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Fame and Fortune in Elite Tennis

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Introduction

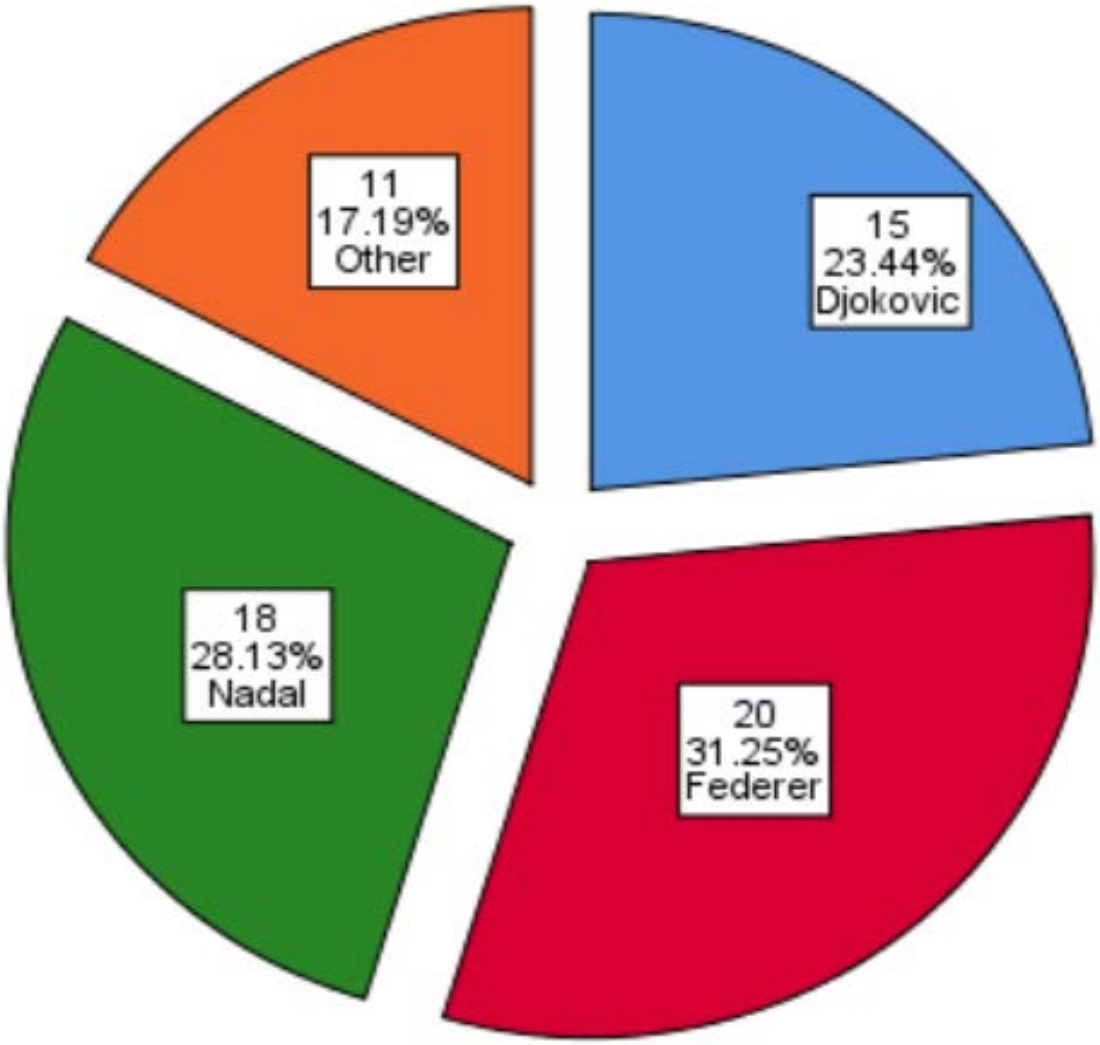
Elite men's tennis is aging. Why do they keep going?

According to Sam Smith, former British #1,it is now easier for older players to continue playing due to:-

- Modern racquets and strings have more power and provide more control.
- Better medical science, better nutrition/diet.
- Bigger prize money to support expert teams.

Or could it be the domination of the "Big 3" that has blocked the rise of younger talent?

64 Grand Slams since 2003 Wimbledon



But is there about to be a “changing of the guard”?

What do the tennis statistics say?

In particular

- What is motivating older and younger players to continue?
  - Is it fame (rankings) or fortune (prize money)?
- How does performance change over a player's career?
  - Are there different trajectories for older and younger generation players

Methodology

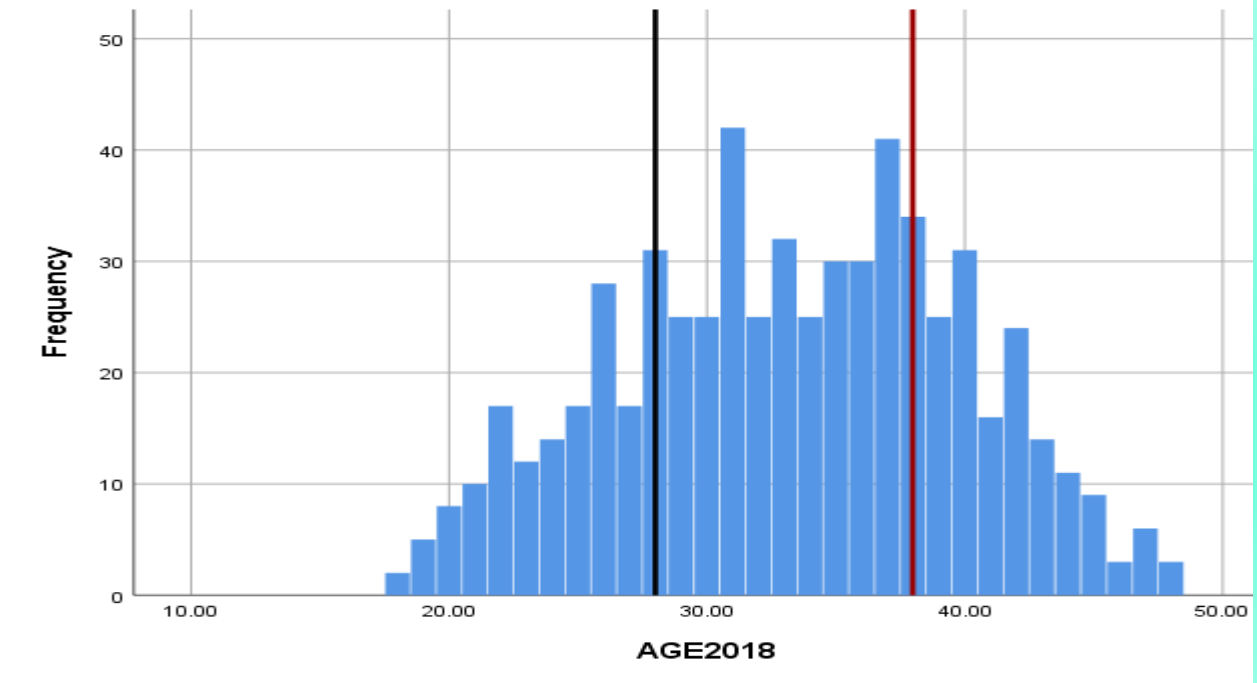
- Measures of Performance following Sunde(2009)
  - Quality measure = percentage of ATP matches won in a single year
  - Quantity measure = number of ATP matches played in a single year reflecting progress in knock-out tournaments
- Models that allow us to test for both age and career affects, allowing for player heterogeneity and missing data.
  - Longitudinal Multi-Level Models can be fitted for the performance of each player individually over his career, with coefficients then averaged (HLM7). Subtract career means for each player within these models and control for Career Success($) and age in 2018.

Data for top 200 ATP players 2004-2018

Generation defined in terms of age in 2018

- Provided by http://www.protennislive.com and downloaded from the On Court database.
- An average of 4.7 years data for 612 players, some now retired.

Younger (≤28) Generation Older (≥38) Generation

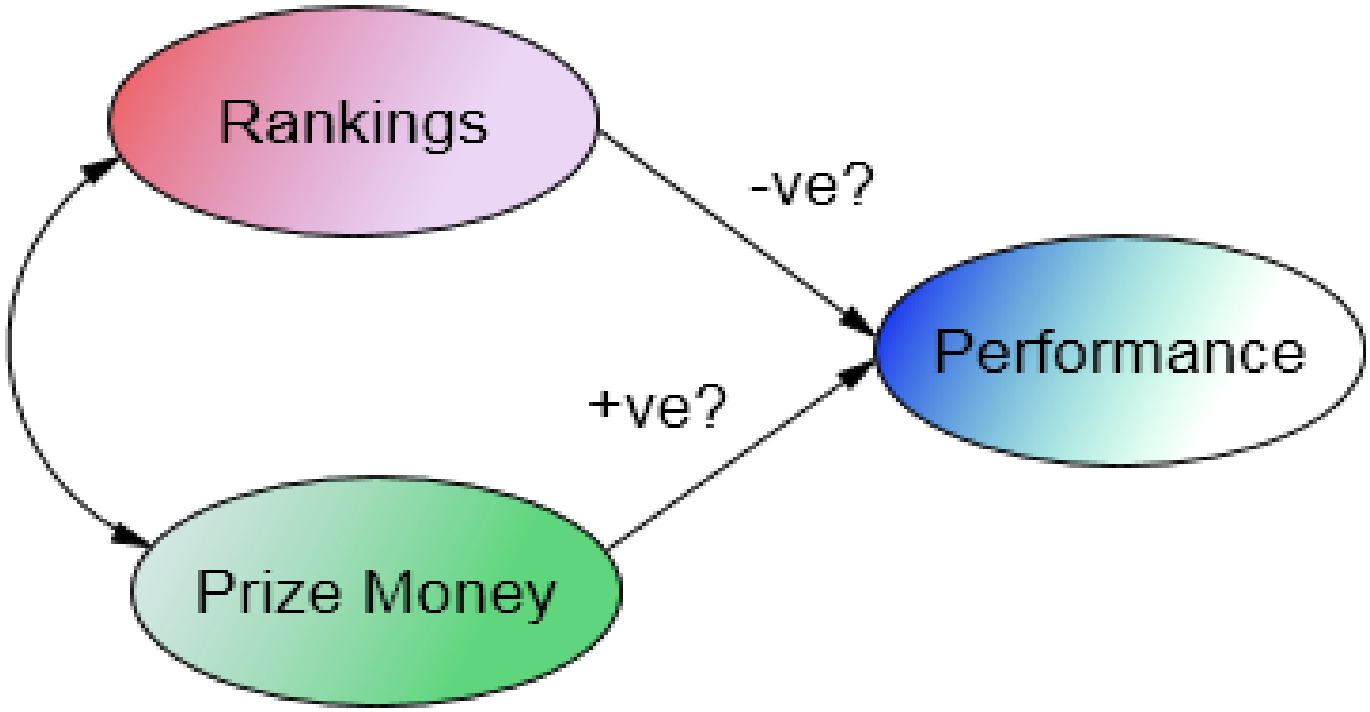


Descriptive Statistics

- Average career prize money at the end of 2018 = $3.8m with a minimum of $95871 and a maximum of $125.8 for Djokovic, followed by Federer at $120.5m.
- Average age in 2018 = 33.2 years with a standard deviation of 6.6 years, a minimum of 18 and a maximum of 48.
- Average number of matches played per year is 28.1 with a standard deviation of 22.1.
- On average 42.8% of matches won with a standard deviation of 19.1%.

First Question

What is motivating older/younger players more?
Is it rankings or prize money?


Rankings
-ve?
Performance
+ve?
Prize Money

What are the effects of prize money?

In tennis prize money does provide an important performance incentive

- Sunde(2009): ATP singles data for 156 grand Slams. Substantially higher final prizes over semi-final prizes improved performance, as measured in terms of the number of games won and number of games played.

What are the effects of prize money?

Anecdotal Evidence: Venus Williams on equality of prize money for men and women at Wimbledon from 2007.

"The 2007 Championships will have even **greater meaning and significance** to me and my fellow players".

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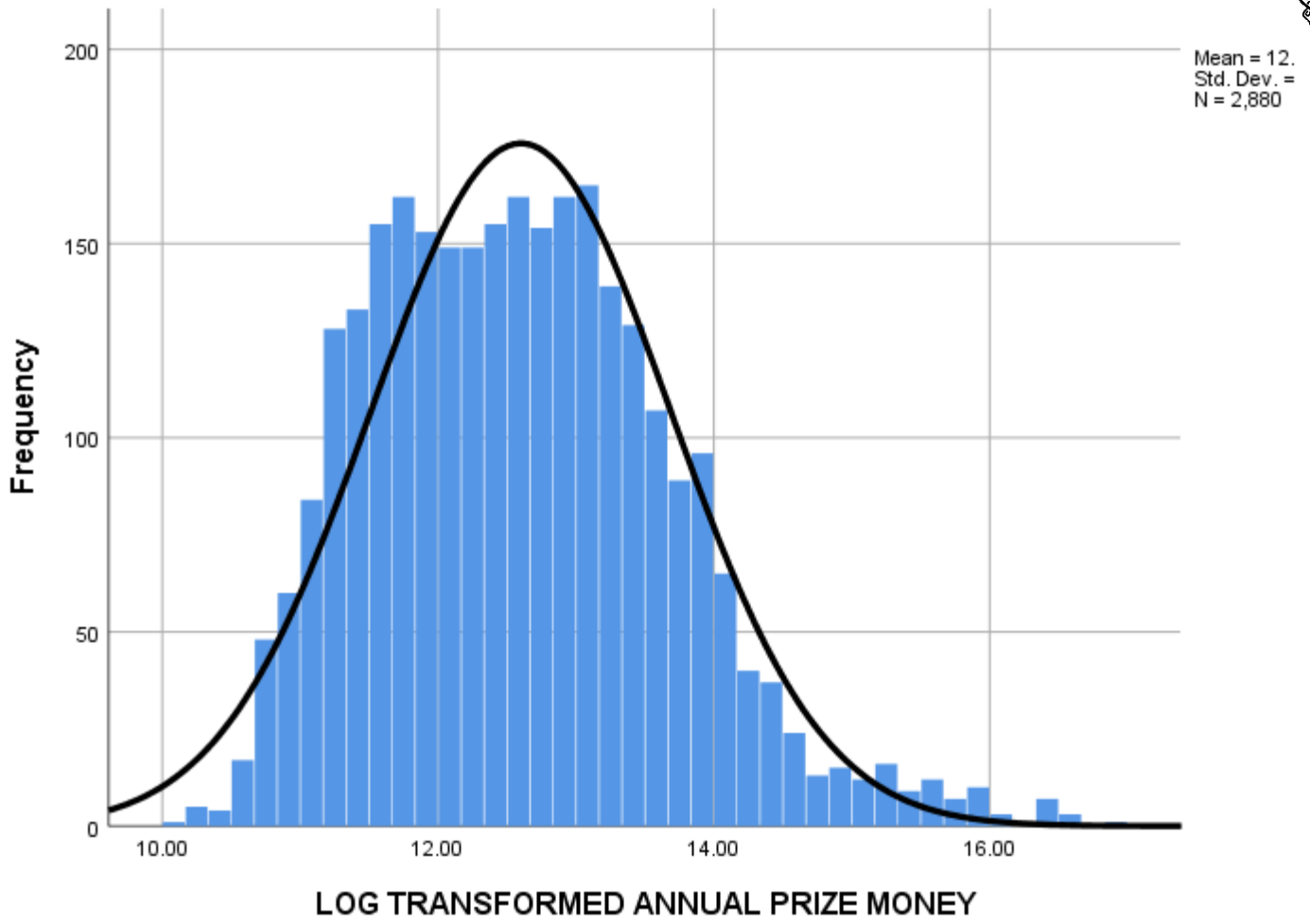
Distribution for annual prize money



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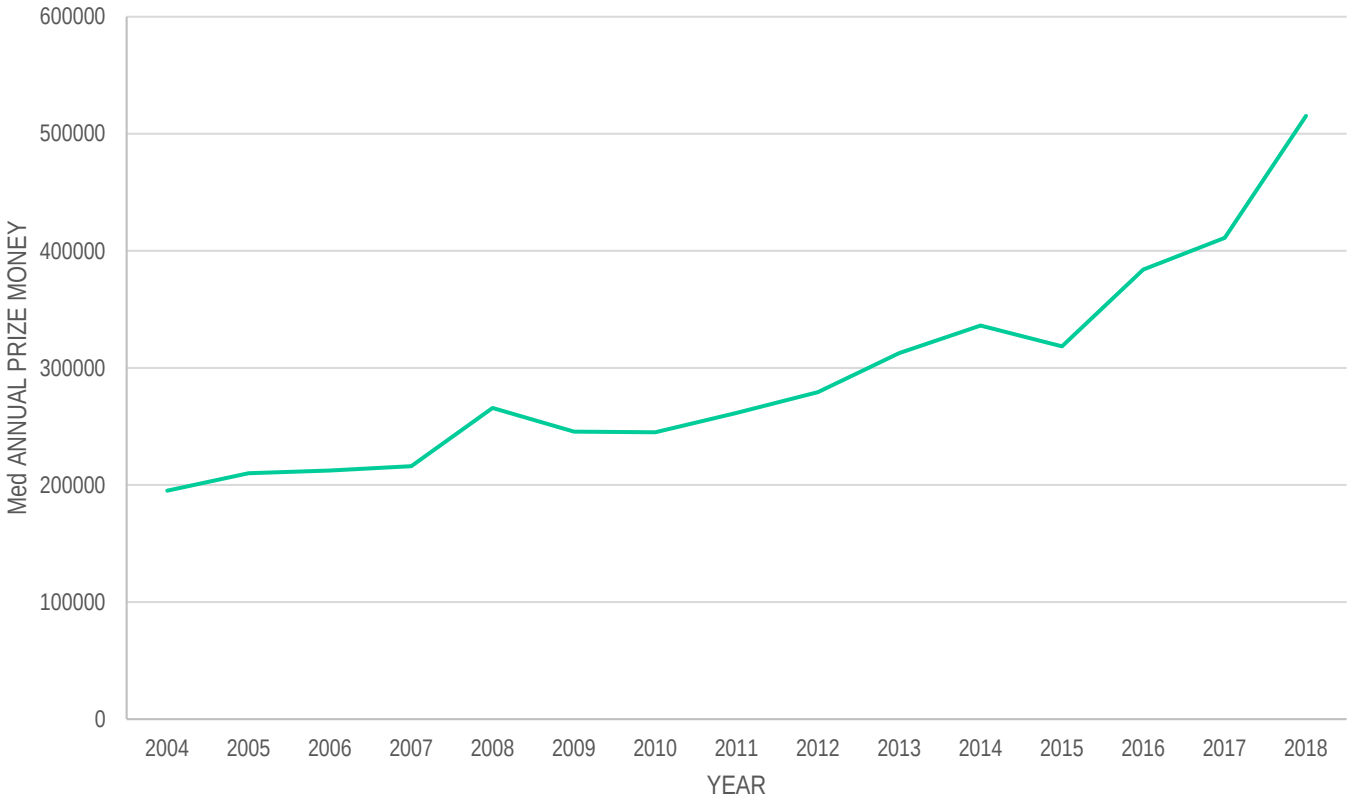
Median Annual Prize Money

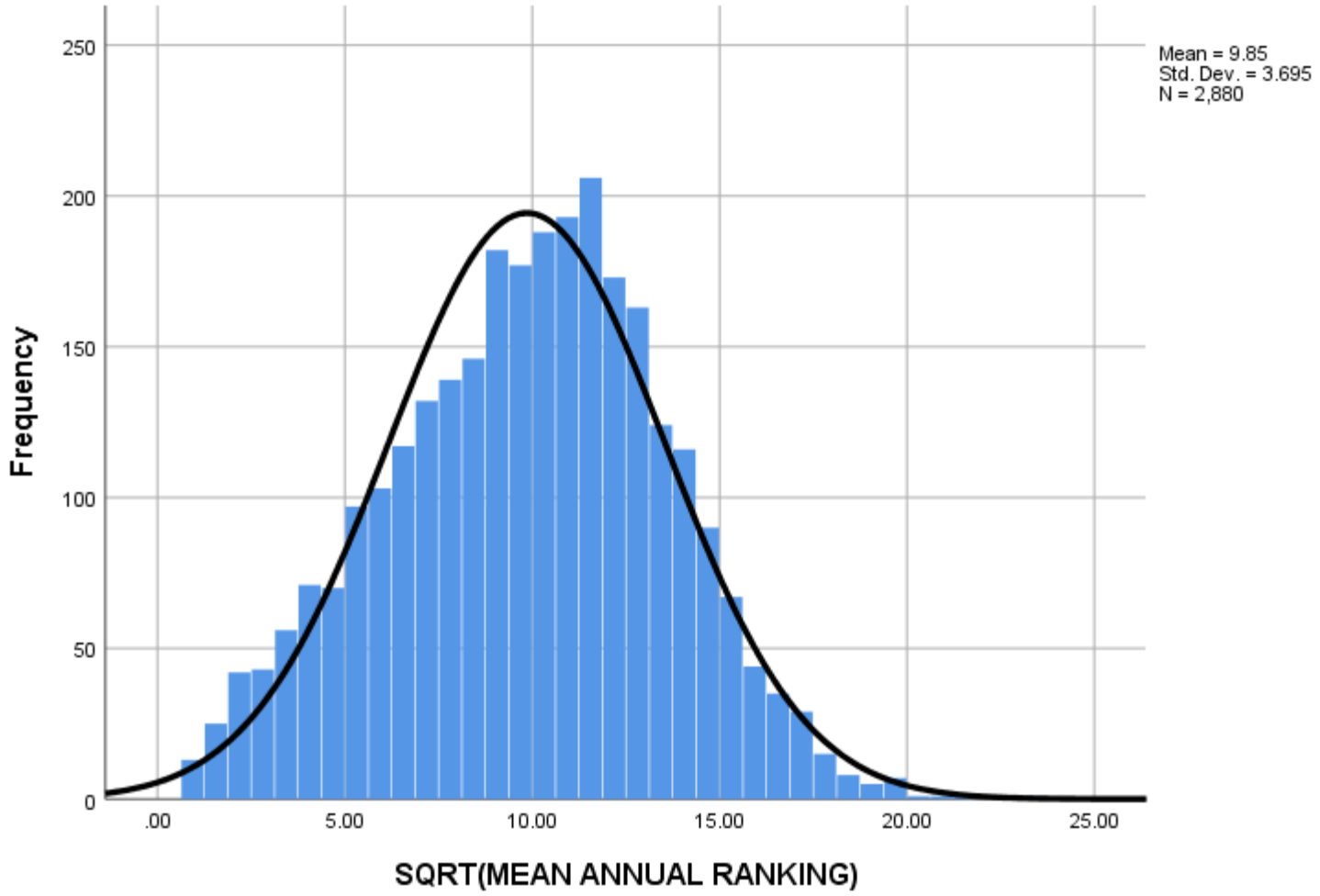
- Increasing since 2004, with a greater share for earlier round knock-outs especially since 2015.



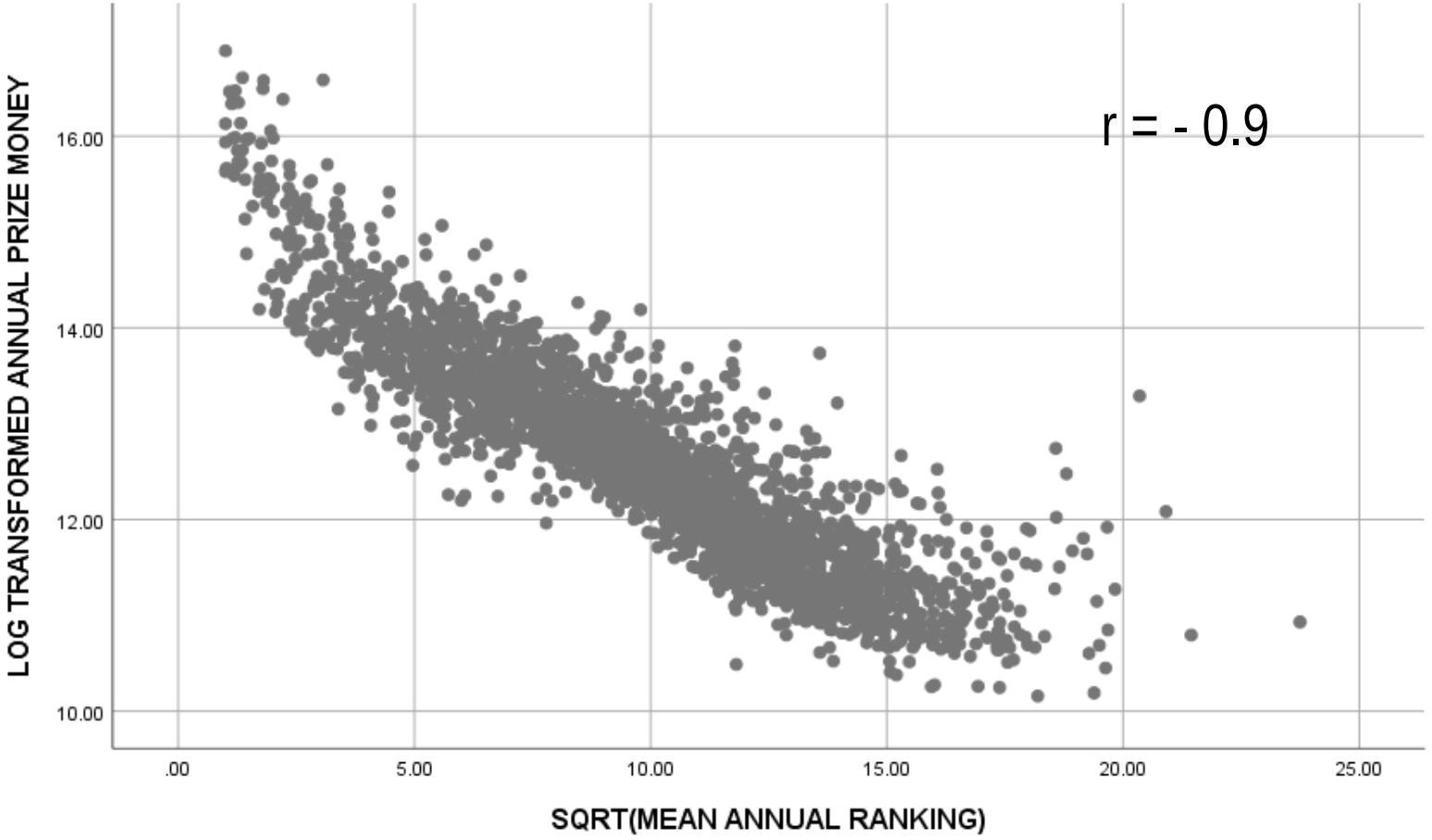
What are the effects of good rankings?

- The best rankings lead to:-
  - Invitations to play in special events and exhibition matches
  - Lucrative advertising contracts
  - Bonus ranking points for ATP Tour Final tournament
  - Preferential tournament treatment
  - Tournament selection
  - Tournament seeding and handicapping
  - Preferential tournament treatment

Distribution for mean annual rankings



Relationship Prize Money and Ranking



Statistical Analysis: Multi-level analysis

Performance	Variation explained by players	Variation unexplained by players
Proportion matches won in any year	15.2%	84.8%
Number of matches played in any year	5.8%	94.2%

Proportion of Matches Won per annum

	Odds Ratio	T-ratio	P-value
Age in 2018	.991*	3.96	<.001
Career Prize Money at Dec 2018 (LN)	1.40	21.60	<.001
Annual Prize Money (LN)	1.28	13.53#	<.001
Average Ranking (SQRT)	0.98	-3.71#	<.001

Younger generation players more likely to win (*).
Prize money more of an incentive than rankings (#)
Generation effect (age in 2018) does not moderate effects of annual prize money or average rankings significantly.
Same model for older and younger generation players.

Expected number matches played pa.

	Exp(B)	T-ratio	P-value
Age in 2018	1.007*	1.97	.049
Career Prize Money at Dec 2018 (LN)	1.738	38.36	<.001
Annual Prize Money (LN)	1.717	24.95#	<.001
Average Ranking (SQRT)	0.896	-16.9#	<.001

Barely a significant player generation effect (*)
Prize money a greater incentive than rankings (#)
Generation effect (age in 2018) does not moderate effects of annual prize money or average rankings significantly.
Same model for older and younger generation players

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Answer to First Question

What is motivating older/younger players?
Is it fame (rankings) or fortune (prize money)?

Prize money is more important than rankings

The relative importance of fame and fortune are similar for younger and older players

Second Question

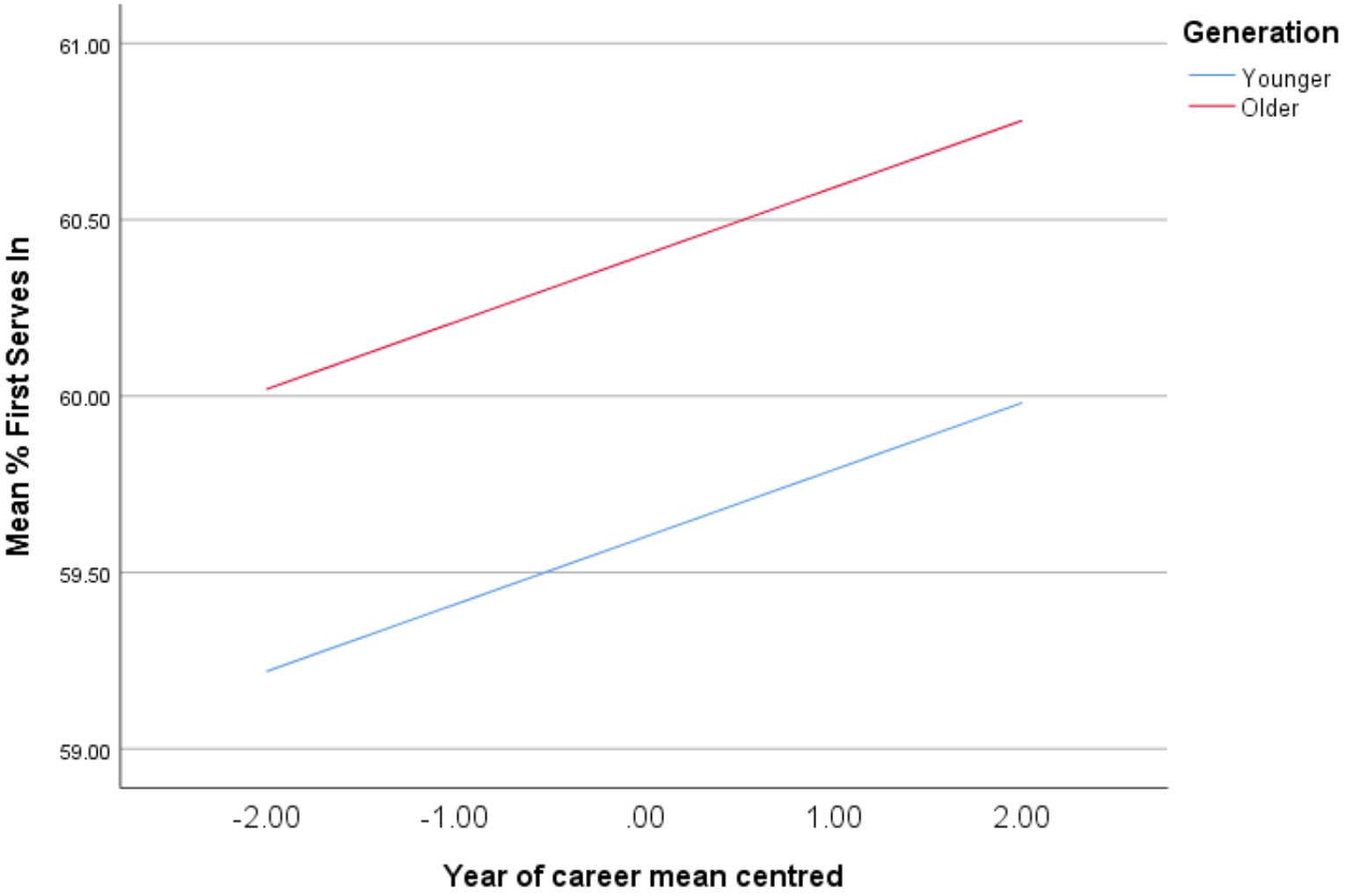
How does performance change over a player's career and are there different trajectories for older and younger players

Service Measures of Performance

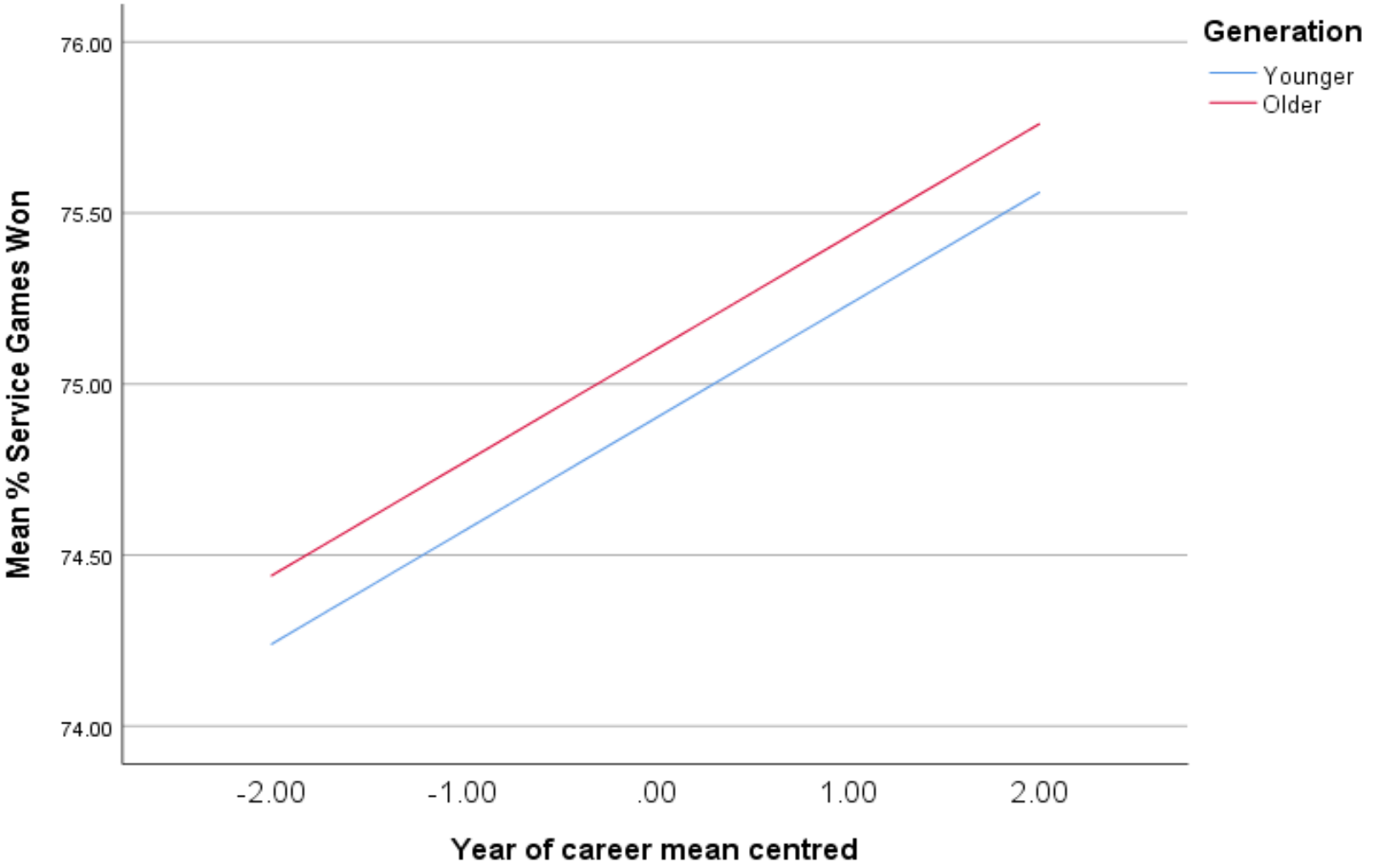
- Service Statistics
  - % First Services In (mean=60%)
  - % Points won on serve (mean=69%)
  - % Points won on second serve (mean=49%)
  - % Service Games Won (mean=75%)
  - % breakpoints served (men=58%)
  - % points won on return 1st serve (mean=27%)
  - % points won on return 2nd serve (mean=48%)
- For following plots
  - Older = 38 years old in 2018
  - Younger = 28 years old in 2018

Career Improvement: % First Services In.

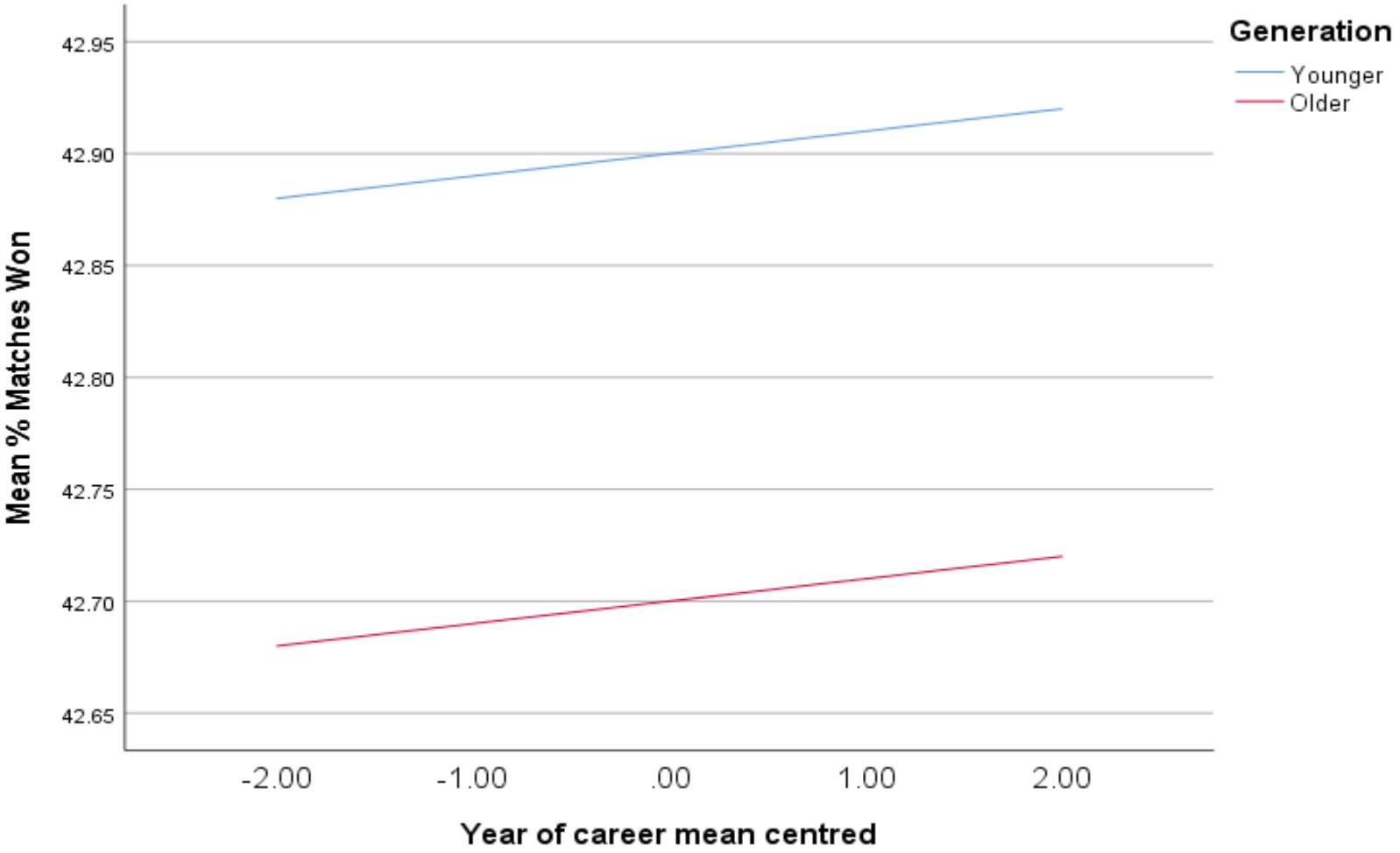
Older generation better than younger on average



Career Improvement: % Service Games Won

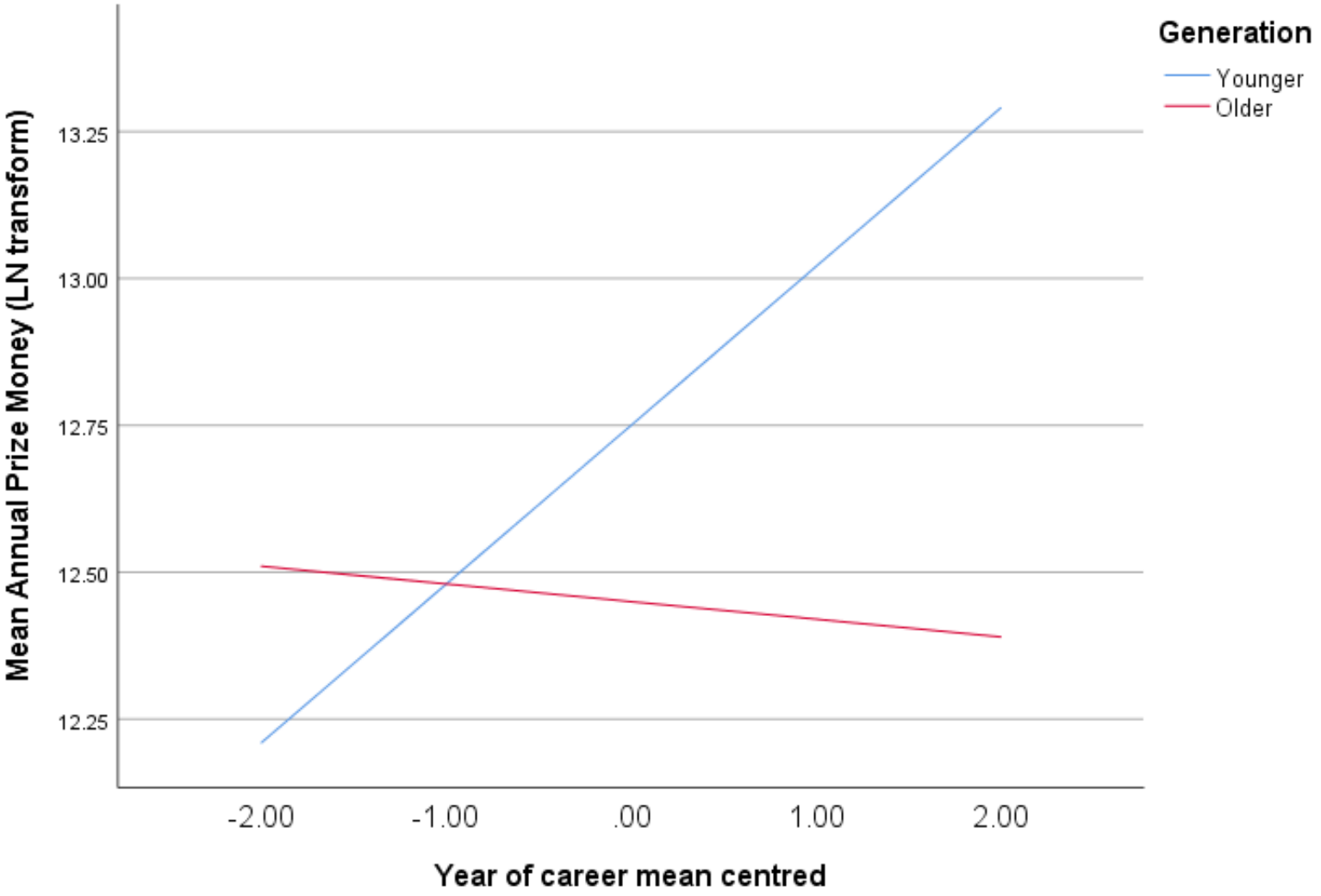


Percentage of Matches Won. On average better performance for younger players



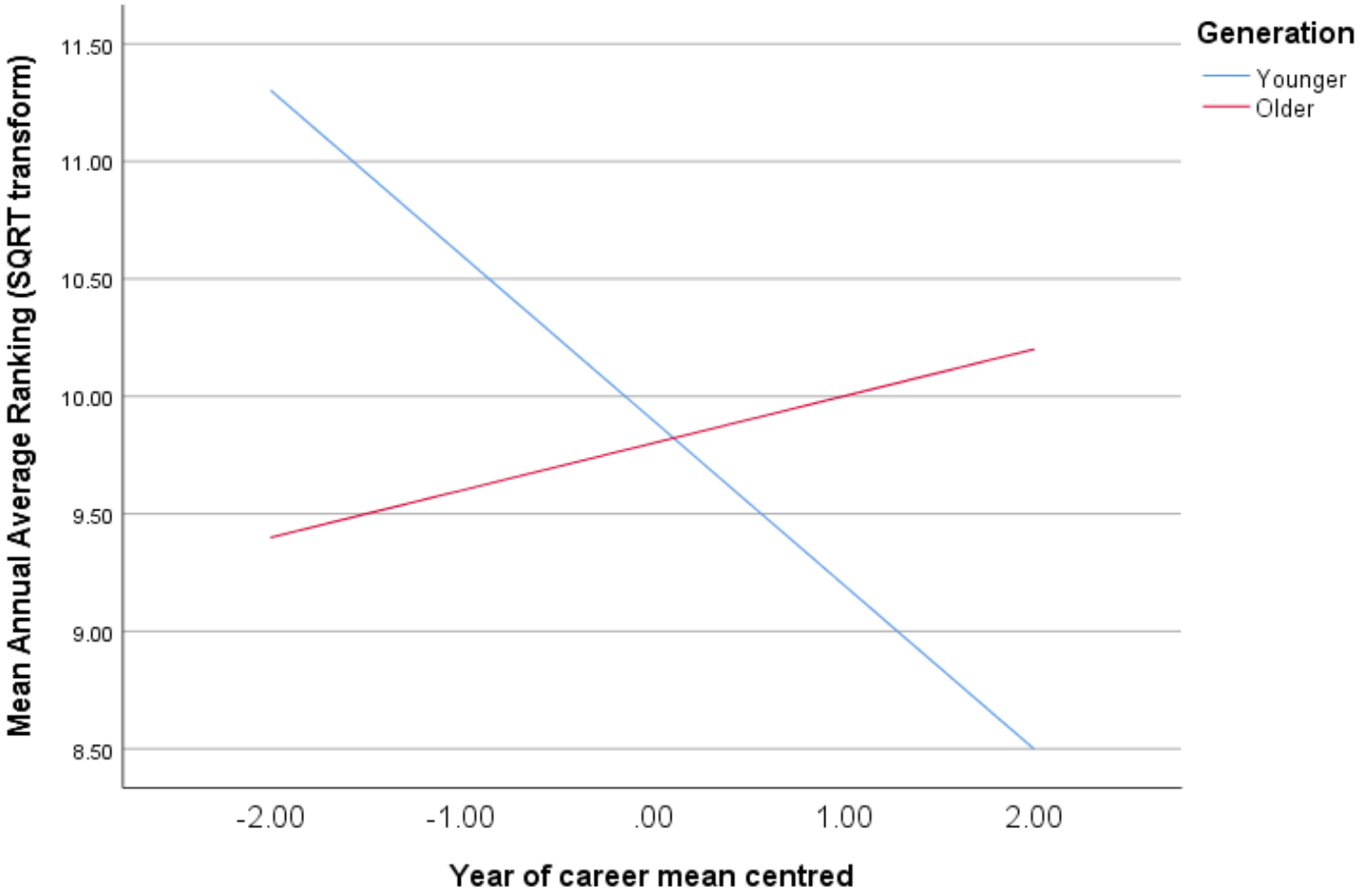
Annual Prize Money (Log Transform)

Improvement only for younger generation players



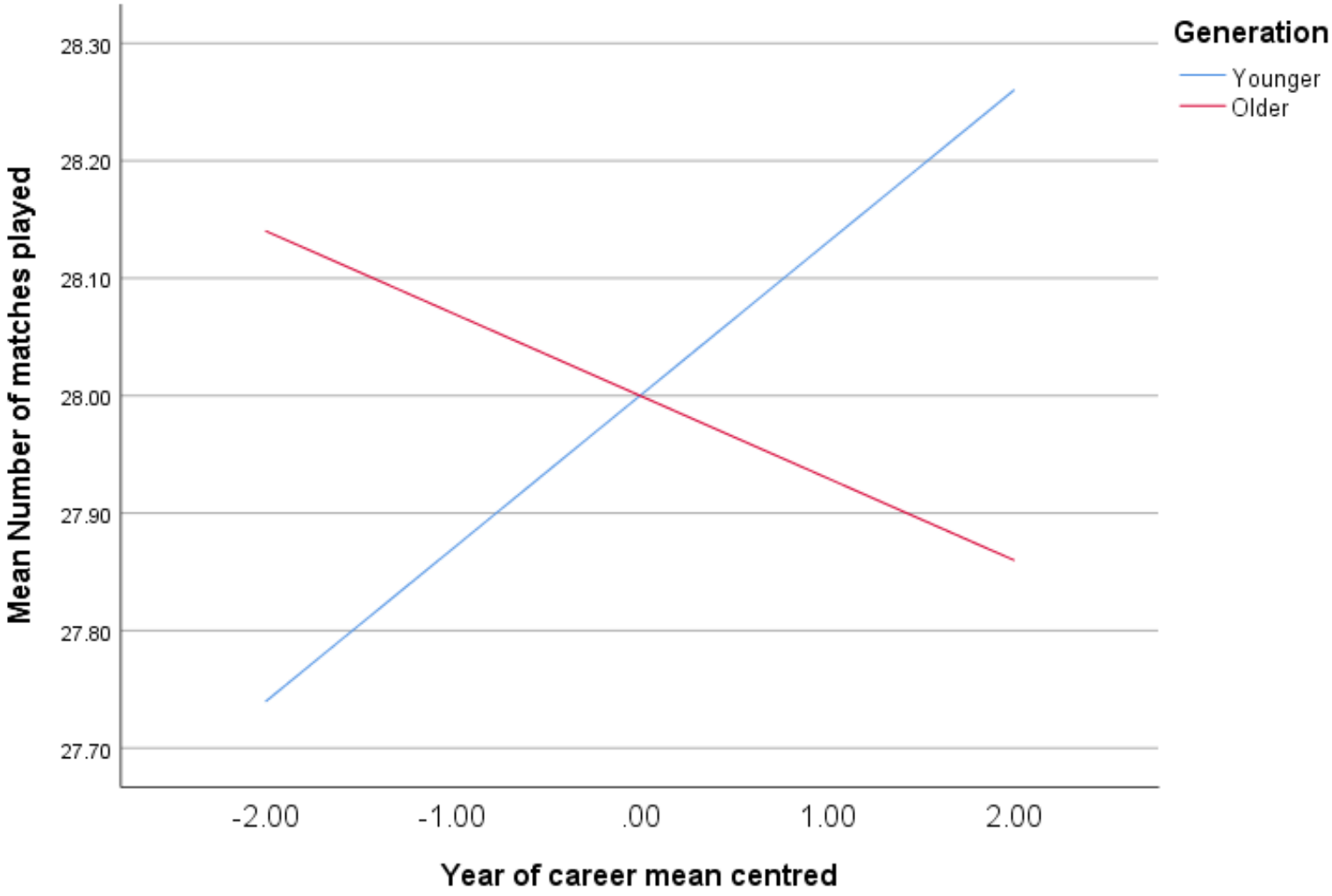
Mean Annual Ranking (SQRT transform)

Improvement only younger generation players



Number of Matches Played Per Annum

Improvement only younger generation players



Other significant career trends – all players

Outcome Measure	Increase per year of career	P-value
% points won on first serve	0.19	<.001
% points on second serve	0.16	<.001
% break points saved	0.31	<.001
Average number of aces per match	0.07	<.001
Average number of double faults per match	0.02	<.05

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Other significant AGE2018 effects

Older generation marginally better for:-

Outcome Measure	Increase per year of age (2018)	P-value
% points won on return of 1st serve	0.06	<.05
% breakpoints won	0.09	<.05

Summary:

- On average the proportion of matches won is higher for younger than older generation players, but 1st serve performance is worse.
- Trend: As players age their service tends to improve and more breakpoints are won, however there is also a slight increase in the average number of double faults per match
- Only for younger generation players improving trends over their career for annual prize money, mean annual rankings and number of matches played per annum

Conclusion

- Why is elite tennis aging?
  - Older generation players are more effective than younger generation players in terms of service..
- Is there evidence for a "changing of the guard". The statistics suggest that YES there is.
  - On average better performance in terms of matches won for younger players
  - Improvement over their careers for younger generation players in terms of number of matches played, rankings and prize money. Not so for older generation players on average.

Limitations of the analysis

- Only linear trends have been assumed.
- Confounded with this trend are:-
  - Improvements in racquets and strings.
  - Improvements in medical science, nutrition, diet.
  - Improvements in match preparation and recovery techniques.
  - Bigger prize money to support expert support teams.

Future Work:

- What motivates elite female tennis players more? Fame or fortune?
- What are the trends for older and younger generation female players?
- Different results are expected because:-
  - The WTA ranking system is less stringent, favouring quantity rather than quality to a greater extent, with Grand Slams contributing a greater percentage of the prize money.
  - Women are more likely to play doubles than men so it will be necessary to consider doubles performance as well as singles performance and to adjust the performance measures accordingly.
  - No Big 3.

References

- Meyer, D. & Pollard, G. (2012). Fame and fortune in elite tennis. *Proc. 11th Australasian Conference Maths and Computers in Sport.*
- Ramsay, A. Australian Open 2017: Why today's tennis players are fitter, stronger – and older. January 21, Sydney Herald.
- Sunde, U. (2009). Heterogeneity and performance in tournaments: a test of incentive effects using professional tennis data. *Applied Economics, 41*, 3199-3208.

Thank you

- To the audience for listening.
- To the organisers for a wonderful conference.
- To Athens for surpassing all my expectations.