



# OPTIMISATION IN CREDIT

WHERE CAN OPTIMISATION HELP YOU MAKE BETTER DECISIONS  
AND BOOST PROFITABILITY

**CSCC XIII**

**Martin Benson**

**Jaywing**

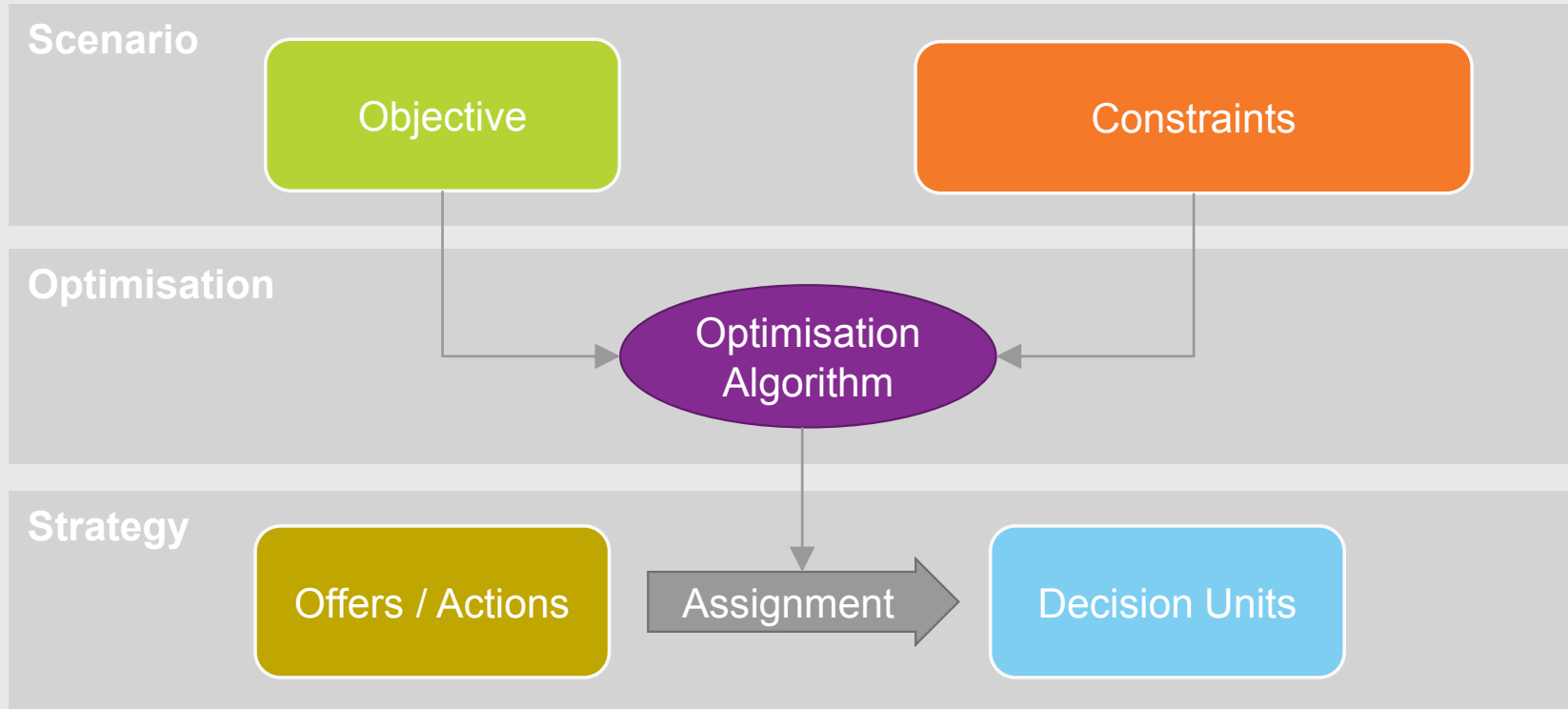


# Many business problems that arise in credit management can be tackled through constrained optimisation

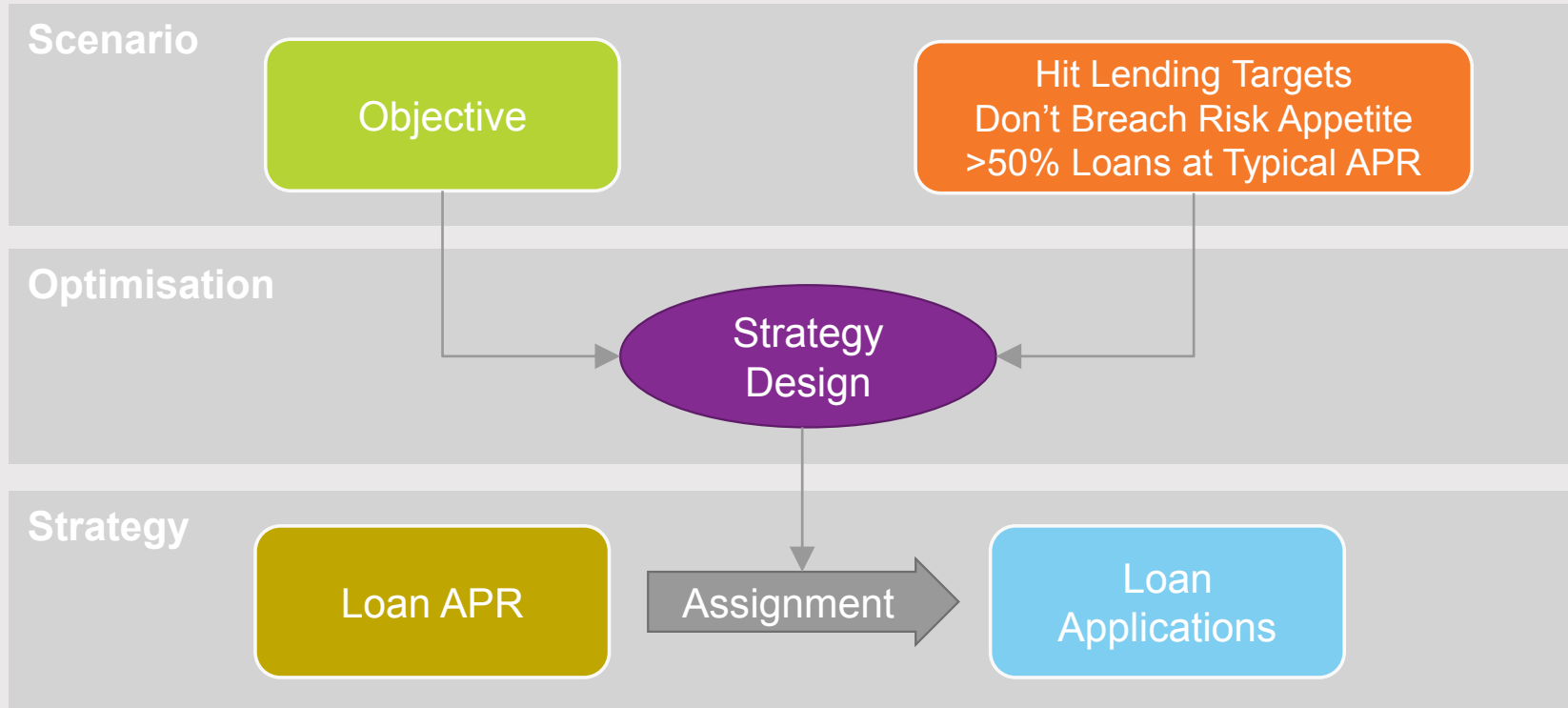
*“How can I assign loan prices to applications in a way that maximises profitability, but subject to meeting targets for lending and losses and being compliant with advertising regulation?”*

*“How can I assign customers to collections strategies in a way that maximises cash collected but subject to operational constraints?”*

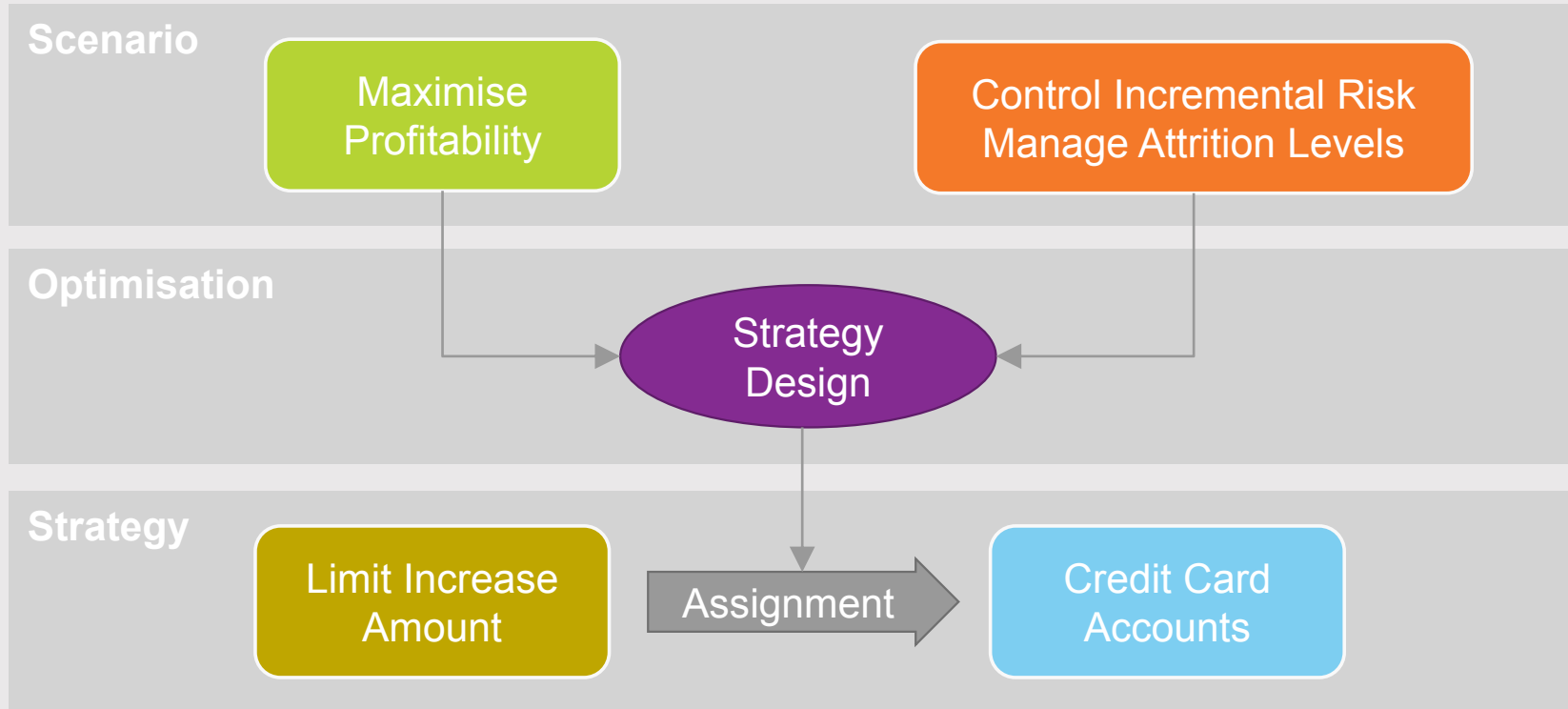
# General Decision Optimisation



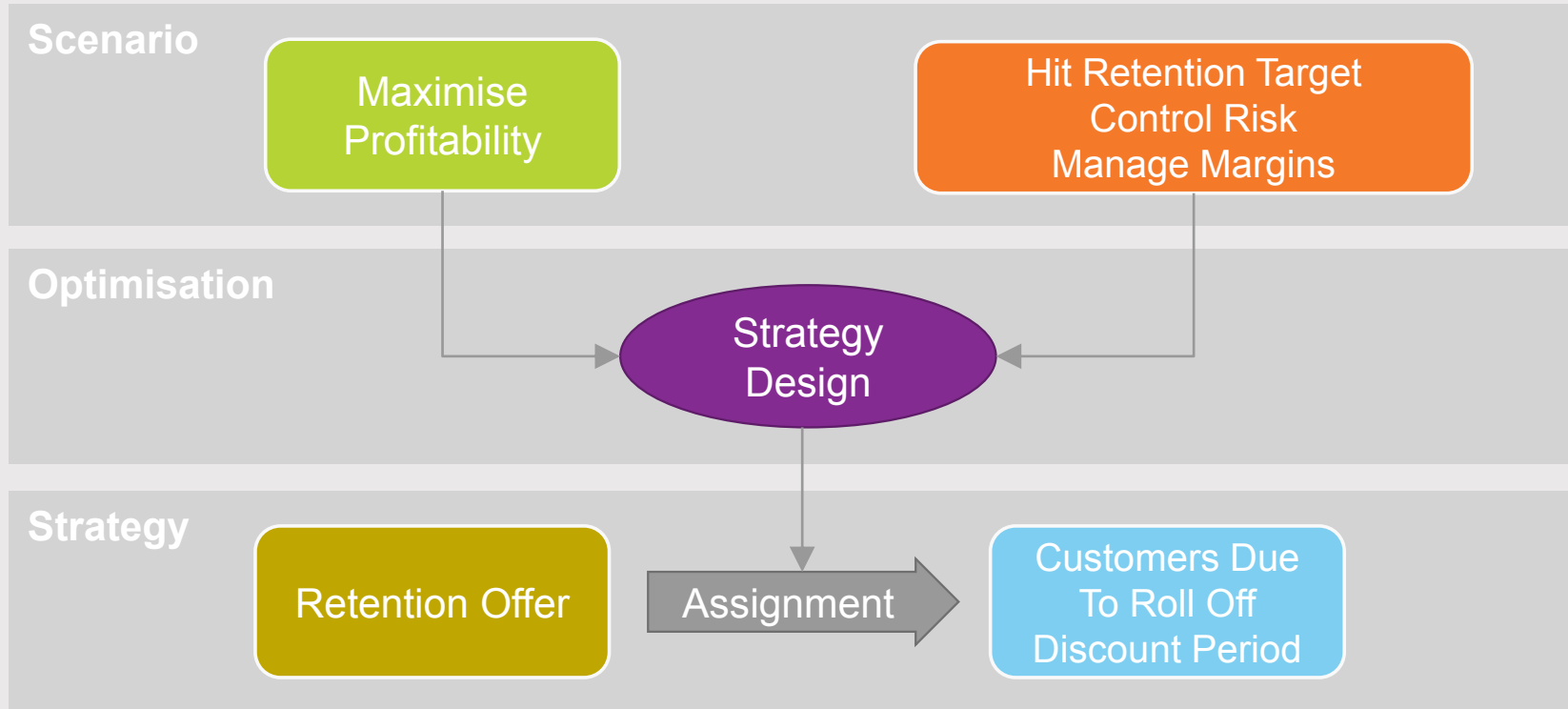
# Loan Pricing



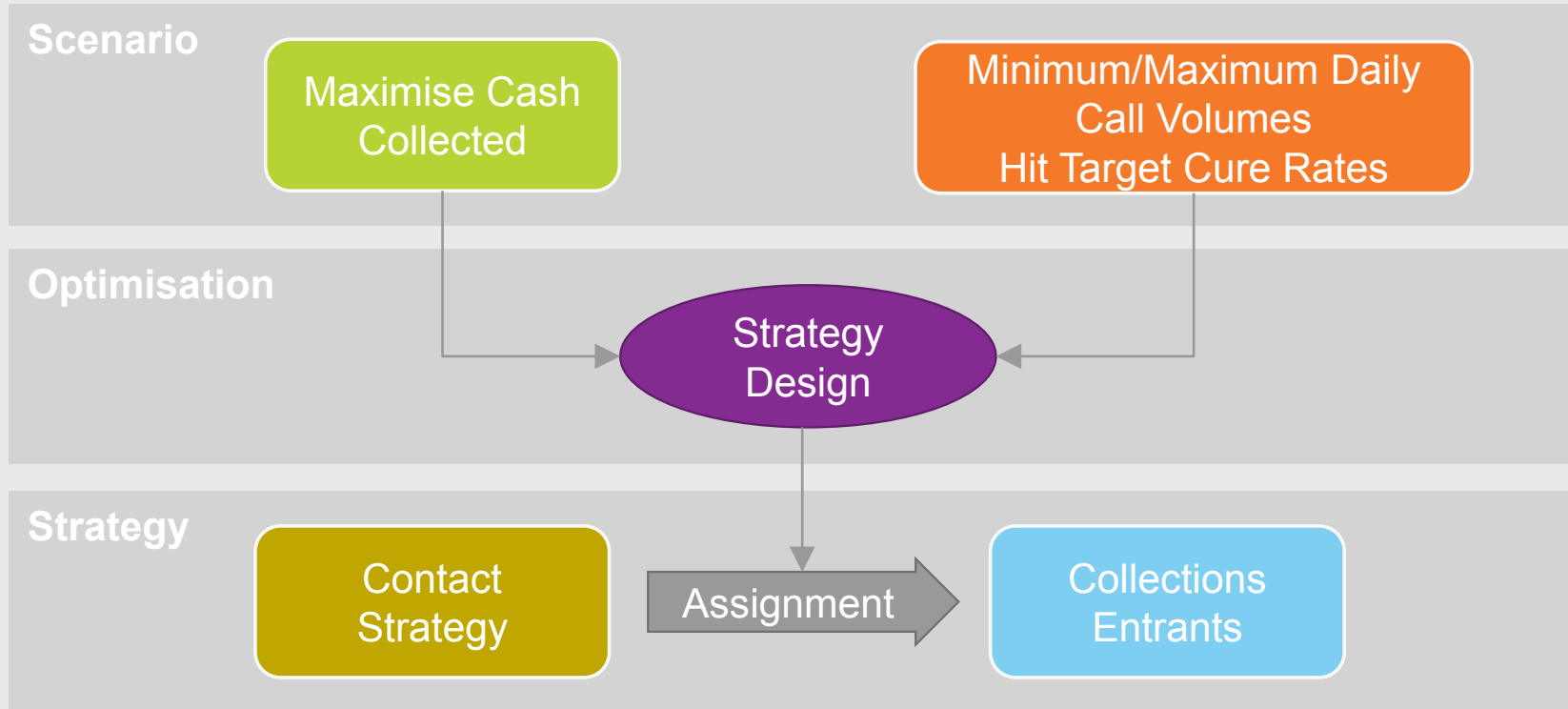
# Credit Card Limit Strategy



# Pro-active Retention (Mortgages & CCs)



# Collections Entry Streaming



# Benefits of optimisation



Optimisation is proven to return higher portfolio profitability than more traditional techniques, across a range of industries and use cases. It is the current state-of-the art in strategy design.





# SOLVING OPTIMISATION PROBLEMS

# The Maths of Optimisation



Maximise

$$\max_{\vec{o} \in O} f(\vec{o})$$

some function

Subject to

over all possible parameter values

$$c_i(\vec{o}) \geq v_i \quad i = 1, \dots$$

subject to a set of constraints

# Solving is difficult in general

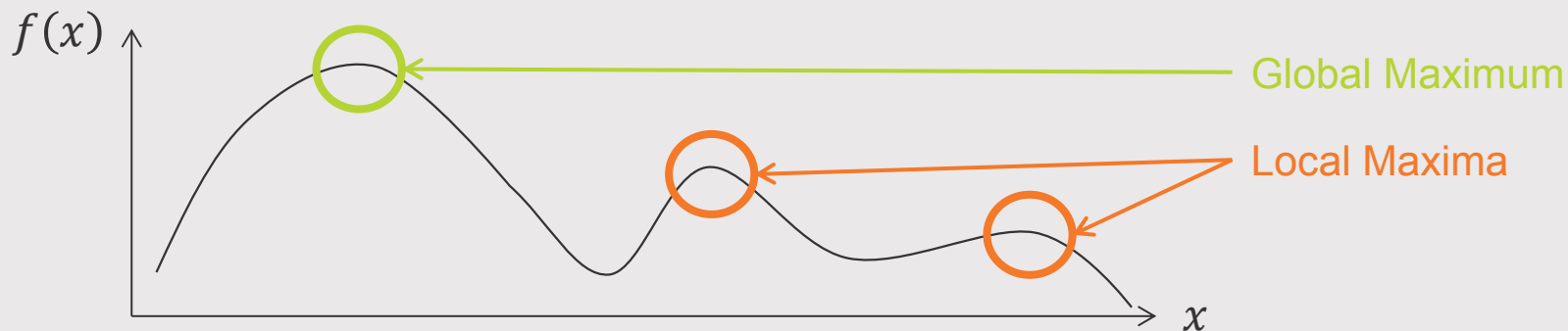


$$\max_{\vec{o} \in O} f(\vec{o})$$

Subject to

$$c_k(\vec{o}) \geq v_k \quad (k = 1, \dots)$$

- General solution techniques exist:
  - Gradient methods
  - Nelder-Mead algorithm
  - Genetic algorithms, etc.
- But, they converge to local maxima, not global maximum (if they converge at all).



# Tractable formulation of decision problems



$$\max_{[o_{i,j}] \in \{0,1\}^{I \times J}} \sum_{i \in I} \sum_{j \in J} o_{i,j} f_{i,j}$$

Subject to

$$\sum_{i \in I} \sum_{j \in J} o_{i,j} c_{i,j,k} \quad (k = 1, \dots)$$

For each decision unit (enumerated by  $I$ ), should you make a particular offer (enumerated by  $J$ ): yes=1 no=0

The optimisation goal is a sum of contribution values, each corresponding to assignment of an offer to a decision unit

Also, assume that all constraints are linear in  $[o_{i,j}]$

# Tractable but not trivial!



$$\max_{[o_{i,j}] \in \{0,1\}^{I \times J}} \sum_{\substack{i \in I \\ j \in J}} o_{i,j} f_{i,j}$$

Subject to

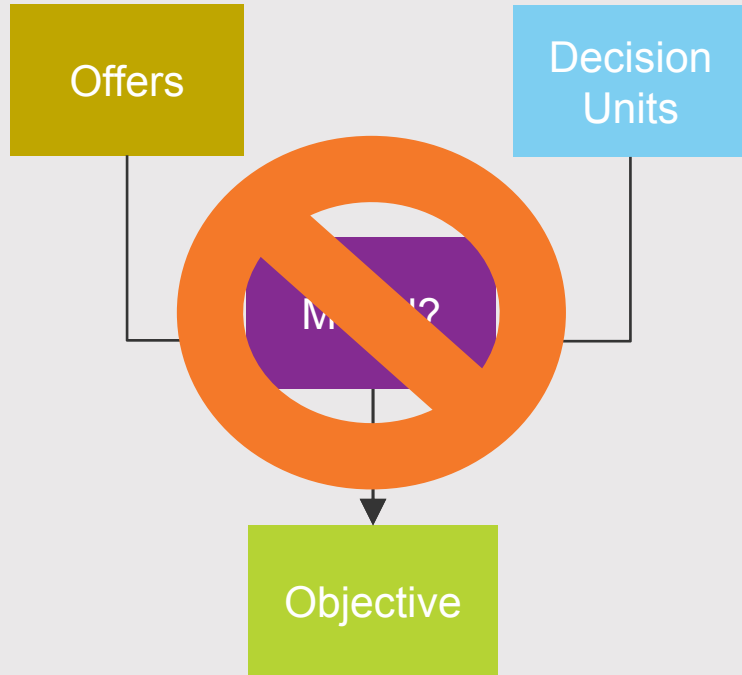
$$\sum_{\substack{i \in I \\ j \in J}} o_{i,j} c_{i,j,k} \quad (k = 1, \dots)$$

- Binary Integer Program - convergence to global optimum is guaranteed...eventually
- Still difficult - BIPs are NP-complete
- Most statistical software packages can solve BIPs using generic algorithms, but may take a very long time, even for small problems
- However, use of proprietary heuristic algorithms can enable even large problems to be solved quickly



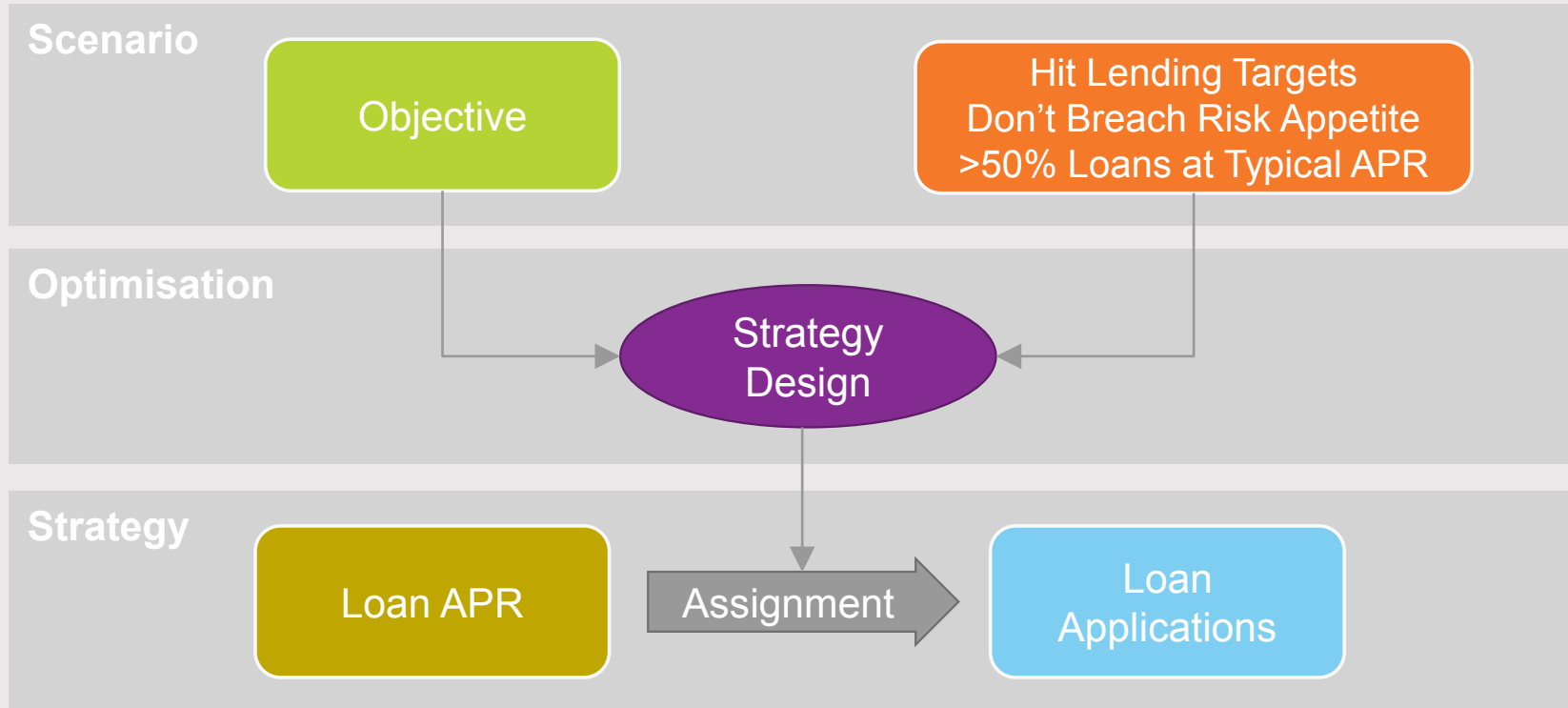
# PREDICTIVE MODELS

# Modelling requirement

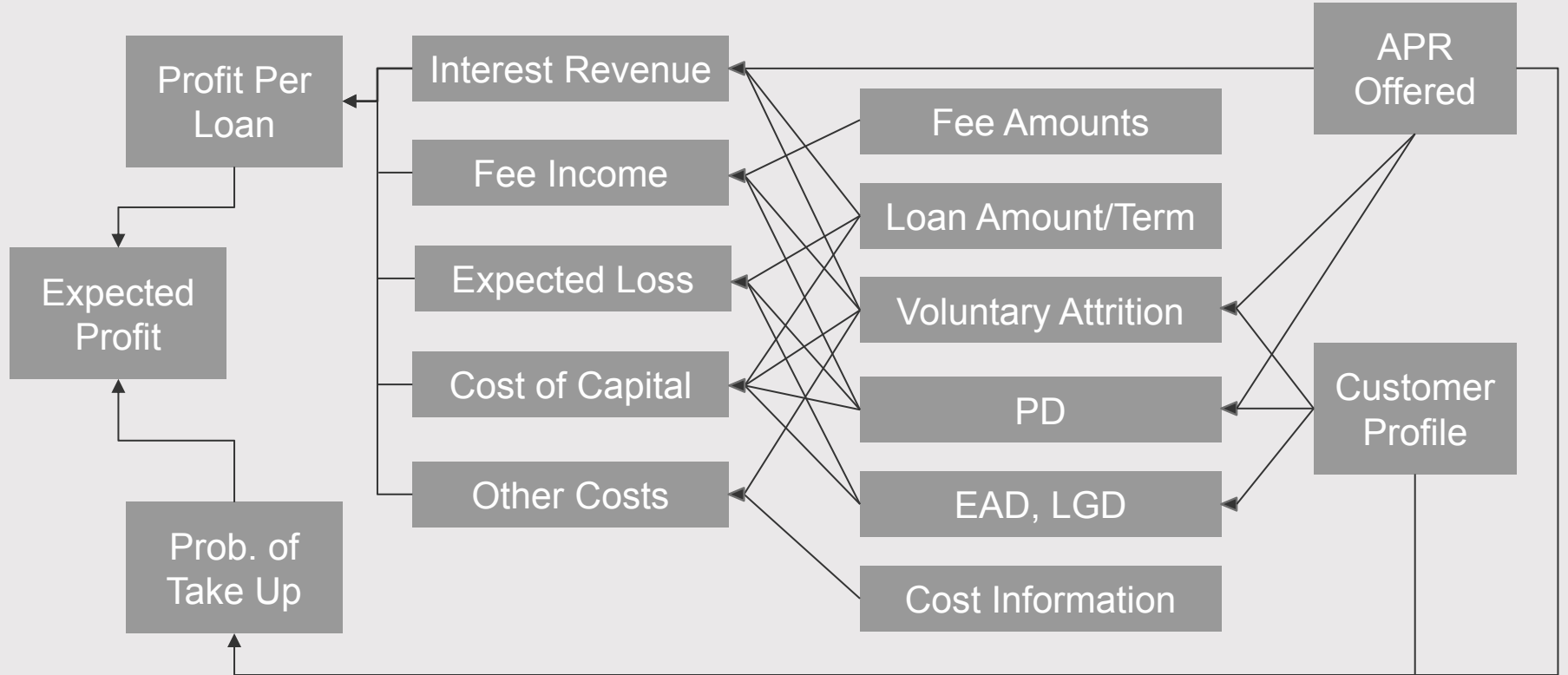


- A key requirement for optimisation is the ability to predict objective values for every decision unit, for every offer
- Could attempt to model the relationship directly...
- ...but it's not a good idea! Too many moving parts in the middle. Instead...

# Loan Pricing example



# Profitability map





Offers

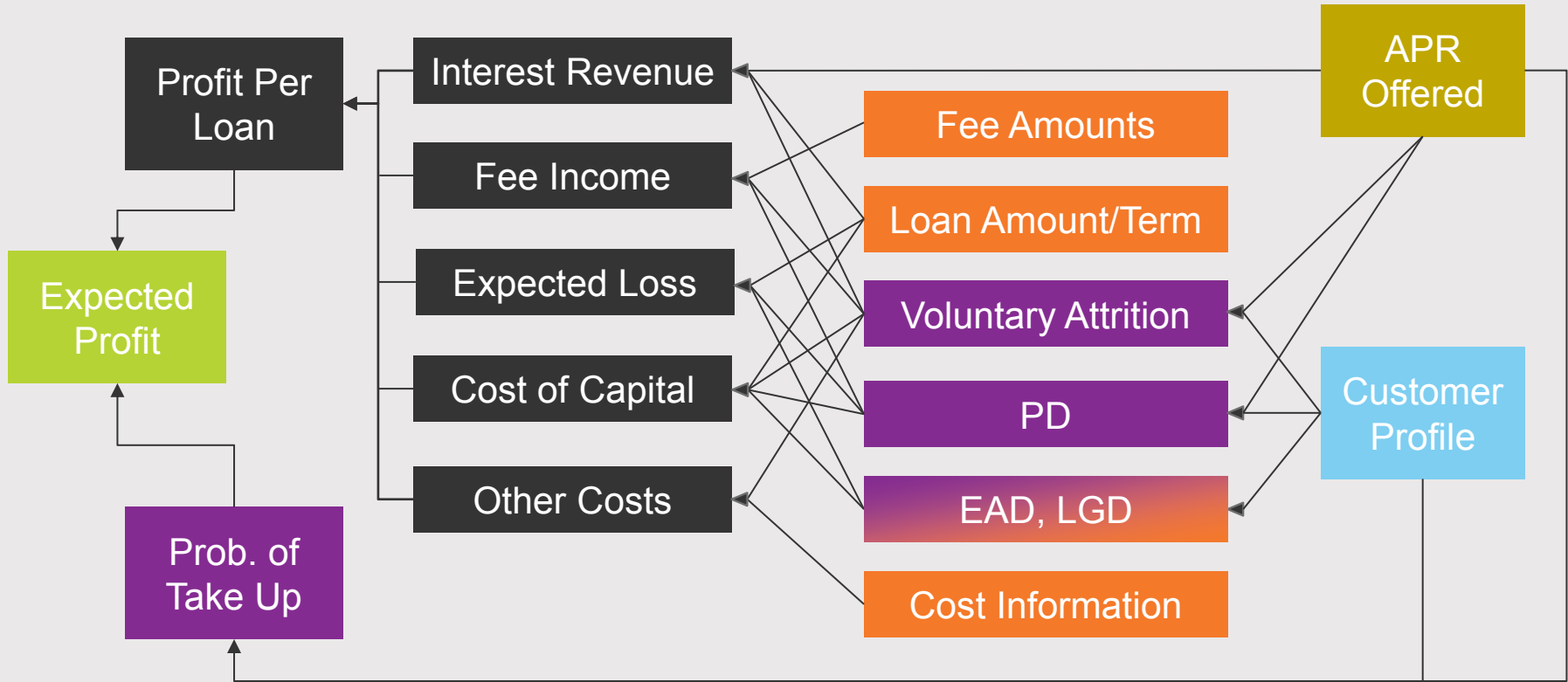
Decision Units

Objective

Regression Model

Parameter

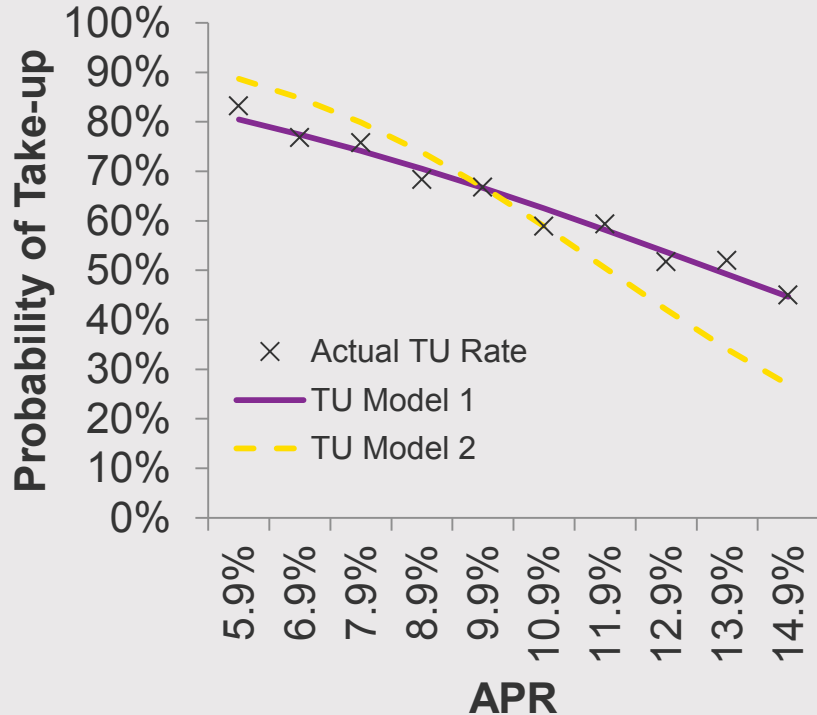
Derived



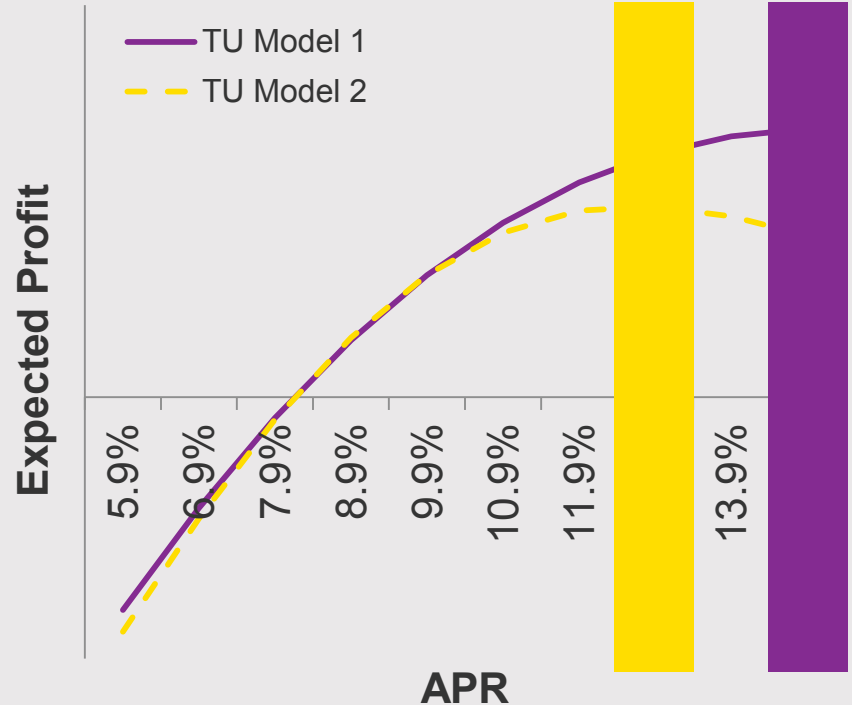
# Model errors drive decision errors



## Errors in predictive models...



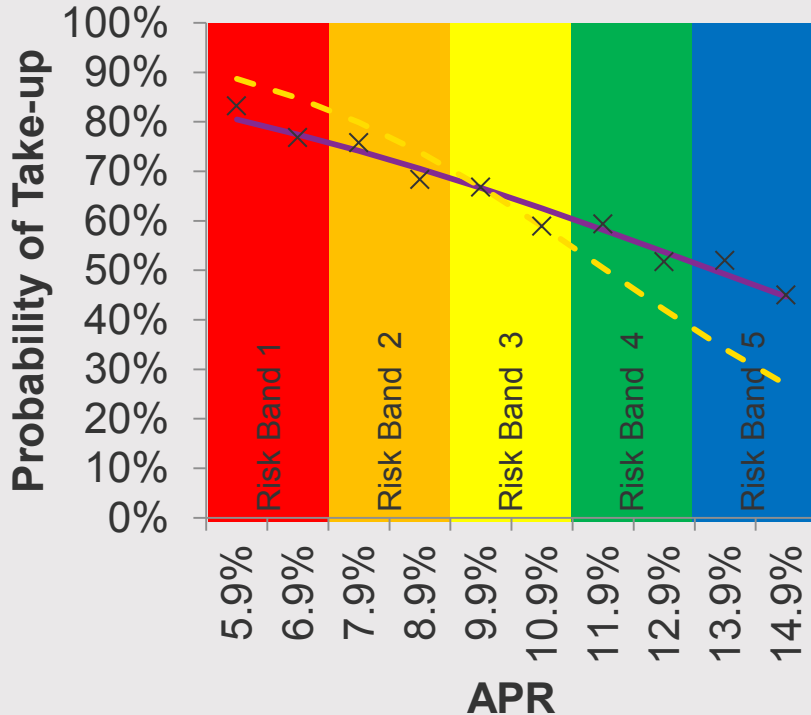
## ...generate sub-optimal decisions



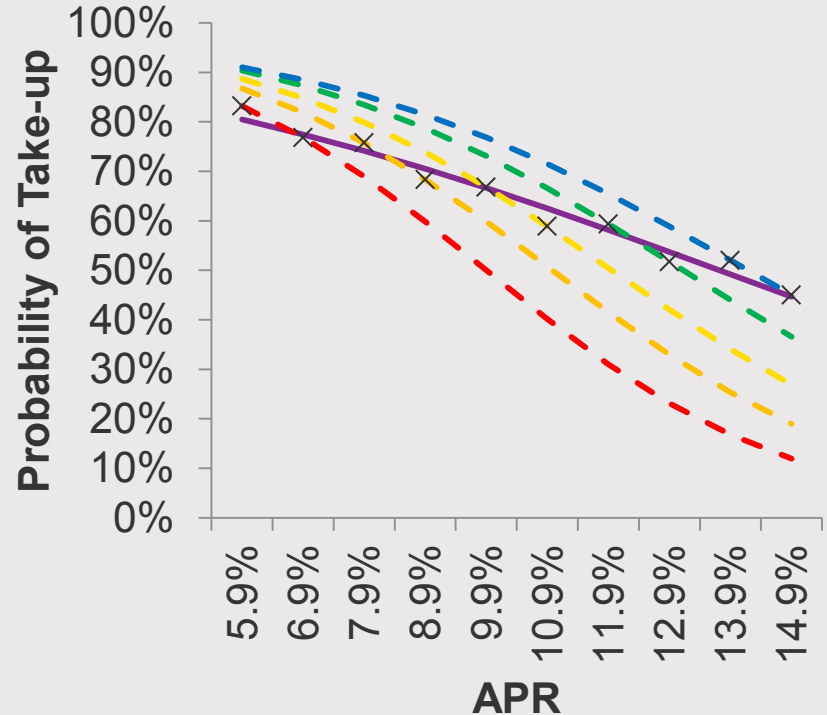
# Historic strategy can create modelling challenges



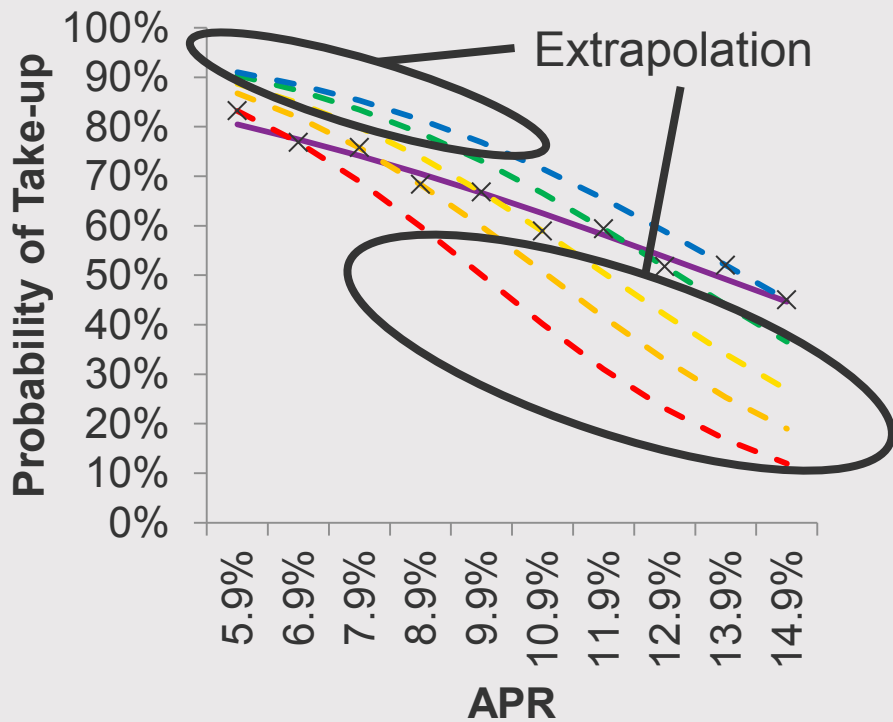
Historic strategy may confound data...



...Masking true offer impacts



# Extrapolation potentially drives under-performance



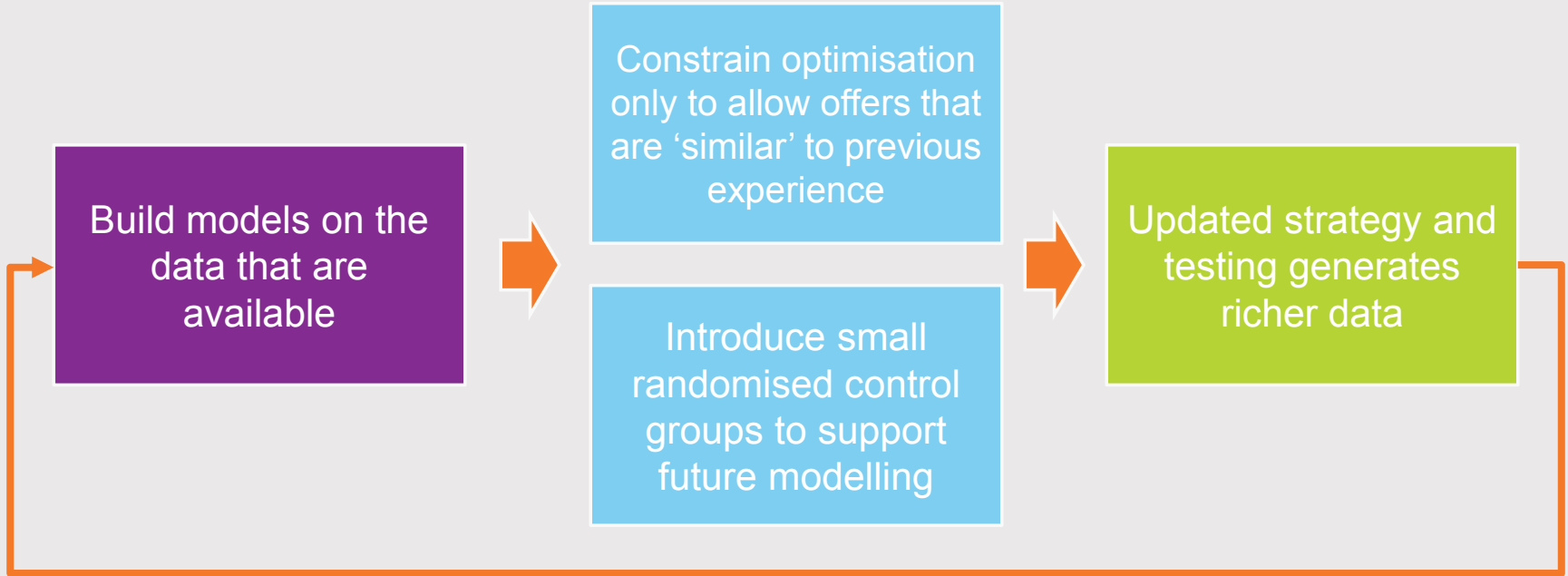
Over/under prediction of propensities

Overestimation of the value of some offers

Selection of suboptimal offers

Strategy under delivers, models look misaligned

# How to prevent problems



Iterate to unlock the full potential of optimisation in a controlled manner



# SUMMARY

# Summary



- Many business problems encountered in **credit management** can be addressed through the use of optimisation techniques
- Optimisation can deliver **significant benefits** over traditional approaches to strategy design.
- However, this is not straightforward, and success requires the **right expertise and tools**
- Careful consideration must be given to what models are required to support optimisation, and special care taken to ensure that areas of model weaknesses cannot compromise strategy performance

**Interested in finding out more?**

**Read our White Paper:**

**[www.jaywing.com/creditriskoptimisation/](http://www.jaywing.com/creditriskoptimisation/)**

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