

Quantifying The Effect of Pitching Metrics

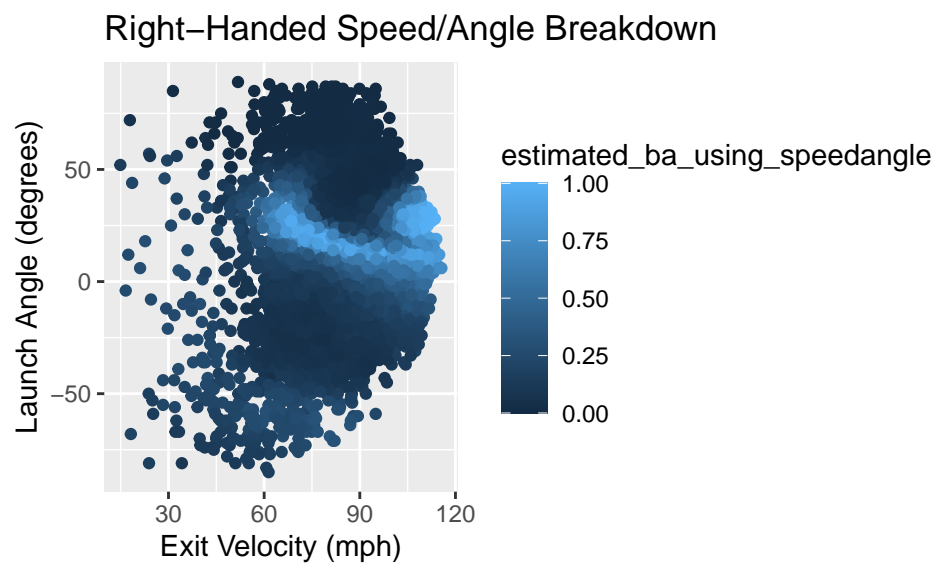
Max Brown

May 20, 2022

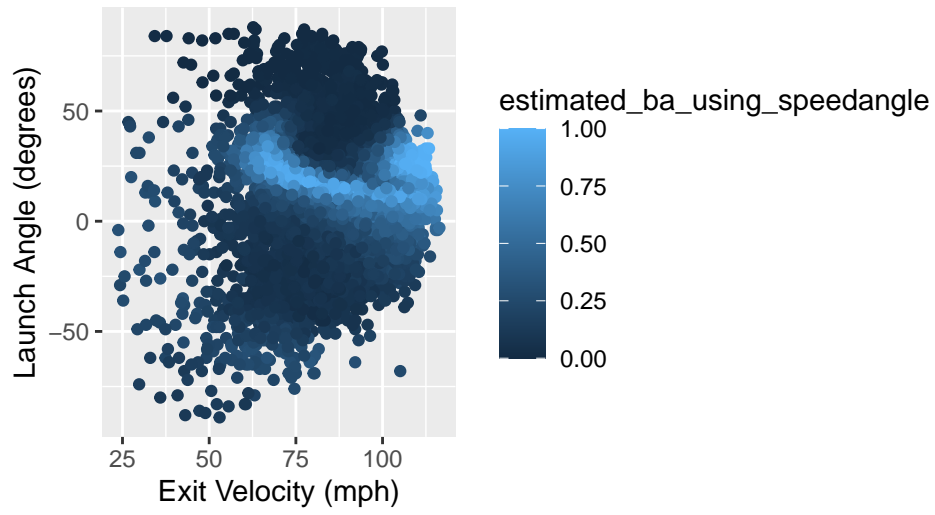
Introduction

The methodology of analyzing the performance of pitchers has drastically changed over time. At the surface one can evaluate at pitcher's win-loss record to determine their impact on the teams' performance. It's a results-based model, but includes several factors far out of a pitcher's control, fundamentally the

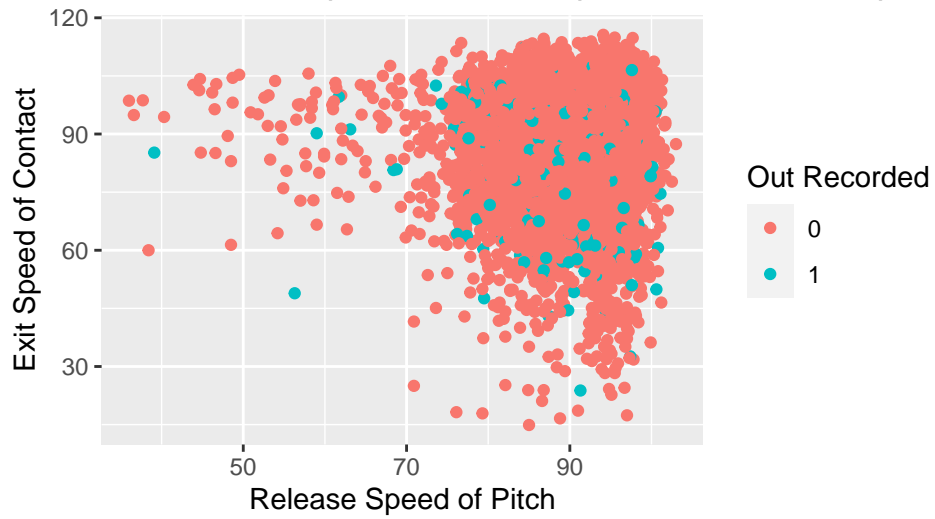
General EDA



Left-Handed Speed/Angle Breakdown



No Relationship For Release Speed and Launch Speed/



Fastball EDA

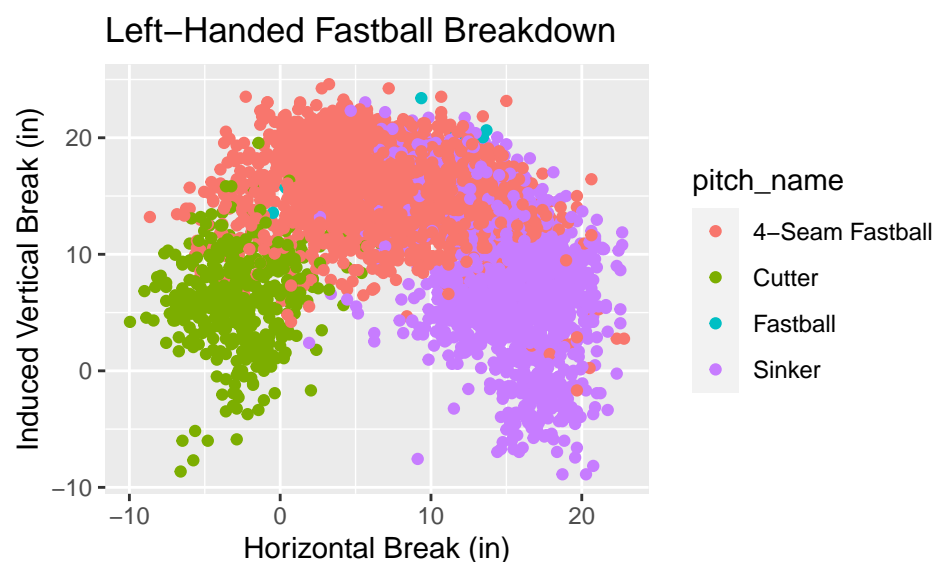
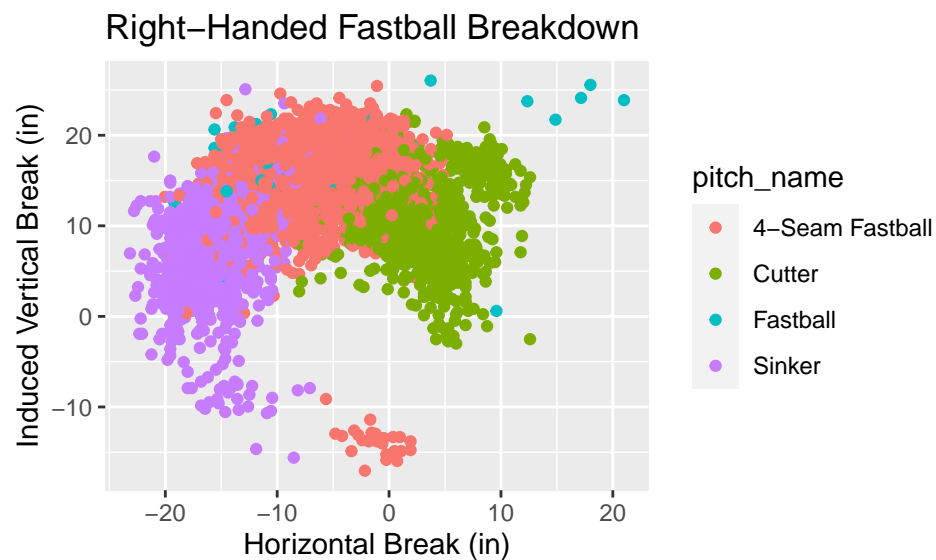


Table 1: Average RH Fastball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
4-Seam Fastball	94.80	2305.91	-7.21	16.03	213.12
Cutter	91.89	2406.00	2.93	10.42	180.08
Fastball	67.53	1644.83	-6.98	15.00	220.67
Sinker	94.73	2163.39	-14.97	8.71	223.89

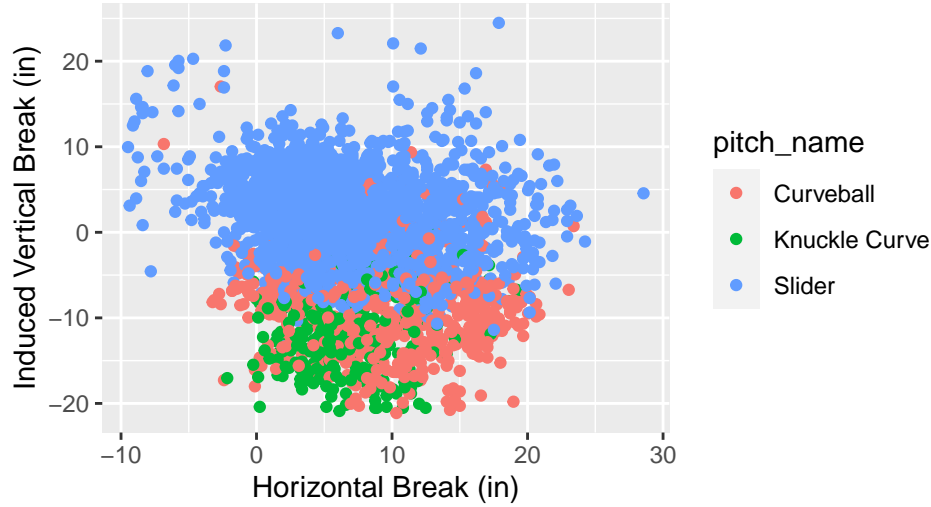
Table 2: Average LH Fastball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
4-Seam Fastball	93.82	2284.07	7.37	16.07	150.59

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Cutter	88.14	2352.89	-2.49	6.28	190.93
Fastball	65.86	1726.84	7.93	16.81	137.47
Sinker	93.72	2143.96	14.43	9.55	129.72

EDA Breaking Balls

Right-Handed Breaking Ball Breakdown



Left-Handed Breaking Ball Breakdown

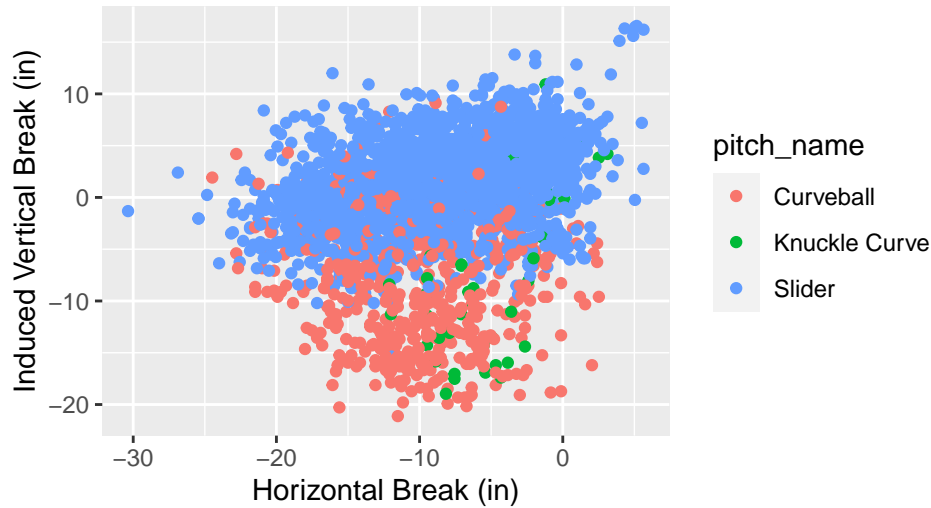


Table 3: Average RH Breaking Ball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Curveball	79.89	2564.19	9.65	-9.06	42.03
Knuckle Curve	82.64	2490.87	6.99	-11.49	32.58
Slider	85.44	2422.05	6.33	1.94	111.79

Table 4: Average LH Breaking Ball Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Curveball	78.02	2441.83	-10.18	-7.97	309.08
Knuckle Curve	80.26	2282.49	-4.39	-6.28	273.40
Slider	83.20	2421.40	-8.37	1.33	259.26

EDA Change Ups

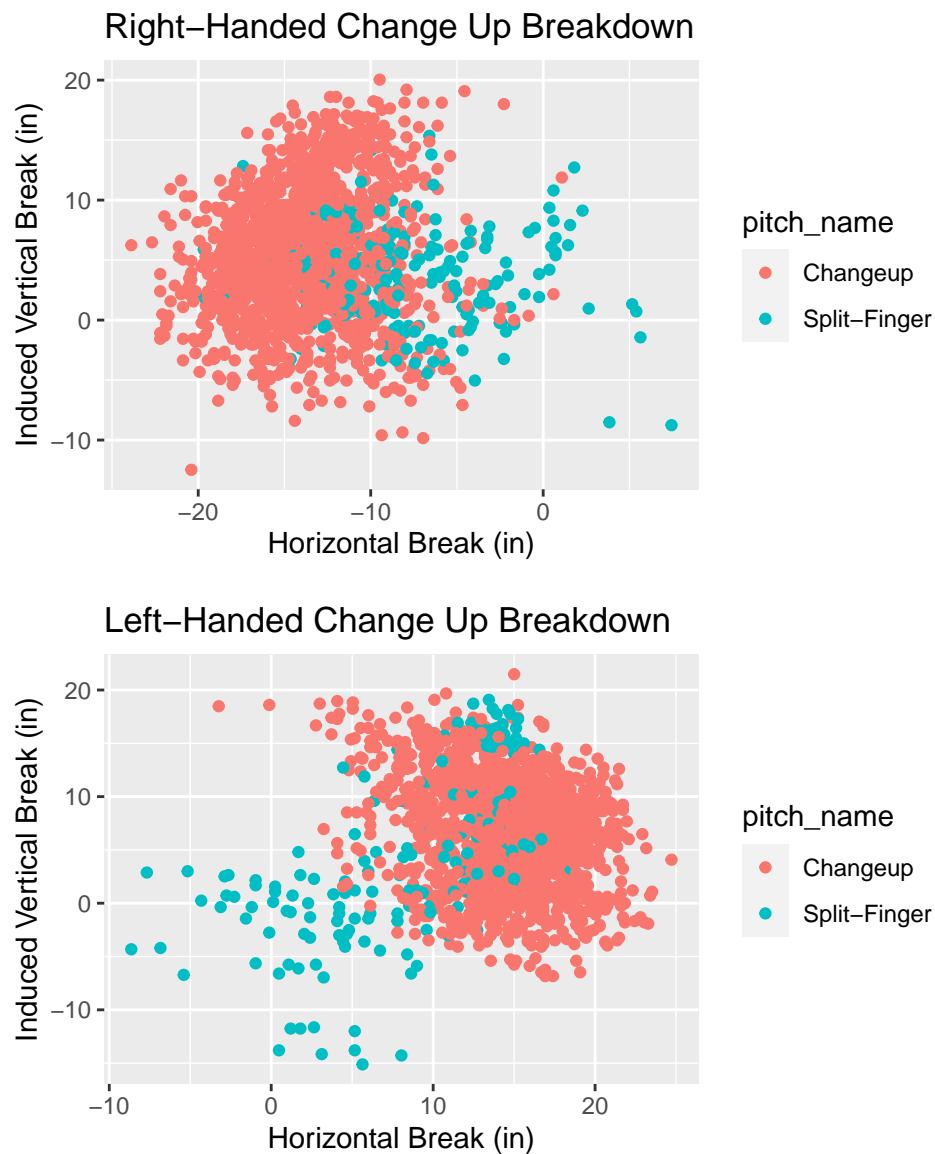


Table 5: Average RH Change Up Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Changeup	86.17	1811.65	-14.04	5.60	239.98

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Split-Finger	86.42	1169.79	-8.46	3.67	236.62

Table 6: Average LH Change Up Type Metrics

pitch_name	release_speed	release_spin	hor_break	vert_break	tilt
Changeup	84.16	1834.34	14.64	6.96	117.97
Split-Finger	84.99	1202.66	8.69	4.08	121.30

Methodology

Creating Breaking Ball Models

Right-Hand

term	estimate	std.error	statistic	p.value
(Intercept)	-1.201	0.736	-1.631	0.103
release_speed	0.016	0.008	1.867	0.062
hor_break	0.016	0.007	2.210	0.027
ind_vert_break	0.004	0.005	0.716	0.474
mean_centered_spinrate	0.001	0.000	2.344	0.019

term	estimate	std.error	statistic	p.value
(Intercept)	0.2447	0.0356	6.8647	0.0000
ind_vert_break	0.0047	0.0051	0.9272	0.3538
mean_centered_spinrate	0.0006	0.0003	2.0722	0.0382

Left-Hand

term	estimate	std.error	statistic	p.value
(Intercept)	0.922	1.049	0.879	0.379
release_speed	-0.009	0.012	-0.745	0.456
hor_break	-0.015	0.007	-2.033	0.042
ind_vert_break	0.020	0.007	2.661	0.008
mean_centered_spinrate	0.000	0.000	0.754	0.451

Creating Change Up Models

Right-Handed

term	estimate	std.error	statistic	p.value
(Intercept)	-0.6875	1.1501	-0.5978	0.5500
release_speed	0.0122	0.0135	0.9104	0.3626
hor_break	0.0173	0.0120	1.4429	0.1491

term	estimate	std.error	statistic	p.value
ind_vert_break	-0.0058	0.0095	-0.6143	0.5390
mean_centered_spinrate	-0.0006	0.0003	-1.9627	0.0497

Left-Handed

term	estimate	std.error	statistic	p.value
(Intercept)	0.673	1.155	0.583	0.560
release_speed	-0.008	0.013	-0.606	0.544
hor_break	0.008	0.011	0.688	0.491
ind_vert_break	0.001	0.009	0.143	0.886
mean_centered_spinrate	0.000	0.000	-0.320	0.749

Creating RH Fastball Models

RH Sinker

term	estimate	std.error	statistic	p.value
(Intercept)	-0.327	1.937	-0.169	0.866
release_speed	0.000	0.021	0.009	0.992
hor_break	-0.048	0.019	-2.490	0.013
ind_vert_break	-0.008	0.012	-0.685	0.493
mean_centered_spinrate	0.000	0.001	-0.024	0.981

RH 4-Seam Fastball

term	estimate	std.error	statistic	p.value
(Intercept)	-2.192	1.217	-1.801	0.072
release_speed	0.012	0.014	0.876	0.381
hor_break	-0.009	0.008	-1.056	0.291
ind_vert_break	0.019	0.009	2.087	0.037
release_spin_rate	0.000	0.000	2.344	0.019

term	estimate	std.error	statistic	p.value
(Intercept)	0.0167	0.1418	0.1181	0.9060
ind_vert_break	0.0260	0.0086	3.0180	0.0025

```
## # A tibble: 3,739 x 98
## # Groups:   player_name [345]
##   pitch_type game_date release_speed release_pos_x release_pos_z player_name
##   <chr>      <date>         <dbl>         <dbl>         <dbl> <chr>
## 1 FF        2022-06-04         95.1         -1.45          5.66 Wick, Rowan
## 2 FF        2022-06-04         95.3         -1.26          5.81 Wick, Rowan
## 3 FF        2022-06-04         95.4         -1.33          5.73 Wick, Rowan
## 4 FF        2022-06-04         95.7         -1.18          5.82 Wick, Rowan
## 5 FF        2022-06-04         82.7         -4.3           1.14 Rogers, Tyler
```

```
## 6 FF      2022-06-04      95.2      -3.06      5.76 Strickland, ~
## 7 FF      2022-06-04      95.4      -3.05      5.76 Strickland, ~
## 8 FF      2022-06-04      97       -1.33      5.76 Wick, Rowan
## 9 FF      2022-06-04      95.7      -3.03      5.9  Strickland, ~
## 10 FF     2022-06-04      94.6      -2.57      6.17 Markel, Park~
## # ... with 3,729 more rows, and 92 more variables: batter <dbl>,
## #   pitcher...8 <dbl>, events <chr>, description <chr>, spin_dir <lgl>,
## #   spin_rate_deprecated <lgl>, break_angle_deprecated <lgl>,
## #   break_length_deprecated <lgl>, zone <dbl>, des <chr>, game_type <chr>,
## #   stand <chr>, p_throws <chr>, home_team <chr>, away_team <chr>, type <chr>,
## #   hit_location <dbl>, bb_type <chr>, balls <dbl>, strikes <dbl>,
## #   game_year <dbl>, pfx_x <dbl>, pfx_z <dbl>, plate_x <dbl>, ...
```

RH Cutter

term	estimate	std.error	statistic	p.value
(Intercept)	-3.259	1.771	-1.840	0.066
release_speed	0.040	0.020	2.001	0.045
hor_break	0.050	0.019	2.572	0.010
ind_vert_break	-0.012	0.017	-0.694	0.488
mean_centered_axis	0.002	0.006	0.284	0.776

Creating LH Fastball Models

LH Sinker

term	estimate	std.error	statistic	p.value
(Intercept)	-0.176	1.488	-0.118	0.906
release_speed	0.003	0.016	0.175	0.861
hor_break	0.013	0.015	0.870	0.384
ind_vert_break	0.011	0.011	1.036	0.300
mean_centered_axis	-0.002	0.004	-0.369	0.712

LH 4-Seam Fastball

term	estimate	std.error	statistic	p.value
(Intercept)	-0.744	1.117	-0.666	0.505
release_speed	0.008	0.012	0.690	0.490
hor_break	-0.007	0.008	-0.908	0.364
ind_vert_break	0.025	0.011	2.216	0.027
mean_centered_axis	0.003	0.003	0.758	0.449

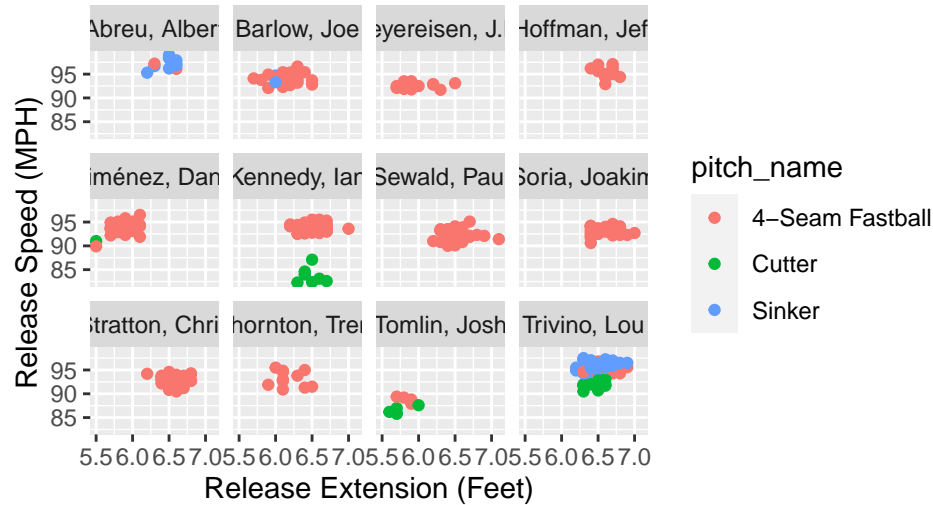
LH Cutter

term	estimate	std.error	statistic	p.value
(Intercept)	0.451	3.489	0.129	0.897
release_speed	-0.001	0.040	-0.033	0.973
hor_break	-0.078	0.037	-2.105	0.035

term	estimate	std.error	statistic	p.value
ind_vert_break	-0.012	0.027	-0.449	0.653
mean_centered_axis	0.003	0.003	1.107	0.268

Appendix

Inconclusive Evidence of Righty Extension/Speed Relatic



Inconclusive Evidence of Lefty Extension/Speed Relatio

