken into account, because of the similar behavior by almost every contestant. Therefore, 116 episodes of round 4 are being used. Round 4 is pooled with the remaining 61 contestants in round 5. For the analysis, a total of 177 decisions are used.

Before the descriptive statistics of the variables that are taken into account are presented, some of the variables need to be clarified.

Most contestants tell their age, but unfortunately not all. If this is not told by a participant, he is classified in an age class with a width of 10 years. Of course, it is not possible to guess all ages correct, but within a range of 10 years this should be possible. All contestants who did not tell their exact age where separately divided into age classes by a second evaluator. All unequal classes where discussed and therefore, the guessed age is in my opinion reliable. The center of the class is used as the age.

Another variable which needs to be clarified is the relationship status of the contestant, which is told by most of the contestants during the game. A distinction is made between single, relationship, going to marry, married, divorced and widow. The simplest distinction between single and in a relationship is used in the analysis. All the single and divorced contestants are pooled with the widows versus the contestants who are married, in a relationship or going to marry.

One of the variables that will be examined is the salary of the contestant. Due to privacy legislation, the salary of the contestant is unknown, but what is known is the job of the contestants. The occupation of the contestant is shown on the desk they are standing behind and because there are many different occupations, it makes sense to use the job as an indicator for their corresponding income. The Salaris Check of Loonwijzer[10] is used to recode the jobs into income figures. For the "mothers" the salary is set to zero. For the students, the income is based on information from the Dutch Central Bureau of Statistics[11]. The salary is the net month salary. As an input variable, the ratio of the salary to offer is used. With the ratio, it is taken into account that the offer is not worth the same for every contestant. The interpretation of the ratio is slightly different from the other ratios. While all other ratios are a variable divided by the offer, it is the other way around with this ratio. This is done because

[10] http://www.loonwijzer.nl/home/salaris/salarischeck (27-04-2012)
[11] http://www.cbs.nl/en-GB/menu/themas/inkomen-bestedingen/publicaties/artikelen/archief/2009/2009-2869-wm.htm?Languageswitch=on (27-04-2012)

some contestants have a salary of €0 and the ratio could not be calculated otherwise. So the lower the ratio, the relatively higher the offer is.

The contestant is also classified based on his job using the International Standard Classification of Occupations[12] (ISCO). The major groups are used to classify the contestants. The major groups are Managers, Professionals, Technicians and associate professionals, Clerical support workers, Service and sales workers, Skilled agricultural forestry and fishery workers, Craft and related trades workers, Plant and machine operators and assemblers, Elementary occupations, and Armed forces occupations. The use of the ISCO coding and the job as an indicator for salary explains the different measurement levels that were stated in table 2. The ISCO coding is also used as an alternative to the Salary/Offer variable in models 2-5. When the ISCO coding is used, hypothesis 6a is replaced with hypothesis 6b.

The number of episodes a contestant has been in is easy to derive[13]. Every episode the host tells which contestant is new and it is clear who leaves the show. All contestants have the same spot behind the desk in every episode. Furthermore, the contestants are not replaced when a new seasons starts.

For the variable AverageWinnings the average of the five previous episodes is used. This variable is used for the learning effect and is a reference point for the contestants. The number of five is based on the length of a week. At the first episodes of a new week Beau and the contestants always refer to the previous week and in the last episodes of a week they refer to the current week and the last episodes of the previous week. Of course, for the first episode of a new season there is no reference point. For the second till the fifth episode the average is based on the previous one, two, three or four episodes. For contestants who played less than five episodes, the average of the five previous episodes is also used. This is based on the fact that the contestant is already waiting in the audience and therefore, also uses these episodes as a reference point.

[12] http://www.ilo.org/public/english/bureau/stat/isco/docs/resol08.pdf (27-04-2012)

[13] Unfortunately, due to the missing of episodes 75-79 of the spring 2008 season, it is not possible to derive the exact number of episodes for 4 of the contestants. This is because they were "the new one" in one of those 5 episodes. For simplicity, it is assumed that they all arrived in episode 77. Furthermore, Vince Ronde and Alami Attal Haoui are in the game show twice. Vince misses the first 15 episodes of the spring 2009 season, because of the birth of his child. Alami misses episodes 16 till 35 of the spring 2009 season, because of the death of his father. Both series of episodes are added together.

The descriptive statistics of all the variables are shown in table 3. The prices which are won differ from the minimum of €1 till the maximum of €250,000. However, the average price has a mean of nearly €18,000 and a standard deviation of over €29,000[14].

It can be seen that from the 123 contestants 64 are male and 59 are female. They differ in age from 18 till 65 with a mean of 33. In total there are 92 contestants in a relationship and 28 are single, for 3 contestants the status is unknown. The average contestant has a net month salary of €1469.61 with a standard deviation of €608.11. The ratio of net month salary to offer is on average 2.15. Of all the contestants 53 have in total 91 children which makes an average of 0.78 children per contestant. Furthermore, 27 contestants are classified as Managers, 21 as Professionals, 20 as Technicians and associate professionals, 6 as Clerical support workers, 24 as Service and sales workers, 3 as Craft and related trades workers, 1 as Plant and machine operators and assemblers, and 1 as Elementary occupations. The Skilled agricultural forestry and fishery workers and Armed forces occupations are not represented. Several of the groups have only a few classifications and therefore, some groups are combined. The Clerical support workers and the Service and sales workers are combined in a Front and back office workers group and the Craft and related workers, Plant and machine operators and assemblers, and the Elementary occupations are combines in a Hands-on occupations group. Several contestants are retired, housewives or students. Because they do not have a job, they are not classified in ISCO, and so a separate Retired, housewives and students group is created.

With the new classification, 27 contestants are classified as Managers, 21 as Professionals, 20 as Technicians and associate professionals, 30 as Front and back office workers, 5 as Hands-on occupations and 18 as Retired, housewives, or students. Two contestants are not classified, because of odd jobs[15] which are not included in the ISCO list.

There are a lucky few who only need one episode to play the game, but there is also the unlucky Linda Scharphof who was in the game show for 63 episodes before she played the game. The average contestant is in the show for 17.79 episodes. The number of episodes

[14] In total the bank paid €2,213,412 in prices for suitcases owned by the contestants with a total value of €3,742,988. 28 contestants ended with the value of their own suitcase, 52 made a better deal and 43 a worse deal. The biggest absolute winner is Mirjem Dokmen who sells her suitcase containing €10 for €75,600. The biggest relative winner is Donna Rahajaan who sells her suitcase containing €1 for €28,800. The biggest loser in absolute and relative sense is Martijn Wulder who sells his suitcase containing €250,000 for €21,200.

[15] One of them is Robert Raap who is a tarot card reader and the other is Roosmarie Ruigrok who is a freelance green consultant in the clothing business.

has a standard deviation of 13.78 episodes. The average of the AverageWinnings is almost €18,000, similar to the average prize won, but has a lower standard deviation, due to the fact that it is an average of five episodes, of over €13,000.

**Table 3 Descriptive statistics**

| | N | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|---|
| PrizeWon | 123 | € 17,995.22 | € 29,054.15 | € 1.00 | € 250,000.00 |
| Offer | 177 | € 14,728.63 | € 20,386.92 | € 14.00 | € 170,000.00 |
| Offer/EV | 177 | 0.52 | 0.21 | 0.17 | 1.42 |
| Gender = Female° | 123 | 0.48 | 0.50 | 0 | 1 |
| Age | 123 | 33.46 | 8.88 | 18 | 65 |
| Relationship = Yes°° | 120 | 0.77 | 0.43 | 0 | 1 |
| Salary | 108 | € 1,496.61 | € 608.11 | € 0 | € 2,850 |
| Salary/Offer | 153 | 2.15 | 9.99 | 0.00 | 119.64 |
| #Children°°° | 117 | 0.78 | 0.98 | 0 | 3 |
| #Episodes | 123 | 17.79 | 13.78 | 1 | 63 |
| AverageWinnings | 121 | € 17,866.38 | € 13,270.91 | € 100.00 | € 76,377.00 |
| Offer/PreviousMax | 177 | 1.62 | 1.29 | 0.00 | 6.42 |

° This is a dummy variable where 0 = male and 1 = female. There are 64 males and 59 females in the dataset.

°° This is a dummy variable where 0 = single, divorced or widow and 1 = married or in a relationship. There are 92 contestants with a partner and 28 single contestants. For 3 contestants the status is unknown.

°°° When a contestant talks about his or her children, the number is set to two, although this could be higher in reality. If a contestant is pregnant, the baby is counted as a child. This is because the parents already feel the responsibility.

The offer, offer to expected value ratio, and offer to previous highest offer ratio all have a sample size of 177. This is because rounds 4 and 5 are pooled together. The offer in those two rounds differs between €14 and €170,000 with an average of almost €15,000 and a standard deviation of over €20,000. The ratio of the offer to the expected value of the remaining suitcases falls between 0.17 and 1.42, which was also shown in table 1. The ratio has an average of 0.52 and a standard deviation of 0.21. The offer divided by the previous highest offer has a mean of 1.62 and differs from 0 till a maximum of 6.42 times the previous maximum offer.

Because several variables are derived from the offer, a previous offer or an average, it is important to calculate the correlations. Because all the variables are numeric, the Pearson correlation coefficients are calculated. It can be seen from table 4 that most correlations are not high, but some are significant. When the models are tested, the correlations between the ratios are taken into account and robustness checks will be performed.

**Table 4 Pearson correlations**

| | Offer | Offer/EV | Salary/Offer | Average Winnings | Offer/Previous Max |
|---|---|---|---|---|---|
| Offer | - | | | | |
| Offer/EV | 0.173** | - | | | |
| Salary/Offer | -0.186** | 0.211*** | - | | |
| AverageWinnings | 0.036 | 0.038 | 0.076 | - | |
| Offer/PreviousMax | 0.552*** | -0.068 | -0.312*** | -0.050 | - |

* is significant at the 10% level ** at the 5% level *** at the 1% level

## VI. Analysis

### *A. Risk preferences*

The question about the risk behavior of the contestants can be answered quite easily given the theory about risk preferences. In short, the acceptation of an offer with a ratio below 1 indicates a risk averse contestant. The rejection of an offer with a ratio above 1 indicates a risk loving contestant. A risk neutral contestant rejects offers with a ratio below 1 and accepts offer with a ratio above 1 and is indifferent between accepting or rejecting an offer with a ratio of 1. A contestant cannot be classified when he rejects al his offers with a ratio below 1, or accepts an offer with a ratio above 1.

In round 1 and round 2, all 123 contestants receive and reject an offer with a ratio below 1. In round 3, 116 contestants reject an offer with a ratio below 1, but 7 contestants accept an offer with a ratio below 1. Those 7 contestants can be described as "risk averse". In round 4, 1 contestant receives an offer with a ratio above 1, which is accepted by her. She cannot be classified based on her decisions. The other 115 contestants receive an offer with a ratio below 1. The offer is 61 times rejected, but the 54 contestants who accept the offer can again be classified as "risk averse". In round 5, 2 persons receive an offer with a ratio above 1, 1 person receives an offer with a ratio of 1, and the remaining 58 contestants receive an offer with a ratio below 1. The offer with a ratio above 1 is accepted and rejected one time. Therefore, the man who rejected the offer can be classified as "risk loving" and from the man who accepted the offer the risk behavior is unknown. The offer with a ratio of 1 is rejected. It is clear that this woman is not risk averse, but it is unknown whether she is risk neutral or risk loving. From the offer with a ratio below 1, 32 are accepted. All these 32 contestants can again be classified as "risk averse". The 26 contestants who rejected 5 offers with a ratio

below 1 cannot be classified based on their behavior. In sum, of the 123 contestants, 93 are risk averse, 1 is risk loving, 1 is not risk averse and 28 cannot be classified.

*B. Model results*

The hypotheses will be tested using a logit regression model. Several models will be tested. The first model only contains the offer and the ratio of the offer to the expected value of the remaining suitcases. In the second model, the basic determinants of risk preferences are added. These variables are the gender, age and salary/offer of the contestant, a dummy for the relationship status, and the number of children the contestant has. In the third model, the appropriator effect is added to model 2. In the fourth model, the learning effect is added to model 2. In the fifth model, the recovery effect is included and this is again added to model 2.

**Table 5 Logit regression coefficients with Salary/Offer**

| | Basic | Basic + Determ. | Basic + Determ. + Appropriator effect | Basic + Determ. + Learning effect | Basic + Determ. + Recovery effect |
|---|---|---|---|---|---|
| Intercept | -0.428 | -1.226 | -1.361 | -1.471 | -1.854* |
| Offer° | 0.022** | 0.003 | 0.007 | 0.003 | -0.011 |
| Offer/EV | 0.316 | 2.151** | 2.178** | 2.123** | 2.247** |
| Gender = Female | - | -0.187 | -0.170 | -0.155 | -0.091 |
| Age | - | 0.016 | 0.016 | 0.016 | 0.013 |
| Relationship = Yes | - | 0.182 | 0.150 | 0.132 | 0.159 |
| Salary/Offer | - | -0.350*** | -0.348*** | -0.379*** | -0.251** |
| #Children | - | -0.035 | -0.041 | -0.054 | -0.101 |
| #Episodes | - | - | 0.006 | - | - |
| #Episodes*Offer° | - | - | -0.000 | - | - |
| AverageWinnings° | - | - | - | 0.018 | - |
| Offer/PreviousMax | - | - | - | - | 0.472*** |
| N°° | 143 | 143 | 143 | 143 | 143 |
| Omnibus test | 5.592* | 24.887*** | 25.001*** | 26.108*** | 30.939*** |
| Deviance | 192.586 | 173.290 | 173.176 | 172.070 | 167.238 |
| Df | 139 | 135 | 133 | 134 | 134 |
| ΔDev model 1 | - | 19.296 | 19.41 | 20.516 | 25.348 |
| ΔDf model 1 | - | 4 | 6 | 5 | 5 |
| P-value Chi-square | - | 0.001*** | 0.004*** | 0.001*** | 0.000*** |
| ΔDev model 2 | - | - | 0.114 | 1.220 | 6.052 |
| ΔDf model 2 | - | - | 2 | 1 | 1 |
| P-value Chi-square | - | - | 0.945 | 0.269 | 0.014** |

* is significant at the 10% level ** at the 5% level *** at the 1% level

° The reported coefficient is scaled by $10^3$ to enhance readability.

°° The sample size is 177 rounds minus 28, due to missing data about mostly the salary, the relationship status or the number of children. Because the first contestant at the beginning of a season cannot refer to a previous episode, the learning effect lowers the sample size with 2.

It holds for every model in table 5 that the fitted model is significantly better than the intercept-only model based on the Omnibus test. It can be seen from the basic model in the first column of table 5, that the contestant accepts a deal earlier if the offer is higher. The influence of the offer is significant at the 5% level. This finding confirms hypothesis $H_1$. The differences between the basic model plus the determinants, the second column, and that second model plus the appropriator effect or learning effect, in the third and fourth column, are minor. It can be seen that for models 2-4, the Offer/EV is at least significant at the 5% level and that the Salary/Offer is significant at the 1% level.[16] Therefore, hypotheses $H_2$ and $H_{6a}$ are confirmed. Besides the Omnibus test, which tests the fitted model versus an intercept-only model, it is preferred to test the incremental value of additional variables. When the deviation in deviance of the models is tested against model 1, it can be seen that the determinants and the determinants plus the different effects have a significance decline in deviance. When the difference in deviance is tested against model 2, the addition of the effect to the basic model plus determinants is only significant for the recovery effect. This can be explained by the fact that the Offer/PreviousMax is a significant variable in model 5 and so, hypothesis $H_{11}$ can be accepted as well. Besides the Offer/PreviousMax, the Offer/EV and Salary/Offer are both again significant. So, the models 1-5 in table 5 indicate that hypotheses $H_1$, $H_2$, $H_{6a}$ and $H_{11}$ are true. However, $H_1$ and $H_2$ are not significant simultaneously.

Table 6 displays the same models as table 5. Because I am aware of the fact that the salary is an estimate of the contestants their income and not the real income, the ISCO coding is used as alternative of which the values are known for sure. So, the only difference is that the Salary/Offer variable is replaced by the ISCO coding.

To make the comparison between the models easier, the basic model is also included in table 6. This basic model is slightly different from the basic model in table 5, because of the different sample size. Models 2-4 are not significantly different from the intercept-only model, based on the Omnibus test. Also with the deviance test taken into account, it becomes clear that the addition of the variables does not increase the explanatory power of the model. However, the offer is persistently significant in the predicted direction, again confirming $H_1$. Furthermore, model 5 with the recovery effect is significant at the 1% level. The

[16] Because of the earlier warning about the significant correlations between the ratios with the offer, a robustness check will be performed in subsection D of this section where the Salary/Offer variable is replaced with the Salary variable.

Offer/PreviousMax and Offer/EV are significant in the predicted direction, indicating that $H_2$ and $H_{11}$ are true. The deviance tests with respect to model 1 and model 2 are both significant.

**Table 6 Logit regression coefficients with ISCO**

| | Basic | Basic + Determ. | Basic + Determ. + Appropriator effect°°° | Basic + Determ. + Learning effect | Basic + Determ. + Recovery effect |
|---|---|---|---|---|---|
| Intercept | -0.612 | -0.972 | -1.165 | -1.081 | -1.956* |
| Offer° | 0.028*** | 0.031*** | 0.037** | 0.031*** | 0.000 |
| Offer/EV | 0.481 | 0.555 | 0.585 | 0.540 | 1.242* |
| Gender = Female | - | -0.077 | -0.054 | -0.059 | 0.042 |
| Age | - | 0.003 | 0.004 | 0.004 | -0.000 |
| Relationship = Yes | - | 0.206 | 0.202 | 0.196 | 0.272 |
| ISCO = Hands-on | - | 1.576 | 1.606 | 1.624 | 1.489 |
| ISCO = Front and back office | - | 0.137 | 0.090 | 0.135 | 0.156 |
| ISCO = Retired, Housewives and students | - | -0.391 | -0.381 | -0.383 | -0.246 |
| ISCO = Technicians and associate professionals | - | 0.106 | 0.128 | 0.141 | -0.052 |
| ISCO = Professionals°° | - | 0.277 | 0.276 | 0.280 | 0.313 |
| #Children | - | -0.015 | -0.030 | -0.035 | -0.076 |
| #Episodes | - | - | 0.007 | - | - |
| #Episodes*Offer° | - | - | -0.000 | - | - |
| AverageWinnings° | - | - | - | 0.005 | - |
| Offer/PreviousMax | - | - | - | - | 0.677*** |
| N°°°° | 160 | 160 | 160 | 160 | 160 |
| Omnibus test | 9.313*** | 13.526 | 13.733 | 13.673 | 27.743*** |
| Deviance | 212.470 | 208.256 | 208.050 | 208.109 | 194.039 |
| Df | 156 | 148 | 146 | 147 | 147 |
| ΔDev model 1 | - | 4.214 | 4.420 | 4.361 | 18.431 |
| ΔDf model 1 | - | 8 | 10 | 9 | 9 |
| P-value Chi-square | - | 0.837 | 0.926 | 0.886 | 0.030*** |
| ΔDev model 2 | - | - | 0.206 | 0.147 | 14.217 |
| ΔDf model 2 | - | - | 2 | 1 | 1 |
| P-value Chi-square | - | - | 0.902 | 0.701 | 0.000*** |

* is significant at the 10% level ** at the 5% level *** at the 1% level

° The reported coefficient is scaled by $10^3$ to enhance readability.

°° ISCO = Managers is set as the base case.

°°° When the interaction effect is deleted, the offer becomes significant at the 1% level. #Episodes remains insignificant and other parameter coefficients and p-values barely change.

°°°° The sample size is the 177 rounds minus 11, because of missing ISCO classifications missing information on the relationship status or the number of children, or no available learning effect for the contestant at the first episode of a season.

Furthermore, when the determinants for models 3-5 are not taken into account, all models are significantly better than the intercept-only model based on the Omnibus test. The corresponding models are shown in table B1 in Appendix B. However, models 3 and 4 are not significantly better than model 1. Furthermore, in the models with the appropriator effect and the learning effect, the only significant variable is the offer. For both models, this is at least at the 5% level in the predicted direction. The inclusion or exclusion of the interaction effect between the number of episodes and the offer only leads to minor changes to the model. For the fifth model, the Offer/PreviousMax is significant at the 1%-level and the Offer/EV at the 10%-level. Based on the deviance test it can be seen that the basic model plus the recovery effect is the only model that significantly outperforms the basic model.

It becomes clear that the Offer/PreviousMax and the Salary/Offer are always significant. When one of these two variables is included the Offer/EV is also significant. When the Offer/PreviousMax and the Salary/Offer are not included in a model, the Offer variable itself is always significant.

*C. Appropriator effect*

To elaborate on the appropriator effect, subsamples based on the offer made by the bank are used. It might be that the comments of the contestants should be interpreted otherwise. It could be that there is a "fair" price for every contestant based on the number of episodes they have played. After this fair price is offered by the bank, I expect a contestant to deal earlier if he is longer in the game show. In the other scenario, when the offer is below a fair price, I expect a contestant to take risk compared to a contestant who has played fewer episodes and receives the same offer. So, it might be that the appropriator is non-linear, as opposed to the initial hypothesis.

Based on the general opinion of the contestant, the host, the audience, and the family, offers equal to and above €10,000 seems to be perceived as a high offer. It is a bit harder to define what a low offer is, but based on intuition offers below €3,000 are classified as low. Based on these two boundaries, the offers are divided into a low, middle and high offer category. Model 3 is rerun, but again without the determinants. For the low offers, there is an almost complete separation in the data, because of the 52 offers, 46 are not accepted. Therefore, it is hard to draw conclusions for the low offers subsample.

Because the middle subsample is relatively small, the first cut-off point is lowered to see whether this leads to different conclusions. The new value is set at €1,000. Because of an even stronger separation in the dependent variable, of the 33 offers below €1,000 only 2 are accepted, a regression for the new low offer subsample does not make sense. However, because of the larger width for the middle offer subsample, the model is rerun for offers between €1,000 and €10,000. Furthermore, the high offer subsample includes every offer above €10,000, so also the extreme high offers. Therefore, the model is rerun with a cap for the extreme high offers, which is set at €30,000. The regression coefficients for all four subsamples are presented in table 7. The determinants are not included, because that would lower the sample size and furthermore, previous analysis showed that besides the relative income, all determinants are insignificant.

**Table 7 Logit regression coefficients appropriator effect for subsamples on offer**

| | Basic + Appropriator effect | Basic + Appropriator effect €3,000 ≤ Offer < €10,000 | Basic + Appropriator effect €1,000 ≤ Offer < €10,000 | Basic + Appropriator effect Offer ≥ €10,000 | Basic + Appropriator effect €10,000 ≤ Offer < €30,000 |
|---|---|---|---|---|---|
| Intercept | -0.950* | -5.248** | -4.129** | -1.694 | -0.718 |
| Offer° | 0.048*** | 0.362* | 0.207 | -0.032 | -0.107 |
| Offer/EV | 0.361 | 4.936* | 4.678** | 7.512*** | 8.277*** |
| #Episodes | 0.016 | 0.024 | -0.032 | 0.013 | -0.009 |
| #Ep*Offer° | -0.001 | 0.004 | 0.014 | -0.000 | 0.001 |
| N | 177 | 38 | 57 | 87 | 65 |
| Omnibus test | 13.940*** | 6.318 | 15.548*** | 13.701*** | 11.835** |

* is significant at the 10% level ** at the 5% level *** at the 1% level
° The reported coefficient is scaled by $10^3$ to enhance readability.

It can be seen that the two terms related to the appropriator effect are never significant. Furthermore, there is no consistent pattern in the direction of both coefficients. The same subsamples are also used to test the same model, but without the interaction term. This is done because the subsamples are based on the offer. The corresponding coefficients are shown in table B2 in Appendix B. The change does not lead to significant coefficients for the #Episodes variable.

The idea of a "fair" price for every contestant is based on their characteristics and the number of episodes they have played. To test the appropriator effect one last time, subsamples

based on the number of episodes are used. It is very straightforward that playing less than or equal to 10 episodes is very quick. The boundary for a high amount of episodes is set at 30.

**Table 8 Logit regression coefficients appropriator effect for subsamples on number of episodes**

| | Basic + Appropriator effect | Basic + Appropriator effect #Episodes ≤ 10 | Basic + Appropriator effect 10 < #Episodes ≤ 30 | Basic + Appropriator effect #Episodes > 30 |
|---|---|---|---|---|
| Intercept | -0.950* | -3.371** | -0.752 | -5.486 |
| Offer° | 0.048*** | 0.067* | 0.075 | 0.532** |
| Offer/EV | 0.361 | 2.014* | -0.396 | 3.205 |
| #Episodes | 0.016 | 0.276* | 0.028 | 0.070 |
| #Episodes*Offer° | -0.001 | -0.002 | -0.002 | -0.010* |
| N | 177 | 72 | 77 | 28 |
| Omnibus test | 13.940*** | 13.943*** | 5.363 | 7.343 |

* is significant at the 10% level ** at the 5% level *** at the 1% level
° The reported coefficient is scaled by $10^3$ to enhance readability.

The regression coefficients for the subsamples based on the number of episodes are shown in table 8. The idea is that this separation pools contestants together for who the fair price is more or less equal. Both relevant terms are one time significant and furthermore, the coefficients have a consistent direction. This is some evidence for the appropriator effect, but not a persistent evidence. The conclusions hold when the interaction term is deleted, as can be seen in table B3 in Appendix B.

*D. Robustness checks and assumptions*

As a check, the analysis is also repeated with the Salary variable instead of Salary/Offer or the ISCO coding. The output is presented in table B4 of Appendix B. The results are similar to that of the ISCO coding. This implies that the salary is a good approximation of the contestant's income. The offer is the only significant variable in the models 1-4, in the predicted direction. In model 5, the recovery effect is again significant at the 1% level. The Omnibus test en deviance test both state that only model 1 and 5 are significant.

With respect to the ISCO coding there are six groups. Although small groups already are combined, some groups are still quite small. Furthermore, some of the groups are quite comparable with respect to the social economic status. To make less and larger groups the Managers, Professionals, and Technicians and associate professionals are combined in a

Professionals group and the Front and back office workers and the Hands-on occupations are combined in a Workers group. The Retired, housewives and students group remains unchanged. Model 2 is rerun and the results are shown in the first column in table B5 in Appendix B. The output shows that this change does not alter the outcomes and that the model is still not better than the basic model, based on the deviance test.

Some contestants told they have children, but it is unclear how many children they have. In these situations the number of children was set at two. Furthermore, the difference in risk preferences is expected between contestants with and without children. To take these aspects into account the #Children variable is replaced with a dummy variable for having children or not having children. For the models in table 5 and 6, the p-value is almost halved, but not to a significant level. The results for model 2 with the Salary/Offer variable are presented in column 2 from table B5 in Appendix B. It can be seen from the Omnibus Chi-square value that the model is slightly better. However, the conclusion about the influence of having children on the decision making is not altered.

Hallahan, Faff, and McKenzie (2004) found that the number of dependents had a significant negative effect on risk tolerance. So, a new variable is created instead of the number of children. This #Dependents variable is the number of children plus one if the contestant is in a relationship. When this variable is added to the model, the Relationship variable is deleted from the model. It turns out, as can be seen in the third column of table B5 in Appendix B, that this does not change the conclusions and does not improve the model.

Brooks et al. (2009) state that their model performed better when a quadratic, rather than linear, form for age was used. Although, they do not give an explanation for this addition, the squared age is added to the models to test the effect. No prior research on Deal or no Deal found the term to be significant, but it could make sense that younger and elder people have a less secured position and therefore, take less risk. For the models in this section, the inclusion of the square of age has no influence on the model outcomes, as can be seen for model 2 in the fourth column of table B5 in Appendix B. Based on the deviance test it becomes apparent that the addition does not improve the model. In the models of Brooks et al. (2009) the squared term is also non-significant, but the age is significant.

The expected value is the average of the suitcases still in the game. It may be interesting to use the median value of the suitcases instead of the mean, because a lot of

contestants compare their bank offer with the number of cases that are below, around and above this offer. Furthermore, this is easier to calculate for the contestant than the average of the remaining values. To test the influence, the Offer/EV is replaced with the Offer/MV for all the models. This implies that the Offer/EV variable is replaced in models 1-5, but the hypothesis about the direction remains the same. There are no important differences in the models 2-5 when the Offer/EV is replaced by the Offer/MV for table 5. The significance of the other variables does not change. However, the basic model shows some interesting results. This result, as well as the effect for the models of table 6, is shown in table B6 in Appendix B, because the differences are now substantial. With this change, models 2-4 become significant as well. It can be seen that besides the Offer the Offer/MV is significant as well. When the Offer/PreviousMax is included in model 5, the offer is again insignificant, but the Offer/MV remains significant. The significance of Offer/MV might be due to the easiness of calculating this reference point for the contestant compared to the more difficult calculation of the average.

Because of the significance of the easy to interpret reference points like the salary, previous highest offer and the median value, it might be the case that the assumption for the AverageWinnings variable does not hold. Therefore, the assumption of the importance of the previous five episodes is replaced by solely the prize won by the previous contestant. The assumption of five episodes was based on the comments of the contestants themselves, but there might be a difference between what they say and which prize they compare their offer subconsciously with. This change makes model 4 better, as can be seen in column 5 of table B5 in Appendix B. It also is better than model 2 of table 5, which was not the case with the AverageWinnings based on five episodes. This is due to the fact that the new variable is significant, but not in the direction that was expected.

## VII. Conclusion

This final section summarizes the main findings, gives some shortcomings about the game setting and analysis, and provides suggestions for further research.

In this paper, the Dutch Deal or No Deal TV game show is analyzed to explore contestant's risk preferences and the determinants of their behavior. The main contribution of this paper to the field of behavioral finance is the development of new ideas and concepts that could explain the behavior of the contestant. Furthermore, the information of the contestant is

translated in a creative way into independent variables. The most important finding is the outcome of an easy to calculate and remember reference-dependent decision. Furthermore, in contrast with traditional expected utility theory, it becomes clear that the path of decisions is important and it turns out that most contestants are risk averse.

The first part of the analysis section answered the question: *Are people risk loving, risk neutral or risk averse?* Of the 123 contestants, 93 are risk averse, 1 is risk loving, 1 is not risk averse and 28 cannot be classified. Although Brooks et al. (2009), Post et al. (2008) and De Roos and Sarafidis (2010) do no state their conclusions in this way, my results are in line with their findings about risk aversion.

In the second part, the influence of demographics as the gender, age, relationship status, salary, job and number of children were tested. Basic variables as the offer and the ratio of the offer to the average value of the remaining suitcases were also taken into account. Furthermore, new effects, such as the appropriator effect, the learning effect and the recovery effect, are introduced.

The new concepts are based on related research, intuition and qualitative research. The house-money effect is the effect where people make risky bets with money they have recently won (Thaler and Johnson, 1990). The appropriator effect is based on this finding. Contestants who are just in the show and immediately play the game are expected to play the game differently than someone who has been waiting for 25 episodes. I expect that people, who have waited for several episodes, see the money that they can win more as if they deserve it, and therefore, are less likely to take a risk. The learning effect is based on the expectation that contestants use the prize won by contestants in previous episodes as a reference point. It makes sense that the playing style of the contestant is influenced by the winnings of the other contestants during the previous episodes. The concept of the recovery effect is comparable with the "break-even effect" introduced by Thaler and Johnson (1990). When a decision maker has a prior loss, the opportunity to break even is very attractive. In the context of Deal or No Deal, it is expected that when the current offer is much lower than the previous highest offer, the contestant is willing to take a lot of risk to make up his loss. This effect is supported by the findings of Post et al. (2008) that risk aversion decreases after earlier expectations have been shattered by unfavorable outcomes or surpassed by favorable outcomes.

Although no evidence of the appropriator and learning effect was found, I believe that the concepts are relevant. Based on the related theory of for example the house-money effect and the comments of the contestants, evidence of the effects could be expected in future research.

The consistent significance of the ratio of the offer to the highest offer so far points to the existence of the recovery effect. People are willing to make up their loss if their offer is low compared to the previous highest offer. This conclusion also underpins the importance of path-dependency, what was also found by Post et al. (2008).

It becomes clear that when a ratio as the offer to the highest offer so far or the salary to offer is included in the model, the offer to expected value becomes significant as well. This emphasizes the importance of reference points in the decision process of the contestants. From the robustness check with the offer to median value it becomes clear that this variable is even better in predicting the decision of a contestant than the offer to expected value. This again emphasizes the importance of reference points, but also stresses the fact that the relevant reference points are easy to remember and easy to calculate. This could also be the reason why the learning effect is not significant, because it is harder to remember than the previous own offer. When the input for the learning effect is changed from the prizes won in the previous five episodes to the prize won in the previous episode, the model is improved, but the learning effect is still insignificant. These findings underpin the importance of easy to calculate and easy to remember reference points.

The significant results of salary to offer indicate that the relative income of the contestant matters in the decision on accepting or rejecting the bank offer. However, it becomes clear from the robustness check that it is indeed the relative income which influences the decision and not the absolute income. This last result is in line with the findings of Brooks et al. (2009) that the absolute income is not a statistically significant determinant of risk aversion. All in all, evidence was found for the influence of the offer, the ratio of the offer to expected value, the salary to offer, and the recovery effect.

No evidence was found for the influence of gender, age, relationship status or number of children. Brooks et al. (2009) found that age and gender are statistically significant determinants of risk aversion. De Roos and Sarafidis (2010) found mixed evidence of the influence of gender. It is clear that the contestants in the Dutch Deal or No Deal version are

not typical Dutchmen. They are, among other things, more open in expressing their feelings. Therefore, the results are not representative for every inhabitant of The Netherlands. So, the selection procedure could be the reason that the demographics are insignificant. The differences between for example men or women or younger and older people may be less apparent because of the selection procedure by Endemol, which could minimize these differences. With the Miljoenenjacht version of the show, the contestants do not need to attend a selection procedure, which might clarify the differences in the results.

For both versions of the show, the problem of self-selection sampling holds. The contestants sign up to participate in the show. Not every inhabitant in the Netherlands is able to apply based on for example obligations at work. Therefore, a lot of students, part-timers, entrepreneurs or people with flexible jobs participate in the show.

Deal or No Deal is really interesting for economists because of the real life situation and the high stakes compared to experiments. Therefore, it can be expected that people make their decisions more realistic. However, one can never be sure that the behavior of the contestant is not influenced by the TV show setting, with all the cameras, the audience and the host. It is known that in the pre-selection procedure, the contestants are tested before cameras. So, it can be assumed that the influence of being in a TV show is minimal.

The most important limitation of the models is that not all the data is complete. Unfortunately, the relationship status and number of children as well as the age of the contestant are not known for everyone. Of course, the approximation of one's age and salary are inferior to the real age and income. However, I still believe that using the job as an indicator for salary is superior to the zip code, used by Brooks et al. (2009), as an indicator of the salary. Furthermore, the results when using the ISCO coding versus the salary are comparable, implying that the estimation is reliable. Because the guessed age is double checked, no major differences with the real age are expected and so, no influence on the relationship is expected.

There are a lot of arguments to prefer the Dutch Deal or No Deal version over other versions of the game show. However, due to the evidence of the recovery effect and the existence of path-dependency, I would suggest to elaborate on this concept. To test this concept, the Miljoenenjacht version might be more suitable, because there are more rounds in the game. Therefore, there arises a longer path of decisions to investigate. I also noticed that

some contestants refer to the lowest remaining suitcase. Of course, this minimum value is the price they are taking home for granted. In the Deal or No Deal version, contestants needs to open three suitcases at a time, so there are significant fluctuations in the expectations of the contestant. In the Miljoenenjacht version, a contestant only needs to open one suitcase in the later rounds, so it is interesting to test whether there exists something as a threshold effect. For the appropriator effect the Miljoenenjacht version is not suitable, because the 500 participants in the show are replaced per episode. With respect to the learning effect, the Deal or No Deal version is preferred, because it is on a daily basis, the contestants interact with each other and they do not miss an episode.

The concept of the appropriator effect is supported by the thoughts and comments of the contestants. Although no evidence was found for the existence of the effect, I would suggest to continue to investigate this topic, because of the theoretical and practical underpinning. It might be that the comments were misinterpreted in the sense that the interaction effect is non-linear, but regressions on subsamples based on the offer and subsequently the number of episodes showed no evidence of the effect. My suggestion would be to elaborate on the idea of a "fair" price for every contestant based on, among other things, the number of episodes the contestant has been waiting. The same argumentation holds for the learning effect. The significant influence, in the opposite direction than expected, for the check with the price won by the previous contestant only, gives interesting insights about the importance of the prizes won by fellow contestants. It might be that the comments of the contestants are misinterpreted and therefore, I suggest to examine the impact of the possible reference points on the decision making .

One final suggestion is to examine whether the demographics about a secure position (job, income, education) are more or less important than demographics about responsibilities (number of children, marital status, and age) in the decision about a gamble.

As stated before, the main contribution of this paper to the field of behavioral finance is the development of new ideas and concepts. With the distinction between Deal or No Deal and Miljoenenjacht, there might be other aspects to investigate and new concepts to introduce. The most important finding is the outcome of an easy to calculate and remember reference-dependent decision. Furthermore, in contrast with traditional expected utility theory, it becomes clear that the path of decisions is important and it turns out that most contestants are risk averse.

## Appendices

### Appendix A: Selection question

For 122 of the 123 episodes the number of people who answered the question correct is available. The average number of people who answered the question correct is $\bar{x}$ = 11.40, the standard deviation s = 5.03, and the sample size n = 122. So, on average 11.40 / 20 = 57.01% of the contestants answered the question correct.

When making a 95% confidence interval, using the formula $\bar{x} \pm t^* \times \frac{s}{\sqrt{n}}$, it becomes clear that with 95% certainty the real number of people who answer the question correct is between 10.50 and 12.30 or 52.50% and 61.52%. Of course, this is much higher than the expected percentage of 33.33% in the case of a multiple choice question with 3 options. This is additional proof to confirm that the selection question does not influence the number of episodes a contestant has been in.

### Appendix B: Tables

**Table B1 Logit regression coefficients without determinants**

| | Basic | Basic + Appropriator effect°° | Basic + Learning effect | Basic + Recovery effect |
|---|---|---|---|---|
| Intercept | -0.625* | -0.889* | -0.724* | -1.726*** |
| Offer° | 0.032*** | 0.044** | 0.032*** | -0.001 |
| Offer/EV | 0.425 | 0.471 | 0.412 | 1.172* |
| #Episodes | - | 0.014 | - | - |
| #Episodes*Offer° | - | -0.001 | - | - |
| AverageWinnings° | - | - | 0.006 | - |
| Offer/PreviousMax | - | - | - | 0.725*** |
| N°°° | 173 | 173 | 173 | 173 |
| Omnibus test | 11.313*** | 12.205** | 11.610*** | 29.064*** |
| Deviance | 228.464 | 227.571 | 228.167 | 210.713 |
| Df | 170 | 168 | 169 | 169 |
| ΔDev model 1 | - | 0.893 | 0.297 | 17.751 |
| ΔDf model 1 | - | 2 | 1 | 1 |
| P-value Chi-square | - | 0.640 | 0.586 | 0.000*** |

* is significant at the 10% level ** at the 5% level *** at the 1% level

° The reported coefficient is scaled by $10^3$ to enhance readability.

°° When the interaction effect is deleted, the offer becomes significant at the 1% level. However, #Episodes remains insignificant and other parameter coefficients and p-values barely change.

°°° The sample size is the total of 177 rounds minus 4 for unavailable data on the learning effect for the contestants at the first episode of a season (who both play round 4 and 5).

**Table B2 Logit regression coefficients appropriator effect without interaction term for subsamples on offer**

| | Basic + Appropriator effect | Basic + Appropriator effect €3,000 ≤ Offer < €10,000 | Basic + Appropriator effect €1,000 ≤ Offer < €10,000 | Basic + Appropriator effect Offer ≥ €10,000 | Basic + Appropriator effect €10,000 ≤ Offer < €30,000 |
|---|---|---|---|---|---|
| Intercept | -0.761 | -5.410** | -4.790*** | -1.458 | -1.027 |
| Offer° | 0.035*** | 0.405** | 0.395*** | -0.041*** | -0.090* |
| Offer/EV | 0.319 | 4.854* | 4.350** | 7.510*** | 8.271*** |
| #Episodes | 0.007 | 0.042 | 0.025 | 0.000 | 0.009 |
| N | 177 | 38 | 57 | 87 | 65 |
| Omnibus test | 13.130*** | 6.271* | 14.120*** | 13.550*** | 11.793*** |

* is significant at the 10% level ** at the 5% level *** at the 1% level
° The reported coefficient is scaled by $10^3$ to enhance readability.

**Table B3 Logit regression coefficients appropriator effect without interaction term for subsamples on number of episodes**

| | Basic + Appropriator effect | Basic + Appropriator effect #Episodes ≤ 10 | Basic + Appropriator effect 10 < #Episodes ≤ 30 | Basic + Appropriator effect #Episodes > 30 |
|---|---|---|---|---|
| Intercept | -0.761 | -3.173*** | -0.205 | -1.213 |
| Offer° | 0.035*** | 0.054** | 0.025** | 0.044 |
| Offer/EV | 0.319 | 2.028* | -0.568 | 2.911 |
| #Episodes | 0.007 | 0.241** | 0.004 | -0.014 |
| N | 177 | 72 | 77 | 28 |
| Omnibus test | 13.130*** | 13.867*** | 4.743 | 3.312 |

* is significant at the 10% level ** at the 5% level *** at the 1% level
° The reported coefficient is scaled by $10^3$ to enhance readability.

**Table B4 Logit regression coefficients with Salary**

| | Basic | Basic + Determ. | Basic + Determ. + Appropriator effect°° | Basic + Determ. + Learning effect | Basic + Determ. + Recovery effect |
|---|---|---|---|---|---|
| Intercept | -0.428 | -0.913 | -0.992 | -0.969 | -1.877* |
| Offer° | 0.022** | 0.023** | 0.028* | 0.023** | -0.007 |
| Offer/EV | 0.316 | 0.370 | 0.381 | 0.355 | 1.065 |
| Gender = Female | - | -0.129 | -0.114 | -0.120 | -0.000 |
| Age | - | 0.017 | 0.016 | 0.017 | 0.013 |
| Relationship = Yes | - | 0.180 | 0.180 | 0.174 | 0.204 |
| Salary° | - | -0.098 | -0.095 | -0.097 | -0.072 |
| #Children | - | -0.036 | -0.037 | -0.045 | -0.134 |
| #Episodes | - | - | 0.004 | - | - |
| #Episodes*Offer° | - | - | -0.000 | - | - |
| AverageWinnings° | - | - | - | 0.003 | - |
| Offer/PreviousMax | - | - | - | - | 0.687*** |
| N°°° | 143 | 143 | 143 | 143 | 143 |
| Omnibus test | 5.592* | 6.547 | 6.634 | 6.607 | 20.875*** |
| Deviance | 192.586 | 191.630 | 191.543 | 191.570 | 177.302 |
| Df | 139 | 135 | 133 | 134 | 134 |
| ΔDev model 1 | - | 0.956 | 1.043 | 1.016 | 15.284 |
| ΔDf model 1 | - | 4 | 6 | 5 | 5 |
| P-value Chi-square | - | 0.916 | 0.984 | 0.961 | 0.009*** |
| ΔDev model 2 | - | - | 0.087 | 0.060 | 14.328 |
| ΔDf model 2 | - | - | 2 | 1 | 1 |
| P-value Chi-square | - | - | 0.957 | 0.807 | 0.000*** |

* is significant at the 10% level ** at the 5% level *** at the 1% level

° The reported coefficient is scaled by $10^3$ to enhance readability.

°° When the interaction effect is deleted, the offer becomes significant at the 5% level. The variable #Episodes remains insignificant. The variable #Episodes remains insignificant and other parameter coefficients and p-values barely change.

°°° The sample size is 116 plus 61 rounds minus 28, mostly because of missing data on the salary, but also because of missing data about the relationship status or the number of children. Because the first contestant at the beginning of one season does not have an episode to refer to, the learning effect lowers the sample size with 2.

**Table B5 Logit regression coefficients for the robustness checks**

| | Basic + Determ. with ISCO Check: 3 ISCO groups instead of 6 | Basic + Determ. with Salary/Offer Check: Children Dummy instead of #Children | Basic + Determ. + with Salary/Offer Check: #Dependents instead of #Children & Relationship Dummy | Basic + Determ. + with Salary/Offer Check: Age$^2$ is included | Basic + Determ. + Learning effect with Salary/Offer Check: Average Winnings1 instead of Average Winnings5 |
|---|---|---|---|---|---|
| Intercept | -0.722 | -1.408 | -1.098 | -2.673 | -1.317 |
| Offer° | 0.031*** | 0.001 | 0.003 | 0.003 | 0.003 |
| Offer/EV | 0.486 | 2.233** | 2.123** | 2.189** | 2.170** |
| Gender=Female | -0.096 | -0.185 | -0.197 | -0.296 | -0.227 |
| Age | -0.002 | 0.023 | 0.015 | 0.099 | 0.012 |
| Age$^2$ | - | - | - | -0.001 | - |
| Relationship=Yes | 0.222 | 0.236 | - | 0.128 | 0.083 |
| Salary/Offer | - | -0.358** | -0.346*** | -0.356*** | -0.381*** |
| ISCO=Profs.°° | -.509 | - | - | - | - |
| ISCO=Workers | 0.170 | - | - | - | - |
| #Children | 0.030 | - | - | -0.047 | -0.029 |
| Children=Yes | - | -0.378 | - | - | - |
| #Dependents | - | - | 0.010 | - | - |
| Av.Winnings1° | - | - | - | - | 0.017 |
| N°°° | 160 | 143 | 143 | 143 | 143 |
| Omnibus test | 11.507 | 25.570*** | 24.786*** | 25.252*** | 29.911*** |
| Deviance | 210.275 | 172.607 | 173.391 | 172.925 | 168.266 |
| Df | 151 | 135 | 136 | 134 | 134 |
| ΔDev model 1 | 2.195 | 19.979 | 19.195 | 19.661 | 24.32 |
| ΔDf model 1 | 5 | 4 | 3 | 5 | 5 |
| P-value Chi$^2$ | 0.822 | 0.001*** | 0.000*** | 0.001*** | 0.000*** |
| ΔDev model 2 | - | - | - | 0.365 | 5.024 |
| ΔDf model 2 | - | - | - | 1 | 1 |
| P-value Chi$^2$ | - | - | - | 0.546 | 0.025** |

* is significant at the 10% level ** at the 5% level *** at the 1% level

° The reported coefficient is scaled by $10^3$ to enhance readability.

°° ISCO = Retired, Housewives and students is set as the base case.

°°° The sample size is set at 143 for the models with the Salary/Offer variable and at 160 for the model with the ISCO coding. This is done to make the deviance test of the models possible. With respect to the deviance tests, column 1 is compared to model 1 of table 6 for and columns 2-5 to model 1 of table 5. Furthermore, column 4 and 5 are compared to model 2 of table 5.

**Table B6 Logit regression coefficients with ISCO and Offer/MV**

| | Basic | Basic + Determ. | Basic + Determ. + Appropriator effect°°° | Basic + Determ. + Learning effect | Basic + Determ. + Recovery effect |
|---|---|---|---|---|---|
| Intercept | -0.696*** | -0.814 | -0.847 | -0.952 | -1.348 |
| Offer° | 0.029*** | 0.034*** | 0.031* | 0.034*** | 0.010 |
| Offer/MV | 0.033*** | 0.036*** | 0.036*** | 0.036*** | 0.032*** |
| Gender = Female | - | -0.030 | -0.033 | -0.007 | 0.069 |
| Age | - | -0.001 | 0.000 | 0.000 | -0.003 |
| Relationship = Yes | - | 0.005 | 0.004 | -0.006 | 0.064 |
| ISCO = Hands-on | - | 1.327 | 1.339 | 1.393 | 1.212 |
| ISCO = Front and back office | - | 0.207 | 0.185 | 0.200 | 0.252 |
| ISCO = Retired, housewives and students | - | -0.757 | -0.791 | -0.754 | -0.615 |
| ISCO = Technicians and associate professionals | - | 0.173 | 0.159 | 0.216 | -0.017 |
| ISCO = Professionals°° | - | 0.397 | 0.375 | 0.398 | 0.395 |
| #Children | - | -0.002 | -0.008 | -0.025 | -0.049 |
| #Episodes | - | - | 0.001 | - | - |
| #Episodes*Offer° | - | - | 0.000 | - | - |
| AverageWinnings° | - | - | - | 0.007 | - |
| Offer/PreviousMax | - | - | - | - | 0.563*** |
| N°°°° | 160 | 160 | 160 | 160 | 160 |
| Omnibus test | 20.955*** | 26.032*** | 26.095** | 26.246*** | 36.263*** |
| Deviance | 200.787 | 195.750 | 195.687 | 195.536 | 185.519 |
| Df | 156 | 148 | 146 | 147 | 147 |
| ΔDev model 1 | - | 5.037 | 5.100 | 5.251 | 15.268 |
| ΔDf model 1 | - | 8 | 10 | 9 | 9 |
| P-value Chi-square | - | 0.754 | 0.884 | 0.812 | 0.084* |
| ΔDev model 2 | - | - | 0.063 | 0.214 | 10.231 |
| ΔDf model 2 | - | - | 2 | 1 | 1 |
| P-value Chi-square | - | - | 0.969 | 0.644 | 0.001*** |

* is significant at the 10% level ** at the 5% level *** at the 1% level

° The reported coefficient is scaled by $10^3$ to enhance readability.

°° ISCO = Managers is set as the base case.

°°° When the interaction effect is deleted, the offer becomes significant at the 1% level. The variable #Episodes remains insignificant and other parameter coefficients and p-values barely change.

°°°° The sample size is the 116 plus 61 rounds minus 11, because of missing ISCO classifications, relationship status or missing information on the number of children. The models have a sample size of 160, because the first contestant at the beginning of both seasons does not have an episode to refer to. Both contestants are in round 4 and round 5.

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