

# PERFORMANCE UNDER PRESSURE: EVIDENCE FROM PRO TENNIS PLAYERS

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## Choking vs. Clutch Performance under Pressure

There is a large body of literature in sport psychology and economics on performance difference between high and low pressure moments: specifically **choking/clutch refers to inferior/superior performance in high pressure moments relative to low pressure moments**.

Basketball (Cao et al., 2011), golf (Wells and Skowronski, 2012), soccer (Kocher et al., 2008), tennis (Knight and O'donoghue, 2012), football (Hsu et al., 2019), dart (Deutscher et al., 2018), biathlon (Harb-Wu and Krumer, 2019).

I highlight two sets of results from the current study:

- (1) **How performance differential evolves over time.**
- (2) **How does expectation of win and loss affects performance.**

## Dataset

A unique point-by-point (shot-by-shot) dataset on professional single tennis matches (for both men and women) from 1974-2019 by Jeff Sackmann.

**About 440K points played in 3K matches by 750 players.**

Caveat: dataset collected by crowd-sourcing, is not a random sample of all matches, might be biased towards including high profile tournaments and higher ranked players.

Supplementary dataset: demographics and year-by-year ATP/WTa ranking of each player in the dataset (in progress).

## Overview of the Rule of Tennis

Hierarchical scoring system (match, set, game, point).

A **match** is determined by the best of 3 or 5 sets (best of 5 only in the 4 Grand Slams) for men and best of 3 sets for women.

A **set** is determined by the "win by two" rule: (1) a player wins 6 or 7 games and wins at least 2 more games than the opponent (e.g., wins the set at 6-4 or 7-5), (2) a player wins a 7 point "win by two" tie-break at 6-6.

A **game** is determined by a 4-point "win by two" rule: a player has to win at least 4 points (15, 30, 40, win), and 2 more points than the opponent.

## Defining High Pressure Moments

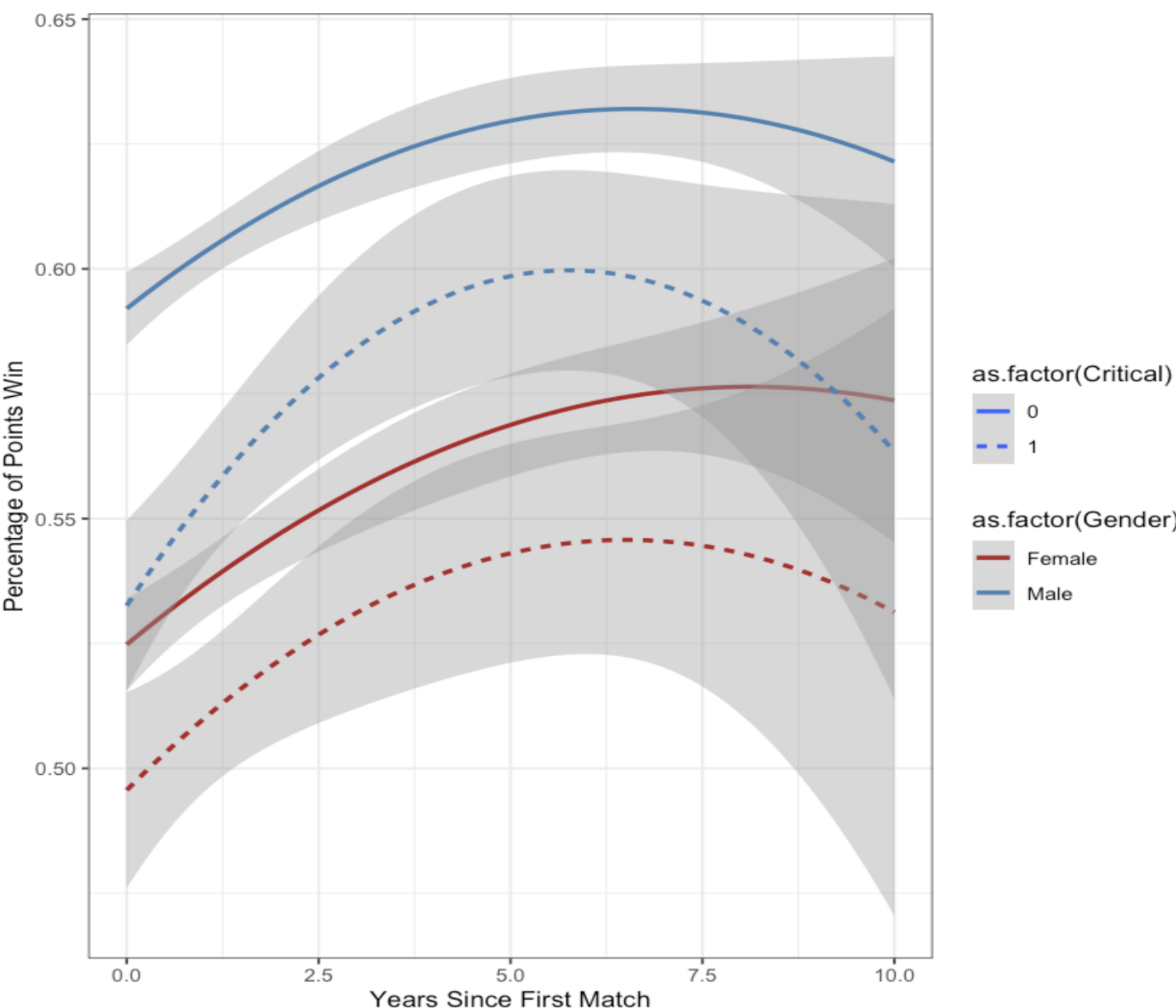
Two players alternate to serve the ball in each game (called **service game**), and serving is a big advantage (men/women win over 60%/55% of points in a service game on average).

A **break-point** is a point in a player's service game such that losing the point would result in losing the game. Because a player is expected to win his or her service game, in general losing a service game puts him or her to a big disadvantage in the set.

Therefore I use break points to define high pressure/critical moments.

## Some Preliminary Results

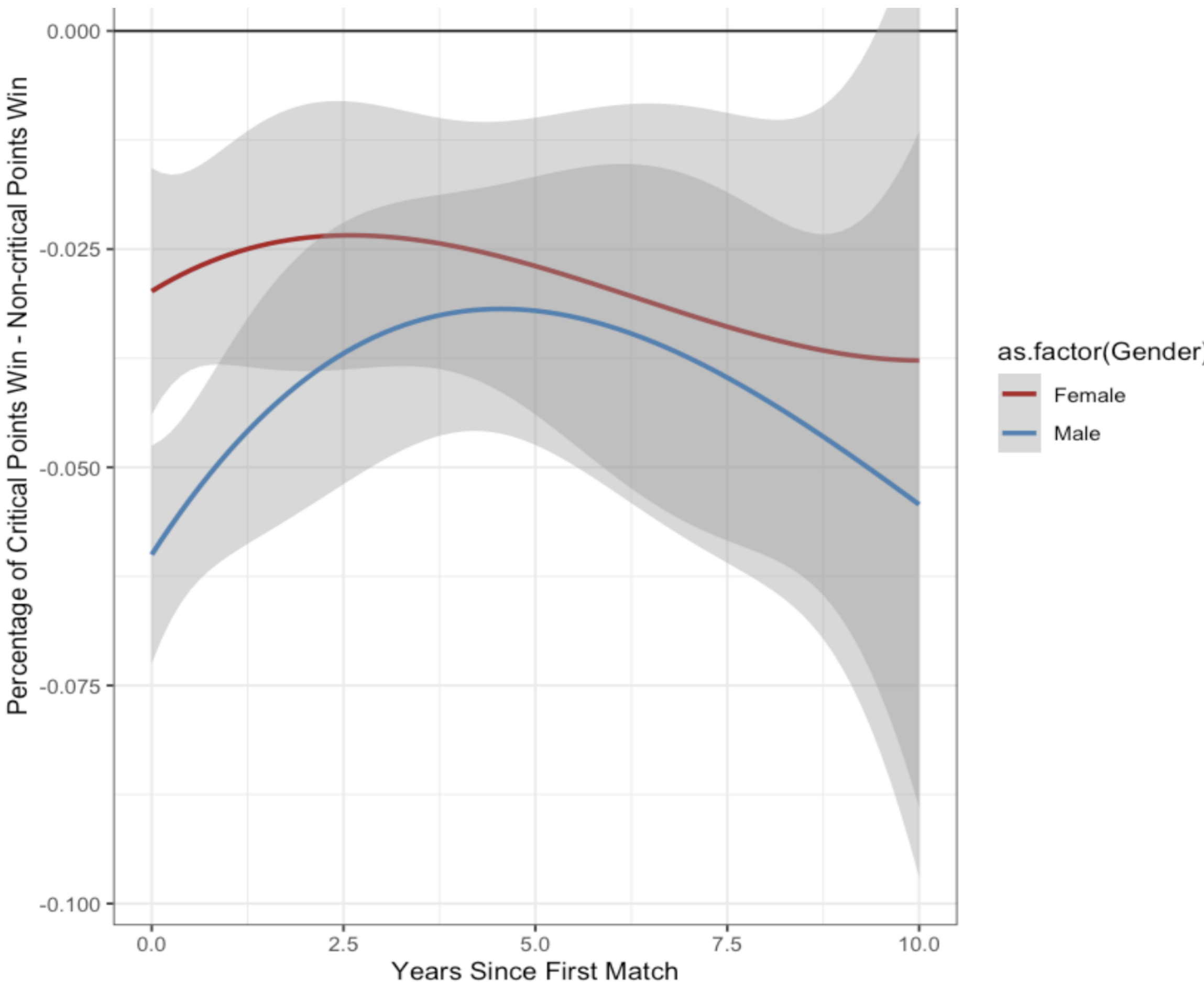
- **Percentage of points win over time by gender and pressure in service games:**



Three observations:

- (1) Performance tend to exhibit an inverse U shape with time.
- (2) Servers win less points under pressure.
- (3) Male has a bigger advantage in their service games compared with female.

- **Percentage of points win differential over time by gender in service games.**



Two observations:

- (1) male players show an inverse U shape but not female players.
- (2) male players under perform more than female players.

## Why do Servers Win Less Points under Pressure?

Is server playing worse or returner playing better?

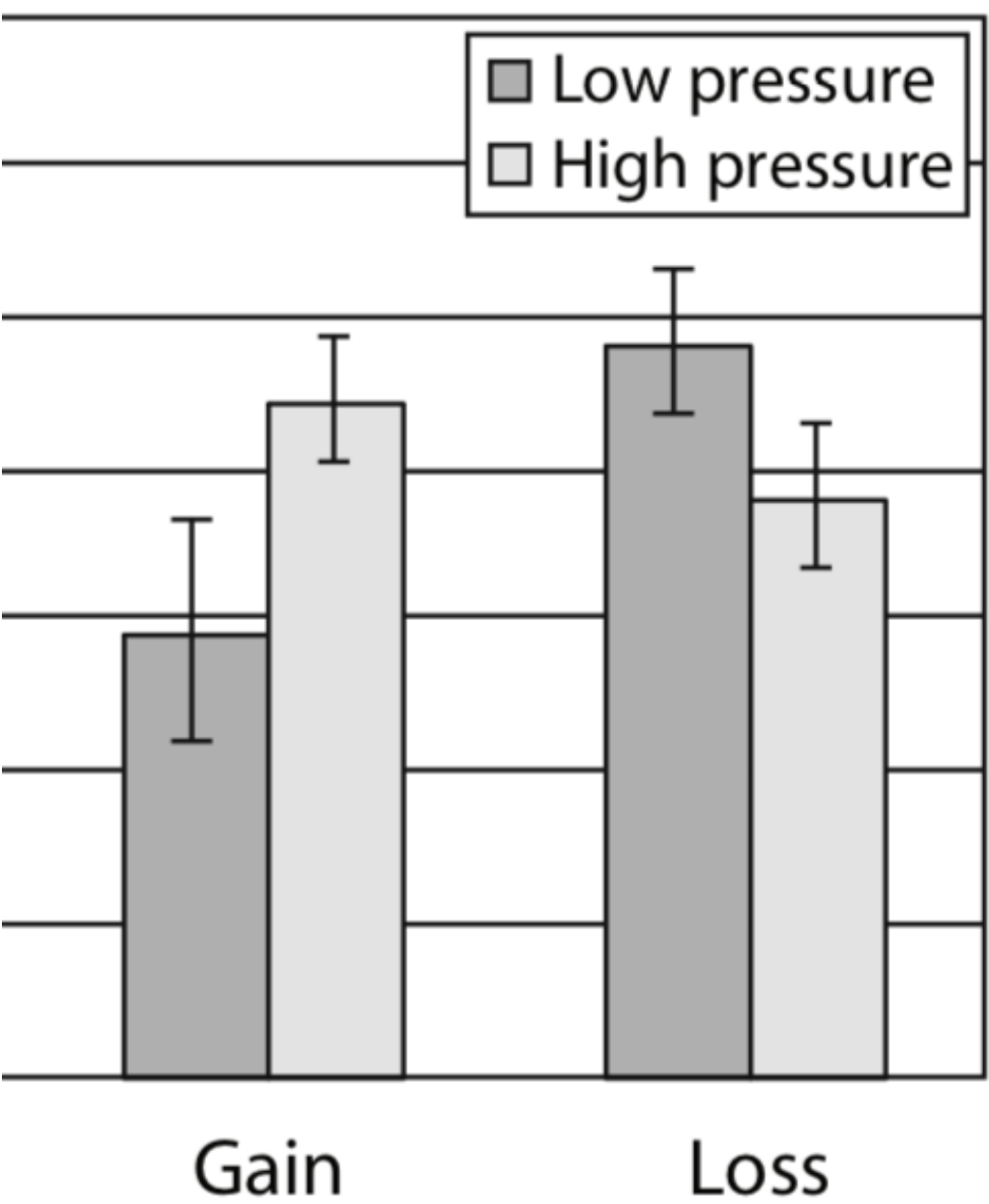
When under pressure:

- (1) the server serves less ace.
- (2) the server has more unforced errors.
- (3) rally length is longer.

Returner's performance is similar on break points vs. non break points. It seems to suggest that servers under perform (aka., choke) under pressure.

This is consistent with **regulatory focus theory** (e.g., Higgins, 1997): on break points servers tend to have a **prevention focus** because being broken is considered a loss, and returners tend to have a **promotion focus** because breaking opponent's service game is considered as a gain.

A similar pattern is shown in Worthy et al., 2009:



## Robustness Check and Ongoing Work

Results are qualitatively similar after:

- (1) Restricting the sample to players with e.g., career  $\geq 10$  to deal with survivor bias (stronger players tend to have longer career).
- (2) Controlling for tournament importance: separate Grand Slam matches.

In progress:

Experience (years played) is confounded with age: controlling for age.

Adjusting for the quality of opponent using player rank.

Use alternative definition of pressure moment/point importance: e.g., take game and set into consideration (Morris, 1997; Klasssen and Magnus, 2001)

## Key References

- Higgins, E. Tory. "Beyond pleasure and pain." American psychologist 52.12 (1997): 1280.
- Knight, Gareth, and Peter O'donoghue. "The probability of winning break points in Grand Slam men's singles tennis." European Journal of Sport Science 12.6 (2012): 462-468.
- Worthy, Darrell A., Arthur B. Markman, and W. Todd Maddox. "What is pressure? Evidence for social pressure as a type of regulatory focus." Psychonomic bulletin & review 16.2 (2009): 344-349.