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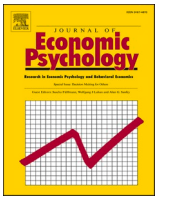

Expectations, gender, and choking under pressure: Evidence from alpine skiing

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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 45,467 men's and 41,221 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 2001/2002 and 2019/2020 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 expectations and choking under pressure in skill-based tasks.

1. Introduction

Being in an advantageous position in a competitive environment is desirable for economic agents because, by definition, such an advantage is likely to increase the probability of a successful outcome. Examples include private information in trading (Kyle, 1985), competing at home in sports competitions (Courneya & Carron, 1992), leading in political races (Klumpp & Polborn, 2006), performing last in music contests (Page & Page, 2010), etc. Intuitively, it is even more desirable to be in an advantageous position when the stakes are high. Such an advantage may create expectations to perform well. While there can be a positive relationship between expectations and performance (Bandura, 1977), it can also provoke choking under pressure (Baumeister et al., 1985), which impairs performance and results in economic losses.

The three theories previously used to explain choking under pressure are the self-focus theory (Baumeister, 1984), the distraction theory (Mullen et al., 2005), and the theory on the optimal level of arousal (Hebb, 1955). The self-focus theory argues that automated skillful performance will be disturbed if persons explicitly monitor their task execution under pressure (Masters, 1992; Beilock et al., 2002). The distraction theory explains underperformance with worries about not meeting expectations (Wine, 1971; Beilock, 2008).

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This may distract individuals while performing under pressure. Finally, the relationship between performance and pressure could follow an inverse U-shape (Yerkes & Dodson, 1908), and individuals may be over-aroused in high-stake situations when they are in an advantageous position and expectations are high. 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 distraction and over-arousal models (DeCaro et al., 2011).[1]

In this paper, we investigate the performance of racers in alpine skiing who need to complete a race by applying physical effort and precision skills. Applied to these competitions, the self-focus theory argues that racers who fail to complete a race think too much about the process of passing the posts, which disturbs their trained automatisms. In contrast, the distraction theory would argue that those racers who do not complete a course are distracted by thoughts about succeeding or failing in the competition. Finally, according to the Yerkes-Dodson law, the performance of racers should be best when they perceive a moderate level of stress but not too low or too high pressure.

In addition, choking under pressure in an advantageous position may differ between genders. Previous literature has shown that men typically have higher performance expectations than women (Corbin et al., 1983; Lirgg, 1991). This may be the result of evolution (Vugt et al., 2007) and/or socialization (Gneezy et al., 2009). According to Bandura's (1977) self-efficacy theory, positive expectations about one's performance should be associated with positive competitive outcomes. However, biased expectations yield inefficient outcomes – either because of overconfidence (Moore & Healy, 2008) or because too high expectations create psychological pressure (Dai et al., 2018; Nurmohamed, 2020). Combining the theories on choking under pressure and gender differences in competitive behavior, men racers may be more prone to choking under pressure because they want to win too much (Niederle & Vesterlund, 2007; Niederle and Vesterlund, 2007; Corbin et al., 1983).

For instance, Cohen-Zada et al. (2017) utilized data from professional tennis, where servers are in an advantageous position over receivers. The authors found that men were less likely to win their service games at the end of a set, where the stakes are high, compared to the beginning of a set, where the stakes are lower. For women, however, the effect of high stakes was mixed, and in any case significantly lower than for men. The authors concluded that men choked under pressure more than women. Yet the direction of the gender effect on performance under pressure is under debate. For example, Shurchkov (2012) observed that while women performed better in a low-pressure verbal exam, they underperformed men in a high-pressure math-based exam. Cai et al. (2019) found that women but not men students underperformed in high-stake college entrance exams compared to exams with lower stakes. Likewise, Dilmaghani (2020) observed that – especially for elite women players – time pressure in chess led to underperformance. Furthermore, the analysis of quiz show data by Booth and Lee (2021) suggested that women are more hindered by stress than men. 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. However, Jetter and Walker (2015) found that men and women tennis players perform similarly in high-stake situations. In the same spirit, Ariely et al. (2009) showed that high monetary rewards can lower performance in general, but no gender differences were observed in responding to such rewards. Other than indicating that the results on gender differences under pressure are mixed, the results of Cohen-Zada et al. (2017) could also have an opposite interpretation. It is theoretically possible that it was the receivers who enhanced their performance in the decisive moments rather than the servers choking. Additional evidence in non-interactive settings would therefore be needed to address this issue.

Unfortunately, nature rarely creates real-life settings that allow a clear view of the relationship between being in an advantageous high-stake situation and performance. 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 in an advantageous position, 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 (1) the course setters may set a course that best fits their compatriots' preferences and abilities and (2) course setters are most likely to provide detailed instructions on the possible pitfalls of the course.[2] However, being on a course that best fits one's abilities may set overly high expectations to succeed, which may distract racers during their performance (Beilock, 2008) and yield performance decrements when the stakes are already high (Yerkes & Dodson, 1908). Moreover, too detailed instructions on the course in high-pressure situations may impede automatic processes of skill-based tasks according to the self-focus theory (Baumeister et al., 1985).[3] Thus, the aim of this study is two-fold. First, we wish to investigate whether, and in which competitions, having a compatriot course setter affects performance. And second, whether there are gender differences in that regard.

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

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

[2] For example, the Austrian coach Juergen Kriechbaum admitted that he tried to favor his compatriots when setting the course in the 2010 Vancouver Olympic Games. Similarly, the Croation racer Ivica Kostelic admitted that he trained some of the combinations that his coach had set on the course (Reuters, 2010).

[3] For example, in the 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.

published in top economic journals, including all traditional top-five journals (Bar-Eli et al., 2020).

We used data on 45,467 performances of men and 41,221 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 2001–2002 and 2019–2020 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 posts are closer to each other and the turns are more frequent (Supej & Holmberg, 2019). Thus, our results support the previous finding of Cohen-Zada et al. (2017) that men are more likely than women to underperform in a seemingly advantageous situation.

The remainder of the paper is organized as follows: Section 2 describes the institutional settings of alpine skiing 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.

2. Description of alpine skiing settings

The goal of professional alpine skiing is to complete a given course as fast as possible. The Féderation Internationale de Ski (FIS) organizes races 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 the speed is 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 the World Championships and Winter Olympic Games, all athletes who completed their first run are allowed to participate in the

Table 1
Course setters per country.

Country	First run				Second run		
	Super Giant	Giant Slalom	Slalom	Total	Giant Slalom	Slalom	Total
Men							
Austria	22	38	36	96	25	34	59
Canada	10	3	10	23	5	8	13
Croatia	1	3	9	13	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	12	26	24	62	22	21	43
Great Britain	0	0	4	4	0	0	0
Germany	3	8	17	28	9	12	21
Italy	20	17	19	56	27	32	59
Japan	0	0	4	4	0	6	6
Liechtenstein	0	1	0	1	0	0	0
Norway	23	16	16	55	18	18	36
Russia	0	0	3	3	0	3	3
Slovenia	2	4	8	14	2	9	11
Switzerland	21	13	14	48	21	14	35
Sweden	2	6	18	26	8	23	31
USA	17	17	13	47	17	9	26
Total	**134**	**160**	**198**	**492**	**160**	**198**	**358**
Women							
Austria	26	28	33	87	33	28	61
Canada	6	5	8	19	10	4	14
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	13	9	33	12	18	30
Germany	19	17	19	55	14	20	34
Italy	13	24	7	44	26	9	35
Liechtenstein	4	2	0	6	2	0	2
Norway	3	5	8	16	3	7	10
Slovenia	7	10	6	23	13	7	20
Spain	1	3	0	4	5	0	5
Switzerland	20	11	13	44	7	11	18
Slovakia	0	2	7	9	2	8	10
Sweden	10	22	23	55	19	28	47
USA	18	10	21	49	12	17	29
Total	**146**	**165**	**178**	**489**	**164**	**176**	**340**

second run (Nielsen Sports, 2022).

In Downhill races, the course setter is a neutral official from the 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 appointment procedure for course setters. However, according to Michael Bont, an SRF (Swiss Broadcasting Company) expert on alpine skiing, the course setters are assigned before the beginning of the season in a lottery, and there is a higher probability that a course setter will be picked from a country that has more racers ranked in the top 30 (Bont, personal communication, October 26, 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).

3. Data and variables

3.1. 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 2001/2002 to 2019/2020. These are the most prestigious tournaments in professional alpine skiing. The starting season was chosen because the FIS has published detailed results for every race in alpine skiing since 2001. The last season is the one before the outbreak of the COVID-19 pandemic.

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.

The final dataset consists of 492 men's and 489 women's competitions. The data include performances of 1,274 men and 1,039 women racers from both runs. In men's competitions, there were course setters from 17 countries; in women's competitions from 16 countries. Austrian representatives set the course in 18.2 % of men's and 17.8 % of women's competitions, followed by Italian (14 %) and German (11 %) course setters (see Table 1 for the full list). Overall, our data consist of 45,467 individual performances among men and 41,221 individual performances among women.

3.2. Variables and descriptive statistics

Our main variable of interest is *Compatriot Setter*, which is a dummy variable that receives the value of one if the course setter is a coach of the national team of the respective 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 2, we see that among men, in 18.3 % of the cases, a racer fails to complete the first run when his compatriot sets the course compared to 24.3 % in the case of a non-compatriot course setter. The reason for this could be that racers whose compatriots set the course are from stronger alpine skiing countries than racers whose compatriot does not set the course. Among women, in 15.5 % of the cases, a racer fails to complete the first run when her compatriot sets the course compared to 18.4 % 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 women, in 8.2 % of the cases, a racer fails to complete the run when her compatriot sets the course compared to 9.4 % in the case of a non-compatriot course setter. Among men, we even see that in 12.6 % of cases, a racer fails to complete the run when his compatriot sets the course compared to only 10.9 % in the case of a non-compatriot course setter.

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, and bronze medal for the first, second, and 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 89 % of our dataset (the other competitions are the Olympic Games and World Championships).[4] 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 also see that most observations for both genders are from SL competitions, followed by GS. The least frequent discipline and the

[4] Note that it is not possible to include the final rankings as an outcome variable since those who failed to complete the race have no ranking (but they do have zero WC points).

Table 2
Descriptive statistics.

	Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max
	Compatriot course setter				**Non-compatriot course setter**			
Variables	*Men (1,274 racers)*							
DNF1 (Did not finish run 1)	0.183	0.387	0	1	0.243	0.429	0	1
DNF2 (Did not finish run 2)	0.126	0.332	0	1	0.109	0.311	0	1
Top 3	0.067	0.250	0	1	0.041	0.198	0	1
World Cup points	14.12	22.62	0	100	10.076	19.194	0	100
Home event	0.024	0.152	0	1	0.104	0.305	0	1
Lagging time after run 1 (sec)	1.614	1.09	0	18.6	2.426	3.242	0	62.8
Slalom	0.387	0.487	0	1	0.443	0.497	0	1
Giant Slalom	0.336	0.472	0	1	0.323	0.468	0	1
Super Giant	0.277	0.448	0	1	0.234	0.424	0	1
Number of observations in run 1	2960				30,190			
Number of observations in run 2	1185				11,132			
	Mean	**St. Dev.**	**Min**	**Max**	**Mean**	**St. Dev.**	**Min**	**Max**
	Compatriot course setter				**Non-compatriot course setter**			
Variables	*Women (1,039 racers)*							
DNF1 (Did not finish run 1)	0.155	0.362	0	1	0.184	0.387	0	1
DNF2 (Did not finish run 2)	0.082	0.274	0	1	0.094	0.292	0	1
Top 3	0.071	0.256	0	1	0.046	0.210	0	1
World Cup points	15.04	22.65	0	100	11.33	20.13	0	100
Home event	0.028	0.164	0	1	0.107	0.308	0	1
Lagging time after run 1 (sec)	1.879	1.092	0	8.11	2.481	2.263	0	49.2
Slalom	0.349	0.477	0	1	0.389	0.487	0	1
Giant Slalom	0.350	0.477	0	1	0.357	0.479	0	1
Super Giant	0.301	0.459	0	1	0.255	0.436	0	1
Number of observations in run 1	2530				27,163			
Number of observations in run 2	1077				10,451			

Notes: *Lagging time after run 1* refers to the second run only. All the other variables are split according to having a compatriot course setter or not in at least one of the runs. For men, the number of observations for the World Cup points with and without compatriot course setter is 4831 and 24,596, respectively. The respective numbers for women are 4039 and 22,447.

only one that uses one run is SG. In addition, we 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 smaller gap behind the leader, suggesting that these racers are of a higher ability. The 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, 2023).

4. 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, as presented in Tables 1 and 2, 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 (2023), this individual ability may 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-per-season fixed effects. We follow Gschwend and Krumer (2023), who used a large part of this dataset (up to 2017/18 season) 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 course setter by exploiting the variability of the nationality of the course setters across different races for a given racer. Using a fixed-effects model, the most basic specification takes the following form:

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

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, and 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 or SG, beyond the effect in 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).[5]

5. Results

5.1. Main results

In Panel A of Table 3, we present the results for men's competitions. Standard errors clustered at the 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 3.9 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.

In Panel B of Table 3, we present the results of the 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. In contrast, 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 3.5 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 women. We find no effect on the probability of being on the podium (Column 3), but women whose compatriot sets the course in the second run of SL competitions are expected to gain 1.61 World Cup points more (however, $p = 0.055$).

5.2. 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 4, 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).

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 the 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, women enhance their performance by reducing their probability of failing to complete the race by 3.7 percentage points. To put these results into perspective, the mean share of DNF2 in World Cup SL competitions among women is 0.108. The respective mean share among men is 0.127. Thus, we find non-negligible effects of the compatriot course setter, whose sizes are 34 % 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 2. Thus, in Column (3), we restricted the data to the maximum lagging time after the first run of 4.77 s among men, and 4.96 s among women. These thresholds were chosen because these are the maximum 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. Specifically, we excluded all the racers who were lagging behind the leader by more than 1 standard deviation (0.92 s among men, and 1.09 s among women) above the mean (1.46 s among men, and 1.91 s among women). Thus, the lagging time threshold was set at 2.38 s among men, and 3 s among women. Even though the coefficient in the men's case is not significant at a conventional level ($p = 0.066$), the magnitude of the effect is similar to the results presented in previous columns. The results for women are again in the opposite direction. Women who compete on the course that was set by their compatriots have a 4.5 percentage points lower probability of failing to complete the race compared to cases in which they were

[5] It is worth noting that Foellmi et al. (2016) found an 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 disciplines.

Table 3
FE estimates of the compatriot course setter.

	(1)	(2)	(3)	(4)
Panel A: Men	DNF1	DNF2	Top 3	World Cup points
Compatriot setter run 1	−0.011		0.001	−0.174
	(0.012)		(0.006)	(0.546)
Compatriot setter run 1*GS	0.011		−0.004	0.695
	(0.012)		(0.012)	(1.049)
Compatriot setter run 1*SG	−0.008		−0.004	1.319
	(0.018)		(0.011)	(0.938)
Compatriot setter run 2		0.039*	0.009	0.668
		(0.019)	(0.008)	(0.631)
Compatriot setter run 2*GS		−0.029	−0.013	−0.756
		(0.023)	(0.011)	(0.99)
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		−0.003	0.521
[p-val]	[0.99]		[0.75]	[0.525]
H_0: Compatriot setter1 + Compatriot setter1*SG = 0	−0.019		−0.003	1.145
[p-val]	[0.177]		[0.781]	[0.157]
H_0: Compatriot setter2 + Compatriot setter2*GS = 0		0.01	−0.004	−0.088
[p-val]		[0.451]	[0.569]	[0.884]
Observations	33,150	11,482	33,150	29,427
	(1)	(2)	(3)	(4)
Panel B: Women	DNF1	DNF2	Top 3	World Cup points
Compatriot setter run 1	0.007		0.006	0.26
	(0.013)		(0.007)	(0.56)
Compatriot setter run 1*GS	−0.014		−0.009	−0.642
	(0.018)		(0.012)	(1.117)
Compatriot setter run 1*SG	0.005		−0.008	0.616
	(0.018)		(0.012)	(0.88)
Compatriot setter run 2		−0.035*	0.008	1.61
		(0.015)	(0.008)	(0.839)
Compatriot setter run 2*GS		0.035	−0.016	−1.219
		(0.021)	(0.016)	(1.23)
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	−0.007		−0.003	−0.382
[p-val]	[0.573]		[0.75]	[0.658]
H_0: Compatriot setter1 + Compatriot setter1*SG = 0	0.012		−0.002	0.876
[p-val]	[0.412]		[0.859]	[0.202]
H_0: Compatriot setter2 + Compatriot setter2*GS = 0		0	−0.008	0.391
[p-val]		[0.96]	[0.538]	[0.641]
Observations	29,693	10,895	29,693	26,486

Notes: Dependent variables appear below the column numbers. The H_0 includes a *Compatriot Setter* related variable in the relevant specification, and the p-values of the relevant null hypotheses are presented in square parentheses. Standard errors clustered at the racer level are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

competing on a course that was not set by their compatriot.

Finally, we conducted a falsification test with similar analyses to those presented in Table 4. However, instead of using a variable that represents a compatriot course setter in run 2, we use a compatriot course setter in run 1. In other words, we test whether having a compatriot course setter in run 1 affects 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 5, where we indeed find no such relationship in any of the sub-samples for both genders.

6. 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 1,274 men and 1,039 women racers over a period of 19 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. Men, on the other hand, completed the decisive run in SL significantly less often when their compatriots set the course, which suggests that women and men reacted differently to a seemingly advantageous situation. In other words, it is only in the women's decisive SL run that the positive effect of the compatriot course setter – who may try to set the course according to the compatriots' skills – outweighs the negative effect of the additional burden of expectations. However, among men, it is the other way around. In the first run, in which the

Table 4
FE estimates of having a compatriot course setter in the second run of SL competitions.

Panel A: Men	(1) DNF2 All SL	(2) DNF2 All WC	(3) DNF2 Restricted WC	(4) DNF2 Restricted WC
Compatriot setter run 2	0.043*	0.050*	0.048*	0.040
	(0.019)	(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	6,239	5,400	5,379	4,445
Panel B: Women	(1)	(2)	(3)	(4)
Compatriot setter run 2	−0.041**	−0.037*	−0.036*	−0.045**
	(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	5,595	4,798	4,759	3,898

Notes: Column 1 represents the results for all SL competitions in the data. In Column 2, we use data on all the World Cups. In Column 3, we restrict the World Cup data to racers whose lagging time is below the maximum lagging time of a racer whose compatriot sets the course in the second run (4.77 s and 4.96 s among men and women, respectively). In Column 4, we restrict the World Cup 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 (2.38 s and 3 s among men and women, respectively). Standard errors clustered at racer level are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 5
Falsification test of having a compatriot course setter in the first run on DNF2 in SL competitions.

Panel A: Men	(1) DNF2 All SL	(2) DNF2 ALL WC	(3) DNF2 Restricted WC	(4) DNF2 Restricted WC
Compatriot setter run 1	−0.019	−0.004	−0.003	−0.017
	(0.015)	(0.015)	(0.015)	(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	6,239	5,400	5,379	4,445
Panel B: Women	(1)	(2)	(3)	(4)
Compatriot setter run 1	0.010	0.005	−0.001	−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	5,595	4,798	4,759	3,898

Notes: Column 1 represents the results for all SL competitions in the data. In Column 2, we use data on all the World Cups. In Column 3, we restrict the World Cup data to racers whose lagging time is below the maximum lagging time of a racer whose compatriot sets the course in the second run (4.77 s and 4.96 s among men and women, respectively). In Column 4, we restrict the World Cup 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 (2.38 s and 3 s among men and women, respectively). Standard errors clustered at racer level are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

psychological pressure is arguably lower, we found insignificant results for both genders, suggesting that the potential advantages and disadvantages of having a compatriot course setter may cancel each other out.

Our findings on the existence of gender differences in choking under pressure, only in the second and decisive run of the most complex discipline, are in line with the interaction of several strands in the literature on choking under pressure, such as high stakes, expectations, the complexity of the task, and gender.

First, the existence of the negative effect among men in the second and decisive run is in line with the literature on suboptimal levels of arousal on performance (Yerkes & Dodson, 1908; Hebb, 1955) and the phenomenon of choking under pressure that describes a negative relationship between performance and overly high incentives (Baumeister, 1984; Ariely et al., 2009). 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 percentages dropped in the last 30 s 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 of missing 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.

Second, having a compatriot course setter who sets the course according to the racer's abilities may yield high expectations to succeed, which further increases the psychological pressure of the competition (Dai et al., 2018; Nurmohamed, 2020). The distraction theory argues that thoughts about the consequences of the competition, such as success or failure, distract the racers from performing well (Beilock, 2008). The compatriot racer's performance expectation might stimulate these thoughts.

Third, and in line with the self-focus theory, detailed instructions of the course setter combined with expectations to perform well could make the racers think too much about the task execution. This may disturb automatic processes leading to choking in skilled-based tasks such as Sl. 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 exert 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 of skiing and the precision-based task of shooting. The authors found that professional biathletes from the highest ability distribution performed significantly worse in 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. For example, Beilock and Carr (2001) discovered 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 instructions from the course setter creates greater expectations, which make the athletes monitor each of their moves. The mixture of expectations that leads to over-thinking coupled with the fact that SL is the most technical discipline might induce choking (among men) more in SL than in other, less technical disciplines.[6] However, the effect of expectations may differ between men and women.[7]

The observed gender differences in choking under pressure are in line with Niederle and Vesterlundt (2007), who argue that men want to win too much. Detailed instructions before the decisive SL run on a course that was set according to the racer's abilities seem to help women but paradoxically impede men racers' skillful performance under (overly high) pressure. Our results confirm the findings of Cohen-Zada et al. (2017), who observed choking under pressure among men tennis players that 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. It is also worth mentioning Lovász et al. (2022), who 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, women's performance slightly increased in this treatment compared to a baseline, in which participants only saw the score without encouragement. In contrast, men's high scores, average scores, and accuracy dropped significantly in the encouragement treatment.

One of the possible explanations for such gender differences can be found in 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), is negatively associated with the performance of men in the Iowa Gambling Task. However, women's performance and their level of cortisol follow 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. Therefore, we can speculate that women may benefit from the help of their coach without being exposed to the negative side of expectations. However, for men, the negative side of pressure driven by the increase in cortisol outweighs the positive side.

Taken together, our findings on choking under pressure among men racers in the decisive SL run can be explained by a combination of the three behavioral theories presented in the introduction. Overly high performance expectations among men may lead to distraction and performance decrements, and too detailed instructions may induce a self-focus on the task execution that impedes automatic processes in skill-based competitions. The gender differences observed in the second run of the most skill-based task SL are best explained with the self-focus theory and inverted U-shape hypothesis of the Yerkes-Dodson law: Women racers' perceived pressure seems to be close to the optimal level in the decisive run, but men racers' perceived pressure seems to be higher than optimal. Moreover, we cannot rule out the distraction theory, according to which overly high expectations yield distracting thoughts about succeeding in the competition. Our results confirm the notion of DeCaro et al. (2011) that the three theories depend on each other.

One implication of our results is that coaches do not need to further motivate athletes before decisive runs, half times, quarters, or important games. For men, 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, the size of the pool of contestants, treatment and customer discrimination, and performance under pressure (Frick et al., 2022). 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. 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 asymmetric information and make the competition fairer.

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, the results may differ in other environments. For example, in the labor market, individuals do not need to take such serious risks where a

[6] 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.

[7] One alternative explanation is that gender differences are driven by differences in viewership numbers, which affect the pressure competitors feel. However, viewership for men's and women's alpine skiing competitions is quite balanced (Nielsen Sports, 2022).

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 a financial but also from a 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 in a seemingly advantageous situation that involves high pressure. Such an interaction may yield large economic losses, which is especially true in men-dominant occupations, e.g., in the military and financial markets.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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