What Numbers Can Tell Us About Professional Cage Fighting (Mixed Martial Arts)

Reed Kuhn • www.fightnomics.com • Twitter @fightnomics
Evolution of (Combat) Sport

Agonistic Behavior
Evolution of (Combat) Sport
Evolution of (Combat) Sport
1-Minute MMA
Size Matters
The Reach Advantage
The Southpaw Advantage
The Youth Advantage
What Else is There?
Are Oddsmakers Accounting for All This?
Numbers? For cage fighting?! Surely you can’t be serious....

- I am serious.
- And don’t call me Shirley.

Ok. So what stats? Like the number of times a dude gets punched in the face?

- Well, yes, actually. But that’s 12 different variables...
- ..out of over a hundred!
Modern Mixed Martial Arts: The Evolution of Combat Sports

MMA = Striking + Grappling

- Boxing
- Wrestling
- Jiu Jitsu
- Kickboxing

Three ways to win:
- TKO/KO or Referee Stoppage
- Submission
- Judges Decision

Far From “No Holds Barred”

- Controlled Weight Classes
- Referees, Judges & Scoring
- Timed Rounds
- Variety of Rules & Violations
- Commissions for regulatory control and athlete testing
The Big Picture – How Do MMA Fights End?

How UFC Fights End

- KO/TKO/Stoppage: 39%
- Submission: 36%
- Decisions: 24%
- No Winners: 1%

N = 2,246

All UFC Fights 1993-April, 2013
Size Matters

Fightnomics: How UFC Fights End

Share of Total Fight Outcomes for Each Weight Class

“Finishes”
TKO/KO/Stoppages & Submissions

Decisions

N=1448 fights
Size Matters

Fightnomics: How UFC Fights End

Share of Total Fight Outcomes for Each Weight Class

TKO/KO/Stoppages
Submissions
Unanimous Decisions
Split/Majority Decisions

N=1448 fights
Size Matters: “Knockdown Rate”

Likelihood of Knockdown Per Landed Power Head Strike

*It’s not the “chin” that counts.*

- Fly, 125: 2.1%
- Bantam, 135: 3.0%
- Feather, 145: 3.2%
- Light, 155: 2.8%
- Welter, 170: 4.0%
- Middle, 185: 4.7%
- Light Heavy, 205: 4.6%
- Heavy, 265: 6.1%

UFC Average Rate = 3.9%
FRANK MIR VS SHANE CARWIN

BORN

30

AGE

35

HEIGHT

6'3"

WEIGHT

265

REACH

79"

265

80"
UFC Arms Race

Average UFC Fighter Size by Division for Different Eras
Height and Reach in Inches

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UFC Arms Race

Average UFC Fighter Size by Division for Different Eras
Height and Reach in Inches

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Weighted Average UFC Size 2009-2013

Average Fighter Reach (Wingspan in Inches)

Average Fighter Height (Inches)
Win Rates by Reach Advantage
For Various Fight Position Profiles

Win Rate for Fighter with Reach Advantage

Reach Differential Category

Mostly Standing Fights Only
All UFC Fights
Mostly Grounded Fights Only

*Note: Eliminates Youth Advantage Effect
Win Rates by Reach Advantage
For Various Fight Position Profiles

- Mostly Standing Fights Only
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*Note: Eliminates Youth Advantage Effect
The Trouble with Lefties

- ~20% of UFC fighters are left handed (twice population rate)
- Disproportional share of Southpaws in Top 10 division rankings
- In head-to-head competition, Southpaws win a little more often than Orthodox fighters
- Consistent with other analysis
The Southpaw Advantage
Or… the “Contra-Southpaw Disadvantage”

Test of the Southpaw Advantage
Performance by Stance and Matchup Scenario (No Reach or Age Differentials)

<table>
<thead>
<tr>
<th>Stance Match Up</th>
<th>Same Stance</th>
<th>Mixed Stance Fight</th>
<th>Same Stance</th>
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</thead>
<tbody>
<tr>
<td>Performance Metric</td>
<td>Southpaw Fighters</td>
<td>Southpaw Fighters</td>
<td>Orthodox Fighters</td>
</tr>
<tr>
<td>Distance Head Jab Accuracy</td>
<td>28%</td>
<td>31%</td>
<td>27%</td>
</tr>
<tr>
<td>Distance Power Head Accuracy</td>
<td>24%</td>
<td>26%</td>
<td>22%</td>
</tr>
<tr>
<td>Distance Head Power Share</td>
<td>46%</td>
<td>55%</td>
<td>58%</td>
</tr>
<tr>
<td>Knockdown Rate</td>
<td>2.7%</td>
<td>3.0%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Total Standing Attempts/Min</td>
<td>6.3</td>
<td>4.9</td>
<td>4.7</td>
</tr>
<tr>
<td>Takedown Success Rate</td>
<td>33%</td>
<td>41%</td>
<td>38%</td>
</tr>
<tr>
<td>Ground Advances per Takedown</td>
<td>1.01</td>
<td>1.10</td>
<td>0.89</td>
</tr>
</tbody>
</table>

- Southpaws aren’t inherently superior fighters...
- ...but all fighters perform worse when facing Southpaws...
- ...even other Southpaws!
The Youth Advantage

FIGHTER AGE DIFFERENTIAL & WIN RATE; ISOLATED

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Win % of Younger Fighter

Age Differential Between Fighters in Years

UFC Only

WEC & Strikeforce

Younger Fighter by >4yrs Total UFC Win Rate = 59.5%
Getting Hit in the Head Sucks

Distance Power Head Strikes Absorbed Per Knockdown
By Age of Recipient

20’s Mean = 36.4
30’s Mean = 23.9
40’s Mean = 9.8

R² = 0.7846

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What Does the *Ultimate* Ultimate Fighter Look Like?
The Home-Field Advantage in Sports

- UFC - BRA: 74%
- MLS: 69%
- NBA: 61%
- NFL: 57%
- NHL: 56%
- UFC - CAN: 54%
- MLB: 54%
- UFC - GBR: 53%
- UFC - USA: 50%
- UFC - JPN: 46%
**Other Factors**

**Ring Rust: Fighter Layoffs & Returning Win Rate**

*By Period of Layoff*

![Graph showing win rate by period of layoff](image)

- **Ring Rust**: Fighter layoffs and returning win rate.
- **@fightnomics**

**Octagon Jitters:**
- Debuting fighters don’t fare as well.
- Even worse when debut is in a more important fight.

**Weigh-In Day:**
- Fighters who miss weight lose more often.
- Coming in under weight isn’t good either.
- The “extra pound” doesn’t matter.
Astrology of MMA: Pitting Zodiac Signs in a Cage Fight

Strong Signs:
- Aries
- Taurus
- Leo

Weak Signs:
- Virgo
- Pisces
- Aquarius

UFC Win Rate by Fighter Zodiac Sign

Strong Group vs Weak Group = 50%-50% win rate!
Physics and Gambling

1. Nothing is produced. The net effect is always Zero.

2. You’re always playing with a stacked deck. The longer you play, the more you’ll lose.

3. You can’t change the rules to level the playing field.
Oddsmakers are Good at Their Jobs

Actual UFC Win Rates by Odds Implied Win Rate

Matchups Since 2008

Bookmaker’s Margin

Implied Win Probability

Actual Win Rate

Underdogs  @fightnomics  Favorites

0-14%  Very Strong 15-24%
15-24%  Strong 25-34%
25-34%  Clear 30-39%
30-39%  Slight 40-45%
40-45%  Pick ’Em 45-50%
45-50%  Pick ’Em 50-55%
50-55%  Slight 55-60%
55-60%  Mild 61-65%
61-65%  Clear 66-70%
66-70%  Strong 71-75%
71-75%  Very Strong 76-85%
76-85%  Extreme 86-100%
We Can Look at Fighters in More Detail Than Ever Before
(with the help of numbers!)

<table>
<thead>
<tr>
<th>Fightnomics: Uber Tale of the Tape</th>
<th>Josh Koscheck</th>
<th>Tyron Woodley</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIO</strong></td>
<td></td>
<td></td>
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<tr>
<td>Last Fight Weight Class</td>
<td>WW</td>
<td>WW</td>
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<tr>
<td>Age at Fight Date</td>
<td>37.0</td>
<td>32.6</td>
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<tr>
<td>Height</td>
<td>70</td>
<td>69</td>
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<tr>
<td>Reach</td>
<td>73</td>
<td>73</td>
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<tr>
<td>Stance</td>
<td>Orthodox</td>
<td>Orthodox</td>
</tr>
<tr>
<td>Analyzed Minutes</td>
<td>225 Mins</td>
<td>110 Mins</td>
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<tr>
<td><strong>Standup Striking Offense</strong></td>
<td></td>
<td></td>
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<tr>
<td>Knockdown Ratio (Total Scored : Received)</td>
<td>4 : 6</td>
<td>5 : 1</td>
</tr>
<tr>
<td>Distance Knockdown Power</td>
<td>5.5%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Head Jab Accuracy</td>
<td>16%</td>
<td>36%</td>
</tr>
<tr>
<td>Head Power Accuracy</td>
<td>24%</td>
<td>30%</td>
</tr>
<tr>
<td>Total Standup Strike Ratio</td>
<td>0.7</td>
<td>0.7</td>
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<tr>
<td><strong>Striking Defense</strong></td>
<td></td>
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<tr>
<td>Total Head Strike Defense</td>
<td>76%</td>
<td>80%</td>
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<tr>
<td>Distance Knockdown Defense (&quot;Chin&quot;)</td>
<td>95%</td>
<td>100%</td>
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<tr>
<td><strong>Significant Striking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant Strikes Attempted per Minute</td>
<td>5.0</td>
<td>4.7</td>
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<tr>
<td>Significant Strike Accuracy</td>
<td>37%</td>
<td>57%</td>
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<tr>
<td><strong>Wrestling and Grappling</strong></td>
<td></td>
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</tr>
<tr>
<td>TD Atts per Min Standing/ Clinch</td>
<td>0.5</td>
<td>0.8</td>
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<tr>
<td>Takedown Accuracy</td>
<td>53%</td>
<td>42%</td>
</tr>
<tr>
<td>Opponent Takedown Atts</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>Takedown Defense</td>
<td>63%</td>
<td>94%</td>
</tr>
<tr>
<td>Share of Total Ground Time in Control</td>
<td>70%</td>
<td>89%</td>
</tr>
<tr>
<td>Sub Attempts per Trip to Ground</td>
<td>0.14</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Pick 'em Fight?
Are MMA gambling markets rational and efficient?

Hint: most bets are placed by humans. MMA fans, no less.

There are two rules for success...
1. Never reveal everything you know
Quantitative Evolution of MMA

Currently:
- Numbers already provide context - e.g., rankings, odds
- Numbers elucidate trends and drivers – improved understanding
- Gambling odds create a “game outside the game” - vested interest
- Live stats can highlight the “fight within the fight”
- Live stats are limited due to technology, but there’s hope
- Pre/Post fight analysis gives more fodder for debate and interaction

Future:
- Motion sensing and locational data – K Zone for MMA
- Accelerometers and pressure sensors – pitch speed for MMA collisions
- In-fight biometric data – measuring fitness and fatigue
Thank You

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Source data provided by:

FightMetric is the world’s only comprehensive mixed martial arts statistics system, and the official statistics provider of the UFC
Fight Metric created a system to measure everything in a MMA fight

**FightMetric Data**

### Striking
- **Position**: Distance, Clinch, Ground
- **Target**: Head, Body, Leg
- **Strength**: Power, Jab
- **Success**: Attempted/Landed

**Example Metrics** = “Standup Head Power Landed,” or “Ground Body Jab Attempted”

### Takedowns
- **Position**: Distance: Shooting, Clinch: Upper Body, Clinch: Lower Body
- **Success**: Attempts/Landed

### Grappling
- **Position Advances**: See Below
- **Submission Attempts**: By Type, Secured / Finished
  - Rear Naked Choke
  - Guillotine Choke
  - Triangle Choke
  - Arm Triangle Choke
  - Other Choke
  - Arm Bar
  - Shoulder Lock
  - Knee Bar
  - Ankle Lock
  - Other Lock

### Ground Position Advances:
- **Offense**:
  - Full Guard
  - To Half Guard
  - To Side Mount
  - To Full Mount
  - To Back Control

- **Defense**:
  - Full Guard
  - From Half Guard
  - From Side Mount
  - From Full Mount
  - From Back Control

**Additional Metrics**:
- Knockdowns by position (distance or clinch)
- Slams on takedown (by type of takedown)
- Ground Sweeps/Reversals
- Standups
- Time in Position
Not All Submissions Are Created Equal

UFC Submission Attempts & Success Rates
By Type, Per 15 Minute Fight

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Includes all UFC events 2007 - Q2 2012; totaling 1,318 fights and 26,258 fighter-minutes
Performance Stats Matter

Striking Assessment: UFC Middleweight Division

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Relative Size of Bubble Indicates Total Knockdowns per Landed Power Head Strike; Smallest Bubbles Indicate 0 Zuffa Knockdowns

Orthodox Stance Strikers

Southpaw or Switch Stance Strikers
What Happens When Fighters are Tired?

Leg triangle success rates go up in later rounds because the hold doesn’t require use of arms, and opponents may be too tired to defend
Performance Stats Matter

Hit & Don’t Be Hit: Striking Offense and Defense
Accuracy of Distance Power Head Strikes

- Good Accuracy, Good Defense
- Good Accuracy, Poor Defense
- Poor Accuracy, Good Defense
- Poor Accuracy, Poor Defense

Includes career metrics of fighters with >45 minutes of fight time
Struve: Kickboxer with 6’ 11” and 83” Reach
vs. Barry: Kickboxer with 5’11” and 74” Reach

Photo Credits: UFC.com, Tracy Lee
Anthropometrics

<table>
<thead>
<tr>
<th></th>
<th>RANDY COUTURE</th>
<th>VS</th>
<th>LYOTO MACHIDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>47</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>6'1&quot;</td>
<td>6'1&quot;</td>
<td></td>
</tr>
<tr>
<td>Reach</td>
<td>75&quot;</td>
<td>74&quot;</td>
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</tr>
<tr>
<td>Stance</td>
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<td>Southpaw</td>
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Historical Performance

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</thead>
<tbody>
<tr>
<td>Striking Accuracy</td>
<td>27%</td>
<td>40%</td>
<td></td>
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<tr>
<td>Striking Defense</td>
<td>35%</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>Takedown Accuracy</td>
<td>49%</td>
<td>63%</td>
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</tr>
<tr>
<td>Takedown Defense</td>
<td>59%</td>
<td>83%</td>
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</tr>
<tr>
<td>Knockdowns Scored</td>
<td>1</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Knockdowns Received</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
MMA is a weight controlled sport, but that doesn’t mean everyone is the same size.

Based on UFC active roster as of June 1, 2013