Better indicator of success: Exit Velocity vs. Launch Angle

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Introduction

In the new age of advanced metrics in baseball, "exit velocity" and "launch angle" are two terms that have become quite popular. Exit velocity measures the speed of the ball as it comes off the bat right after contact. Launch angle represents the vertical angle at which the ball leaves a player's bat after contact. These two things work together of course, as a combination of the ideal exit velocity and launch angle is expected to produce the best possible outcome. It is very difficult to connect with this ideal combination on a consistent bases. So the question is, which quality in a player is a better indicator for success? Does success correlate more with the high exit velocity or with the more ideal launch angle?

Data

The data to be used for this case study will be strictly MLB player statistics. The main goal is to use current player performance as the model for our analysis. MLB is considered the highest level of competitive baseball. A study using MLB will allow for more consistent results as the playing field is more competitively balanced. www.Baseballsavant.mlb.com will be the main source for data. www.Baseballsavant.mlb.com boasts an extensive database with all the advanced statistics that will be needed for this case study. For the purposes of this study we will be using slugging percentage as our indicator of success.

```
library(tidyverse)
```

Importing packages

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.6     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.1     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(lubridate)
```

```
##
## Attaching package: 'lubridate'

## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(ggplot2)
library(dplyr)
library(knitr)
```

```
bs_stats <- read.csv('~/desktop/Case Study 1/stats_complete.csv')
head(bs_stats)
```

Importing the data

```
##     last_name first_name player_id year player_age b_ab b_total_pa b_total_hits
## 1    Martinez     Victor    400121 2018         39  467        508          117
## 2       Mauer        Joe    408045 2018         35  486        543          137
## 3        Choo   Shin-Soo    425783 2018         35  560        665          148
## 4      Molina     Yadier    425877 2018         35  459        503          120
## 5 Encarnacion      Edwin    429665 2018         35  500        579          123
## 6       Jones       Adam    430945 2018         32  580        613          163
##   b_single b_double b_triple b_home_run b_strikeout b_walk b_k_percent
## 1       87       21        0          9          49     32         9.6
## 2      103       27        1          6          86     51        15.8
## 3       96       30        1         21         156     92        23.5
## 4       80       20        0         20          66     29        13.1
## 5       74       16        1         32         132     63        22.8
## 6      113       35        0         15          93     24        15.2
##   b_bb_percent batting_avg slg_percent on_base_percent on_base_plus_slg
## 1          6.3       0.251       0.353           0.297            0.651
## 2          9.4       0.282       0.379           0.350            0.729
## 3         13.8       0.264       0.434           0.376            0.810
## 4          5.8       0.261       0.436           0.314            0.750
## 5         10.9       0.246       0.474           0.335            0.809
## 6          3.9       0.281       0.419           0.313            0.732
##   isolated_power b_rbi b_lob b_total_bases r_total_caught_stealing
## 1          0.103    54   249           165                      0
## 2          0.097    48   135           184                      1
## 3          0.170    62   197           243                      1
## 4          0.174    74   201           200                      3
## 5          0.228   107   248           237                      0
## 6          0.138    63   240           243                      1
##   r_total_stolen_base   xba  xslg  woba xwoba  xobp  xiso exit_velocity_avg
## 1                   0 0.266 0.406 0.281 0.313 0.314 0.140             87.8
## 2                   0 0.295 0.448 0.319 0.354 0.365 0.153             91.1
## 3                   6 0.250 0.464 0.355 0.362 0.365 0.214             89.3
## 4                   4 0.266 0.432 0.323 0.329 0.321 0.166             88.2
## 5                   3 0.245 0.479 0.346 0.356 0.341 0.234             89.9
```

```
## 6                   7 0.269 0.411 0.315 0.311 0.303 0.142             88.3
##   launch_angle_avg sweet_spot_percent barrel_batted_rate poorlyunder_percent
## 1             14.1               35.1                4.7                28.7
## 2              4.4               36.9                5.0                12.4
## 3              6.1               35.9               11.1                15.2
## 4             15.4               37.6                5.5                27.8
## 5             18.0               34.1               11.2                26.7
## 6             13.2               35.6                4.9                27.3
##   poorlytopped_percent poorlyweak_percent hard_hit_percent  X
## 1                 29.4                3.1             30.6 NA
## 2                 39.1                1.7             44.3 NA
## 3                 38.1                3.2             40.5 NA
## 4                 28.8                4.0             33.8 NA
## 5                 26.9                2.9             41.4 NA
## 6                 32.0                2.0             33.1 NA
```

```
bs_stats2 <- bs_stats %>%
  select('slg_percent', 'launch_angle_avg', 'exit_velocity_avg', 'xslg', 'barrel_batted_rate')
head(bs_stats2)
```

Clean to show relevant data

```
##   slg_percent launch_angle_avg exit_velocity_avg  xslg barrel_batted_rate
## 1       0.353             14.1              87.8 0.406                4.7
## 2       0.379              4.4              91.1 0.448                5.0
## 3       0.434              6.1              89.3 0.464               11.1
## 4       0.436             15.4              88.2 0.432                5.5
## 5       0.474             18.0              89.9 0.479               11.2
## 6       0.419             13.2              88.3 0.411                4.9
```

Visualize

```
slg_exit <- ggplot(bs_stats2, aes(x = slg_percent, y = exit_velocity_avg)) +
  geom_point(color='darkred') +
  geom_smooth(se = FALSE, color='blue')

slg_la <- ggplot(bs_stats2, aes(x = slg_percent, y = launch_angle_avg)) +
  geom_point(color='darkblue') +
  geom_smooth(se = FALSE, color='red')

xslg_exit <- ggplot(bs_stats2, aes(x = xslg, y = exit_velocity_avg)) +
  geom_point(color='darkred') +
  geom_smooth(se = FALSE, color='blue')

xslg_la <- ggplot(bs_stats2, aes(x = xslg, y = launch_angle_avg)) +
  geom_point(color='darkblue') +
  geom_smooth(se = FALSE, color='red')

library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
grid.arrange(slg_exit, slg_la, xslg_exit, xslg_la, nrow = 2)
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
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```

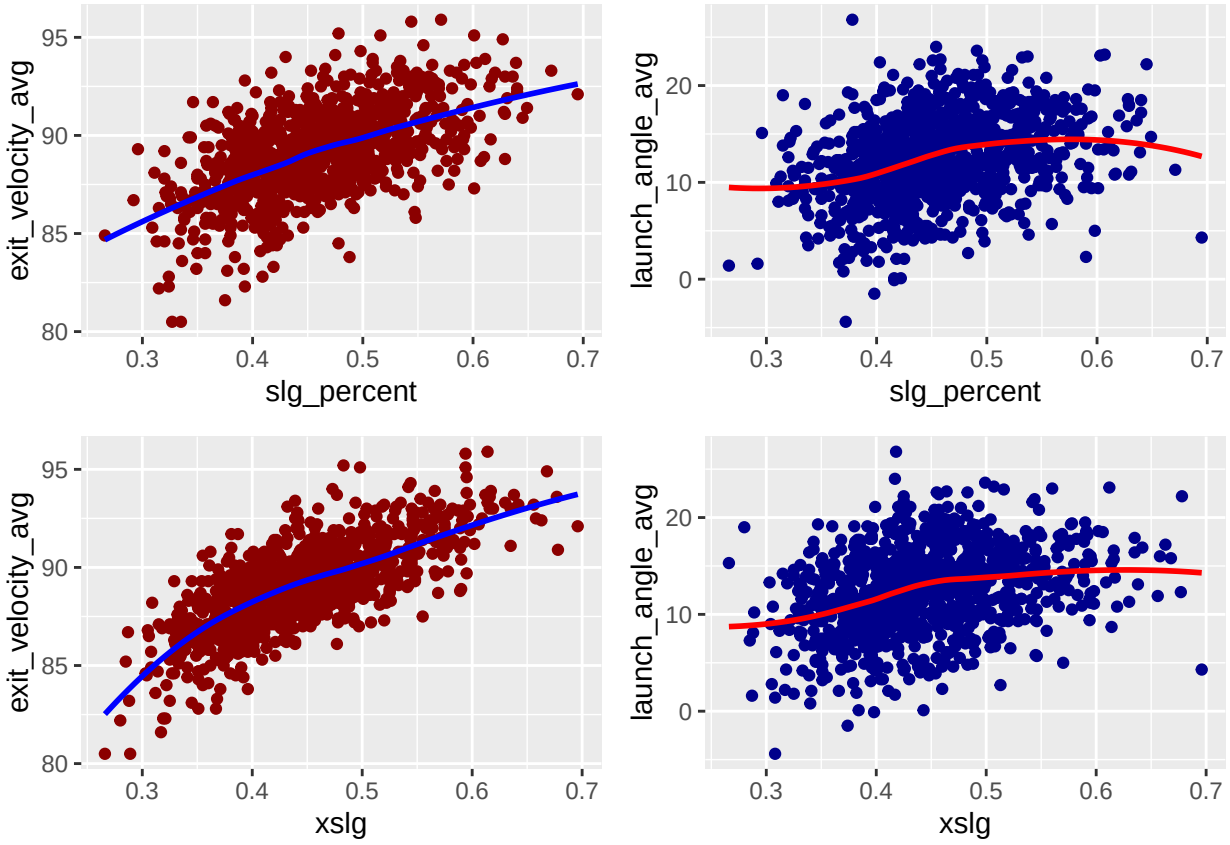

Analysis

We created four visualizations showing the correlations between each variable, exit velocity and launch angle, and slugging percentage and expected slugging percentage. These visuals clearly show a more direct, positive correlation between exit velocity and slugging percentage. The trend line on the launch angle data is more of a flat line showing less direct correlation between launch angle and slugging percentage. Using this information we can determine that when evaluating a player on a single variable, exit velocity is a more valuable indicator for success. What does this mean? By no means does the data indicate that launch angle

is not relevant. It does however show that prioritizing exit velocity in player development could produce better results. In conclusion, players who hit the ball harder on average have proven to be more productive hitters. Exit velocity should be at the top of the list when evaluating baseball hitters.

References

www.Baseballsavant.mlb.com