Paddy Power Risk Management

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Overview

- History of Paddy Power

- Risk Management in bookmaking

- A primer on Modelling Sports
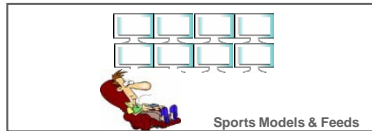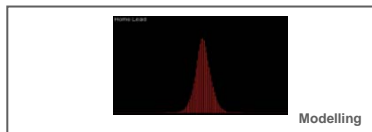
- Beating the Bookie
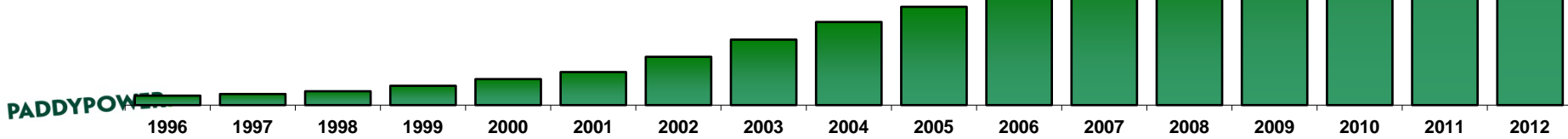
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History of Paddy Power Genesis

- **1988 Paddy Power was founded through the merging the shops of 3 Irish bookmakers: John Corcoran, David Power & Kenny O' Reilly**

- **Power bookmakers had a 100% clean record as being a reliable payer in the Irish market and this was the main reason for the name.**

  - "Paddy" was added to make it more Irish

  - Launched with a widely publicised payout limit of £100,000

  - They started with an 8% share of the Irish Market

- **From this Irish Retail base, through phone, online, mobile international expansion - Paddy Power has grown to be the world's biggest quoted bookmaker**

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History of Paddy Power
Building the Company

Racing as Major Focus

The Internet

Modelling

Geographical Expansion

Price Change Distribution

The Growth of Sports

Sports Models & Feeds

Recent Technical Leaps: Mobile; HPC; SPE

€5.7bn

85% of Turnover in Retail Estate

Targets Set on UK & Ireland

Automated Risk Management

Run Like a Bookmaker!

Sweating In Running

Chart years: 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012

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Before managing Risk
Paddy Power created lots of it!

- **Cheltenham 1993 – Champion Bumper**
  - "If an Irish trained horse wins the Bumper we'll double the SP". "Heist" was the Irish banker of the meeting at 2/1
- **Success! Queues snaked out the doors of the shops**
- **By Luck or by Genius – we escaped a very very large payout**
  - Heist led up the straight and was beaten into 2nd by half a length.
- **Out of sheer necessity the concept for Paddy Power Lucky Underpants was invented!**

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Building the Brand

Using some very big letters

Building the Brand

With the best team ever!

Risk Management in Paddy Power

- **In 2003 management took a decision to build a Risk management model based on a financial services skillset**

  - Bookmaking and Financial services Risk is similar but also really rather different!

- **This led to a trading floor in Paddy Power operated by PhDs, mathematicians, ex-bankers, actuarial graduates and a whole host of sports and racing fanatics!**

- **Staff numbers are over 150 including 40+ 'Quants'**

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It's Risk Jim ...but not as we know it

- **There are no standardised/market pricing models in the industry**

  - Prices have to be plucked from traders head or derived from an in-house model

  - We don't have Black-Scholes, duration, basis point sensitivities or any such

  - Sometimes we wish that sport was a simple Brownian motion with a bit of drift that could be valued in a Risk Neutral world ... but basketball players have other ideas!

- **Academia doesn't help the industry out here either**

  - Academics have a bet too!

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It's Risk Jim ...but not as we know it

- **Our customers often know more than the market maker – or at least something that the bookmaker doesn't**
  - Asymmetric information is generally not visible to the bookmaker. We have to listen and react in real time to their view on any particular market
  - Our prices depend both on our models/expertise as well as 'reading' what our customers opinions are through their betting volumes and patterns
  - Unfortunately filtering out what your customers know is not as not as easy as reading the volumes of money

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It's Risk Jim ...but not as we know it

- **Transaction levels mirror those of a decent sized investment bank**
  - The trade counts are very similar
  - The ticket size is a good deal smaller!
- **Online Bookmaking is more 'Amazon' than 'AIB'**
  - Our inventory can amount to circa. half a million different betting opportunities on offer at any point in time
  - Amazon constantly re-prices it's inventory - Paddy Power re-prices much of it every second
  - Our real time pricing software similar to what most banks would run overnight.

It's Risk Jim ...but not as we know it

- **Finally we get a break relative to banking…**
  - Bookmaking, unlike financial markets, suffers very little from correlation or contagion effects - all *games* are independent!
  - Great…. but then we don't get the nights/weekends off to update our software, run our reports and get some sleep

- **Capital Adequacy is replaced by individual event limits**
  - Event and market limits are set to control spikes in exposure. Pricing is available to trade on almost all our open positions at all times and our market position crystalizes within a few short hours

- **It's a beautifully very transparent world to be operating in**

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It's Risk Jim ...but not as we know it

- **We're not paranoid but sometimes everyone is out to get us!**
  - Time/Rule/Strategy/Equipment changes all cost us money if we don't spot them
- **We use the same skillsets as banking – but use them in a very different way.**
  - We don't make big bets we just make lots and lots of small ones
  - If we are good at our job we can extract a positive margin on a sequence of unrelated events
  - When we make a mistake our customers tell us quickly by dipping their hand in the till - so we get a chance to learn and ensure it never happens again!

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When is Margin not really Margin?

- **Margin is only really margin if you apply it to the right probability!**

- **Flick of a fair coin - 50% probability for both Heads & Tails**
  - **Bookmaker offers 9/10 each side**
  - **Bookmaker's 'overrround' = sum(1/(1+odds)) = <u>105.26%</u>**
  - **Expected profit for bookmaker = 1 – (1+ 9/10) * 50% = 5%**

- **If the we got it wrong and it's 60% probability of Heads**
  - **Bookmaker's 'overrround' = sum(1/(1+odds)) = <u>105.26%</u>**
  - **Expected 'Heads' profit = 1 – (1+ 9/10) * 60% = -14%**
  - **Expected 'Tails' profit = 1 – (1+ 9/10) * 40% = 24%**

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Risk Management - Sports Models

- **To ascertain the correct probabilities Paddy Power's Quants pricing team is charged with producing pricing models for all sports**
  - Racing, Soccer, Tennis, Basketball etc. etc. etc.

- **Integrated into an expert systems these models:**
  - Remove subjectivity from pricing - smoothing achieved margin
  - Create scale by increasing quantity of games that can be traded simultaneously and the quantity of betting propositions within each of those games

- **Sounds easy – but writing and implementing models isn't trivial and relies on high performance parallel computing and significant brains!**

Risk Management – Market Models

- **Arriving at our own price in only half the battle!**
  - We can't be so arrogant to think we always have it right
  - Self doubt is very valuable when dealing with asymmetric information – as is a knowledge of <u>submarines</u>!

- **Customers and other market participants betting activity and price movements contain significant 'hidden' information**

- **Working with the traders Quants have developed a suite of models and trading tools have been development to monitor, assimilate and act upon a huge volume of information in real time**

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Risk Management – Submarines

- **Whether it be popping up when they least expect it to keeping the head down when keeping the head down is the thing to do:**
  - **Bookmakers have lot to learn from submarines!**
- **1968: The search for the USS Scorpion**
  - **"Bayesian Mathematics works!"**
- **1970: The search for a Soviet undersea telephone cable connecting Petropavlovsk to the Russian mainland across the Sea of Okhotsk**
  - **"Mathematics may work – but don't overcomplicate it"**
- **There are a lot of 'undersea' invisible perils!**
  - **"On the surface of it" …**

A Primer on Modelling Sports

- **For very good reasons those who have a decent sports model don't tend to share it with the world – they bet it instead!**

- **Modelling a sport involves blending:**
    - **As much data as you can get your hands on**
    - **Rules of the game**
    - **Models of the <u>psychology</u> of the players/officials**
    - **Models of player fatigue**
    - **Advanced statistical models and distributions**

Modelling Sports– Psychology?

- **Imagine tennis match where any two equal players are pitted against each other**
  - The win probability of the first set is 50% for each player
- **After the first set one player is now ahead**
  - Are the probabilities for each player for the second set still 50%?
- **In a rare piece of published work two TCD academics showed it wasn't!**
  - David Jackson/Krizysztof Mosurski (2005) published an article entitled "Heavy Defeats in Tennis: Psychological Momentum or Random Effect"
- **It turns out – getting walloped in the first two sets significantly impacts your desire to win (and perhaps your ability to play!)**

Modelling Sports – Soccer

- Soccer, a large component of our turnover, has, on and off, exercised our modellers' brains for several years.

- Most modelling of sports begins with a little charting to get a feel for the game dynamics. For example, in soccer, a chart of goals against time shows that the game scoring rate evolves throughout the game – with a notable time varying impact

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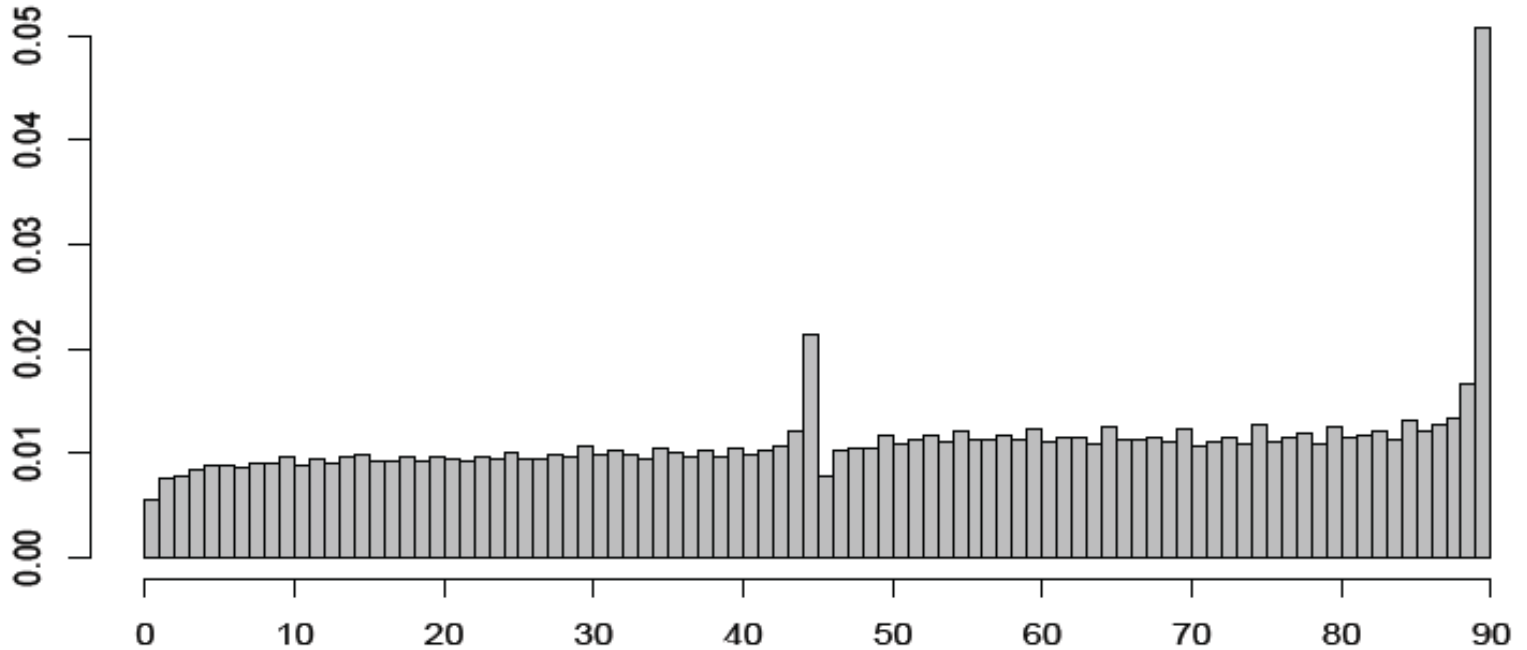
Modelling Sports – Soccer

Sports Models – Soccer

- **Scores (in aggregate) appear to increase with time**

- **An analyses of the results from the same matches shows that there are also far too many draws for the scoring rates to be independently distributed**

  - This is true for most sports! A force, called colloquially in Paddy Power, "bouncebackability" pulls the teams back together

- **The work of Dixon (et al.) proposed that scoring rates in soccer could be modelled with a time-dependent piecewise constant poisson distribution of scoring rates**

Modelling Sports – Soccer

- **To price more esoteric derivative markets and to stay ahead of customers and competitors - models have to be significantly more complex than anything available in the public domain**
  - Corners
  - Yellow and red cards
  - Impact of two-legged and knock-out competitions
  - Impact of injury and extra time
  - Impact of relative strength of the teams
  - Many other, less obvious, effects – right down to crowd attendance!

Beating the Bookie

- **It still can be done but work very hard to make it a somewhat more difficult with Paddy Power!**
  - Old School
    - Singles vs Multiples
    - Short prices
    - Spotting mistakes
    - Bad E/W – very common (especially multiples)
  - Automated Arbitrage
  - Plain Hard Work - Become a specialist in a niche sport/market

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The End of the Beginning

(so many)

Questions

THANK YOU
Rob Reck

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