People's productivity is influenced by the environment in which they find themselves. In this case, one of the important points is other people (peers) with whom a person interacts, and the effect they have is called the peer effect. The manifestation of this effect depends on the situation under consideration and can be either positive (for example ...) or negative (for example Battiston et al. (2021)). Moreover, even within the same environment, women and men respond differently to peers. For example, Jørgensen et al. (2022) showed that girls choose to compete more often with the increase in the number of friends entered a competition, but the same is not true for boys.

The impact of competitors in sports has been extensively studied and analyzed. However, the influence of peer effects in running events remains a subject of contradiction. For example, the presence of pacemakers can positively influence participants by setting the pace and pushing them to achieve better results. Meanwhile, competitors may also introduce social pressure that can impact the performance of runners. The extent of this peer effect tends to be more noticeable in longer-distance running events, while the short-term distances may not exhibit significant peer effects due to the predominance of individual biological capabilities. Thereas, among research devoted to differences in speed across different kilometer percentiles, and breaking the 2-hour barrier, marathons have the potential to explore implications of peer effects in running.

There have been found positive peer effects in swimming and running sports (Yamane & Hayashi (2015), Hill (2014b)). At the same time, negative peer effects have also been discovered (Emerson & Hill (2018). The difference partly comes from the various ways to detect a peer. The previous research mainly focused on the superstar effect (Brown (2011), Hill (2014b), Cohen-Zada et al. (2017), Nishihata (2022)) or the average level of opponents (Guryan et al. (2009), Hill (2014a), Emerson & Hill (2014), Emerson & Hill (2018)). Apart from the peer effects, the runner's result in a marathon race can be influenced by weight, height and age (Dotan et al., 1983), weather (Ely et al. (2007)), air pollution level (Marr & Ely (2010)), training volume (Fokkema et al. (2020)) and incentive effects (Frick & Prinz (2007)).

We are introducing a new approach to assessing the competitiveness of a race for a particular athlete — the number of marathon participants whose career-best time is close enough to that athlete's best time. In contrast to previous literature, which uses the presence of a superstar in the race or the average level of opponents in the competition as a proxy for competitiveness, our approach simultaneously allows us to take into account the heterogeneity of players, and the resulting different levels of competition for them and also does not consider the influence of opponents, who do not actually show the impact on the athlete's performance because the time is too high or too low.

Our main goal is to show how the competitiveness of the race for each athlete can affect his result (time in the race). Using a regression model that, in addition to competitiveness, includes personal characteristics of the athlete (age, gender, best time), characteristics of the environment (weather), and tournament (type of tournament, city, and year), we show that competitiveness increases the result in the race for women. The relationship between competitiveness and results for women is inverse U-shaped, from which we can conclude that starting from a certain point, the number of competitors begins to reduce the result, but in practice, the number of competitors in Russian races is not so high. For the man, the result was not significant.

We associate this difference in the behavior of women and men with different levels of attitude towards risk. It is known that men are generally less risk-averse than women, but a competitive environment can increase risk-taking among women (Harris & Jenkins (2006), Jetter & Walker (2017)). In marathon races, athletes should balance their efforts to avoid injury or exhaustion. Riskier strategies can improve performance, but also carry the risk of misalignment of efforts and potential withdrawal. We used a logit model to analyze the relationship between the number of participants and the likelihood of not finishing the race. The results showed that professional female runners were more likely to complete marathons compared to males, indicating a higher propensity for risk taking among men. In addition, the number of participants had an inverse U-shaped relationship with the likelihood of not finishing, but this effect was observed only in women.

## References


Battiston, P., Gamba, S., Rizzolli, M., & Rotondi, V. (2021). Lies have long legs cheating, peer scrutiny and loyalty in teams. *Journal of Behavioral and Experimental Economics*, *94*, 101732. URL: https://www.sciencedirect.com/science/article/pii/S2214804321000720. doi:https://doi.org/10.1016/j.socec.2021.101732.

Brown, J. (2011). Quitters never win: The (adverse) incentive effects of competing with superstars. *Journal of Political Economy*, *119*, 982–1013. doi:10.1086/663306.

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. doi:10.1016/j.joep.2017.04.005.

Dotan, R., Rotstein, A., Dlin, R., Inbar, O., Kofman, H., & Kaplansky, Y. (1983). Relationships of marathon running to physiological, anthropometric and training indices. *European Journal of Applied Physiology and Occupational Physiology*, *51*, 281–293. doi:10.1007/BF00455191.

Ely, M. R., Cheuvront, S. N., Roberts, W. O., & Montain, S. J. (2007). Impact of weather on marathon-running performance. *Medicine and science in sports and exercise*, *39*, 487–493. doi:10.1249/mss.0b013e31802d3aba.

Emerson, J., & Hill, B. (2014). Gender differences in competition: running performance in 1,500 meter tournaments. *Eastern Economic Journal*, *40*, 499–517. doi:https://doi.org/10.1057/eej.2014.28.

Emerson, J., & Hill, B. (2018). Peer effects in marathon racing: The role of pace setters. *Labour Economics*, *52*, 74–82. doi:https://doi.org/10.1016/j.labeco.2018.03.008.

Fokkema, T., van Damme, A. A., Fornerod, M. W., de Vos, R.-J., Bierma-Zeinstra, S. M., & van Middelkoop, M. (2020). Training for a (half-) marathon: Training volume and longest endurance run related to performance and running injuries. *Scandinavian journal of medicine & science in sports*, *30*, 1692–1704. doi:10.1111/sms.13725.

Frick, B., & Prinz, J. (2007). Pay and performance in professional road racing: the case of city marathons. *International Journal of Sport Finance*, *2*, 25–35.

Guryan, J., Kroft, K., & Notowidigdo, M. J. (2009). Peer effects in the workplace: Evidence from random groupings in professional golf tournaments. *American Economic Journal: Applied Economics*, *1*, 34–68. doi:10.1257/app.1.4.34.

Harris, C. R., & Jenkins, M. (2006). Gender differences in risk assessment: why do women take fewer risks than men? *Judgment and Decision making*, *1*, 48–63. doi:10.1017/S1930297500000346.

Hill, B. (2014a). The heat is on: Tournament structure, peer effects, and performance. *Journal of Sports Economics*, *15*, 315–337. doi:doi.org/10.1177/1527002512461156.

Hill, B. (2014b). The superstar effect in 100-meter tournaments. *International Journal of Sport Finance*, *9*, 111.

Jetter, M., & Walker, J. K. (2017). Anchoring in financial decision-making: Evidence from jeopardy! *Journal of Economic Behavior & Organization*, *141*, 164–176. doi:10.1016/j.jebo.2017.07.006.

Jørgensen, L. K., Piovesan, M., & Willadsen, H. (2022). Gender differences in competitiveness: Friends matter. *Journal of Behavioral and Experimental Economics*, *101*, 101955. URL: https://www.sciencedirect.com/science/article/pii/S2214804322001264. doi:https://doi.org/10.1016/j.socec.2022.101955.

Marr, L. C., & Ely, M. R. (2010). Effect of air pollution on marathon running performance. *Medicine and science in sports and exercise*, *42*, 585–591. doi:10.1249/MSS.0b013e3181b84a85.

Nishihata, M. (2022). Heterogeneous peer effects by gender, task, and monetary incentive: Evidence from speed skating. *Southern Economic Journal*, *89*, 62–89. doi:https://doi.org/10.1002/soej.12585.

Yamane, S., & Hayashi, R. (2015). Peer effects among swimmers. *The Scandinavian Journal of Economics*, *117*, 1230–1255. doi:https://doi.org/10.1111/sjoe.12124.