Hint of a Universal Law for the Financial Gains of Competitive Sport Teams. The case of Tour de France cycle race.

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Abstract

This short note is intended as a "Letter to the Editor" Perspective in order that it serves as a contribution, in view of reaching the physics community caring about rare events and scaling laws and unexpected findings, on a domain of wide interest: sport and money. It is apparent from the data reported and discussed below that the scarcity of such data does not allow to recommend a complex elaboration of an agent based model, - at this time. In some sense, this also means that much data on sport activities is not necessarily given in terms of physics prone materials, but it could be, and would then attract much attention. Nevertheless the findings tie the data to well known scaling laws and physics processes. It is found that a simple scaling law describes the gains of teams in recent bicycle races, like the Tour de France. An analogous case, ranking teams in Formula 1 races, is shown in an Appendix.
This short note stems from a recent set of aggregated data\[1\] about the financial gains of the teams in the recent Tour de France. The gains of the 22 teams comprised of originally 9 riders, for a 23 day race with 21 stages are accumulated every day according to some pre-established rules\[2\]. Usually teams and riders aim at specific ”jerseys” (going with money rewards) beside winning a stage.

It is of course trivial to rank the 22 teams according to their final gains at the end of the competition. It is on the other hand unexpected to find that such a size-ranking is best fitted by nothing else that a fine hyperbola with exponent $\simeq -1$, obtained through a Levenberg-Marquardt algorithm; see Fig.1. Motivated by such an unexpected finding I looked at whether similar data could be obtained for previous Tour de France races. From two different sources\[3,4\] I obtained the equivalent data for 2016 and 2015. Quite unexpectedly, the same hyperbolic law occurs again with a decay exponent $\sim -1 \pm 0.05$; see Fig. 1.

Unfortunately, in view of ”proving a universal behavior”, one cannot find such data for the other similar top long\[5\] races, like Giro and Vuelta. It is known that these races have not so much money to distribute, - whence there is less ”advertisement” of the matter. This likely means that such a kind of (financial) data is not easily available.

From a physics point of view, a few comments are in order. First, the exponent (-1) is reminiscent of Zipf’s finding about the ”least effort law” \[2\], when understood as an equilibrium steady state process. However, it can also be understood, as in a recent set of papers on UEFA and FIFA soccer team or country ranking, respectively, in terms of a dissipative structure process, arising

\[1\] from [http://www.sports.fr/cyclisme/tour–de–france/articles/tour–de–france–le–classement–des–gains–1899047/]
\[2\] [http://www.portailduvelo.fr/tour–de–france–2012–primes–et–gains–de–epreuve–maillot–jaune–vert–a–pois/]
\[3\] [http://videosdecyclisme.fr/tour–de–france–2016–gains–empoches–par–toutes–les–equipes/]
\[4\] [http://www.eurosport.fr/economie/gains–tour–de–france–2015–sky–et–chris–froome–terminent–en–tete–avec–556–630–euros_504887058/story.html]
\[5\] the case of one day or a few days races is technically and financially different
from the number of points ("input energy flow") given each year according
to scores in different competitions, thereby leading to a self-organizing system
\[3, 4, 5\]. *Mutatis mutandis*, several riders contribute to the team gains along the
race. This is different from a Matthew like effect, in which the winner takes all.
A very parsimonious toy model containing ingredients leading to team ranking,
under such complex rules, was proposed in [1]. The model suggests that peer
classes are an extrinsic property of the ranking, as obtained in many nonlinear
(nonequilibrium) systems under boundary condition constraints.

This is different from individual gains (and ranking) due to individual com-
petitions. For such a case, a model was proposed by Deng et al. [1] in which
players ranks and/or prize money are accrued based on their own competition
wins/scores. The model is mimicking a tournament, like an inverse tree; as in
tennis tournaments with direct elimination; notice that team tournaments can
be often also based on direct elimination. However, sometimes, before the di-
rect elimination stage, teams played against each other (home-and-away) in a
"round robin" format \[3, 4, 5\].

Let it be observed that cycling competition is a different matter: even though
(it seems that) a cyclist race is won by only one individual, it is well known
that this is a team activity \[6, 7, 8\] as usually recognized by the winner in
interviews. The to-be-agent-based-model should use ideas based on cooperation
beside competition \[9, 10, 11, 12, 13\], - a quite open and intense field of research
in "new statistical physics".

In so doing, it seems that from a rare type of data, one can tie some "pre-
universality feature" to a complex world. Beside the aim of this report and
findings, one may suggest to look at such similar data in other sports (see
Appendix) in view of some accumulation toward more scientific impetus and
subsequent work.
Appendix. F1 team ranking

Another case in which team ranking depends on individual member performance occurs in Formula 1 races. According to their place at the end of a race, the pilot gets a certain number of points. There are usually 2 drivers for a team. In fact, such pilots are often competing against each other even though being in a team. There are about 20 races per year. At the end of the year, the teams are compared and ranked according to the number of cumulated points ($P$) of their drivers. The best team is known as the "best constructor for the year".

The 2014, 2015 and 2016 cases are shown in Fig. 2. The rank-size law is also characterized by a decay exponent $\sim -1$. The analogy is obvious, even though the number of teams is smaller and the matter is not directly the amount of financial gains.

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Figure 1: Display of team financial gains in Tour de France 2017, 2016, and 2015
Figure 2: Display of team ranking in F1 races at the end of 2016, 2015, and 2014

\[ P = B r^k \]

- 2016: \( R^2 = 0.958 \quad k = 1.07 \pm 0.13 \)
- 2015: \( R^2 = 0.983 \quad k = 1.04 \pm 0.09 \)
- 2014: \( R^2 = 0.967 \quad k = 0.99 \pm 0.11 \)