The Role of Rankings, Big Shots, and Random Successes

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Introduction (I/III)

- In many professions one great success helps a lot to spur a career.
 - First-job experience important for research productivity, career mobility, or salary increases.
- Relative positions affect behavior & performance in education or firms.
 - Relative positions matter: Marsh & Parker (JPerSocPsy 1984)
 - Rankings used to increase effort in firms and universities: Lazear & Rosen (JPE 1981), Marino & Zabochnik (RAND 2004), Coffey & Maloney (JLabE 2010).
 - Positive effects of rankings: Azmat & Iriberry (JPub 2010), Tran & Zeckhauser (JPub 2012), Kuhnen & Tymula (MS 2012)
 - Negative effects of information provision: Card, Mas, Moretti, Saez (AER 2012), Mas (QJE 2006)

Introduction (II/III)

- Identification problem: success and ranking are non-random.
 - How to disentangle the effect of treatment (one-time success or higher ranking position) on future performance from the effect of unobserved higher skills and effort?
- Our approach to the problem:
 - We examine performance in World Cup alpine skiing which attracts an audience of about 28m per race.
 - We focus on close races in the period 1995–2013 as external manipulation of relative positions and success.
 - Assuming small time differences to be random, we test whether relative positions and one-time successes have effects on racers' subsequent behavior and performance.
 - We identify the treatment effect by applying a sharp Regression Discontinuity (RD) design.

Introduction (III/III)

Preview of Results:

- We document a setting in which success and ranking positions are randomized.
- There is no evidence that great achievements (victories, podium finishes) improve performance or affect risk behavior.
- Instead, missing the podium causes a decrease in performance.
- This effect is amplified among (younger) racers without prior victories.
- Main contributions:
 - We present novel evidence that even small and *random* variations in relative positions affect performance.
 - Benefit from great successes and the introduction of rankings may be more limited than suggested by previous studies.

Agenda

- 1 Treatment
- 2 Outcomes
- 3 Econometric Framework
- 4 Data & Descriptive Statistics
- 5 Results
- 6 Conclusion

Treatment (I/III): Random Successes

- Assume in a given ski race j , three variables determine an individual's race time:

$$T_{i,j} = f(\theta_i, \lambda_{i,j}, n_{ij}) \quad (1)$$

- θ_i for the time-invariant talent of racer i ,
 - $\lambda_{i,j}$ for the training or fitness level,
 - $n_{i,j}$ as a noise parameter (e.g. weather)
- The ranking position is then given by

$$P_{i,j} = g(T_{i,j}, T_{s,j}) = g(\theta_i, \lambda_{i,j}, n_{i,j}, \theta_s, \lambda_{s,j}, n_{s,j}) \quad \forall s \neq i. \quad (2)$$

- Skill differences usually explain most of the variation in positions.
- In close races, however, random noise becomes critical.
- Then 'random successes' are possible if variations in $n_{i,j}$ overcome skill and training deficits.

Treatment (II/III): Anecdotal Evidence

- The effect of random weather shocks can be amplified by errors which not only cause an immediate time loss but also affect speed in the following sections. (e.g. Vancouver 2010 Olympics downhill race)
- In close races is often a tiny margin that determines whether a racer finishes first or second, third or forth, or even sixth or tenth.

World Cup race in Adelboden (SUI) 2010/11 (men, giant slalom):

Rank	Name	Nationality	Time	Difference
1	Ted Ligety	USA	1:13.33	
2	Carlo Janka	SUI	1:13.69	0.36
3	Benjamin Raich	AUT	1:13.80	0.47
4	Thomas Fanara	FRA	1:13.82	0.49
5	Philipp Schoerghofer	AUT	1:13.95	0.62
6	Aksel Lund Svindal	NOR	1:13.99	0.66
7	Kjetil Jansrud	NOR	1:14.08	0.75

- In our data set, we have 96 (214) observations where the difference between winner and second (third and forth) is smaller than 0.05 seconds.

Treatment (III/III): Empirical Evidence

- Further support for our identifying assumption from a comparison with *individual* variation in race times.
- Ideally, the same racer would go down the same track several times so that we could measure individual variance.
- Since no such data exists (training times biased), we use proxies:
 - We restrict the sample to all racers with at least one second finish and at least four races at a given place.
 - Their average distance to the winner (at a given race track) is 1.42 seconds. This is much more than the average distance between winner and second which is 0.45 seconds.
 - For the distance to third rank, we find an individual variation of 0.86 seconds which is four times larger than the average time distance between third and forth (0.21 seconds).

Treatment (III/III): Empirical Evidence

Importance of Individual Variation in Race Times

Treatment (III/III): Empirical Evidence

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Treatment (III/III): Empirical Evidence

Importance of Individual Variation in Race Times

Thus assignment to treatment occurs according to time differences that are way smaller than individual time variation. [► Podium](#)

Outcomes (I/III): Performance

Why should racers change their performance level after one-time successes?

- Positive self-image:
Kahneman et al. (QJE 1997), Klaassen & Magnus (JASA 2001),
Santos-Pinto & Sobel (AER 2005), Santos-Pinto (EJ 2008, IER 2010)
- Motivation and more ambitious goal setting:
Camerer et al. (QJE 1997), Farber (JPE 2005),
Benabou & Tirole (QJE 2002, JPE 2004)
- Addiction to success:
Becker & Murphy (JPE 1988), Benabou & Tirole (QJE 2004)
- Individuals may be disappointed if they miss top ranks:
Card, Mas, Moretti, Saez (AER 2012), Mas (QJE 2006)

Outcomes (II/III): Absolute vs Relative Performance

- Using relative performance measures (position or distance to winner) is problematic with respect to the SUTVA: own outcome is affected by treatment status of others. [▶ Example of SUTVA violation](#)
- Absolute performance: change in race time

$$\Delta T_{i,j} = (T_{i,j-1} - T_{i,j+1}) / T_{i,j-1}. \quad (3)$$

- Balance tests show zero difference in $\Delta T_{\text{median},j}$ for treated and non-treated.
- Transformation from levels to changes removes a substantial amount of serial correlation in individual performance.

Outcomes (III/III): Risk Behavior

- We estimate the effect using

$$s_{i,j+1} = s_{i,j-1}\beta + D_{i,j}\tau + \mathbf{X}_{i,j}\gamma + \mathbf{Z}_{i,j}\delta + \varepsilon_{i,j} \quad (4)$$

- $s_{i,j}$ denotes the probability of survival
 - $D_{i,j}$ denotes the treatment (victory, podium, higher ranking)
 - $\mathbf{X}_{i,j}$ is a vector of racer i 's observed characteristics
 - $\mathbf{Z}_{i,j}$ is a vector of competitors' characteristics
- We find no effect of treatment $D_{i,j}$, neither positive nor negative.
 - ▶ RDD Plot
 - This allows for the estimation of the effect on performance without principal stratification on survival (Frangakis & Rubin, Biometrics 2002).
 - Brown & Li (2010) as well as Brown (JPE 2011) find no evidence of risky behavior among golfers in the presence of a superstar.

Econometric Framework (I/III)

- In any world cup ski race, racer i achieves a podium finish if her race time $T_{i,j}$ is superior to a cutoff time c_j which is determined by her competitors.
- This setting generates a *sharp* discontinuity in the treatment (e.g. achieving the podium) as a function of race times.

$$Y_{i,j} = D_{i,j}\tau + (T_{i,j} - c_j)\beta + D_{i,j}(T_{i,j} - c_j)\phi + \mathbf{X}_{i,j}\gamma + \mathbf{Z}_{i,j}\delta + \varepsilon_{i,j} \quad (5)$$

- $Y_{i,j}$ denotes the outcome variable
 - $D_{i,j}$ denotes the treatment (victory, podium, higher ranking)
 - ϕ allows for different slopes to the left & right of the cutoff
 - $\mathbf{X}_{i,j}$ is a vector of racer i 's observed characteristics
 - $\mathbf{Z}_{i,j}$ is a vector of competitors' characteristics
- Estimation of a *weighted* average treatment effect.

Econometric Framework (II/III)

- Treatment and control group:
 - treated: victory or podium finish within bandwidth
 - control: non-victory or non-podium within bandwidth

Rank	Name	Nationality	Time	Difference
1	Ted Ligety	USA	1:13.33	
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3	Benjamin Raich	AUT	1:13.80	0.47
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- no random victory
- random podium finish for #3 and #4 using 0.05 sec bandwidth

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Rank	Name	Nationality	Time	Difference
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- no random victory
- random podium finish for #2 and #3 and #4 and #5 using 0.15 sec BW

Econometric Framework (II/III)

- Treatment and control group:
 - treated: victory or podium finish within bandwidth
 - control: non-victory or non-podium within bandwidth

Rank	Name	Nationality	Time	Difference
1	Ted Ligety	USA	1:13.33	
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- no random victory
- random podium finish for #2 and #3 and #4 – #6 using 0.25 sec BW

Econometric Framework (II/III)

- Treatment and control group:
 - treated: victory or podium finish within bandwidth
 - control: non-victory or non-podium within bandwidth

Rank	Name	Nationality	Time	Difference
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- no random victory
- random podium finish for #2 and #3 and #4 – #6 using 0.25 sec BW
- Bandwidths: 5, 15, and 25 hundredths of a second
 - much smaller than what is suggested by data-driven optimal bandwidth methods, e.g. Imbens & Kalyanaraman (RES 2012)

Econometric Framework (III/III)

- Assumptions for RDD fulfilled:
 - Treatment obviously determined by the assignment variable, and discontinuity in the level of treatment at the cutoff.
 - No manipulation: marginal density continuous around the cutoff (McCrary, JE 2008) ▶ Plot
 - Conditional distributions of other variables smooth at the cutoff (Imbens & Lemieux, JE 2008) ▶ Balance Tests
- Due to randomization, covariates only used to improve efficiency.
 - Individual: # victories, podiums, top five classifications, races
 - Competitors: # victories and podiums of top 5 racers
- Estimation within season and discipline.

Dataset

- Data from the *Fédération Internationale de Ski* (FIS)
 - Panel dataset of 1,021 male and 832 female athletes in all World Cup ski races for the period 1995–2013
 - Total of 75,106 unit observations, including 1,269 victories and 3,782 podium finishes
 - Data include: each racer's exact result (in hundredths of a second), bib, status, gender, age, nationality, and race discipline
- Distribution of race times fairly stable over time.
- Long time horizon allows to follow entire career paths.
- Competition is fierce: only 13.2% ever won a race.
- No skill-determinism: variation in previous positions of winners

[► Evidence](#)

Empirical Results (I/IV)

OLS vs. RDD estimation: Effect on Performance

	Podium		Victory	
	OLS	RDD	OLS	RDD
Treatment	0.017** (0.007)	0.123*** (0.045)	0.004 (0.011)	0.059 (0.084)
Observations	7,106	214	7,106	96
R-squared	0.009	0.059	0.007	0.197

- OLS implies using all non-winners (non-podium finishers) as control.
- Victory as treatment measures the benefit additional to podium.

Empirical Results (II/IV)

Table : RDD: Effects of Podium Finish, different BWs and time periods

Horizon	Full Sample			No Prior Victory		
	1	2	3	1	2	3
<i>Outcome: Change in Time</i>						
Bandwidth 5	0.123*** (0.045)	-0.044 (0.086)	-0.105 (0.128)	0.164** (0.068)	0.085 (0.094)	-0.003 (0.166)
Bandwidth 15	0.101** (0.041)	-0.026 (0.080)	-0.037 (0.101)	0.172** (0.071)	0.077 (0.081)	-0.144 (0.129)
Bandwidth 25	0.104** (0.042)	-0.040 (0.072)	-0.033 (0.105)	0.148* (0.084)	0.037 (0.104)	-0.119 (0.139)

- Effect subsides in second race after treatment.
- One explanation: more than one week between races.

Empirical Results (II/V)

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Empirical Results (III/V)

Interpretation of Results:

- The estimates suggest that a random podium finish enhances performance by about 12–17 percentage points in the next race.
- There is no evidence for any persistent effect.
 - In the long run, the signal of being able to compete seems more relevant than a single success.
 - This may imply that skills are more important than luck w.r.t. career achievements.
 - It also emphasizes the importance of having another opportunity to be successful.
- However, the questions remains what drives the difference:
 - The increased performance by treated or...
 - ...the decreased performance by non-treated?

Empirical Results (IV/V)

- Effect of podium full sample: short-term 'losing mood':

Empirical Results (V/V)

- Sample with no prior victories: short-term 'losing mood'.

Robustness Checks

- Placebo Treatments:

- 4th vs 5th, 10th vs 11th
- No significant effects → podium is the crucial cutoff

► Regression

- Placebo Outcomes:

- Pre-treatment outcome $[(T_{i,j} - T_{i,j-1})/T_{i,j}]$
- No significant effects irrespective of bandwidth

► Regression

- Are treated and non-treated systematically different?

- Balance tests of a wide range of covariates
- No significant difference in prior achievements, age, experience, or length of subsequent race.
- There is also no evidence of a home bias.

► Balance Tests

Conclusion

- Applying an RD approach for randomized positions in World Cup alpine ski races, we present novel evidence that even small changes in relative positions affect subsequent performance.
- Significant treatment effect of podium finishes on performance, while no evidence of impact on behavior. The effects are amplified among racers without prior victories and largely driven by disappointed fourth.
- Economic consequences extend beyond alpine skiing since rankings are increasingly used in firms and academic institutions. The positive effects might be more limited than suggested by previous research.
- In the long run, skills appear to be more relevant than lucky successes. This, however, depends on the fact that losers get a second chance.

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Appendix: No Skill Determinism

- Distribution of positions prior to random podium:

Random Successes: Empirical Evidence

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Appendix: Example of SUTVA Violation

- Assume there are three racers
 - high skill A , mid-skill B , and low-skill C .
- Further assume that treatment (i.e. victory) has a positive effect on the time in the next race.
- SUTVA might be violated if we use a relative measure of performance—such as the position—for the outcome:
 - Depending on the time differences and the size of the treatment effect, it matters for the outcome of racer B whether A or C won the last race.
 - If C won, C might outperform B in next race thus causing B to finish third.
 - If A won, B will still finish second.

Appendix: RDD Plot for Survival Rates

- RDD plot for survival around the cutoff podium:

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Appendix: Continuous Density of Forcing Variable

- Distribution of observations around the cutoff podium:

Appendix: Balance Tests (Podium)

Table : Balance of Covariates for Full Sample

	Bandwidth 5	Bandwidth 15	Bandwidth 25
Podium			
Gender	0.02 (0.04)	-0.00 (0.02)	-0.02 (0.02)
No. podiums top 5	-0.04 (0.15)	-0.05 (0.08)	-0.05 (0.06)
No. victories top 5	-0.01 (0.38)	-0.05 (0.25)	-0.09 (0.21)
No. podiums top 10	-0.04 (0.06)	-0.04 (0.04)	-0.02 (0.03)
Racer's no victories	-1.64 (1.02)	-0.11 (0.39)	0.78 (0.35)
Racer's no podiums	-3.26 (2.37)	-0.11 (0.97)	1.92 (0.85)
No. races	-10.78 (7.51)	-3.86 (4.23)	2.11 (3.60)
Age	-0.45 (0.31)	-0.30 (0.19)	-0.10 (0.15)
Home dummy	-0.01 (0.03)	0.01 (0.02)	0.00 (0.01)
Time difference	-0.01 (0.04)	-0.01 (0.02)	-0.01 (0.01)

Appendix: Balance Tests (Victory)

Table : Balance of Covariates for Full Sample

	Bandwidth 5	Bandwidth 15	Bandwidth 25
Victory			
Gender	-0.00 (0.06)	-0.01 (0.04)	-0.01 (0.03)
No. podiums top 5	0.02 (0.18)	0.07 (0.13)	0.03 (0.09)
No. victories top 5	-0.02 (0.20)	0.08 (0.21)	-0.03 (0.15)
No. podiums top 10	-0.04 (0.11)	0.01 (0.05)	-0.01 (0.05)
Racer's no. victories	1.56 (0.93)	1.40 (0.77)	1.14 (0.65)
Racer's no podiums	3.41 (2.05)	2.80 (1.60)	2.30 (1.34)
No. races	2.87 (8.52)	2.34 (6.07)	1.40 (5.07)
Age	0.34 (0.43)	0.06 (0.29)	0.15 (0.22)
Home dummy	-0.04 (0.05)	0.01 (0.03)	0.00 (0.03)
Time difference	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Time Differences of all Racers

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Placebo Treatment

Table : RDD Placebo Treatment Test on Outcome in Next Race

	Rank 5–6	Rank 10–11
Change in Time		
Bandwidth 5	0.006 (0.041)	-0.003 (0.005)
N	303	581
Bandwidth 15	-0.003 (0.032)	-0.007 (0.005)
N	897	1196
Bandwidth 25	-0.009 (0.036)	-0.004 (0.006)
N	1532	1940

Placebo Outcome

Table : RDD Placebo Treatment Test on Outcome in Next Race

	Podium	Victory
Change in Time		
Bandwidth 5	0.027 (0.047)	0.016 (0.037)
N	161	53
Bandwidth 15	0.045 (0.040)	0.012 (0.054)
N	460	158
Bandwidth 30	-0.007 (0.030)	0.001 (0.058)
N	812	284