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BELIEF-BASED AND TASTE-BASED GENDER DISCRIMINATION. EVIDENCE FROM A GAME SHOW

Michał Krawczyk
Natalia Starzykowska

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University of Warsaw
Faculty of Economic Sciences

Belief-based and taste-based gender discrimination. Evidence from a game show

Michał Krawczyk
Faculty of Economic Sciences
University of Warsaw
e-mail: mkrawczyk@wne.uw.edu.pl

Natalia Starzykowska
Faculty of Economic Sciences
University of Warsaw
e-mail: nstarzykowska@wne.uw.edu.pl

Abstract

Gender discrimination, based on taste or on perception of competence, remains to be a likely contributor to females' lower wages and slower professional advancement. In this project we use a novel data set of decisions made by participants of the Ten to One TV show. During the game, contestants repeatedly nominate the next person to answer a question. Being nominated reduces one's probability of eventually winning the game. General tendency to nominate one gender more often than the other signifies taste-based discrimination against this gender. The construction of the game makes it relatively more profitable to nominate the most competent rather than the least competent opponents in some strategic circumstances, which allows to identify biased perception of the two genders' competence. Having analyzed over 6000 decisions from 117 episodes aired in the last 21 years we find clear evidence of belief-based discrimination against females, yet taste-based in favor of them.

Keywords:
taste-based discrimination, belief-based discrimination, gender, games

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1. Introduction

Studies such as Weichselbaumer and Winter-Ebmer (2005) show that substantial gender gap persists in the labor market. While part of it is often ascribed to some form of discrimination against women (see Romei and Ruggieri, 2014, for a review), such practices are often difficult to identify using existing field data. This is partly due to possible unobservable productivity differences. It is only rarely the case that these can be controlled for, as in the Goldin and Rouse's (2000) analysis of the impact of blind vs. non-blind orchestra auditions on the fraction of job offers made to women.

Even if a bias can be established, it is typically difficult to distinguish between information-based discrimination (believing, typically incorrectly, that members of group X are more competent than members of group Y) and taste-based discrimination (caring more about the well-being of members of group X than members of group Y or willing to interact with Xs rather than Ys). Yet the distinction can be highly important, in particular when choosing between possible remedies, as discussed later. These identification difficulties may be overcome in laboratory experiments such as Albrecht et al. (2013), but such studies also have obvious limitations, including homogeneity of the sample, possible experimenter effect, artificiality of tasks, and low stakes.

Some innovative methods seek to avoid these constraints while maintaining lab-like control. One of the new approaches involves the use of data from TV shows (List, 2006). Because the game is observable and follows well-defined rules, it is much easier to quantify participants' decisions and tell if they show gender bias. Importantly, unlike in the labor market, the researcher generally knows the information upon which the decision was based. In comparison to typical lab experiments, samples are much more diversified (especially in terms of age and employment status) and the stakes tend to be much higher.

The present study also follows this path, by exploring decisions made by participants of a game show *Ten to One* (*Jeden z dziesięciu* in Polish), a close relative of the British show *Fifteen to One*. Specifically, we look for a gender bias in the way the contestants nominate the next person to answer a question (which reduces nominee's chances of surviving in the game and winning the prize). To the best of our knowledge this game format has not been subject to academic work so far. One of its advantages is that such decisions are plenty, about 60 per episode in our sample, which increases the statistical power to identify inequality. Related to this, the participants are forced to make their nomination decisions very quickly. Some studies suggest that this could strengthen (implicit) discrimination (Bertrand et al., 2005, Price and Wolfers, 2010), giving a better understanding of what the participants are naturally inclined to do.

Another attractive feature of the game is that it has been broadcasted in unchanged format for more than 20 years now. We can therefore compare the intensity of gender discrimination in early 90s to the present situation. As Poland has undergone very substantial political, economic and societal changes in the period, our study can offer some test whether (post-communist) transition affects patterns of gender discrimination.

We find participants' choices to be driven by taste-based discrimination against men and information-based discrimination against women. None of these tendencies seems to have changed much over the analyzed period. In the following section we review some relevant literature, including studies using television game shows. Then we discuss the rules of *Ten to One* and provide our predictions concerning participants' decisions. Next we examine our data set and the identification strategy. Finally we report the empirical results and discuss some of the lessons they teach us.

2. Literature review

This project is most closely related to the strand of literature that explores discrimination in game shows. In his path-breaking paper, Levitt (2004) investigated decisions of participants of *The Weakest Link*, in which it pays to vote to eliminate weak competitors at the beginning of the game and strong competitors towards the end. Thus discrimination based on beliefs (but not based on taste) would predict phase-dependent biases. He found some information-based discrimination against Hispanics and taste-based discrimination against the elderly, but no gender discrimination. Likewise, Anwar (2012) observed that non-black participants of *Street Smarts* underestimated the ability of black "savants" to correctly answer the questions (in some categories), while gender played no role. Van den Assem et al. (2012) found no trace of (taste-based) gender discrimination in the show *Golden Balls*. By contrast, Atanasov and Dana (2013) reported same-sex favoritism in *One Bid* game of *The Price is Right* show. Similarly, Antonovics et al. (2005), who used a different method to analyze *The Weakest Link*, found evidence of taste-based voting of women against men. Finally, Wall (2011) reported information-based discrimination against female contestants in the reality show *Survivor*.

Because we track the extent of gender effect over time, our study also relates to the literature studying how gender discrimination changes with economic transition (of post-communist countries). Official communist propaganda emphasized gender equality and treated labor as privilege and duty of all adult citizens. However, while women were often better educated, traditionally male occupations such as those in the mining industry were generally considered prestigious and better paid. Moreover, highest managerial and partisan positions were hardly accessible for women.

Unlike in the West, the nineties were characterized by a decline in female labor force participation (Goraus and Tyrowicz, 2013). Findings concerning gender wage gap and its unexplained component (often interpreted in terms of discrimination) are more mixed, depending on specific data coverage and methods used. In particular Newell and Reilly (2001) concluded that the gap remained quite stable throughout the nineties, Brainerd (2000) reported diminishing gap and discrimination in former non-Soviet Eastern Bloc countries, and the opposite in Ukraine and Russia. By contrast, Munich et al. (2005) found an increase in gender discrimination in the Czech Republic in the same period, and Adamchik and Bedi (2003) no change in gender wage gap Poland (in the years 1993-1997).

3. The game

The Polish version of *Fifteen to One,* locally known as *Jeden z dziesięciu* is a highly successful game show, on air continuously since 1994. The rules are essentially analogous to the UK original, except that only ten contestants are involved. Standing behind randomly allocated, consecutively numbered lecterns forming a semicircle, they are asked a number of trivia quiz questions. Each incorrect answer (or no answer at all within three seconds) means losing one of the "lives"; a contestant with no lives left is eliminated from the show. The game proceeds in three rounds. The first one involves no strategic decisions – contestants are asked two questions each and have to answer at least one of them correctly to proceed to Round 2, where they retain two or three of their initially assigned lives.

Round 2 starts with Contestants 1, 2, 3 etc. each being asked one question. However, as soon the first correct answer is given, often by Contestant 1 (or C1 for short) already, the players start nominating one another to answer the next question. The contestant who gave the last correct answer is always the one to nominate. For example, if C2 nominates C4 and she fails to answer, C2 nominates again (possibly C4 again if she is still in the game). Round 2 ends when only three players are left standing.

These three start Round 3 with three lives each, no matter how many they had left after Round 2. The first questions in this round are answered by whoever is the first one to push their buzzer upon hearing the question. Players start nominating only once one of them has answered three questions correctly. In this round, unlike in Round 2, contestants sometimes nominate themselves,[1] because a correct answer yields 20 points after self-nomination (provided at least one other contestant is still alive) and only 10 points otherwise. Players also receive a small tie-breaking bonus equal to the number of chances they had after Round 2 plus the number of chances they have after Round 3. The round ends after 40 questions or (more often) as soon as all contestants lose all their lives. In the former case the high scorer among the survivors (not necessarily having the largest number of lives left) is the winner. If all contestants have been eliminated, the last survivor is the winner (even if his or her final score is lower than that of somebody eliminated previously). The winner typically earns 3,000 PLN (ca. 700 euro), which is just shy of mean gross salary, and a weekly stay in a luxurious hotel. The number of points the winner ends up with is also relevant, because only 10 top scorers in a series of 25 consecutive shows qualify to the Grand Finale, which follows the same rules, except that the value of the prizes is as high as 50,000 PLN.

1The game goes back to the buzzer mode after a self-nominated contestant answers incorrectly (unless only one contestant is left – in this case she will always get all the remaining questions, earning 10 points per correct answer). Nominations start again after first correct answer in such a case.

4. Predictions

Close to 60 decisions are made on average in an episode in our sample, with up to 9 possible actions in each of them. On top of that there are even more resolutions of risk (corresponding to players trying to answer the questions). The game tree is thus gargantuan. Moreover, unknown (but partially revealed during the game) individual probabilities of answering correctly should be taken into account when deciding whom to nominate. Finally, one should note that players are often indifferent in a sense that one of two or more hitherto behaviorally indistinguishable players must be nominated. This means that in all probability numerous equilibria survive even subtle refinements suitable for such a dynamic game with incomplete information and that players are very unlikely to be able to tell how these equilibria look like. Attempting a complete game-theoretic analysis therefore appears futile. However, this does not preclude suggesting some features of seemingly reasonable moves and inferring something about players' tastes and beliefs.

Given the rules of the game, being nominated during Round 2 is clearly an unfortunate occurrence, as it results in a risk of losing a "life".[2] Therefore, other things being equal, stronger taste-based discrimination against any specific group is expected to result in its member being nominated more often.

For the information-based discrimination, the picture is more complex. Let us focus on Round 2 decisions. On the one hand, nominating opponents that are perceived to be relatively weak makes it more likely that the nominee will fail to answer the question. This brings the decision maker one step towards qualifying to the next round and makes her retain the right to nominate. On the other hand, the strongest competitors are most dangerous. Ideally, one would like to qualify to Round 3 together with two weak contestants (who were lucky enough to get few questions in Round 2), while the stronger ones are eliminated after being nominated several times. Again, while we cannot prove that it is a feature of all solutions of the game, we propose that if a player is in a relatively bad strategic situation (having a poor record so far), she should rather focus on survival, i.e. nominate rather weak players. The better one's relative situation, the more one can afford to nominate strong players to eliminate them and qualify to Round 3 with the weak ones. To grasp the intuition, consider a stylized example. Suppose that towards the end of Round 2, Player 1 who is about to nominate, only faces three opponents (Players 8, 9, and 10), with just one chance each. Further suppose that each of Players 8 and 9 have so far correctly answered 15 questions (and obviously, two incorrectly), while Player 10 has

2 This is not always true in Round 3, as players earn points for correct answers (and more points if they self-nominate while an opponent is alive) and the game ends after 40 questions. Thus when a contestant is nominated (and answers correctly, but this is typically the case, as good players dominate in Round 2), she earns points and gains the right to self-nominate, which may be necessary to win the episode (when another player survives till the end) and to qualify for the Grand Finale. However, because typically only one player survives till the end and expected payoff in the Grand Finale of a player who is just able to reach it is low anyway, being nominated is, again, unprofitable in vast majority of cases.

only answered one question correctly. Suppose one can infer from that record that each of Players 8 and 9 will answer about 80% of questions, while Player 10 will only answer 30% correctly. For simplicity, Player 1 will not update these beliefs further. Clearly, Player 1 will have a better chance for final success (say, 50%) if she could eliminate one of the strong players (numbered 8 and 9) before Round 3 starts, compared to her chances of qualifying if both strong players make it to Round 3 with her (say, 33%). Now, compare two scenarios:

A) Player 1 also has but one life

B) Player 1 has "many" lives (so that she will not be eliminated in this round; in practice, her chance of being eliminated if she has three lives are indeed low)

Suppose Player 1 believes her own probability of answering correctly is also 80% and that other players play a simple strategy of nominating back. Compare two strategies: "Always nominate Player 8 (strong)" (of course any strategy that only involves nominating 8 or 9 will be just as good) and "Always nominate Player 10 (weak)". Denote her probability of making it to Round 3 under Scenario A, if she keeps nominating Player 8 by p_8^A. If Player 8 answers the first question correctly, then *his* chance will be p_8^A because of the symmetry. As eventually either Player 1 or Player 8 will be eliminated, we have $p_8^A + 0.8p_8^A = 1$, so that $p_8^A = \frac{5}{9}$. If, by contrast, Player 1 keeps nominating the week Player 10, she will make it to the next round if Player 10 fails immediately, if he answers correctly, then Player 1 answers correctly and then Player 10 fails etc., so that probability of success is $p_{10}^A = .7 + .3 \cdot .8 \cdot .7 + (.3 \cdot .8)^2 . 7 + \cdots \approx .92$. When we multiply these by corresponding chances to win the entire episode conditional on entering Round 3 with or without a weak opponent (50% and 33% respectively), it turns out that nominating the weak Player 10 is preferred. By contrast, if Player 1 can be sure to survive to Round 3 (as she has "many" lives, as in Scenario B), she should obviously keep nominating a strong opponent.

We therefore expect that players nominate opponents they (perhaps due to gender stereotypes) perceive as relatively weak when their own situation is poor and those they perceive as relatively strong when their situation is good. Of course, we cannot be sure if the players recognize this consideration. Browsing through the Internet forums suggests that at least some do. "A guy with one chance is nominating and picks someone with… three chances. I understand that before the game you may decide that you most of all try to eliminate the strong (opponents), but you can't do it in such a moment! I have not seen such a situation recently but they are not unheard of." (translated from Polish, http://forum.tvp.pl/index.php?topic=145859.0;imode). Still, we empirically validate if contestants indeed tend to nominate strong players relatively less often when their situation is poor.

Taste-based discrimination against women would thus mean that they are disproportionally often nominated throughout the game (or at least in Round 2). Information-based discrimination against women would mean that they are relatively

often nominated by participants in relatively poor strategic situations (at least in Round 2).

5. The dataset and methods of analysis

Ideally, the past episodes would be obtained from the broadcaster. Unfortunately, this turned out to be impossible. We thus used various Internet sources. We have not verified if they were allowed to distribute the files. Downloading and streaming from unauthorized sources is not illegal in Poland (let alone when done for research purposes only) and in our view it is obviously justified from ethical viewpoint in these particular circumstances. One disadvantage of this is that only some episodes could be found. In particular, we wish we could find more episodes from the 1990s. On the other hand, it is very hard to think of a reason why episodes characterized by a specific pattern of nominations (say: women being nominated particularly often) were to be more likely to be available than other episodes. In this sense, we believe we have a random selection with the time of broadcasting being the only variable that significantly affected the probability that an episode is included in the sample. Table 1 shows summary statistics, broken by the period in which the program was aired. Most post-2000 episodes come from the year 2011, they were thus recorded nearly 15 years after those from the nineties.

Table 1: summary statistics

	#episodes	#nomination decisions	%women	% univ. edu	% big city	%student
1990s	35	1936	12.29	18.86	40.29	12.00
2000s	82	4707	13.54	22.56	50.85	22.80
total	117	6643	13.16	21.45	46.50	19.57

Overall, 55.59% of questions were answered correctly. The median success rates were 56.23% for males and 51.14% for females, a significant difference as verified by a Mann-Whitney test (p=0.037).[3]

Clearly, this difference makes it more cumbersome to identify unwarranted information-based discrimination. Indeed, of two contestants with identical record, the man can typically be rationally expected to perform slightly better in the future because of the difference in the base rate. We thus proceed as follows. First, using each player's performance in the entire episode we calculate kernel density estimate of player-specific probability of answering a question correctly. We do so separately for males and females,

[3] Other variables like education level, graduated faculty and size of the city of origin of a player were not significant predictors of performance.

gender being the only variable that is significant in terms of performance observed in the game. Using thus obtained prior distributions—one for males and one for females—we apply the Bayes rule to calculate, given each player's performance showed so far, his or her probability of answering the next question correctly (*posteriori pot.*). For example, a woman who has so far answered 9 questions correctly and 4 questions incorrectly may be expected to answer any question with a probability of 63.42%, compared to 64.51% for a man with a 9-4 record. As a proxy for the nominating player's strategic situation we simply use the percent of his or her correct answers up to the moment of decision in question, a variable we call *past % correct own.*

We are interested in nomination decisions, we thus disregard the first round, early questions of Round 2 (before the first correct answer) and of Round 3 (before the third correct answer of the same contestant) as well as the final questions of Round 3 when only one contestant remains. For the remaining questions, we focus on the variable *actually nominated*, which takes the value of 1 if a *potentially nominated* contestant (often abbreviated to *pot.*) was actually nominated and 0 otherwise.

To account for repeated decisions and possibly heterogeneity of subjects, we run a mixed logit model, which allows estimating individual-specific coefficients. We then calculate the mean and standard deviation of these estimates. Because self-nominating is suicidal in Round 2 and essentially never happens, we drop the cases when *potentially nominated=nominating* and simultaneously *round*=2. Because strategic situation is different in Round 3 compared to Round 2, as described before, we also run separate regressions for these two rounds.

6. Results

To make the presentation of the estimates for our numerous explanatory variables clear, we divide them by the type of discrimination. Table 2 includes the variables that allow investigating taste-based discrimination and Table 3 is dedicated to information-based one. In Appendix B we show results for remaining (control) variables, most of which come out insignificant. Entries in all the tables are based on the same specifications, e.g. model (1) includes variables from *potential is female* through *same sex in* 90's visible in Table 2, *past % correct own * posteriori pot.* through *past % correct own * fem. pot.* from Table 3 etc. All the tables show *marginal effects* rather than mean coefficient for given variable. For example, value -0.072 for *potential is female* in Table 2 means that the probability of being nominated due to the effect of gender is lowered for females by 7.2 percentage points.

Model (1) only includes the basic variables for taste-based and belief-based discrimination such as gender of the potentially nominated player (also in interaction with the gender of the decision maker). Each of these effects is tested for stability over time. The probability that the potentially nominated player will correctly answer the question, as it can be calculated based on his or her gender and past performance (also in

interaction with past performance of the nominating player) is included there. Each further specification adds to this basic model. In particular, specification (2) allows (in the model estimated on entire dataset) for the possibility that the effect of the potential nominee being female differs between rounds and that male and female nominators react differently to the number of chances of the potential nominee. Model (3) verifies whether male and females differ in terms of probability of self-nominating (only on round 3 and entire game, as in round 2 there is no inventive nor an example of doing so). Model (4) additionally controls if willingness of nominating a player holding his or her last chance differs between male and female contestants. It also allows for the willingness to nominate a player back immediately after having been nominated by him or her. Model (5) investigates whether men and women are equally likely to immediately nominate a player back and also studies the effect of proximity between decision maker and potential target, the impact of inequality between those two players in terms of number of their chances. Additionally that specification controls whether the nominations are affected by the information concerning the level of education of male and female contestants and their academic major. Model (6) controls for the experience of being nominated by a given player in the past (except for the case of direct nomination), also in an interaction with gender. Additionally that specification verifies whether we can observe a taste-based discrimination on the basis of information concerning the size of the city of origin of a potentially nominated player.

Table 2: Marginal effects for taste-based discrimination hypothesis.

Variable \ Specification	(1)	(2)	(3)	(4)	(5)	(6)
ROUND 2						
potential is female	-0.072***	-0.097***	-0.097***	-0.098***	-0.102***	-0.103***
potential is female in 90's	-0.022	-0.007	-0.006	-0.006	-0.006	-0.005
same sex	-0.047***	-0.103***	-0.105***	-0.092***	-0.081***	-0.095***
same sex in 90's	-0.013	-0.006	-0.004	-0.007	-0.004	-0.003
N	**42690**	**42690**	**42690**	**42690**	**42690**	**42690**
ROUND 3						
potential is female	-0.103**	-0.163***	-0.117***	-0.120***	-0.102**	-0.101**
potential is female in 90's	-0.034**	-0.007*	-0.006	-0.006	-0.004	0.002
same sex	-0.024***	-0.040***	-0.032***	-0.051***	-0.040***	-0.055***
same sex in 90's	-0.002	-0.004	-0.000	0.005	0.001	0.006
N	**23740**	**23740**	**23740**	**23740**	**23740**	**23740**
ENTIRE GAME						
potential is female	-0.073***	-0.139***	-0.102***	-0.108***	-0.077***	-0.079***
potential is female in 90's	-0.019	-0.000	0.005	0.004	-0.002	-0.002
same sex	-0.047***	-0.283***	-0.179***	-0.205***	-0.143***	-0.141***
same sex in 90's	-0.006	0.005	0.010	0.011	0.001	0.001
potential is female * round		0.008***	0.004**	0.003*	0.003	0.003

N	**66430**	**66430**	**66430**	**66430**	**66430**	**66430**

Both in Rounds 2 and 3 taken separately we find evidence of taste-based discrimination against male contestants, as the estimate on *potential is female* is significantly below zero. The same is true for the entire sample and these findings are very robust. As the interaction with the 90's is not significant, there is no reason to reject the null hypothesis of no change in the discriminatory patterns during the period under scrutiny. Same sex favoritism is also statistically significant for all of specifications and both rounds. Except of model (1), the values are lower than for *potential is female,* implying that indeed both genders discriminate against females (this is particularly true for the case of the potential nominee having more than one chance, whereby the positive effect of *number of chances and same sex* is stronger than that of the interaction of the potential's gender and number of chances). Again, there is no evidence a change of same sex favoritism over time here.

Table 3: Marginal effects for information-based discrimination hypothesis.

Variable \ Specification	(1)	(2)	(3)	(4)	(5)	(6)
ROUND 2						
past % correct own * posteriori pot.	0.071***	0.072***	0.070***	0.071***	0.073***	0.072***
posteriori pot.	-0.042**	-0.222***	0.238***	-0.241***	-0.280***	-0.287***
posteriori pot. * fem. pot.	0.005*	0.007**	0.007**	0.007**	0.006*	0.007**
past % correct own * fem. pot.	-0.002**	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**
chances=2		-0.027***	-0.028***	-0.036***	-0.050***	-0.051***
chances=3		-0.065***	-0.066***	-0.076***	-0.087***	-0.087***
chances=2 * fem.pot.		0.018***	0.014***	0.011***	0.013***	0.015***
chances=3 * fem.pot.		0.057***	0.060***	0.050***	0.037***	0.032***
number of chances and same sex		0.053***	0.054***	0.055***	0.055***	0.055***
fem. nominates * potential has last chance				-0.008*	-0.008**	-0.005**
abs. chances diff.					-0.030***	-0.029***
N	**42690**	**42690**	**42690**	**42690**	**42690**	**42690**
ROUND 3						
past % correct own * posteriori pot.	0.076***	0.074***	0.073***	0.074***	0.077***	0.076***
posteriori pot.	0.063**	-0.274***	-0.265***	-0.305***	-0.513***	-0.509***
posteriori pot. * fem. pot.	0.015***	0.018***	0.015***	0.014**	0.011*	0.010*
past % correct own * fem. pot.	-0.002	-0.002*	-0.003*	-0.003*	-0.002	-0.002

chances=2		0.021**	0.011	0.022**	-0.019*	-0.018*
chances=3		-0.056***	-0.063***	-0.055***	-0.078***	-0.078***
chances=2 * fem.pot.		0.048**	0.060***	0.128***	0.091***	0.091***
chances=3 * fem.pot.		0.080***	0.088***	0.129***	0.108***	0.109***
number of chances and same sex		0.060***	0.065***	0.064***	0.060***	0.056***
self nominated			-0.060***	-0.082***	-0.126***	-0.134***
female nominates herself			-.052*	-0.058	-0.050	-0.051
fem. nominates * potential has last chance				0.124***	0.076***	0.070***
abs. chances diff.					-0.056***	-0.058***
N	**23740**	**23740**	**23740**	**23740**	**23740**	**23740**
ENTIRE GAME						
past % correct own * posteriori pot.	0.075***	0.077***	0.052***	0.062***	0.038***	0.038***
posteriori pot	-0.078***	-0.307***	-0.208***	-0.232***	-0.252***	-0.249***
posteriori pot. * fem. pot.	0.007***	0.010***	0.006***	0.005***	0.005***	0.006***
past % correct own * fem. pot.	-0.000	-0.003***	-0.002***	-0.002***	-0.002***	-0.002***
chances=2		-0.016***	-0.026***	-0.025***	-0.050***	-0.050***
chances=3		-0.068***	-0.077***	-0.082***	-0.095***	-0.096***
chances=2 * fem.pot.		0.083***	0.062***	0.064***	0.044***	0.042***
chances=3 * fem.pot.		0.156***	0.124***	0.145***	0.112***	0.098***
number of chances and same sex		0.063***	0.041***	0.041***	0.032***	0.032***
self nominated			-0.088***	-0.092***	-0.113***	-0.116***
female nominates herself			0.014	0.009	-0.002	-0.002
fem. nominates * potential has last chance				0.030**	0.010	0.007
abs. chances diff.					-0.029***	-0.023***
N	**66430**	**66430**	**66430**	**66430**	**66430**	**66430**

Turning now to variables allowing identification of information-based discrimination, from Table 3 we conclude that strong contestants are generally less likely to be nominated, as the coefficient *posteriori pot.* is negative and strongly significant (and is not outweighed by its interactions). At the same time, the interaction of this variable with gender of potential player (*posteriori pot. * fem. pot.*) is significantly positive. This suggests that women are perceived differently than men, although the size of this effect is tiny.

Crucially, if the decision maker is in a good strategic situation, they will prefer to nominate a strong contestant (*past % correct own * posteriori pot.*), as we have hypothesized. This effect is highly significant in all the specifications. We may thus hope

that *past % correct own* is indeed a good proxy for own strategic situation and, if it is high, it compels the contestant to nominate strong players. If it now interacts with *fem. pot*, we can infer direction of information-based discrimination (if any). Indeed, we observe that in Round 2 and the entire sample, females are less likely to be nominated when the nominator is in a good situation (controlling for other factors), implying they are considered inferior beyond what is justified given their (and other women's) performance.

7. Conclusions

We believe that our data set offers an excellent opportunity to identify the main types of gender discrimination in a real-life setting involving high stakes. To be sure, there are some inherent limitations. In particular, arguably the game creates an artificial environment, rather different from daily professional life. Yet, to perform well in the show one needs broad knowledge and ability to focus and perform well under stress and time pressure, while competing with others. Such qualities are also valued in the labor market, especially in the highly competitive corporate environment. It may thus be hoped that patterns identified here will generalize to other settings.

Another concern is that vast majority of our participants are male. Obviously, this reduces statistical power to identify any systematic gender effects. Luckily, it turns out that at least some of them are strong enough to show up anyway (partly thanks to the large number of observations we have). One may also wonder whether gender composition per se affects discriminatory patterns. We have run some regressions accounting for the number of women on the episode and it did not seem to make a difference. However, we only have limited statistical power to test for such effects as there is little variation in the starting composition, for example as many as 51.3% of episodes in our sample started with but one female and 30.8% of episodes started with two. The negative result may also be associated with the fact that players take into account the fraction of women in the whole population of participants, not in the particular episode in which they happen to partake. For example, it could be that females tend to be "spared" because there are so few of them on *Ten to One* anyway. Then again, such a gender imbalance is also characteristic for top managerial positions as well as in many well-paying professions at large (particularly the IT industry). In this sense, even if gender composition plays a major role, it may not render extrapolating our results to these important environments meaningless. Nevertheless, in future research, it would be desirable to also have more gender-balanced samples.

The main finding of our study is that contestants' decisions reveal taste-based discrimination against males and information-based discrimination against females. These tendencies are robust across specifications and over time. One way of understanding this pattern is in terms of "ambivalent sexism" (Glick and Fiske, 1996) under which women are perceived as weaker (also mentally) than men and thus deserving protection. In our context this indeed translates into preference for elimination of men

from the show but expecting females to underperform (so that they should be nominated when the strategic situation is poor). Such a distinct pattern may help understand apparent discrepancies in existing literature; it underscores that it is essential that we are in a position to distinguish between information-based and taste-based discrimination. Again, in practice this is often difficult and the present study provides one example how it may be achieved.

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9. Appendix

9.1. Definitions of variables

potential is female denotes sex of potentially nominated player: 1 if the potentially nominated contestant is female, 0 otherwise;

potential is female in 90's represents the interaction between sex of the potentially nominated player and the fact that the episode aired in the 90's: 1 if potentially nominated is female and episode is from 90's, 0 otherwise;

same sex: 1 if the potentially nominated and the nominating player are of the same sex, 0 otherwise;

same sex in 90's represents the interaction between *same sex* and the fact that the episode aired in the 90's: 1 if the potentially nominated and the nominating player are of the same sex and episode is from 90's, 0 otherwise;

*potential is female * round* represents the interaction between the sex of the potentially nominated player and the round: 2 if potentially nominated is female and the *round*==2, 3 if potentially nominated player is female and *round*==3, 0 otherwise;

closest contestant (on the left): 1 if the potentially nominated player is the closest surviving contestant to the left of the nominating player, 0 otherwise;

closest contestant (on the right): 1 if the potentially nominated player is the closest surviving contestant to the right of the nominating player, 0 otherwise;

distance from nominating to potential denotes the distance from the nominating player to the potentially nominated (absolute value of the difference of numbers of these two players);

potential from big city: 1 if the potentially nominated player comes from a city of 100,000 or more inhabitants, 0 otherwise.

potential from mid-sized city: 1 if the potentially nominated player comes from a city of 20,000-100,000 inhabitants;

posteriori pot denotes the posteriori expectation of correctness of answers for the potentially nominated player. It is a characteristic estimated separately for each moment of the game and player on the basis his or her or performance hitherto and the prior gender-specific distribution;

*past % correct own * posteriori pot.* stands for the interaction of past performance of the nominating player and *posteriori pot;*

*posteriori pot. * fem. pot.* represents the interaction of *posteriori pot* with the sex of the potentially nominated player, equal to *posteriori pot.* for female nominees, 0 for males;

*past % correct own * fem. pot.* is the interaction of past performance of the nominating player with the sex of the potentially nominated player, equal to *past % correct own* for female nominees, 0 for males;

chances=2 is a dummy variable indicating that the potentially nominated player has exactly 2 chances;

chances=3 is a dummy variable indicating that the potentially nominated player has exactly 3 chances;

*chances=2 * fem.pot* is the interaction of *chances=2* with the sex of the potentially nominated player (1 if the potentially nominated is female and has 2 chances, 0 otherwise);

*chances=3 * fem.pot* is the interaction of *chances=3* with gender of the potentially nominated player (1 if potentially nominated is female and has 3 chances, 0 otherwise);

number of chances and same sex: the number of chances of the potentially dominated if the latter and the nominator are both male or both female, 0 otherwise;

self nominated is dummy variable denoting that the nominator and the potential nominee is the same person;

female nominates herself is the interaction of *self nominated* with the sex of the nominator;

*fem. nominates * potential has last chance*: 1 if a female nominates and the potentially nominated has 1 chance, 0 otherwise);

abs. chances diff.: absolute value of the difference of the number of chances between the nominator and the potential nominee;

instant revenge takes the value of 1 if the potentially nominated player has nominated the current nominator to answer the previous question, 0 otherwise;

female instant revenge is the interaction of *instant revenge* with the sex of the nominator: *instant revenge* if she is female, 0 otherwise;

revenge later: 1 if the nominator has ever been nominated by the potentially nominated player in the past, 0 otherwise;

female takes revenge later: *revenge later* if the nominating player is female, 0 otherwise;

major in ____ dummies encode the academic major of the potentially nominated contestant

___ *edu.* dummies encode education level of the potentially nominated contestant

9.2. Estimates for control variables

Table B1: Reciprocal motives (marginal effects)

Variable \ Specification	(4)	(5)	(6)
ROUND 2			
instant revenge	0.008***	0.004***	0.002
female instant revenge		-0.001	-0.000

revenge taken later			0.001
female takes revenge later			-0.003*
N	**42690**	**42690**	**42690**
ROUND 3			
instant revenge	0.027***	0.024***	0.017***
female instant revenge		0.011	0.000
revenge taken later			0.029***
female takes revenge later			0.011
N	**23740**	**23740**	**23740**
ENTIRE GAME			
instant revenge	0.051***	0.049***	0.036***
female instant revenge		0.047***	0.020*
revenge taken later			0.005
female takes revenge later			0.009
N	**66430**	**66430**	**66430**

Legend: * p<.1; ** p<.05; *** p<.01

Each specification for Round 3 and the entire game indicates that the players are willing to nominate back, directly after having been nominated. According to the estimates for the entire game, it is the female contestants that are more likely to take such revenge. The estimate for the delayed revenge is positive in Round 3, and the interaction with gender of the nominating player shows that that tendency is not affected by gender of the decision maker. However, in Round 2 we can observe that being nominated by a player in the past makes a female contestant, at a later stage of the game, less likely to nominate that player.

Table B2: Other control variables (marginal effects)

Variable \ Specification	(6)	(7)
ROUND 2		
major in social sciences	0.002	0.002
major in natural sciences	-0.000	-0.000
major in humanities	0.002	0.002
major in health sciences	0.000	0.000
major in mathematics etc.	0.002	0.002
other major	-0.013	-0.010
secondary edu.	0.001	0.002
vocational edu.	-0.003	-0.003
university edu.	-0.000	-0.000
secondary edu. * fem.pot	-0.001	-0.001
vocational edu. * fem.pot	0.004	0.006
university edu. * fem.pot	0.001	0.001
closest contestant (on the left)	0.011***	0.011***
closest contestant (on the right)	-0.005	-0.005
distance from nominating to potential	0.043***	0.043***

potential from big city		0.005
potential from mid-sized city		0.001
N	**42690**	**42690**
ROUND 3		
major in social sciences	-0.000	0.002
major in natural sciences	0.008	0.011
major in humanities	0.003	0.006
major in health sciences	-0.031	-0.029
major in mathematics etc.	-0.026	-0.028
other major	0.456	0.047
secondary edu.	0.008	0.008
vocational edu.	0.003	0.002
university edu.	-0.008	-0.008
secondary edu. * fem.pot	0.013	0.004
vocational edu. * fem.pot	0.016	0.020
university edu. * fem.pot	0.028	0.023
closest contestant (on the left)	0.016**	0.016**
closest contestant (on the right)	-0.004	-0.003
distance from nominating to potential	-0.008	-0.008
potential from big city		-0.006
potential from mid-sized city		0.005
N	**23740**	**23740**
ENTIRE GAME		
major in social sciences	0.003	0.003
major in natural sciences	-0.001	-0.001
major in humanities	0.005	0.005
major in health sciences	-0.006	-0.006
major in mathematics etc.	-0.004	-0.004
other major	-0.003	-0.002
secondary edu.	-0.000	-0.000
vocational edu.	-0.003	-0.003
university edu.	-0.002	-0.002
secondary edu. * fem.pot	0.001	0.001
vocational edu. * fem.pot	0.024	0.023
university edu. * fem.pot	0.008	0.007
closest contestant (on the left)	-0.004	-0.004
closest contestant (on the right)	-0.015***	-0.015***
distance from nominating to potential	0.006***	0.008***
potential from big city		0.000
potential from mid-sized city		-0.001
N	**66430**	**66430**

Generally speaking, measures of physical proximity have a plausible effect: contestants often nominate their nearest surviving neighbor on the left (the next clock-wise, often bearing a number equal to nominator's number plus one). However, they are also more likely (in Round 2) to nominate an opponent far away from self and thus and presumably psychologically distant, as well as comfortably visible without the need to turn the head.

Demographic variables other than gender play no role.

Faculty of Economic Sciences
University of Warsaw
44/50 Długa St.
00-241 Warsaw
www.wne.uw.edu.pl