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Feedback, Gender, and Choking under Pressure: Evidence from Alpine Skiing

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Feedback, gender, and choking under pressure: Evidence from alpine skiing

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Abstract:

In alpine skiing competitions, one of the coaches of the participating countries sets the course. This may provide an advantage, but it may also exert higher pressure on the racers. We analyze 40,150 men's and 36,968 women's performances from all competitions in alpine skiing's Slalom, Giant Slalom, and Super Giant disciplines that took place in the World Cups, World Championships, and Olympic Games between the 2001-02 and 2017-2018 seasons. We compare the performance of racers when competing on a course that was set by their compatriot to the performance of the same racers in the same season when the course was set by a coach from another country. Having a compatriot course setter only has an effect in the second (and decisive) run of the most technical discipline Slalom. We find that men fail significantly more often to complete their run when their compatriots set the course, whereas women fail significantly less in the same situation. The most likely drivers of our results relate to gender differences in response to feedback and choking under pressure in skill-based tasks.

Keywords: Alpine skiing; choking under pressure; gender differences; panel data

JEL: C33; C93; D91; J16; J24; Z20

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Introduction

It is impossible to imagine our life without the existence of feedback. It serves as an integral part of learning processes that help to achieve a certain goal or improve performance. In most cases, feedback indeed improves performance. However, not every piece of feedback achieves this goal. For example, Saavedra et al. (2012) investigated the effect of timeouts in basketball, where coaches provide their players with feedback. The authors found that timeouts played a very minor role in the scoring dynamics of a team whose coach asked for a timeout. One problem with investigating the effect of feedback in an interactive sport, such as basketball, is that both teams receive feedback during a timeout. It is theoretically possible that the feedback of one coach is as good as that of the other, which makes it difficult to investigate the pure effect of feedback. Thus, most evidence is based on controlled experiments. For example, Berger and Pope (2011) showed that only feedback indicating that individuals are just slightly behind their competitors enhanced the individuals' effort in a computer game. Other types of feedback, such as being far behind, tied, or slightly ahead did not improve performance compared to the control group of individuals who received no feedback.[1] The possible issue with these experiments, however, is that often participants receive false feedback (see also Baumeister and Tice, 1985; Helton et al., 1999; Martin-Krumm et al., 2003).

In addition, feedback may affect the performance of men and women differently. For instance, Wozniak et al. (2014) conducted an experiment with math and word tasks and found that relative (and true) performance feedback moved high-ability females toward more competitive forms of compensation, whereas low-ability men moved toward less competitive forms. Moreover, they found that the menstrual cycle had a positive effect on the willingness to compete. In another real-effort experiment, based on solving as many sums of five two-digit numbers as possible, Berlin and Dargnies (2016) found that women reacted more to the feedback on their own performance level, whereas men reacted more to information on the overall competition. More recently, Lovász et al. (2022) used an online game with a visual perception task that required some effort and skill. In addition to the intermediate score, participants in the encouragement treatment were supposed to be motivated by emoticons and feedback that expressed high expectations concerning the subsequent performance. As a result, females' performance slightly increased in this treatment compared to a baseline, in which participants only saw the score without encouragement. In contrast, males' high scores, average scores, and accuracy dropped significantly in the encouragement treatment. Despite the intriguing results, the authors provided several limitations regarding online sampling, low stakes, and non-interaction with

[1] Also, Berger and Pope (2011) investigated basketball games in the National Basketball Association (NBA) and National Collegiate Athletic Association (NCAA) and found that teams that were slightly behind at half-time, were more likely to win the game. The authors concluded that feedback helped the lagging teams to adjust their efforts to meet their goals. However, a follow-up study by Klein Teeselink et al. (2022) could only replicate the findings of Berger and Pope (2011) for the same years but not with larger NBA and NCAA datasets, nor in the Women's NBA, Australian and American football, and rugby.

real-life supervisors, calling for additional evidence on the effect of feedback from real-life supervisors with higher stakes.

However, nature rarely creates situations that allow a clear view of feedback on performance in real-life settings. In this paper, we take advantage of an unusually clean, non-interactive real competitive environment with high stakes among professionals, in which some individuals are provided with detailed feedback, whereas others are not. More specifically, we used data from Slalom (SL), Giant Slalom (GS), and Super Giant (SG) competitions in alpine skiing, where the course setter is a coach of one of the competing countries. Even though obligated to fulfill certain requirements, course setters still have some freedom in setting a course, which may create an advantage for course setters' compatriots. This is because the course setters may set a course that best fits their compatriots' abilities and because course setters are most likely to provide detailed feedback on the possible pitfalls of the course.

There have been heated debates in the alpine skiing community about the advantage of having a compatriot course setter. For example, Austrian coach Juergen Kriechbaum admitted that he tried to favor his compatriots when setting the course in the 2010 Vancouver Olympic Games. Similarly, Croatian racer Ivica Kostelic admitted that he trained some of the combinations that his coach had set on the course (Reuters, 2010). On the other hand, having a compatriot course setter may create expectations to perform well, which in turn may exert additional pressure and tend to impair performance in skill-based tasks (Baumeister et al., 1985; Harb-Wu & Krumer, 2019). For example, in a recent SL race in Kitzbühel in 2022, an Italian coach set the course of the second run with four Italian athletes being in the top 10 after the first run. However, only one of them (Tommaso Sala) remained in the top 10 after the second run, whereas two others failed to complete the race (Stefano Gross and Giuliano Razzoli), and the leader after the first run (Alex Vinatzer) only finished in 18th place. Whether having a compatriot course setter is an advantage or not is thus an open question, which we try to address in this paper.

Using data from professional sports for economic and managerial research has many advantages because participants compete under fixed and known rules with strong incentives to win. Moreover, the outcomes and the identities of the participants are fully observable. According to Kahn (2000), sports data are unique in that no other setting provides researchers with such detailed information. As evidence, a growing number of articles have used sports data to investigate economic behavior, with many of these being published in top economic journals, including all traditional top five journals (Bar-Eli et al., 2020).

In our paper, we used data on 40,150 performances of men and 36,968 performances of women, from the SL, GS, and SG disciplines that took place in all the World Cups, World Championships, and Olympic Games between the 2001-02 and 2017-2018 seasons. Comparing the performance of the same racer within the same season, we found that men failed to complete the second run of the SL discipline significantly more often when their compatriot set the course as opposed to when the course setter was from another country. Interestingly, we found the opposite result for women, who completed the second run of the SL discipline significantly more often when the course setter was from their country. We found no significant effect of having a compatriot course setter in disciplines other than SL, which is considered the most technical discipline because the poles are closer together and the turns are more frequent (Ski Republic, 2021).

There are several explanations for our findings. First, the existence of the effect only in the second, decisive, run is in line with the literature on choking under pressure. This term was coined by Baumeister (1984), who described a negative relationship between performance and incentives. The importance of a task is typically highest during the final moments of close competitions. For example, Toma (2017) found that basketball players' free-throw percentage dropped in the last 30 seconds of tight NBA games. Similarly, Dandy et al. (2001), observed that Australian basketball players' free-throw percentage is worse in games than in training sessions. Looking at the Professional Golf Association (PGA) Tour, Hickman and Metz (2015) found that the likelihood to miss a putt on the last hole increases with the prize money. Thus, given that the second run in SL competitions has higher stakes, the likelihood of choking is greater there.

Another feature that may induce choking under pressure is the expectation to perform well. For instance, Baumeister et al. (1985) showed in experimental settings that high audience expectations harm performance in skill-based tasks. The home crowd's expectation, or the desire to perform especially well in front of a supportive audience, may motivate but also yield pressure (Baumeister & Steinhilber, 1984; Butler & Baumeister 1998). Following this line, Harb-Wu and Krumer (2019) investigated performance in biathlon, a sport that combines the effort-based task skiing and the precision-based task shooting. The authors found that professional biathletes from the highest ability distribution performed significantly worse in the shooting when competing in their home country, not however in the skiing task in the same situation. Such a difference between effort-based and precision-based tasks may be explained by over-caution or over-ambition. In other words, if people consciously monitor skill-based processes that are best executed as automated actions, the result is often poor performance. Beilock and Carr (2001) exemplified this pattern when studying the performance of golf players. They found that a complex sensorimotor task is best performed when executed as an automated action. Overthinking or monitoring each step is likely to end in choking. In our case, it is plausible to assume that having a compatriot course setter and receiving feedback from him creates greater expectations, which make the athletes monitor each of their moves. Thus, the mixture of expectations that leads to overthinking coupled with the fact that SL is the most technical discipline might induce choking more in SL than in other, less technical disciplines.[2]

Our paper also contributes to the literature on gender differences in performance under pressure. The finding that in decisive moments of a competition, men whose compatriot set the course failed to

[2] See also Ariely et al. (2009), who showed that big mistakes under high stakes are relevant for skill-based but not for effort-based tasks.

complete the race significantly more often, whereas women do not, is in line with Cohen-Zada et al. (2017). The authors showed that in the deciding stages of a tennis set, men were significantly more likely to lose their service game compared to other, less decisive service games in the match. However, this effect was significantly smaller for women, and in some specifications did not exist at all.[3] To explain their results, Cohen-Zada et al. (2017) referred to the literature on the stress hormone cortisol. For instance, Lautenbach et al. (2014) found that cortisol response and a drop in serving performance in tennis are positively correlated. Moreover, Van den Bos et al. (2009) observed that a higher level of salivary cortisol, induced by the Trier Social Stress Test (TSST), was negatively associated with men's performance in the Iowa Gambling Task. However, women's performance and their level of cortisol followed an inverse U relationship. Kivlighan et al. (2005) found that cortisol levels measured directly before a rowing ergometer competition are positively correlated to men's but not women's competitiveness measured with a survey. Thus, men may want to win too much (Niederle & Vesterlundt, 2007), which could induce additional stress. In line with this notion, Booth and Nolen (2022) showed that women's effort does not depend on the degree of pressure (induced by incentive schemes) in a real-effort lab experiment, whereas men's effort increased under tournament incentives compared to piece-rate incentives. Furthermore, Stafford (2018) analyzed more than 5.5 million chess tournament matches and found that female players outperform expectations when playing against men.

However, the direction of the gender effect on performance under pressure is under debate. For example, Englert and Seiler (2020) showed that female, but not male participants of a volleyball university course performed worse in a test situation compared to practice sessions. Cai et al. (2019) obtained similar results for low- vs. high-stake college entry examinations. Likewise, Dilmaghani (2020) observed that – especially for female elite players – time pressure in chess leads to underperformance. Furthermore, the analysis of quiz show data by Booth and Lee (2021) suggests that female participants respond more to stress than male participants. In the real effort experiment by Cahlíková et al. (2020), women (but not men) performed worse under stress than without stress if tournament incentives, as opposed to piece-rate incentives, were paid. Similar to Van den Bos et al. (2009), the authors also used TSST to manipulate stress and confirmed the manipulation by measuring cortisol levels.

Our paper sheds additional light on gender differences in performance in a real-life non-interactive task that involves feedback. Using a different type of feedback, we found a similar result to Lovász et al. (2022), according to which women react significantly better to feedback than men. The remainder of the paper is organized as follows: Section 2 describes the institutional settings of alpine competitions. The data and some descriptive results are presented in Section 3. Sections 4 and 5 present the empirical strategy and the results, respectively. We discuss the results and conclude in Section 6.

[3] Note that in tennis, the server has an advantage over the receiver.

Description of Alpine skiing settings

The goal of professional alpine skiing is to complete a given course as fast as possible. Races take place in four main events (Downhill, SG, GS, SL). Downhill and SG are considered speed events, with Downhill having the biggest distances between posts and therefore allowing for the highest speed (Gilgien et al., 2015). Both downhill and SG are carried out in one run. GS and SL are considered technical events. The distance between posts is smaller (FIS, 2020) and therefore speeds are lower in SL. Technical events are carried out in two runs on two different courses (FIS, 2020). The result is determined by adding the times of both runs. In World Cup races, only athletes ranked in the top 30 after the first run are allowed to participate in the second run. At World Championships and Winter Olympic Games, all athletes who completed their first run are allowed to participate in the second run.

In Downhill races, the course setter is a neutral official from the Féderation Internationale de Ski (FIS), whereas, in all other disciplines, the course setter is a coach of one of the competing teams. Thus, in this paper, we only concentrate on SL, GS, and SG competitions. We could not find an explicit rule that determines the procedure of course setters' appointments. However, according to Michael Bont, an SRF (Swiss Broadcasting Company) expert on alpine skiing, there is a higher probability to pick a course setter from a country that has more racers that are ranked in the top 30 (Bont, personal communication, 26.10.2018). In races carried out in two runs, there are different course setters for each of the runs. Even though obligated to fulfill certain requirements, course setters still have some freedom when setting a course.

The most important competitions in alpine skiing are the World Cup, the World Championships, and the Winter Olympic Games. The World Cup traditionally starts at the end of October and ends at the beginning of March. Per season and gender, 30-40 races are held at different locations worldwide with various combinations of events. The calendars for women and men are independent of each other, meaning that races are not held at the same time and place. The only exceptions are races in Sölden and Levi at the beginning of the season, the World Cup final, the Winter Olympic Games, and the World Championships.

At each World Cup race, athletes ranked in the top 30 are rewarded with up to 100 World Cup points, depending on their result. At the end of a season, the athletes winning the most points in all events combined are awarded the large overall World Cup trophy. Winners of the individual disciplines are awarded a small World Cup trophy. At the World Championships and the Winter Olympic Games, which take place every second and every fourth year respectively, the athletes do not get World Cup points. However, athletes in 1st to 3rd place are awarded medals (gold, silver, and bronze).

Data and variables

Data

We collected data from the official website of the FIS on all men's and women's SL, GS, and SG competitions that took place in the World Cups, World Championships, and Olympic Games for the seasons from 2001/02 to 2017/18. These are the most prestigious tournaments in professional alpine skiing. The starting season was chosen because, since 2001, the FIS has published detailed results for every race in alpine skiing.

For each race, we have full information on racers' names and nationality, event date, type of competition, whether the racer completed all the runs of the race correctly or not, and the final result. Additionally, we have information on the course setters' names and nationalities.

Table 1: Course setters per country among men

Country	**First run**				**Second run**		
	Super Giant	**Giant Slalom**	**Slalom**	**Total**	**Giant Slalom**	**Slalom**	**Total**
Austria	21	35	34	90	23	29	52
Canada	10	3	9	22	4	8	12
Croatia	1	3	8	12	0	6	6
Czech Republic	0	0	0	0	0	1	1
Finland	0	8	3	11	6	2	8
FIS	1	0	0	1	0	0	0
France	10	23	22	55	20	16	36
Great Britain	0	0	2	2	0	0	0
Germany	1	7	15	23	5	11	16
Italy	18	16	19	53	25	29	54
Japan	0	0	4	4	0	6	6
Liechtenstein	0	1	0	1	0	0	0
Norway	20	14	13	47	15	16	31
Russia	0	0	2	2	0	3	3
Slovenia	1	2	7	10	2	9	11
Switzerland	19	12	10	41	20	12	32
Sweden	2	4	17	23	8	21	29
USA	16	16	13	45	16	9	25
Total	**120**	**144**	**178**	**442**	**144**	**178**	**322**

The final dataset consists of 442 men's and 445 women's competitions. The data include performances of 1,196 men and 956 female racers. In men's competitions, there were course setters from 17 countries; in women's competitions from 16 countries. Austrian representatives set the course in 18.5% of men's and 18.0% of women's competitions, followed by Italian (14%) and German (11%) setters (see Tables 1 and 2, for the full list). Overall, our data consist of 40,150 individual performances among men and 36,968 individual performances among women.

Table 2: Course setters per country among women

Country	First run				Second run		
	Super Giant	**Giant Slalom**	**Slalom**	**Total**	**Giant Slalom**	**Slalom**	**Total**
Austria	24	26	30	80	31	26	57
Canada	6	4	7	17	10	3	13
Croatia	3	4	8	15	2	4	6
Czech Republic	0	0	8	8	0	5	5
Finland	0	9	8	17	4	10	14
FIS	5	0	0	5	0	0	0
France	11	12	9	32	10	17	27
Germany	18	15	19	52	13	18	31
Italy	11	23	6	40	22	9	31
Liechtenstein	2	2	0	4	2	0	2
Norway	1	4	7	12	1	5	6
Slovenia	7	9	6	22	13	6	19
Spain	1	3	0	4	5	0	5
Switzerland	18	10	10	38	7	11	18
Slovakia	0	0	6	6	2	6	8
Sweden	10	21	19	50	18	27	45
USA	16	8	19	43	10	15	25
Total	**133**	**150**	**162**	**445**	**150**	**162**	**312**

Variables and descriptive statistics

Our main variable of interest is $Compatriot\ Setter$, which is a dummy variable that receives the value of one if a course setter is a compatriot of a racer in the respective run. To estimate the possible effect of having a compatriot course setter on performance in alpine skiing, we have a set of four outcome variables. The first two are dummy variables that receive the value of one if a racer did not finish (complete) the run in the first (DNF1) or the second run (DNF2). In Table 3, we see that among men, in 18.5% of cases a racer fails to complete the first run when his compatriot set the course compared to 24.4% in the case of a non-compatriot course setter. Among women, in 15.7% of cases, a racer fails to complete the first run when her compatriot set the course compared to 18.3% in the case of a non-compatriot course setter. We see a smaller gap between finishing and not finishing the second run. More specifically, among men in 12.7% of cases, a racer fails to complete the run when his compatriot sets the course compared to 11.8% in the case of a non-compatriot course setter. Among women, in 8% of cases, a racer fails to complete the run when her compatriot sets the course compared to 10.2% in the case of a non-compatriot course setter.

Table 3: Descriptive statistics

	Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max
	Compatriot course setter				**Non-compatriot course setter**			
Variables	*Men (1,196 racers)*							
DNF1	0.185	0.388	0	1	0.244	0.429	0	1
DNF2	0.127	0.333	0	1	0.118	0.323	0	1
Top 3	0.066	0.249	0	1	0.041	0.198	0	1
World Cup points	14.07	22.54	0	100	10.087	19.221	0	100
Home event	0.023	0.150	0	1	0.104	0.305	0	1
Lag time run 1 (sec)	1.631	1.109	0	18.6	2.576	3.343	0	62.8
Slalom	0.388	0.487	0	1	0.443	0.497	0	1
Giant Slalom	0.340	0.474	0	1	0.323	0.468	0	1
Super Giant	0.272	0.445	0	1	0.234	0.423	0	1
Number of observations in run 1	2695				27,078			
Number of observations in run 2	1066				9311			
	Mean	**St. Dev.**	**Min**	**Max**	**Mean**	**St. Dev.**	**Min**	**Max**
	Compatriot course setter				**Non-compatriot course setter**			
Variables	*Women (956 racers)*							
DNF1	0.157	0.364	0	1	0.183	0.387	0	1
DNF2	0.080	0.271	0	1	0.102	0.303	0	1
Top 3	0.070	0.255	0	1	0.047	0.211	0	1
World Cup points	14.95	22.65	0	100	11.31	20.12	0	100
Home event	0.030	0.170	0	1	0.107	0.309	0	1
Lag time run 1 (sec)	1.863	1.087	0	8.11	2.443	2.475	0	40.74
Slalom	0.343	0.474	0	1	0.388	0.487	0	1
Giant Slalom	0.354	0.478	0	1	0.355	0.478	0	1
Super Giant	0.303	0.459	0	1	0.256	0.437	0	1
Number of observations in run 1	2327				24,721			
Number of observations in run 2	993				8927			

Notes: The variables *DNF1* and *DNF2* represent *Did not finish run 1* and *Did not finish run 2.* They are split according to having a compatriot course setter or not in the respective run. All the other variables are split according to having a compatriot course setter or not in at least one of the runs. Note that the number of observations for the World Cup points with and without compatriot course setter is 2,539 and 23,777, respectively for men. The respective numbers for women are 2,184 and 21,895.

The third outcome variable is a dummy variable that receives the value of one if a racer finished the competition in the top three, which makes him/her a medalist of a competition (gold, silver, or bronze medal for the first, second, or third places respectively). Our last outcome variable is the number of World Cup points that a racer achieved in the respective competition. These World Cup points are assigned only in the World Cup competitions, which account for 88.7% of our dataset (the other competitions are the Olympic Games and World Championships). We see that for both genders, racers finish in the top three more frequently and achieve more World Cup points if their compatriot sets the course in at least one of the two runs of the respective competition.

We see that most observations for both genders are from SL competitions, followed by GS. The least frequent discipline and the only one that uses one run is SG. We also have information on the lagging time behind the leader of the first run. Again, we see that for both genders, racers whose compatriots set the course have a lower gap behind the leader, suggesting that these racers are of a higher ability. One last variable that we use, represents whether a racer is competing in his or her home country, which may play a role in alpine skiing (Gschwend & Krumer, 2021).

Estimation strategy

We are interested in learning the effect of having a compatriot course setter on one of the four measures of performance that were described in the previous section. A naïve approach of correlating a dummy variable of having a compatriot course setter with performance would yield biased and inconsistent estimates. This is because racers whose compatriot sets the course are from strong alpine skiing countries whose racers are on average more skilled than racers that come from other countries where alpine skiing is less popular. In addition, an individual's unobserved ability is likely to affect a racer's performance. Furthermore, as illustrated in Gschwend and Krumer (2021), this individual ability may also vary over time, differing over the years due to different preparations between seasons, for example. Hence, we need to take the different sources of unobserved heterogeneity into account.

Our panel data follows the same racers over time, which allows us to use a fixed-effects model that controls for all time-invariant differences between the individuals. Therefore, we can use racer or racer-season fixed effects. We follow Gschwend and Krumer (2021) who used the same dataset and showed that racer-per-season has more plausible assumptions concerning the racers' abilities. The main advantage of using a fixed-effects model is that it considers omitted variables under the condition that these variables are constant over time. The most important variable is ability, which is very difficult to model. Thus, by using racer-per-season fixed effects we assume that the ability may change between the seasons, however, it is constant within a given season, which is more plausible than assuming constant ability over the span of a racer's career.

Therefore, our most general specification allows us to test the effect of having a compatriot setter by exploiting the variability of the nationality of course setters across different races for a given racer. Using a fixed-effects model, the most basic specification takes the following form:

$$(1)\ Y_{its} = \alpha_1\, Compatriot\ Setter_{its} + \alpha_2\, Compatriot\ Setter_{its} * GS + \alpha_3\, Compatriot\ Setter_{its} * SG + \alpha_4\, X_{its} + \delta_{is} + \mu_t + \varepsilon_{its}$$

where $Y_{it(s)}$ is one of the four measures of performance, which were described in the previous section (DNF1, DNF2, Top 3, and World Cup points), that was achieved by racer *i* in competition/run *t* of season s. The variable $Compatriot\ Setter_{its}$ is a dummy variable that receives the value of one if a course setter is a compatriot of a racer in the respective competition/run. Note that when the outcome variables are DNF1 or DNF2, we define $Compatriot\ Setter_{its}$ as having a compatriot course setter in runs 1 or 2, respectively. As noted above, in the Super Giant competition there is only one run, thus when the outcome variables are Top 3 or World Cup points that represent the overall performance in the competition, we include $Compatriot\ Setter_{its}$ from both runs.

We also included interaction terms between the $Compatriot\ Setter_{its}$ in the respective run and the disciplines GS as well as SG. This means that SL is our base group, thus the effect of having a compatriot course setter on performance in SL is expressed via α_1. The coefficients α_2 and α_3 are the differential effects of having a compatriot course setter in GS and SG, respectively beyond SL. The total effects of having a compatriot course setter in GS and SG are $\alpha_1 + \alpha_2$, and $\alpha_1 + \alpha_3$, respectively.

As discussed, the model includes fixed effects for racer-per-season (δ_{is}). We also use, μ_t, which is the specific competition's fixed effects that allows us to control for all the features of this specific competition that were common for all participants, such as the number of spectators or capacity utilization, the general climate conditions in the area of competition, and the difficulty of the track on the specific day. Finally, our set of control variables X_{its} includes a variable that represents whether a racer competes in his/her country and the lagging time behind the leader of the first run (when the outcome variable is DNF2).[4]

Results

Main results

In Panel A of Table 4, we present the results for men's competitions. Standard errors clustered at racer level are in parentheses. In Column (1), we see that having a compatriot course setter has no significant effect on the probability of failing to complete the first run in all three disciplines. However, in Column (2) we find that having a compatriot course setter increases the probability of failing to complete the second run by 4 percentage points in SL competitions. This result suggests that having a compatriot course setter in the second run of SL competitions not only does not help but even impairs the performance of the racers. However, we find no significant effect in GS competitions. Finally, the results in Columns (3)-(4) show no significant relationship between having a compatriot course setter and being on the podium or achieving World Cup points, respectively.

[4] It is worth noting Foellmi et al. (2016), who found the effect of the leftmost digit of the lagging time on the probability of not finishing the second run in SL and GS competitions. However, that paper did not distinguish between genders and the types of the disciplines.

Table 4: FE estimates of the compatriot course setter

Panel A: Men	(1) DNF 1	(2) DNF 2	(3) Top 3	(4) World Cup points
Compatriot setter run 1	-0.012		0.000	-0.159
	(0.013)		(0.006)	(0.567)
Compatriot setter run 1*GS	0.012		0.001	0.965
	(0.017)		(0.013)	(1.068)
Compatriot setter run 1*SG	-0.003		-0.004	1.528
	(0.019)		(0.012)	(1.011)
Compatriot setter run 2		0.040**	0.010	0.559
		(0.019)	(0.008)	(0.680)
Compatriot setter run 2*GS		-0.028	-0.016	-0.789
		(0.023)	(0.013)	(1.041)
Home event	Yes	Yes	Yes	Yes
Lagging time after run 1	No	Yes	No	No
Racer per season dummies	Yes	Yes	Yes	Yes
Unique competition dummies	Yes	Yes	Yes	Yes
H_0: Compatriot setter1+Compatriot setter1*GS=0	0		0.001	0.806
(p-val)	(0.96)		(0.888)	(0.346)
H_0: Compatriot setter1 +Compatriot setter1*SG=0	-0.015		-0.004	1.369
(p-val)	(0.307)		(0.740)	(0.117)
H_0: Compatriot setter2 +Compatriot setter2*GS=0		0.012	-0.006	-0.23
(p-val)		(0.416)	(0.438)	(0.714)
Observations	29,773	10,377	29,773	26,316

Panel B: Women	(1) DNF 1	(2) DNF 2	(3) Top 3	(4) World Cup points
Compatriot setter run 1	0.013		0.002	0.045
	(0.014)		(0.008)	(0.611)
Compatriot setter run 1*GS	-0.017		-0.006	-0.469
	(0.019)		(0.013)	(1.186)
Compatriot setter run 1*SG	-0.008		-0.002	1.070
	(0.019)		(0.012)	(0.917)
Compatriot setter run 2		-0.038**	0.007	1.641*
		(0.016)	(0.008)	(0.886)
Compatriot setter run 2*GS		0.033	-0.013	-1.168
		(0.021)	(0.015)	(1.265)
Home event	Yes	Yes	Yes	Yes
Lagging time after run 1	No	Yes	No	No
Racer per season dummies	Yes	Yes	Yes	Yes
Unique competition dummies	Yes	Yes	Yes	Yes
H_0: Compatriot setter1+Compatriot setter1*GS=0	-0.004		-0.004	-0.424
(p-val)	(0.736)		(0.669)	(0.642)
H_0: Compatriot setter1 +Compatriot setter1*SG=0	0.005		0	1.115
(p-val)	(0.72)		(0.956)	(0.11)
H_0: Compatriot setter2 +Compatriot setter2*GS=0		-0.005	-0.006	0.473
(p-val)		(0.751)	(0.601)	(0.578)
Observations	27,048	9,920	27,048	24,079

Notes: Dependent variables appear below the column's' numbers. The H_0 includes a *Compatriot Setter* related variable in the relevant specification. SG and GS represent Super Giant and Giant Slalom respectively. Standard errors clustered at racer level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Panel B of Table 4, we present the results for women's competitions. As in the case with men, in Column (1), we see that having a compatriot course setter has no significant effect on the probability of failing to complete the first run in all three disciplines. However, in Column (2), we find that having a compatriot course setter reduces the probability of failing to complete the second run in SL competitions by 3.8 percentage points. Unlike in the case of men's SL, this result suggests that having a compatriot course setter in the second run of SL competitions enhances the performance of the female racers. Even though we find no significant effect on the probability of being on the podium (Column 3), having a compatriot course setter has a positive effect on the overall performance in terms of the World Cup points in SL competitions. More specifically, female racers whose compatriot sets the course in the second run of SL competitions are expected to gain 1.6 World Cup points more (p=0.06).

Robustness checks

In the previous sub-section, we found that having a compatriot course setter affects the probability of not completing the second run in SL competitions only. More intriguingly, we found opposite effects for men and women. In this sub-section, we probe more deeply into the second run of SL competitions. In Table 5, we present the results of different sub-samples of these competitions. In Column (1), we use all the data on SL. As previously, we find that men have a significantly larger probability of failing to complete the race if the course was set by their compatriot (Panel A), whereas women have a significantly lower probability of such a failing (Panel B).

Table 5: FE estimates of having a compatriot course setter in the second run of SL competitions

Panel A: Men	(1)	(2)	(3)	(4)
Compatriot setter run 2	0.043**	0.050**	0.049**	0.046**
	(0.020)	(0.020)	(0.020)	(0.022)
Home event	Yes	Yes	Yes	Yes
Lagging time after run 1	Yes	Yes	Yes	Yes
Racer per season dummies	Yes	Yes	Yes	Yes
Unique competition dummies	Yes	Yes	Yes	Yes
Observations	5,619	4,837	4,819	3,975
Panel B: Women	(1)	(2)	(3)	(4)
Compatriot setter run 2	-0.043***	-0.036**	-0.036**	-0.043**
	(0.015)	(0.015)	(0.015)	(0.017)
Home event	Yes	Yes	Yes	Yes
Lagging time after run 1	Yes	Yes	Yes	Yes
Racer per season dummies	Yes	Yes	Yes	Yes
Unique competition dummies	Yes	Yes	Yes	Yes
Observations	5,098	4,361	4,329	3,589

Notes: This table presents the results of the second run of Slalom (SL) competitions. The dependent variable is DNF2. Column 1 represents the results for all slalom competitions in the data. In Columns 2-4, we present the results for the World Cups only. In Column 2, we use all the data on the World Cups. In Column 3, we restrict the data to racers whose lagging time is below the maximal lagging time of a racer whose compatriot sets the course in the second run (4.77 seconds and 4.96 seconds among men and women, respectively). In Column 4, we restrict the data to racers whose lagging time is below the mean+sd of the lagging time of a racer whose compatriot sets the course in the second run (2.4 seconds and 2.97 seconds among men and women, respectively). Standard errors clustered at racer level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Columns (2)-(4), we restrict the data to the World Cups only. The reason for this is that in World Cup races, only the top 30 racers after the first run are allowed to participate in the second run. At World Championships and Winter Olympic Games, all athletes who completed their first run are allowed to participate in the second run. In Column (2), we use all data from the World Cups and find that men have a 5-percentage point higher probability of failing to complete the race if the course was set by their compatriot. In contrast, female racers enhance their performance by reducing their probability of failing to complete the race by 3.6 percentage points. To put these results into perspective, the mean share of DNF2 in World Cup SL competitions among women is 0.109. The respective mean share among men is 0.127. Thus, we find non-negligible effects of the compatriot course setter whose sizes are 33% and 39% of the mean among women and men, respectively.

One possible concern is the existence of outliers concerning the lagging time behind the leader as illustrated in Table 3. Thus, in Column (3), we restricted the data to the maximal lagging time after the first run of 4.77 seconds among men, and 4.96 seconds among women. These thresholds were chosen because these are the maximal values of lagging time among racers whose compatriots set the course of the second run in SL World Cup competitions. We see that the results are very similar to those presented in Column (2).

In Column (4), we restricted the data even more. More specifically, we excluded all the racers who were lagging behind the leader by more than 1 standard deviation (0.94 seconds among men, and 1.08 seconds among women) above the mean (1.46 seconds among men, and 1.89 seconds among women). Thus, the lagging time threshold was set at 2.4 seconds among men, and 2.97 seconds among women. The results suggest that men who compete on a course that was set by their compatriots have a 4.6 percentage points higher probability of failing to complete the race compared to cases in which they were competing on a course that was not set by a compatriot. The results for women are again in the opposite direction. Female racers who compete on the course that was set by their compatriots have a 4.3 percentage points lower probability of failing to complete the race compared to cases in which they were competing on a course that was not set by a compatriot.

Finally, we conducted a falsification test, where we conducted similar analyses to those presented in Table 5. However, instead of using a variable that represents a compatriot setter in run 2, we use a compatriot setter in run 1. In other words, we test whether having a compatriot course setter in run 1 has an effect on the probability of failing in run 2. We expect that there should be no significant relationship between failing to complete the race and the nationality of the course setter in the previous run. We present the results of this test in Table 6, where we indeed find no such relationship in any of the sub-samples for both genders.

Table 6: Falsification test of having a compatriot course setter in the first run on DNF2 in SL competitions

Panel A: Men	(1)	(2)	(3)	(4)
Compatriot setter run 1	-0.005	0.010	0.010	-0.005
	(0.016)	(0.016)	(0.016)	(0.016)
Home event	Yes	Yes	Yes	Yes
Lagging time after run 1	Yes	Yes	Yes	Yes
Racer per season dummies	Yes	Yes	Yes	Yes
Unique competition dummies	Yes	Yes	Yes	Yes
Observations	5,619	4,837	4,819	3,975
Panel B: Women	(1)	(2)	(3)	(4)
Compatriot setter run 1	0.010	0.015	0.010	0.002
	(0.013)	(0.013)	(0.013)	(0.013)
Home event	Yes	Yes	Yes	Yes
Lagging time after run 1	Yes	Yes	Yes	Yes
Racer per season dummies	Yes	Yes	Yes	Yes
Unique competition dummies	Yes	Yes	Yes	Yes
Observations	5,098	4,361	4,329	3,589

Notes: This table presents the results of the second run of Slalom (SL) competitions. The dependent variable is DNF2. Column 1 represents the results for all slalom competitions in the data. In Columns 2-4, we present the results for the World Cups only. In Column 2, we use data on all the World Cups. In Column 3, we restrict the data to racers whose lagging time is below the maximal lagging time of a racer whose compatriot sets the course in the second run (4.77 seconds and 4.96 seconds among men and women, respectively). In Column 4, we restrict the data to racers whose lagging time is below the mean+sd of the lagging time of a racer whose compatriot sets the course in the second run (2.4 seconds and 2.97 seconds among men and women, respectively). Standard errors clustered at racer level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Discussion and conclusion

In this paper, we analyzed the effect of having a compatriot course setter on the performance of racers in alpine skiing. Using data on the performance of 1,196 men and 956 female racers over a period of 17 seasons, we found that in the decisive run of the most technical discipline (SL) women benefited from having a compatriot course setter – they completed the run more often and earned more World Cup points. Men, on the other hand, finished the decisive run in SL significantly less often when their compatriots set the course, which suggests that men and women react differently to a seemingly advantageous situation. While women's performance is enhanced, men tend to choke under pressure.

These results are in line with Cohen-Zada et al. (2017). The authors observed choking under pressure among male tennis players, who are more likely to lose their most important service games. Similar to being on serve in tennis, it should be an advantage in alpine skiing if the coach of one's team has set the course. The advantage of our non-interactive setting, in which we analyzed a racer's performance against himself or herself, is that opponents cannot directly influence the outcome. In tennis, it is theoretically possible that a receiver's performance is enhanced rather than a server choking under pressure. Furthermore, our findings are in line with Ariely et al. (2009) as well as Harb-Wu and Krumer (2019), who found evidence of choking under pressure in skill-based but not effort-based tasks.

One possible driver for these gender differences is that male racers' attention may be shifted to irrelevant cues, such as worries about not meeting expectations. This may distract them while performing under pressure, which corresponds to the distraction theory (Wine, 1971; Mullen et al., 2005; Beilock, 2008). Moreover, automated skillful performance could be disturbed if subjects explicitly monitor their task execution under pressure – which is in line with the more prominent self-focus theory (Baumeister, 1984; Masters, 1992; Mesagno et al., 1992). Finally, the relationship between performance and pressure could follow an inverse U (Hebb, 1955), and male racers might be over-aroused in the decisive run that is set by their compatriot. Although the self-focus model receives more support in experimental settings (Beilock and Carr, 2001, Kent et al., 2018), it is not mutually exclusive to the over-arousal and distraction model (DeCaro et al. 2011).[5]

Our results provide real-life evidence with high stakes for the findings of Lovász et al. (2022). They showed with a not incentivized experiment that intermediate encouragement, which induces high expectations concerning subsequent performance, could be harmful to male but not to female performance. One implication of our results is that coaches do not need to further motivate players before important games, runs, or quarters. For male athletes, this may be even counterproductive. Our findings also contribute to the discussion on the reasons for the persistent gender pay gap, which include self-selection, discrimination, and performance under pressure. Our data cast doubt on the notion that men in the same positions earn more than women because they are better able to perform under pressure.

Despite the contributions that our study makes, it also has several limitations that should be noted. First, our results come from the very specific and risky sport of alpine skiing, where individuals are likely to be less risk averse than the overall population. Thus, it is possible that the results would differ in other environments. For example, in the labor market, individuals do not need to take such serious risks where a small mistake may end up in a severe injury. In the same spirit, the stakes are not always as high as in our setting – both from the financial but also from the health point of view. Nevertheless, identifying gender differences among high-ability professionals in response to a seemingly advantageous situation calls for extra attention among individuals who have to perform precision tasks after receiving feedback in situations that involve high pressure. Such feedback may yield large economic losses, which is especially true in male-dominant occupations such as the military and traders in financial markets.

Finally, on a practical note, our findings suggest that it is worthwhile for alpine skiing authorities to consider neutral course setters, at least in SL competitions. This will eliminate asymmetrical information and make the competition fairer.

[5] For additional neuropsychological mechanisms of choking under pressure, see the extensive review of Yu (2015).

References

Ariely, D., Gneezy, U., Loewenstein, G., and Mazar, N. (2009). Large stakes and big mistakes. *The Review of Economic Studies*, *76*(2), 451-469.

Bar-Eli, M., Krumer, A., & Morgulev, E. (2020). Ask not what economics can do for sports-Ask what sports can do for economics. *Journal of Behavioral and Experimental Economics*, *89*, 101597.

Baumeister, R. F. (1984). Choking under pressure: self-consciousness and paradoxical effects of incentives on skillful performance. *Journal of Personality and Social Psychology*, *46*(3), 610-620.

Baumeister, R. F., Hamilton, J. C., & Tice, D. M. (1985). Public versus private expectancy of success: Confidence booster or performance pressure?. *Journal of Personality and Social Psychology*, *48*(6), 1447.

Baumeister, R. F., & Steinhilber, A. (1984). Paradoxical effects of supportive audiences on performance under pressure: The home field disadvantage in sports championships. *Journal of Personality and Social Psychology*, *47*(1), 85.

Baumeister, R. F., & Tice, D. M. (1985). Self-esteem and responses to success and failure: Subsequent performance and intrinsic motivation. *Journal of Personality*, *53*(3), 450-467.

Beilock, S. L. (2008). Math performance in stressful situations. *Current Directions in Psychological Science*, *17*(5), 339-343.

Beilock, S. L., & Carr, T. H. (2001). On the fragility of skilled performance: What governs choking under pressure?. *Journal of Experimental Psychology: General*, *130*(4), 701.

Berger, J., & Pope, D. (2011). Can losing lead to winning?. *Management Science*, *57*(5), 817-827.

Berlin, N., & Dargnies, M. P. (2016). Gender differences in reactions to feedback and willingness to compete. *Journal of Economic Behavior & Organization*, 130, 320-336.

Booth, A., & Lee, J. (2021). Girls' and boys' performance in competitions: What we can learn from a Korean quiz show. *Journal of Economic Behavior & Organization*, *187*, 431-447.

Booth, A. L., & Nolen, P. (2022). Gender and Psychological Pressure in Competitive Environments: A Laboratory-based Experiment, *Economica*, *89*, 71-85.

Butler, J. L., & Baumeister, R. F. (1998). The trouble with friendly faces: skilled performance with a supportive audience. *Journal of Personality and Social Psychology*, *75*(5), 1213.

Cahlíková, J., Cingl, L., & Levely, I. (2020). How stress affects performance and competitiveness across gender. *Management Science*, *66*(8), 3295-3310.

Cai, X., Lu, Y., Pan, J., & Zhong, S. (2019). Gender Gap under Pressure: Evidence from China's National College Entrance Examination. *Review of Economics and Statistics*, *101*(2), 249-263.

Cohen-Zada, D., Krumer, A., Rosenboim, M., & Shapir, O. M. (2017). Choking under pressure and gender: Evidence from professional tennis. *Journal of Economic Psychology*, *61*, 176-190.

Dandy, J., Brewer, N., & Tottman, R. (2001). Self-consciousness and performance decrements within a sporting context. *Journal of Social Psychology*, *141*(1), 150-152.

DeCaro, M. S., Thomas, R. D., Albert, N. B., & Beilock, S. L. (2011). Choking under pressure: multiple routes to skill failure. *Journal of Experimental Psychology: General*, 140(3), 390.

Dilmaghani, M. (2020). Gender differences in performance under time constraint: Evidence from chess tournaments. *Journal of Behavioral and Experimental Economics*, *89*, 101505.

Englert, C., & Seiler, R. (2020). Anxiety and volleyball performance in a real testing situation: gender differences in competitive environments. *Educational Psychology*, *40*(6), 735-749.

FIS (2020). The International ski competitions rules. Retrieved from https://assets.fis-ski.com/image/upload/v1593675483/fis-prod/assets/ICR_02072020.pdf.

Foellmi, R., Legge, S., & Schmid, L. (2016). Do Professionals Get It Right? Limited Attention and Risk-taking Behaviour. *The Economic Journal*, *126*(592), 724-755.

Gray, R. (2020). Attentional theories of choking under pressure revisited. in *Handbook of Sport Psychology* (eds G. Tenenbaum and R.C. Eklund), Hoboken, NJ: Wiley, 595-610.

Gschwend, M., & Krumer, A. (2021). On the importance of fixed effects over a short period of time when using sports data: a lesson from home advantage in alpine skiing. *European Sport Management Quarterly*. In press.

Gilgien, M., Crivelli, P., Spörri, J., Kröll, J. & Müller, E. (2015). Characterization of course and terrain and their effect on skier speed in World Cup alpine ski racing. *PLoS One*, 10(3), e0118119.

Harb-Wu, K., & Krumer, A. (2019). Choking under pressure in front of a supportive audience: Evidence from professional biathlon. *Journal of Economic Behavior & Organization*, *166*, 246-262.

Hebb, D. O. (1955). Drives and the CNS (conceptual nervous system). *Psychological Review*, *62*(4), 243.

Helton, W. S., Dember, W. N., Warm, J. S., & Matthews, G. (1999). Optimism, pessimism, and false failure feedback: Effects on vigilance performance. *Current Psychology*, *18*(4), 311-325.

Hickman, D. C., & Metz, N. E. (2015). The impact of pressure on performance: Evidence from the PGA TOUR. *Journal of Economic Behavior & Organization*, *116*, 319-330.

Kahn, L. M. (2000). The sports business as a labor market laboratory. *Journal of Economic Perspectives*, *14*(3), 75-94.

Kent, S., Devonport, T. J., Lane, A. M., Nicholls, W., and Friesen, A. P. (2018). The effects of coping interventions on ability to perform under pressure. *Journal of Sports Science and Medicine*, *17*(1), 40-55.

Kivlighan, K. T., Granger, D. A., & Booth, A. (2005). Gender differences in testosterone and cortisol response to competition. *Psychoneuroendocrinology*, *30*(1), 58-71.

Klein Teeselink, B., van den Assem, M. J., & van Dolder, D. (2022). Does losing Lead to winning? An empirical analysis for four sports. *Management Science*. In press.

Lautenbach, F., Laborde, S., Achtzehn, S., & Raab, M. (2014). Preliminary evidence of salivary cortisol predicting performance in a controlled setting. *Psychoneuroendocrinology*, *42*, 218-224

Lovász, A., Cukrowska-Torzewska, E., Rigó, M., & Szabó-Morvai, Á. (2022). Gender differences in the effect of subjective feedback in an online game. *Journal of Behavioral and Experimental Economics*, *98*, 101854.

Martin-Krumm, C. P., Sarrazin, P. G., Peterson, C., & Famose, J. P. (2003). Explanatory style and resilience after sports failure. *Personality and Individual Differences*, *35*(7), 1685-1695.

Masters, R. S. (1992). Knowledge, knerves and know-how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British Journal of Psychology*, *83*(3), 343-358.

Masclet, D., Peterle, E., & Larribeau, S. (2015). Gender differences in tournament and flat-wage schemes: An experimental study. *Journal of Economic Psychology*, *47*, 103-115.

Mesagno, C., Garvey, J., Tibbert, S. J., & Gröpel, P. (2019). An investigation into handedness and choking under pressure in sport. *Research Quarterly for Exercise and Sport*, *90*(2), 217-226.

Mullen, R., Hardy, L., & Tattersall, A. (2005). The effects of anxiety on motor performance: A test of the Conscious Processing Hypothesis. *Journal of Sport and Exercise Psychology*, *27*, 221–225.

Niederle, M., & Vesterlund, L. (2007). Do women shy away from competition? Do men compete too much? *Quarterly Journal of Economics*, *122*(3), 1067-1101.

Reuters (2010). "Kostelic gate" opens course debate, February 22, 2010. https://www.reuters.com/article/us-olympics-alpineskiing-course-sb-idUSTRE61L0BK20100222 last retrieved: September 24, 2022.

Saavedra, S., Mukherjee, S., & Bagrow, J. P. (2012). Is coaching experience associated with effective use of timeouts in basketball?. *Scientific Reports*, 2(1), 1-3.

Ski Republic (2021). The Alpine Ski World Cup, December 8, 2021. https://www.ski-republic.com/news/the-alpine-ski-world-cup last retrieved: September 24, 2022.

Stafford, T. (2018). Female chess players outperform expectations when playing men. *Psychological Science*, *29*(3), 429-436.

Toma, M. (2017). Missed shots at the free-throw line: Analyzing the determinants of choking under pressure. *Journal of Sports Economics*, *18*(6), 539-559.

Van den Bos, R., Harteveld, M., & Stoop, H. (2009). Stress and decision-making in humans: performance is related to cortisol reactivity, albeit differently in men and women. *Psychoneuroendocrinology, 34*(10), 1449-1458.

Wine, J. (1971). Test anxiety and direction of attention. *Psychological Bulletin*, *76*(2), 92

Wozniak, D., Harbaugh, W. T., & Mayr, U. (2014). The menstrual cycle and performance feedback alter gender differences in competitive choices. *Journal of Labor Economics*, 32(1), 161-198.

Yu, R. (2015). Choking under pressure: the neuropsychological mechanisms of incentive-induced performance decrements. *Frontiers in Behavioral Neuroscience*, *9*, 19.