RISKY CHOICES IN A NATURAL EXPERIMENT FROM TURKEY: VAR MISIN YOK MUSUN?*

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Abstract

In this paper, we study high-stakes risky choices of contestants in the Turkish edition of the popular TV game show *Deal or No Deal*. We conduct a large-scale replication of Post et al. (2008), and we investigate contestant behavior in Turkey in detail via the expected utility and cumulative prospect theory. We find strong empirical support on the role of path dependence in shaping risk attitudes: Turkish contestants who enjoy early gains or suffer early losses in the initial rounds of the game are more risk-lover than other contestants, which aligns well with the break-even and house-money effects à la Thaler and Johnson (1990). We also document that the cumulative prospect theory predicts contestant behavior better than the expected utility theory empirically. Finally, we demonstrate that risk aversion exhibits sizable heterogeneity over demographics, and female and university-graduate contestants are more risk-averse than their male and less-educated counterparts.

Keywords: Risk Aversion; Expected Utility Theory; Cumulative Prospect Theory; Path Dependence
JEL Classification: D81; D91

*We would like to thank Thierry Post, Mehmet Yiğit Gürdal, the seminar participants at the Remote Economics Seminars of Turkey Series, and the faculty at the Department of Economics of Boston University, and Columbia University for their helpful comments and suggestions. We also thank the associate editor Morten Lou and two anonymous reviewers for their valuable feedback. We are grateful to Neslihan Aldoğan, Ebru Ceylan, Onuralp Demiralp, Can Kuseyri, and Cansu Peker for their efforts in collecting the data, and Li Zhuiang for his assistance with the computation codes. All remaining errors are ours.

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1 Introduction

Decision-making under risk and uncertainty constitutes an integral part of economic choices, and empirical studies of risky choices are plenty. However, non-experimental domains often lack true probability distributions of possible outcomes and decision-makers' beliefs over them, which obfuscates a clear identification of preferences over risk and *ex-post* realization of risky outcomes. Experimental research overcomes this problem by controlling the nature of risk and uncertainty in sterile settings while ensuring incentivized decision-making via real monetary stakes. However, they often feature limited monetary amounts, thus offering little evidence on the empirics of high-stakes risky choices.

A globally-popular TV show, *Deal or No Deal*, provides an excellent environment for rigorous empirical scrutiny of high-stakes risky choices, because "*... it almost appears to be designed to be an economics experiment rather than a TV show*" (Post et al., 2008).[1] In its Turkish edition (*Var Mısın Yok Musun* in Turkish), the game requires a contestant to choose one sealed box among 24 boxes, which contain a hidden monetary amount ranging from ₺1 (Turkish Lira) to ₺500,000 (420,000 USD in September 2007 and 335,000 USD in May 2010, the period in which the show ran).[2] The monetary amounts spread over the 24 sealed boxes are publicly known at the beginning of the game, but which box contains what amount is hidden information. After the contestant chooses her box, she opens 5 of the 23 remaining boxes, thus ruling out 5 possible realizations for the amount hidden in her sealed box. The risk-laden choice in the game presents itself at the end of each round: based on the remaining unopened boxes, *"The Banker"* makes a monetary offer to the contestant in exchange for her to give up her right for the hidden amount in her box. If the contestant accepts the offer ("*Deal*"), the game ends; if she rejects it ("*No Deal*"), she has to try her chances by opening more boxes and waiting for the next take-it-or-leave-it offer, when she must decide whether to accept the deal or reject it and play the next round.

By the game's design, stakes are high, contestants' decisions are straightforward, and the *ex-ante* uniform probability distribution of possible outcomes are publicly known. As a result of these desirable features of the show, its benchmark version and other editions have been scrutinized by several academic studies concentrating on decision-making under risk. The pioneering paper by Post et al. (2008) uses data from the Dutch, German, and American editions of the TV show to test competing economic theories on risky choices, specifically the expected utility theory and the prospect theory. In this paper, we use data from the Turkish edition and adhere to the same structural estimation methodology by Post et al. (2008) to conduct a large-scale replication study and examine results from a considerably larger data set by an upper-middle-income country.

The study of the show's Turkish edition offers valuable contributions. First, the large number of Turkish contestants allows for both a more rigorous re-testing of the earlier empirical results and rendering

[1] The related literature commonly uses the term "risk" when the decision-maker knows possible outcomes and their true probabilities, and "uncertainty" when the decision-maker lacks this information (Park and Shapira, 2017). We refer to the decision-making process in our game as a "risky choice" since our contestants have a perfect record of possible outcomes and their true probabilities throughout the game.

[2] Turkey's average household income per capita fluctuated between $3,550 and $3,750 over the 2007–2010 period. Therefore, especially the top prize is considerable for contestants.

the detection of heterogeneity in risk preferences feasible.[3] Second, the Turkish edition of the show has a novel feature: the number of boxes with the top prize (₺500,000) varies over seasons. Accordingly, although participating under the same set of rules, Turkish contestants could face 1, 2, 3, 4, or 5 (or more) boxes containing the top prize depending on the airing date of the episode. This unique feature of the Turkish edition allows, to a certain extent, for the scrutiny of the "stakes" versus "fortune" effects: Post et al. (2008) claims that stakes have a relatively smaller effect compared to fortune (*path*). As such, the degree of risk aversion should not change materially even if stakes increase or decrease significantly. Of course, when the number of boxes with top prize changes, the expected prize at the beginning of the game increases. As such, we should yield that the show's design only provides *some* indirect support in favor of the smaller effects of stakes versus fortune.[4]

Even though edition differences obfuscate a direct cross-country comparison, our findings indicate that the average risk aversion of Turkish participants is higher than that of their western counterparts in Post et al. (2008). This is exhibited largely in the form of low ball bank offers but is also manifested through different coefficient estimates for contestants' risk aversion parameters under competing theories: the expected utility and the cumulative prospect theory. Second, we find strong empirical support on the role of *path dependence* in shaping risk attitudes, as in Post et al. (2008): Turkish contestants who enjoy early gains or suffer early losses in the initial rounds of the game are more risk-lover than other contestants, which accords well with the break-even and house-money effects, noted by Thaler and Johnson (1990).[5] Third, compatibly with the previous finding, we report that the cumulative prospect theory by Tversky and Kahneman (1992) finds empirical support, again as in the case of Post et al. (2008); and we document that the cumulative prospect theory predicts contestant behavior better than the expected utility theory. Fourth, exploiting the novel variation in the number of top prize in the Turkish edition of the show, we test for the stakes versus fortune effects and report that in accordance with Post et al. (2008)'s claims, stakes have a relatively smaller effect compared to fortune, and risk aversion does not vary significantly over stakes. Fifth, we document novelly that risk aversion exhibits sizable heterogeneity over demographics in Turkey, and female and university-graduate contestants are more risk-averse than their male and less-educated counterparts.[6] We aim that these results contribute to a better understanding of the empirics of high-stakes risky choices.

The rest of the paper is organized as follows: in section 2, we review the related literature, in section 3, we describe the TV show and data we use in detail, in section 4, we present our results, and section 5 concludes.

[3] The Turkish edition of the show aired 248 workable episodes whereas the Dutch, German and American editions that were studied by Post et al. (2008) aired 47, 51, and 53 times, respectively.

[4] Moreover, in this regard, we should also yield that there is a vast literature documenting that contestants are often risk neutral for small stakes, while displaying considerable risk aversion for large stakes. See Rabin (2000), Palacios-Huerta and Serrano, 2006, and Bombardini and Trebbi (2012), among others.

[5] A word of caution is in order here. Since contestant decisions about whether to accept or reject deals are based on their risk preferences, a *confounding selection effect* might be present: it is plausible that risk preferences vary systematically across the loser, neutral, and winner categories even in the absence of any path dependence effects.

[6] The novelty of this finding is pertinent to Turkey, as it already has been documented for other countries in the literature. In particular, Bombardini and Trebbi (2012) examines the relationship between demographics and risk attitudes in the Italian version of the show *Deal or no Deal*.

2 Related Literature

Decision-making under risk and uncertainty has been subject to a large body of literature in economics and beyond (Machina and Viscusi, 2013).[7] Since the seminal work by Von Neumann and Morgenstern (1947), the *expected utility theory* has become the workhorse model to study risky choices in economics. The consequentialist expected utility theory predicts that rational agents pick choices that maximize their expected value under the set of constraints they face. Kahneman and Tversky (1979) and Tversky and Kahneman (1992) discuss the shortcomings of the expected utility theory and propose a competing one instead: the *prospect theory* differs from the expected utility theory mainly on two fronts. First, the prospect theory features a value function that is concave in gains but *convex* (and *steeper*) in losses relative to a reference point. Second, it features a nonlinear transformation of true probabilities by overweighting small probabilities and underweighting others. Later revised based on the subjective probability weighting function (Tversky and Kahneman, 1992), the *cumulative prospect theory* is one of the most prominent contenders of modern non-expected utility theories (Starmer, 2000). Recently published research reveals that the effect of probability range (low and high) on preferences predicted by the prospect theory is an artifact of the method employed by prospect theory. Kusev et al. (2020) provides evidence that human risk preferences (rational or irrational) are constructed "on the fly" during risk elicitation.

A bounty of empirical literature aims to explore individuals' risk preferences. Because real-world data often lacks both true probability distribution of risky outcomes and decision-makers' beliefs over them, researchers often benefit from laboratory, field, and natural experiments in their empirical scrutiny.[8] Sterile laboratory settings allow researchers to design custom-tailored environments to study risky choices rigorously. However, stakes in these settings are often limited due to cost considerations. Accordingly, laboratory experiments seldom offer robust evidence on the empirics of *high-stakes* risky choices.[9] Field and natural experiments could ameliorate this issue if conducting researchers or nature requires high-stakes risky choices of subjects under settings that can also render a clear identification feasible.[10]

In studying economic decisions via natural experiments, TV game shows have gained notable popularity recently.[11] Among the TV shows discussed in Andersen et al. (2008), various editions of one particular show, *Deal or No Deal*, have been studied extensively due to the format's ideal design for the scrutiny of risky choices. Andersen et al. (2006) uses data from the United Kingdom edition and tests several competing theories. They conclude that a constant relative risk aversion utility function aligns with contestant preferences only when integrated with an initial wealth around the average annual United Kingdom income.

[7] In particular, decision-making under risk has been studied extensively in psychology (Kusev et al., 2017). The conventional consequentialist approach in economics formulates that rational agents choose decisions that maximize their expected value (Starmer, 2000). Contrary to *anticipated emotions*, a vast literature in psychology focuses on the role of *immediate emotions* experienced by the decision-maker at the time of the decision in studying risky choices (Loewenstein and Lerner, 2003). See Kusev et al. (2017) for further discussion.

[8] For elaborate discussions on eliciting preferences over risk in economics, see Charness et al. (2013) and Chapman et al. (2018).

[9] Harrison and List (2004) discusses that laboratory experiments could be more prone to selection issues since subjects are often college students who are more conveniently recruited due to their proximity to researchers.

[10] For discussions on the favorability of natural experiments in explaining economic behavior, see Metrick (1995), Berk et al. (1996), Beetsma and Schotman (2001), Levitt (2004) and Drago et al. (2009), among others.

[11] See Andersen et al. (2008) for a detailed review on eliciting risk preferences from TV game shows.

Deck et al. (2008) uses data from the Mexican edition and reports modest risk-aversion estimates in this emerging economy setting. De Roos and Sarafidis (2010) uses data from the Australian edition to estimate a structural stochastic choice model and reports sizable heterogeneity in individual risk preferences while offering evidence of greater risk-aversion by females. Mulino et al. (2009) also relies on the Australian edition to estimate a structural dynamic constant relative risk-aversion expected utility model. Their results confirm that Australian contestants exhibit sizable heterogeneity in their risk preferences. Bombardini and Trebbi (2012) uses data from the Italian edition to estimate a dynamic structural utility model and demonstrates that the natural logarithmic utility function approximates the preferences of contestants rather well. Bombardini and Trebbi (2012) documents also that contestants are risk-neutral at small but risk-averse at large stakes. Blavatskyy and Pogrebna (2010) uses data from the French, Italian, and British editions to *test endowment effects* (Thaler, 1980) when contestants can exchange their box for another one. They report weaker endowment effects in this high-stakes setting than what is typically observed in laboratory experiments. Post et al. (2008), which this paper relates the most, uses data from the Dutch, German, and American editions to test competing descriptive theories.[12] Post et al. (2008) first tests the expected utility theory by structurally estimating a flexible-form expo-power utility function using the Dutch, German, and American editions of the show. Motivated by stark preference differences among those who enjoyed early gains, suffered early losses, or neither, they test the role of path dependence in shaping risk attitudes via the prospect theory. This pioneering study also reports results from laboratory experiments with small fractions (1/1,000 in one treatment and 1/10,000 in another) of the original prizes to isolate the effects of the amounts at stake. Findings from these laboratory experiments reaffirm their conclusion that previous outcomes shape risk attitudes. However, the possibility that risk preferences vary systematically across the loser, neutral, and winner categories as a result of only a confounding selection effect is not ruled out.

In this paper, we closely follow the same methodology by Post et al. (2008) to study risky choices using data from the Turkish edition of the show. In doing so, we benefit from a considerably larger data set that allows us to draw conclusions on the heterogeneity in risk attitudes over gender and education. Post et al. (2008) does not detect significant explanatory power of gender and education on risk attitudes. Our results contradict theirs: female and better-educated (post-high-school-educated) contestants in Turkey are more risk-averse than their male and less-educated counterparts. An overwhelming number of studies find empirical support for females' greater risk aversion, and our results accord well with this literature.[13] Earlier findings on the role of education in shaping risk attitudes are less accordant. Chapman et al. (2018) report via the Dynamically Optimized Sequential Experimentation (DOSE) methodology and the United States data that highly educated individuals exhibit lower risk aversion. Exploiting the exogenous variation in years of education due to the British education reform of 1972, Jung (2015) argues that highly-educated individuals exhibit higher risk aversion. Our results in this high-stakes environment parallel well with hers.

[12] A seminal paper that investigates risk preferences in various countries under different trust situations is Bohnet et al. (2008). While this study concentrates on the role of trust relationships in risky choices, the environment we examine, the Deal or No Deal show, lacks trust relationships between contestants and organizers. Nevertheless, it is noteworthy that Turkey is one of the countries where both risk and betrayal aversion are significant in this particular study.

[13] See Borghans et al. (2009), Eckel and Grossman (2008), Chapman et al. (2018), Jianakoplos and Bernasek (1998), Sapienza et al. (2009) for gender differences in risk aversion, and Byrnes et al. (1999) for a meta-analysis. Nevertheless, we should also yield that there are also contradictory results in the literature such as Cohen and Einav (2007) and Bombardini and Trebbi (2012).

Our estimation results via the flexible-form expo-power utility function demonstrate that Turkish contestants who enjoy early gains or suffer early losses in the initial rounds of the game are more risk-lover than other contestants, as in the case of their Dutch, German and American counterparts. Our findings by the cumulative prospect theory reaffirm the instrumentality of early outcomes in shaping risk attitudes. These results support the claim by Post et al. (2008) that path dependence is relevant in this high-stakes environment. Besides, exploiting the unique exogenous variation in the number of top prize over the airing date of the episodes, we also novelly test for the stakes versus fortune effects, and report that stakes have a relatively smaller effect compared to fortune, again in accordance with the conclusions by Post et al. (2008).

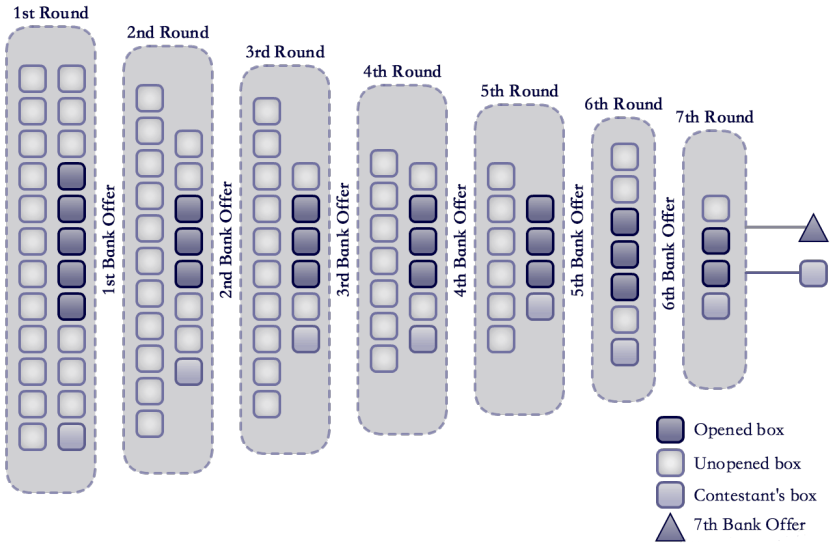
3 Data

3.1 Description of the TV Show

The *Deal or No Deal* TV show aired first in the Netherlands by the Dutch producer *Endemol* in 2002. Due to the show's remarkable popularity, it was quickly sold to producers in several other countries. Its Turkish edition aired first in September 2007 with the running title *Var Mısın Yok Musun* and became the TV show with the highest number of viewers within two months. The Turkish edition of the show was discontinued in May 2010 after three seasons. By the time it ended, it had aired 308 episodes.

There are some edition differences across countries. The main structure of the Turkish edition can be described as follows: Turkish contestants play the game for a top prize of ₺500,000 (Turkish Lira) (equivalent to about 420,000 USD in September 2007 and 335,000 USD in May 2010) in a maximum of seven rounds. In each episode, only one contestant plays. At the beginning of the game, the contestant faces 24 sealed boxes that contain a hidden monetary amount ranging from ₺1 to ₺500,000. Monetary amounts spread over the 24 sealed boxes are publicly known at the beginning of the game (e.g., three boxes contain ₺500,000, one box contains ₺250,000, ...), but which box contains what amount is hidden information both to the contestant and "*The Banker*", i.e., the TV host in charge of presenting monetary offers trying to buy the contestant's box at the end of each round. This double-blind hidden information is enforced by a state-verified independent notary, who allocates prizes into 24 boxes before the game begins, and is present throughout the game to ensure that rules are properly enforced. After the contestant chooses her box, she opens 5 of the 23 remaining boxes in the first round. Ruling out these 5 possible realizations for the amount hidden in her sealed box, she receives the banker's (often low-ball and predictable) monetary offer. If the banker manages to persuade the contestant with this offer, she takes the "*Deal*" and walks away with this sure amount. If she rejects it ("*No Deal*"), she has to open 3 more of the 18 remaining boxes in the second round. At the end of the second round, she receives another offer from the banker and decides whether to accept this offer or reject it and play the next round. The number of boxes she has to open in the third, fourth, fifth, and sixth rounds is also 3. If she makes it to the final round, the number of boxes she has to open in the seventh round is 2. Figure 1 depicts the flowchart of the game.

Figure 1: The Flowchart of the Game



3.2 Data Construction and Methodology

The broadcasted episodes of the Turkish edition of the *Deal or No Deal* show are not publicly available online or in any other form. Our undergraduate research assistants at Boğaziçi University acquired special permission from the Turkish broadcaster (*Acun Medya*) and watched all 308 episodes in the broadcaster's main office to gather relevant data. The collected data set contains information about the "*deal*" or "*no deal*" decisions of contestants, each round's opened and unopened boxes along with their associated monetary amounts, bank offers, and some individual socio-economic and demographic characteristics, such as contestants' gender, age, marital status (and marital duration if married), number of children, years of education, and regional place of origin.[14,15]

As briefly discussed, the data set on the Turkish edition of the show covers three seasons and 308 episodes. However, due to some incompatibility issues, we first drop observations from 30 episodes: in the first season of the show, 30 episodes feature 22 (instead of 24) boxes with (still) a maximum of seven rounds. Consequently, the number of boxes that contestants had to open in each round differed from the benchmark case. Because pooling games with different structures could impair the quality of our empirical results, we drop observations from these 30 episodes. Second, 13 episodes feature episode-specific designs (e.g., the top prize was doubled to ₺1,000,000) due to special events, such as national holidays, celebrity contestants, or philanthropic causes. We drop observations from these 13 idiosyncratic episodes, as well.

[14]The Turkish edition of the show is significantly longer in duration compared to its counterparts elsewhere, mainly because the host of the Turkish edition spent considerable amount of time during the introductory talk stage to learn various details about contestants' characteristics, including, but not limited to, their level of education, age, marital status, and the number of children. This is how we were able to collect personal data about these individual-level variables for over 90% of the contestants. For the remaining contestants for whom we could not elicit data, we estimated missing values for age using physical appearance and education using the profession of the contestants.

[15]Turkey is divided into seven geographical regions: the Aegean Region, Black Sea Region, Central Anatolian Region, Eastern Anatolian Region, Marmara Region, Mediterranean Region, and the Southeastern Anatolian Region, all with diverse geographical, socio-economic, and cultural characteristics.

Third, in case a contestant reached the final round with two boxes with extremely small prizes (e.g., a pair of boxes with ₺1 and ₺10), either the banker did not make an explicit offer, or the contestant rejected the offer before even seeing it. Because observations that lack a proper bank offer would impair the quality of our findings, we drop these 17 episodes, too. In the end, dropping a total of 60 episodes leaves us with 248 workable episodes featuring more than 1,600 risky choices.

To compare our findings with the ones by Post et al. (2008), we also acquired data on the Dutch, German, and American editions of the show from the authors of the cited paper.

3.3 Descriptive Summary Statistics

Table 1 presents descriptive summary statistics of our constructed data set and compares them with their counterparts in the Dutch, German, and American editions.[16]

Table 1: Descriptive Statistics

	Means			
Variables	Turkey	Netherlands	Germany	United States
Number of Observations	248	51	47	53
Age (*in years*)	30.82	45.31	36.47	34.98
Gender (*female*=1)	0.54	0.27	0.34	0.57
Education (*university*=1)	0.61	0.55	0.47	0.49
Best offer rejected (*in* %)	51.73	55.89	89.07	80.98
Offer accepted (*in* %)	67.19	76.27	91.79	91.43
Amount won (*in local currency*)	₺56,572	€227,265	€20,603	$122,545

Notes: Data on the Dutch, German and American editions of the show is by Post et al. (2008). *Education* is a dummy variable that takes a value of one for contestants with more than 12 years of schooling. *Best Offer Rejected* stands for the highest percentage bank offer that is rejected by the contestant. *Offer Accepted* is the percentage bank offer accepted by the contestant or 100 percent for contestants who end up with their own box.

The show formats of the four countries in Table 1 are similar, except for their monetary prizes and the number of game rounds (7 rounds in Turkey and 9 rounds in others). First, Table 1 displays that our data set is significantly larger than the country-level data sets used in Post et al. (2008). Second, Table 1 demonstrates that Turkish contestants are youngest on average, which accords well with Turkey's youngest mean and median age estimates for its entire population. Third, Table 1 shows that the Turkish data set is the most balanced vis-à-vis gender. Fourth, contestants in the Turkish sample are moderately better educated than their western counterparts.[17] Fifth, the *average amount won* by contestants is lowest in the Turkish edition of the show, which parallels Turkey's lowest income per capita estimate among the four countries of interest. Finally, both the *offer accepted* and *best offer rejected* variables are lowest in the Turkish edition of the game, hinting about higher risk-aversion tendencies of Turkish contestants.

[16] The variables reported in Table 1 are age (in years), a dummy variable for gender (female being 1), a dummy variable for education taking the value of one for contestants with more than 12 years of schooling (i.e., fraction of contestants with some college-level education), highest percentage bank offer contestants choose to reject (best offer rejected), percentage of the bank offer accepted by contestants (offer accepted) that is rejected by the contestant (which is assumed to be 100 percent when contestants end up with their own box in the final round), and the amount won in national currency.

[17] In our working sample for Turkey, the share of female contestants with some tertiary education is moderately higher than that of males, respectively 65% and 58%. However, the gender gap is not statistically significant at $p = 5\%$ confidence interval, and as such, our findings on heterogeneity in risk preferences over education cannot stem mainly from gender differences.

4 Results

In this section, we present our estimation results. We start by reporting some raw findings. We then discuss our estimation strategy via the expected utility theory, along with our estimation of the bank offer function. We next describe our cumulative prospect theory estimation procedure and present our findings. Finally, we move to additional analyses with a demographic breakdown of our results.

4.1 Raw Findings

Table 2: Bank Offers and Contestant Decisions

	Unconditional			Deal			No Deal		
Round(s)	BO %	Stakes	No	BO %	Stakes	No	BO %	Stakes	No
Turkey (N=248)									
1	11	103,596	248	-	-	-	11.21	103,596	248
2	18	108,313	248	-	-	-	17.61	108,313	248
3	24	112,082	248	-	-	-	23.70	112,082	248
4	30	117,096	248	-	-	-	29.96	117,096	248
5	35	122,096	248	34.6	141,659	5	34.97	121,694	243
6	46	120,706	243	48.9	126,667	87	47.14	117,381	156
7	73	102,033	156	67.5	141,598	88	79.54	50,831	68
The Netherlands (N=51)									
1	6	387,867	51	-	-	-	6	387,867	51
2	14	376,664	51	-	-	-	14	376,664	51
3	34	369,070	51	36	409,802	10	33	359,135	41
4	61	348,820	41	69	394,860	11	58	331,939	30
5	77	317,618	30	82	557,680	7	76	244,555	23
6	88	234,868	23	90	237,416	12	87	232,107	11
7	98	243,868	11	104	414,106	6	91	39,582	5
8	96	50,376	5	100	78,401	3	90	8,338	2
9	106	11,253	2	91	17,500	1	120	5,005	1
Germany (N=47)									
1	8	24,277	27	-	-	-	8	24,277	27
2	15	24,915	47	-	-	-	15	24,915	47
3	34	23,642	47	-	-	-	34	23,642	47
4	46	21,218	47	-	-	-	46	21,218	47
5	59	22,304	47	59	29,976	2	59	21,963	45
6	72	20,557	45	67	48,038	7	73	15,494	38
7	88	15,231	38	85	21,216	5	88	14,324	33
8	98	15,545	33	91	28,8213	10	101	9,776	23
9	103	14,017	23	109	13,925	11	99	14,101	12
United States (N=53)									
1	11	152,551	53	-	-	-	11	152,551	53
2	21	151,885	53	-	-	-	21	151,885	53
3	36	147,103	53	-	-	-	36	147,103	53
4	50	148,229	53	-	-	-	50	148,299	53
5	62	148,832	53	79	118,517	1	61	150,434	52
6	73	150,549	52	74	139,421	9	73	152,879	43
7	88	15,231	43	91	204,263	15	86	128,416	28
8	92	15,545	28	96	183,917	14	88	44,644	14
9	98	14,017	14	99	53,825	8	97	21,384	6

Notes: Data on the Dutch, German and American editions of the show are from Post et al. (2008). "BO%" stands for the percentage bank offer. "Stakes" stands for the average of the remaining prizes. "No" is the number of contestants present at specified round."Deal" section provides the statistics only for contestants who choose to deal while"No Deal" section provides statistics for the opposite case.

In Table 2, we present descriptive statistics on the relationship between bank offers and contestant decisions. Table 2 displays the *deal* (or *no deal*) decision frequencies of contestants in each round, as well as the average of the percentage of bank offers, remaining prizes, and the number of contestants in the corresponding rounds.

Table 2 reveals that contestants in the Turkish edition start accepting deals at lower percentages of the expected value of unopened boxes (34.6%) compared to their western counterparts, as the respective figures for the Dutch, German, and American editions are 36%, 59%, and 79%. The Dutch edition features the highest stakes, suggesting that monetary loss in any case of misfortune is much larger in this edition compared to the others. This may explain why Dutch contestants are more risk-averse than their German and American counterparts since risk aversion is documented to increase over stakes in the related literature (Bombardini and Trebbi, 2012). Table 2 implies that Turkish contestants can be even more risk-averse than their Dutch counterparts. This is also in line with the results presented in Table 1, in which both the average best offer rejected (%) and offer accepted (%) is the lowest in the Turkish edition of the show. These results also accord well with the low-ball offers by the banker in the Turkish edition of the show.

4.2 Contestant and Bank Behavior

In this subsection, we investigate contestant and bank behavior with the help of the expected utility theory and the cumulative prospect theory.

4.2.1 Expected Utility Theory

Following Post et al. (2008), we start investigating contestants' preferences over risk via the expected utility theory. For the ease of comparison, we also report results by Post et al. (2008).

To analyze the choices of the contestants within the standard expected utility (of wealth) theory, following Post et al. (2008), we use the following flexible-form expo-power utility function with several unknown parameters in Equation (1):

$$u(x) = \frac{1 - \exp(-\alpha(W+x)^{1-\beta})}{\alpha} \tag{1}$$

The utility function $u(\cdot)$ in Equation (1) is quite general and in the limit reduces to a standard constant relative risk aversion (CRRA) function when $\alpha \to 0$, and to a constant absolute risk aversion (CARA) function when $\beta \to 0$. In Equation (1) the risk aversion parameters α and β and the initial wealth parameter W are all to be estimated. We estimate these parameters jointly via maximum likelihood estimation. For this purpose, we first define some preliminaries: the stop value and the continuation value.

The stop value $sv(x_r)$ is defined as in Equation (2): it is simply a function of the bank offer, which itself is a function of the set of remaining prizes, x_r.

$$sv(x_r) = u(B(x_r)). \tag{2}$$

We discuss the specifics of the continuation value shortly.

4.2.1.1 Bank Behavior

Following Post et al. (2008), we formulate the bank offer in any round r as a function of the set of remaining prizes x_r: $B(x_r)$. Post et al. (2008) shows that the banker generally behaves *predictably*: in the initial rounds of the game, bank offers start at low percentages of the average of remaining prizes. As the game unfolds, the low-ball bank offers monotonically increase in percentage terms.[18]

To formulate bank behavior, Post et al. (2008) assumes that the following two equations describe the evolution of bank offers:

$$B(x_{r+1}) = b_{r+1} \cdot \overline{x}_{r+1} \tag{3}$$

$$b_{r+1} = b_r + (1 - b_r) \cdot \rho^{(7-r)} \tag{4}$$

where $B(x_r)$ denotes the bank offer that is the percentage $(100 \times b_r)$ of the average of remaining prizes $(\overline{x}_r)$. The $\rho \in [0,1]$ parameter in Equation (4) refers to the speed of convergence of the percentage bank offer toward a constant percentage of the average of remaining prizes. This constant percentage is assumed to be 100% in Post et al. (2008), as the bank offers in the Dutch, German, and American editions converge approximately to the average of the remaining prizes in the later rounds of the game. Bank offers in the Turkish edition are more conservative than their western counterparts, and they tend to converge to only about 70% of the average of the remaining prizes, as displayed in Table 2. Nevertheless, a contestant who makes it to the final round should still presume that she would get 100% of the expected value of the single remaining box (by construction) if she were to say *no deal*. Therefore, we assume that the last round's bank offer in Turkey also converges to 100% of the average of the remaining prizes.

We estimate the value of the speed of convergence parameter ρ via non-linear least squares regressions. Our estimations yield a coefficient value of ρ =0.788 for Turkey. This estimate is comparable to the Dutch estimate of 0.832, the American estimate of 0.777, and the German estimates of ρ= 0.735 and 0.815 (in two different German series).

Figure 2 demonstrates the goodness of fit of our estimations by plotting predicted bank offers against actual offers. As shown in the two panels in Figure 2, our model explains the observed variation in bank offers with high precision. Specifically, our model explains approximately 86% and 71% of the total variation in monetary offers (Figure 2 (a)) and percentage offers (Figure 2 (b)), respectively. Figure 2 also indicates that bank offers can be predicted via equations Equation (1) and Equation (2) with notable accuracy. These findings are instrumental because the high accuracy of the predicted bank offers makes it reasonable to treat bank offers *deterministically*, as in the case of Post et al. (2008).

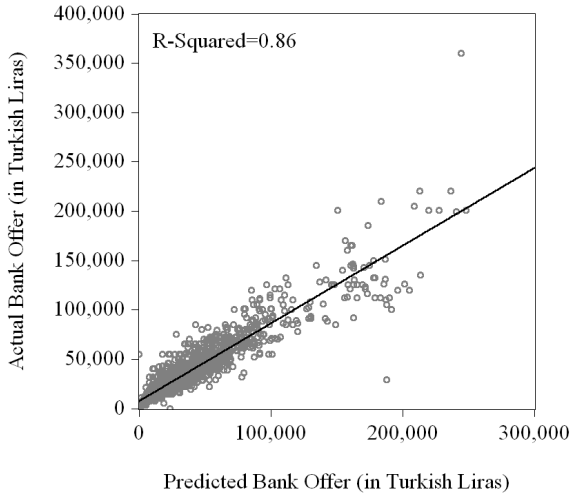
4.2.1.2 Continuation Value

Given the current set of prizes (x_r), the statistical distribution of the set of prizes in the next round (x_{r+1}) is

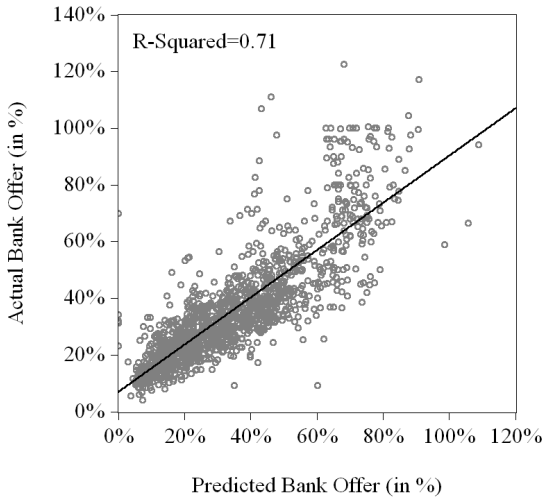
[18] Note that because the banker does not know the prize in the contestant's box (or any other boxes for that matter), bank offers are not informative about the amount hidden in the contestant's box.

Figure 2: Actual versus Predicted Bank Offers

(a) Monetary Offers



(b) Percentage Offers



known for any given subset y of n_{r+1} elements from x_r:

$$P[x_{r+1} = y|x_r] = \binom{n_r}{n_{r+1}}^{-1} = p_r. \tag{5}$$

Here, intuitively, this probability is one divided by the number of possible combinations of n_{r+1} out of n_r. Hence, once we use $X(x_r)$ for all such subsets, the continuation value $cv(x_r)$ for a myopic contestant can be calculated as in Equation (6):

$$cv(x_r) = \sum_{y \in X(x_r)} u(B(y))p_r. \tag{6}$$

Succinctly, contestants in the model do not solve the full dynamic problem they encounter. Instead, they solve a simplified version of it, in which they compare the current offer to the anticipated offers they may receive next round. As in Post et al. (2008), this limitation assumes that contestants will accept an offer in the next round and ignore the option value of rejecting the offer.[19]

4.2.1.3 Maximum Likelihood Estimation

We follow the estimation methodology by Post et al. (2008) in the spirit of Becker et al. (1963) and Hey and Orme (1994), and assume that the deal-or-no-deal decision of a contestant is based on the difference between the continuation and stop values within an error, where errors are assumed to be independent and normally distributed with a mean of zero and standard deviation, $\sigma_{i,r}$. This standard deviation is assumed

[19] Some studies in the literature, e.g., Deck et al. (2008) and De Roos and Sarafidis (2010), solve contestants' full dynamic problem and detect some empirical differences when compared to the static solution. In this replication study, we aim to follow the procedure by Post et al. (2008) as much as possible and refrain from this admittedly complicated exercise.

to equal $\delta(x_{i,r})\sigma$, where σ is a constant noise parameter and $\delta(x_{i,r})$ is defined as in Equation (7):[20]

$$\delta(x_{i,r}) = \sqrt{\sum_{y \in X(x_{i,r})} [u(B(y)) - cv(x_{i,r})]^2 p_r}. \tag{7}$$

The implicit assumption behind this formulation is that standard deviation is higher when contestants face more difficult choices.[21] The likelihood of the deal-or-no-deal decision then follows Equation (8):

$$L(x_{i,r}) = \begin{cases} \phi(\frac{cv(x_{i,r}) - sv(x_{i,r})}{\delta(x_{i,r})\sigma}) & \text{if "No Deal"} \\ \phi(\frac{sv(x_{i,r}) - cv(x_{i,r})}{\delta(x_{i,r})\sigma}) & \text{if "Deal"} \end{cases} \tag{8}$$

Finally, we aggregate the likelihood for all contestants by Equation (8) to get the overall log-likelihood function, as it is defined in Equation (9):

$$ln(L) = \sum_{i=1}^{n} \sum_{r=2}^{R_i} \log(L(x_{i,r})). \tag{9}$$

where R_i denotes the final game round played by contestant i. We then maximize the overall log-likelihood function in Equation (9) to obtain estimates for the parameters of interest: α, β, W, and σ.

4.2.1.4 Expected Utility Theory Results

Time-varying risk aversion is a widely acknowledged phenomenon in the literature on decision-making. Numerous behavioral studies demonstrate that risk attitudes generally exhibit path dependence. Thaler and Johnson (1990) proposes two different effects in explaining the reasons behind path dependence in risky choices: the "break-even effect" and "house-money effect". The former refers to the willingness to take more risk to make up for a previous loss, and the latter to a greater risk appetite after a previous gain.[22]

To investigate if path dependence matters in Turkish contestants' risk preferences, we first rely on the rough categorization by Post et al. (2008), and divide our working sample into three subgroups: "Winner", "Neutral", and "Loser."[23]

The "Winner" category consists of contestants whose average remaining prize, after eliminating the largest one (W_r), is among the best one-fifth.

$$W_r = \frac{n_r \cdot \overline{x}_r - x_r^{max}}{n_r - 1}. \tag{10}$$

[20] Similar to Post et al. (2008), the standard deviation parameter acts at the individual decision level, and there is no equivalent variance parameter at the contestant level. We should yield that this might be a limiting factor.

[21] Giving a larger weight for simple choices increases the overall fit of the model, as in the case by Post et al. (2008).

[22] Hytönen et al. (2014) attempts to explore the underlying forces behind these two effects. They use functional magnetic resonance imaging to record the brain activities of subjects. Their findings support the existence of path dependence, and provide evidence that decreasing risk aversion after gains and losses is strongly associated with several brain processes.

[23] To have more observations in each of the three categories, Post et al. (2008) divides the working sample into three equal subgroups. Benefiting from a considerably larger working sample, we keep the fractions of our "Winner" and "Loser" categories at one-fifth, and the Neutral category at three-fifths.

Similarly, the "Loser" category consists of contestants whose average remaining prize, after eliminating the lowest one (L_r), is among the worst one-fifth.

$$L_r = \frac{n_r \cdot \overline{x}_r - x_r^{min}}{n_r - 1}, \tag{11}$$

where $\overline{x}_r$ stands for the average of remaining prizes, n_r stands for the number of remaining boxes, x_r^{min} and x_r^{max} stand for the minimum and maximum of the remaining prizes, respectively.

Table 3: Good and Bad Fortune

	Loser			Neutral			Winner		
Round(s)	BO %	No	D %	BO %	No	D %	BO %	No	D %
				Turkey (N=248)					
1	8.24	50	-	9.78	148	-	18.44	50	-
2	13.22	50	-	16.57	148	-	25.12	50	-
3	20.35	50	-	22.93	148	-	29.31	50	-
4	29.08	50	-	28.66	148	-	34.70	50	-
5	41.36	50	-	32.53	148	2.03	35.8	50	4.0
6	61.86	49	20.41	40.89	145	44.14	43.44	49	21.53
7	86.76	31	12.90	66.77	94	72.34	76.82	31	51.61
1-7			4.76			16.93			11.02

Notes: "BO%" is the percentage bank offer; "No" is the number of contestants; and "D%" is the percentage of contestants accepting the bank offer given the game round.

Table 3 demonstrates the effect of previous outcomes on contestants' decisions. On average, both "Winners" and "Losers" continue playing later rounds of the game more frequently than "Neutrals," which can be considered an indicator of a more prevalent risk-loving attitude in the former two groups: the "Deal" percentages among both "Winners" and "Losers" are lower than that of "Neutrals", even though bank offers (BO%) are lowest for "Neutrals." Since the break-even effect refers to the willingness to take more risk to make up for a previous loss (by losers), and the latter is associated with a greater risk appetite after a previous gain (by winners), these findings are in accordance with the presence of both the break-even and the house-money effects, and hint that path dependence could have played an instrumental role among Turkish contestants.

In Table 4, we report our estimations results for the entire sample, as well as for the "Loser", "Winner," and "Neutral" categories. In all our expected utility theory estimations, the risk aversion coefficients α and β are significantly different from zero, offering evidence in support of increasing relative risk aversion and decreasing absolute risk aversion. Albeit statistically insignificant in some cases, the coefficient estimate for wealth, W is significant for the entire sample and equals W = ₺20,981. However, because this amount (and the range of wealth coefficients by the three categories: ₺3,420–₺19,030) is considerably lower than the average lifetime wealth of a Turkish contestant, it is reasonable to interpret the estimated coefficient proxying for *income* instead of *wealth*. A similar result is also documented by Post et al. (2008), which claims that this finding is in line with the idea of *narrow framing*, as it is common in the literature on

prospect theory. Compatibly with our previous results, Table 4 reveals that "Losers" and "Winners" are more risk-lover and have higher CCs (implied certainty coefficient for 50%-50% gambles of ₺0 TL and ₺10^z for different values of z) than "Neutrals," which accords well with the break-even and house-money effects à la Thaler and Johnson (1990). As a word of caution, the possibility that risk preferences vary systematically across the three groups only as a result of a confounding selection effect yet remains.

Table 4: Expected Utility Theory Results and Path Dependence

	Whole	Loser	Neutral	Winner
α	0.298 (0.00)	-84.091 (0.00)	0.092 (0.00)	0.144 (0.00)
β	0.099 (0.00)	0.789(0.00)	0.490(0.00)	0.685 (0.01)
W	20981 (0.05)	3420 (0.06)	10749 (0.09)	19030(0.11)
σ	0.409 (0.00)	0.501 (0.00)	0.399 (0.00)	0.498 (0.00)
MLL	-0.247	-0.320	-0.299	-0.297
LR	22.90 (0.00)	35.29(0.00)	38.98(0.00)	34.43(0.00)
Hits	80 percent	82 percent	83 percent	82 percent
No.	1644	549	546	549
CC(0/10^1)	1.000	1.191	1.000	1.000
CC(0/10^2)	0.999	1.302	0.943	0.997
CC(0/10^3)	0.996	1.319	0.817	0.951
CC(0/10^4)	0.949	1.334	0.587	0.758
CC(0/10^5)	0.618	1.357	0.21	0.220
CC(0/10^6)	0.088	1.373	0.035	0.038

Notes: The table displays the estimation results of expected utility theory for our whole sample, as well as for the subsamples of losers, winners, and neutrals. Shown are maximum likelihood estimators for the α, β parameters, and the wealth level W in Turkish Lira (₺), as well as the noise parameter σ. Overall mean log-likelihood (MLL), the likelihood ratio test (LR) relative to the native model of risk neutrality, the percentage of correctly predicted deal-or-no-deal decision (Hits), and the total number of decisions (No.) are also shown in the table. Finally, CC stands for the implied certainty coefficient for 50%-50% gambles of ₺0 TL and ₺10^z for different values of z.

Table 5: Expected Utility Theory Results for Different Numbers of Top Prize

	1	2	3	4	5 and more
α	0.405 (0.00)	0.400 (0.00)	0.384 (0.00)	0.377 (0.00)	0.357 (0.00)
β	0.133 (0.00)	0.114(0.00)	0.107 (0.00)	0.105 (0.00)	0.120 (0.00)
W	240301 (0.20)	29201 (0.27)	16792 (0.19)	19020 (0.20)	20291 (0.19)
σ	0.404 (0.00)	0.399 (0.00)	0.385 (0.00)	0.433 (0.00)	0.364 (0.00)
MLL	-0.322	-0.331	-0.300	-0.341	-0.317
LR	21.20 (0.00)	20.32 (0.00)	20.18 (0.00)	24.41 (0.00)	23.12 (0.00)
Hits	82 percent	84 percent	84 percent	79 percent	77 percent
No.	251	262	616	410	105

Notes: The table displays the estimation results of expected utility theory subsamples created according to the number of the highest possible prize (500,000 Turkish Lira, ₺). Shown are maximum likelihood estimators for the α, β parameters, and the wealth level W in Turkish Lira, as well as the noise parameter σ. Overall mean log-likelihood (MLL), the likelihood ratio test (LR) relative to the native model of risk neutrality, the percentage of correctly predicted deal-or-no-deal decision (Hits), and the total number of decision (No.) are also shown in the table. Finally, the CC stands for the implied certainty coefficient for 50%-50% gambles of ₺0 TL and ₺10^z for different values of z.

As briefly discussed, the Turkish edition of the show has an idiosyncratic feature: the number of boxes containing the top prize (₺500,000) varies exogenously over episodes depending on the airing date. We next use this exogenous variation to study the *stakes* versus *fortune* effects by Post et al. (2008). In particular, we test if contestants who encounter a different number of top prize (stakes) exhibit different risk aversion

tendencies. For this goal, we divide our entire data set into five categories based on the number of top prize (₺500,000). The Turkish edition of the show featured different prize distributions depending on the airing date, but most importantly, the number of boxes containing the top prize gradually increased over time. In the initial episodes of the show, there was only one box containing the top prize. More boxes containing the top prize were added over time. In our data set, we have 37 episodes with only one box containing the top prize, 39 episodes with two boxes, 90 episodes with three boxes, 60 episodes with four boxes, and 22 episodes with five or more boxes.[24] We report our estimation results for these categories in Table 5. Our estimation results demonstrate that the coefficient estimates do not vary significantly over the number of top prize. In particular, when compared jointly via the Kruskal-Wallis test, our coefficient estimates are not significantly different from each other at a p-value of 0.20. When compared in a pairwise manner, none of our coefficient estimates for α and β are significantly different from each other at p=10% confidence level.[25] As such, our findings accord well with Post et al. (2008), which claims that stakes do not matter nearly as much as fortune.

4.2.2 Prospect Theory

We next analyze the risk preferences of Turkish contestants via the cumulative prospect theory. Following Post et al. (2008) again, we assume that contestants take decisions without taking their initial wealth into account, and are myopic (albeit with a specific time frame). We formulate that the value function of contestants is defined over changes relative to a reference point, RP:

$$v(x|RP) = \begin{cases} -\lambda(RP - x)^{\alpha} & x \leq RP \\ (x - RP)^{\alpha} & x > RP \end{cases} \tag{12}$$

where λ stands for the loss aversion parameter and α governs the curvature of the value function. To estimate the reference point, we follow Post et al. (2008) and calculate the reference point as follows:

$$RP = (\theta_1 + \theta_2 d_r^{r-2} + \theta_3 d_r^{(0)}) B(x_r) \tag{13}$$

This reference point formulation is suitable for a dynamic game, where bank offers change every round and the reference point is to be updated accordingly. The effect of outcomes after an earlier round $j \in [0, r)$ is incorporated by the relative increase in the average remaining prize, $d_r^{(j)} = \frac{\overline{x_r} - \overline{x_j}}{\overline{x_r}}$. When $j = 0$, $d_r^{(0)}$ measures the change relative to the initial average, $\overline{x}_0$. Due to the strong correlation between the lagged terms and the limited number of observations when all lags are included, our specification is restricted to include only two terms, $d_r^{(r-2)}$ and $d_r^{(0)}$. The former term stands for the longest fixed lag that can be included for all observations (the analysis starts in the second round) and measures recent changes, whereas the latter term stands for the longest variable lag and captures all changes relative to the initial game conditions. In

[24] There are 7 episodes in which ten boxes contain the top prize, and 15 episodes in which five boxes contain the top prize.

[25] We report that the only exception to the insignificant pairwise comparisons is the case of α comparisons between the first and fifth categories. The equality of αs in this pair is rejected at a p-value of 0.07. While this might hint for lower risk aversion in the category with highest number of top prize, we also find it noteworthy that the number of observations in this category is notably lower (22) than the others. As such we believe this borderline significant and non-robust result is to be taken with a grain of salt.

this specification, we also take into account possible *probability weighting* of contestants and estimate the prospect theory model with and without probability weighting.[26]

The probability weighting function à la Tversky and Kahneman (1992) is given by:

$$\pi(p) = \frac{p^{\delta}}{(p^{\delta} + (1-p)^{\delta})^{1/\delta}} \tag{14}$$

The value of δ, if less than unity, implies that contestants would overweight low probabilities and underweight moderate and high probabilities, depending on how small δ is.

Based on Post et al. (2008)'s findings for Germany, the Netherlands, and the United States, *a priori* one could expect that $\theta_1 > 0$ so that the reference point is strictly positive, and $\theta_2 < 0$ and/or $\theta_3 < 0$ so that the reference point is higher (lower) than the neutral value of $\theta_1 B(x_r)$ after a decrease (increase) in the average of the remaining prizes.

4.2.2.1 Prospect Theory Results

We report our estimation results via the prospect theory in Table 6. In doing so, we report two estimation results, one with and one without probability weighting. We observe that the loss aversion (λ) and the curvature (α) parameters are positive and significant in both estimations. Together with the fact that the estimate for α is strictly less than unity, these findings accord well with the conventional predictions of the prospect theory: contestants' value function is concave in gains and convex in losses relative to a reference point. As for the reference point, our estimate for θ_1 is significantly greater than zero in both estimations, indicating that contestants' neutral reference point is strictly positive. This result is also intuitive because even when contestants experience paper losses throughout the game, they never have to pay any money out of their own pockets. In addition, both estimates for θ_1 are significantly less than unity, suggesting that contestants' neutral reference point generally takes a conservative value, way below the current bank offer.

Table 6: Prospect Theory Results

	Whole	Whole (*Weighting*)
λ	3.198 (0.00)	3.881 (0.00)
α	0.444 (0.00)	0.321(0.00)
θ_1	0.419 (0.01)	0.689(0.00)
θ_2	-0.192 (0.00)	-0.008(0.00)
θ_3	-0.041 (0.00)	-0.007(0.00)
σ	0.287 (0.00)	0.386(0.00)
δ		0.73(0.00)
MLL	-0.301	-0.430
LR	35.12 (0.00)	43.92(0.00)
Hits	86 percent	94 percent
No.	1644	1644

Notes: The table displays the estimation results via the prospect theory with the entire sample without and with probability weighting. p-values are reported in parentheses.

[26] To concentrate on the effect of the reference point, Post et al. (2008) does not report results via probability weighting.

The adjustment parameters for the reference point, θ_2 and θ_3 are both negative and significant, implying that the reference point tends to stick to its earlier values and is higher than the neutral value after losses and lower after gains. In magnitude, our estimate for θ_2 is considerably larger than that of θ_3, suggesting that the effect of recent outcomes is more pronounced than the effect of initial expectations. However, changes in the average of the remaining prizes during the last two game rounds are generally much smaller than changes during the entire game, limiting the effect of the parameter value. Finally, our estimate for δ, the probability weighting parameter equals 0.73, which confirms that Turkish contestants moderately overweight low probabilities and underweight others. As also discussed by Post et al. (2008), including probability weighting raises the number of hits of the model. However, it does not change the overall predictions notably. In sum, our findings in Table 6 offer empirical support for the validity of the cumulative prospect theory.

Finally, similar to the analysis we conduct in Table 6, we present prospect theory estimation results (with probability weighting) by subgroups defined over the number of top prize in Table 7. When compared to benchmark results via the entire sample, our results by top prize categories are materially very similar. As in the case of the expected utility analysis, the estimated risk aversion parameter λ by the category with 5 or more top prize is moderately smaller in magnitude; however, it is not significantly different from any other coefficient estimate by the other categories at p=10% significance level. Combined with the results in Table 6, our findings in Table 7 allow us to conclude that stakes have a relatively small effect when compared to fortune. We interpret this as further indirect validation of the break-even and house-money effects and empirical evidence in support of the stronger fortune effect claim by Post et al. (2008).

Table 7: Prospect Theory Results for Different Stakes Levels

	1	2	3	4	5 and more
λ	3.220 (0.02)	3.215 (0.01)	3.222 (0.02)	3.221 (0.00)	3.160 (0.05)
α	0.488 (0.00)	0.490 (0.00)	0.488 (0.00)	0.490 (0.00)	0.511 (0.03)
θ_1	0.443 (0.01)	0.424 (0.00)	0.420 (0.00)	0.427 (0.00)	0.405 (0.00)
θ_2	- 0.165 (0.00)	-0.162 (0.00)	-0.162 (0.00)	-0.163 (0.00)	-0.176 (0.00)
θ_3	- 0.032 (0.00)	-0.026 (0.00)	- 0.030 (0.00)	-0.035 (0.00)	-0.026 (0.00)
σ	0.291 (0.00)	0.279 (0.00)	0.298 (0.00)	0.301 (0.00)	0.265 (0.00)
δ	0.791 (0.00)	0.769 (0.00)	0.742 (0.00)	0.721 (0.00)	0.690 (0.00)
MLL	-0.325	-0.321	-0.310	-0.289	-0.280
LR	39.87(0.00)	38.50 (0.00)	33.01 (0.00)	30.11 (0.00)	28.80 (0.00)
Hits	85 percent	89 percent	88 percent	89 percent	80 percent
No.	251	262	616	410	105

Notes: The table displays the estimation results of prospect for different subsamples with probability weighting.

4.3 Effects of Demographics

In this subsection, we aim to shed light upon the heterogeneity in contestant behaviors due to gender and educational background. To this end, in Table 8 we report our maximum likelihood estimation results via both the expected utility and the cumulative prospect theory (with probability weighting) models for male,

female, low-educated, and high-educated subsamples. The upper panel presents results by the expected utility and the lower panel presents results by the prospect theory estimations.[27]

The main purpose of estimations reported in Table 8 is to detect if there is heterogeneity in risk preferences among Turkish contestants. Indeed, in the upper panel, we find significantly larger (smaller) estimates for α (β) in the subgroups of female and high-educated contestants, suggesting the presence of varying risk aversion across different subgroups. Moreover, the Mann-Whitney U test results comparing α and β coefficients for male-female and high-low educated groups are significant with a p-value<0.05 in both cases. These results reveal that female contestants are significantly more risk-averse than their male counterparts, and so are high-educated (i.e., those who have completed more than 12 years of schooling) contestants than their low-educated counterparts. As briefly discussed, gender differences in risk aversion have been subject to a large body of literature, and females have been documented to exhibit higher risk aversion than males (Borghans et al., 2009; Chapman et al., 2018; Jianakoplos and Bernasek, 1998; Sapienza et al., 2009; Byrnes et al., 1999). There is somewhat limited and contradictory evidence on the relationship between risk preferences and education. Chapman et al. (2018) argue that high-educated individuals exhibit lower risk aversion in the United States. Exploiting the exogenous variation in years of education due to the British education reform of 1972, Jung (2015) argues that high-educated individuals display higher risk aversion in Britain. Our results in this high-stakes environment align well with hers.[28]

The lower panel in Table 8 demonstrates that the curvature parameter governing risk aversion (α) is lower for female contestants than for male ones, with the corresponding values of 0.286 and 0.503. Because the value function's curvature decreases over α beyond the reference point, these results also provide evidence for the higher risk-aversion tendency of female contestants. Similarly, the α estimate is higher for the low-educated contestants compared to their high-educated counterparts, which accords well with the results from the upper panel that are suggestive of higher risk aversion among better-educated contestants. Moreover, the Mann-Whitney U test results comparing λ and α estimates for male-female and high-low educated groups are significant with a p-value<0.05 in both cases.

Finally, we also present some additional reduced-form estimations via logistic regressions in the Appendix A.2. We do so to provide evidence regarding the effects of contestants' observable characteristics on the probability of accepting or rejecting a bank offer for the sake of transparency.

[27] Moreover, in Appendix A.1, we report additional estimation results using the whole sample where we allow risk parameters to vary with gender and education dummies. These findings are also generally in line with the ones reported in Table 8.

[28] If female contestants are significantly better-educated than male contestants, one could suspect that the higher risk aversion result for high-educated contestants stems mainly from gender differences. As we briefly discussed, in our working sample for Turkey, the share female contestants with some tertiary education is only moderately higher than that of males, with the respective percentages being 65% and 58%. However, the gender gap is *not* statistically significant at p=5% confidence interval, and as such, our findings on heterogeneity in risk preferences over education cannot stem mainly from gender differences. Further, our reduced-form logistic regressions in the Appendix also show that controlling for gender, education is still decisive in decision-making.

Table 8: Estimation Results for Different Demographic Subgroups

Expected Utility Theory Estimation Results				
	Male	Female	Low-Educated	High-Educated
α	0.270 (0.00)	0.551 (0.00)	0.193 (0.00)	0.408 (0.00)
β	0.776 (0.00)	0.304 (0.00)	0.499(0.00)	0.223 (0.00)
W	24901 (0.21)	15912 (0.10)	27810 (0.16)	12190(0.12)
σ	0.413 (0.00)	0.392(0.00)	0.378 (0.00)	0.471 (0.00)
MLL	-0.318	-0.301	-0.280	-0.312
LR	29.93 (0.00)	29.33 (0.00)	27.80(0.00)	29.09(0.00)
Hits	85 percent	84 percent	81 percent	83 percent
No.	756	888	641	1003
CC($0/10^1$)	1.000	1.000	1.000	1.000
CC($0/10^2$)	1.000	1.000	1.000	0.999
CC($0/10^3$)	0.997	0.951	0.989	0.988
CC($0/10^4$)	0.980	0.847	0.934	0.895
CC($0/10^5$)	0.690	0.521	0.671	0.554
CC($0/10^6$)	0.159	0.055	0.147	0.060
Prospect Theory Estimation Results				
	Male	Female	Low-Educated	High-Educated
λ	2.801 (0.00)	4.201 (0.00)	2.904 (0.00)	4.149 (0.00)
α	0.503 (0.00)	0.286 (0.00)	0.561 (0.00)	0.402 (0.00)
θ_1	0.401 (0.00)	0.698 (0.00)	0.435 (0.00)	0.674 (0.00)
θ_2	-0.134 (0.00)	-0.052 (0.00)	-0.158 (0.00)	-0.089 (0.00)
θ_3	-0.024 (0.00)	-0.050 (0.00)	-0.019 (0.00)	-0.038 (0.00)
σ	0.308 (0.00)	0.362 (0.00)	0.189 (0.00)	0.402 (0.00)
δ	0.78(0.00)	0.69(0.00)	0.75(0.00)	0.68(0.00)
MLL	-0.339	-0.347	-0.361	-0.339
LR	36.24 (0.00)	32.01 (0.00)	37.04 (0.00)	39.10 (0.00)
Hits	86 percent	84 percent	88 percent	92 percent
No.	888	756	1003	641

Notes: The table displays the estimation results of expected utility theory and prospect theory for the subsamples of male, female, low-educated, and highly educated contestants, where education categorization relies on whether the contestant attains more than 12 years of schooling.

5 Conclusion

In this paper, we rely on the Turkish edition of the globally-popular TV show, *Deal or No Deal* to conduct a large-scale replication study of Post et al. (2008) and infer individual preferences over risk in Turkey. The show's high-stakes economics laboratory-like design constitutes an excellent natural experiment and allows for rigorous scrutiny of risky choices. Further, the considerably higher number of episodes in the Turkish edition of the show accommodates rigorous re-testing of the earlier empirical claims and renders detecting heterogeneity in preferences over risk feasible. Besides, the unique feature of the Turkish variant of the show, i.e., that the number of top prize varies exogenously over episodes, enables an empirical analysis of the stakes-versus-fortune effects.

Adhering to the same methodology by Post et al. (2008), we study contestants' risky choices via both the expected utility theory and the prospect theory. Our results are generally in line with those by Post et al. (2008): we find strong empirical support on the effects of path dependence in shaping risk attitudes, as in Post et al. (2008). Moreover, we find that the cumulative prospect theory by Tversky and Kahneman (1992)

finds empirical support and predicts contestant behavior better than the expected utility theory in Turkey. Our considerably larger data set also allows us to conclude that risk aversion does not vary significantly over the number of top prize. Finally, we demonstrate that risk aversion changes over gender and educational background in Turkey, i.e., female and university-graduate contestants are more risk-averse than their male and less-educated counterparts. We aim that our robust results with a considerably larger data set contribute to the rigor and reliability of the earlier results.

As briefly discussed, one particular major limitation of our study, shared also by Post et al. (2008), is that a *confounding selection effect* could distort our empirical scrutiny: since contestant decisions about whether to accept or reject deals depend on their risk preferences, their belonging to the "winner", "loser" or "neutral" categories are not independent of the same preferences over risk. Accordingly, it is plausible that risk preferences vary systematically across the winner, loser, and neutral categories, even in the absence of any path dependence effects. In addition, following the footsteps of Post et al. (2008), our estimation strategy does not allow for any contestant-specific unobserved heterogeneity in risk preferences. While admittedly important, overcoming these limitations is beyond the scope of the current paper. We leave the further investigation of these issues to future research.

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A Appendix: Further Estimation Results

A.1 Regressions with Gender and Education Dummies

In this subsection of the appendix, we report additional estimation results with gender and education dummies. We do this additional analysis to estimate both the expected utility and the prospect theory models for females and males, as well as for high- and low-educated contestants while allowing the risk preference parameters to vary with gender and education. Contrary to the demographic analysis in the main text, we estimate both models using the whole sample. However, in our estimations, we include interaction variables between gender and education dummies and the key risk parameters. The estimation results reported in Table A.1 are generally in line with what we observe in Table 8. In particular, for the expected utility theory estimations, the estimated coefficient of the interaction variable of α with the female dummy is positive, and the one with β is negative. The signs of the interaction terms with the high-education dummy are also positive and negative, respectively. These indicate a larger (smaller) estimated value of α (β)for females and the high-education group. Similarly, for the prospect theory estimations, the estimated value of λ and α are higher and lower, respectively, both for females and the high-education group.

Table A.1: Estimation Results for Different Demographic Subgroups

Parameters	EUT	PT	
α	0.201 (0.00)	λ	2.791 (0.00)
$\alpha \cdot female$	0.299 (0.02)	$\lambda \cdot female$	1.223 (0.01)
$\alpha \cdot high-educated$	0.155 (0.01)	α	1.199 (0.05)
β	0.395 (0.00)	α	0.490 (0.00)
$\beta \cdot female$	-0.1208 (0.00)	$\alpha \cdot female$	-0.221 (0.03)
$\beta \cdot high-educated$	-0.173 (0.00)	$\alpha \cdot high-educated$	-0.088 (0.02)
W	22019 (0.24)	θ_1	0.622 (0.00)
σ	0.404 (0.00)	θ_2	-0.037 (0.00)
		θ_3	-0.021 (0.00)
		δ	0.76 (0.00)
		σ	0.299 (0.00)
MLL	-0.332		-0.464
LR	33.90 (0.00)		49.11 (0.00)
Hits	87 percent		96 percent
No.	1644		1644

Notes: The table displays the estimation results of expected utility theory and prospect theory for the whole sample using interactions with gender and education dummies. EUT is the abbreviation for the expected utility theory, and PT is the abbreviation for the prospect theory.

A.2 Reduced-Form Estimations

In this subsection of the appendix, we report estimation results from several logistic regressions to provide additional evidence on the relationship between contestants' observable characteristics and the probability of accepting or rejecting a bank offer.[29] While limited in depth, we hope that our regression analyses are suggestive and descriptive and contribute to the transparency of our findings.

[29] We verify that probit regressions yield both qualitatively and quantitatively similar results.

In what follows, the dependent variable of the regression is the contestant's deal or no deal decision at any round in the show, represented by a dummy variable taking the value of 1 for "Deal" and 0 otherwise. On the right-hand-side of the regression equation, we use several explanatory variables, specifically four within-game and several individual-specific socioeconomic and demographic variables. The first within-game variable is "Relative Remaining Prize," defined as the ratio of the average remaining prize to the initial average prize. Because the tendency to play later rounds of the game depends directly on how attractive the bank offer is, the "Offer" variable, defined as the ratio of the bank offer to the average remaining prize in the game for the contestant, is also included as a control variable. Additionally, "Std. Remaining Prize" and "Median Remaining Prize" variables are included to measure the riskiness of the decision after receiving an offer. "Std. Remaining Prize," the standard deviation of the remaining prizes divided by the average remaining prize, aims to measure the risk of continuing to play, and "Median Remaining Prize" is the ratio of the median of the remaining prizes to the average remaining prize. As for the individual-specific variables, we control for the gender (a dummy taking the value of 1 for females), age (in years), education level (a dummy taking the value of 1 for 12 or more years of schooling, and 0 otherwise) as well as whether the contestant has children or not.[30] Moreover, we also use dummies for the birthplaces of the contestants that might vary across seven different geographical regions in Turkey. These regions are potentially instrumental in controlling for variations in income and socio-economic, ethnic, and cultural characteristics of the contestants.

We present the regression results in Table A.2. The first column only controls the within-game determinants, and as one could expect, all of them turn out to be significant at 1%, with the expected odds ratios (OR). The OR attached to variable "Offer" is extremely large in magnitude, but considering that it is probably the main variable behind the contestant's decision, this finding is not surprising. The significance of the estimated coefficients of the risk measures, "Std. Remaining Prize" and "Median Remaining Prize" reveals that a contestant's odds of accepting an offer increases over risk. Finally, the odds of a deal also increases with the average of the remaining prizes (in relative terms). This is also not surprising as the bank offer largely depends on this average. Moreover, the results with respect to the game-specific variables remain robust under all specifications.

Next, the third, fourth, and fifth columns display the regression results with several individual-specific characteristics added among the right-hand-side variables. In these regressions, coefficients of the "Female" and "Education" dummies turn out to be significant, as well as the coefficients of the two regional dummies. While the odds of accepting an offer are higher for female contestants and the ones with a higher level of education, they are lower for contestants coming from two regions; the Black Sea and the Mediterranean regions.

Because "Age" and the "Number of Children" are statistically insignificant even at 10% and are highly correlated with "Education" (with a correlation coefficient of 0.77), we drop this variable. The results do not change sizebly (Column 4). Finally, we include two interaction terms, "Children×Female" and "Std. Remaining Prize×Female". The former is to capture the differential impact of having children on choices

[30] Additionally, in some unreported regressions the round in the game is also used as a control variable but did not yield significant estimates.

whereas the latter is added to examine different attitudes of male and female contestants towards risk. The important finding is that those female participants are significantly less risk-sensitive.

The final model (Column 5) illustrates that "Female", "the Black Sea Region", and "the Mediterranean Region", together with within-game variables have statistically significant coefficients at 1%; as well as "Education" and "Std. Remaining Prize×Female" at $p = 5\%$.

Table A.2: Alternative Random-Effects Logistic Regressions

	[1]		[2]		[3]		[4]		[5]	
	Odds R.	p>|z|	Odds R.	p>|z|	Odds R.	p>|z|	Odds R.	p>|z|	Odds R.	p>|z|
Offer	8459.66	(0.000)**	5409.17	(0.000)**	6414.09	(0.000)**	6376.25	(0.000)**	7354.62	(0.000)**
Relative Remaining Prize	7.32	(0.000)**	6.89	(0.000)**	7.28	(0.000)**	7.23	(0.000)**	7.96	(0.000)**
Std. Remaining Prize	34.74	(0.000)**	27.25	(0.000)**	31.75	(0.000)**	31.81	(0.000)**	71.43	(0.000)**
Median Remaining Prize	6.05	(0.000)**	6.18	(0.000)**	6.83	(0.000)**	6.86	(0.000)**	7.77	(0.000)**
Female			1.68	(0.043)*	1.74	(0.028)*	1.63	(0.026)*	11.49	(0.003)**
Age			1.01	(0.745)	1.01	(0.547)				
Education			1.58	(0.038)*	1.61	(0.036)*	1.61	(0.034)*	1.56	(0.049)*
Children			1.07	(0.738)	1.04	(0.848)			1.27	(0.105)
Children×Female									.69	(0.108)
Std. Remaining Prize×Female									.32	(0.029)*
Black Sea Region					.28	(0.005)**	.28	(0.006)**	.24	(0.002)**
Marmara Region					.63	(0.234)	.63	(0.247)	.61	(0.207)
Aegean					.57	(0.462)	.58	(0.478)	.59	(0.488)
Mediterranean Region					.37	(0.000)**	.37	(0.001)**	.35	(0.000)**
Central Anatolia					.52	(0.482)	.52	(0.486)	.51	(0.436)
Eastern Anatolia					.38	(0.194)	.36	(0.180)	.34	(0.187)
Constant	4.9e-08	(0.000)	4.5e-07	(0.000)	6.1e-08	(0.000)	8.1e-08	(0.000)	1.8e-08	(0.000)
Goodness-of-Fit Measures										
LL	-364.19		-359.20		-354.19		-354.38		-349.40	
Mc_Fadden R^2	.36		.37		.38		.38		.38	
Cox-Snell R^2	.80		.81		.82		.82		.83	
No. of obs. (clustered)	248		248		248		248		248	

Notes: The table presents the results from the logit regressions of the " Deal/No Deal" decisions of 248 contestants in the Turkish data under different specifications. Together with odds ratios and p-values, the table reports the number of observations (clustered) as well as some goodness-of-fit measures: log-likelihood (LL), Cox-Snell R-squared, and McFadden's R-squared. ** and * indicate significance at the 1% and 5% levels.