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Effort Prediction

CO3095, CO7095, CO7508

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Planning Poker

When the requirements are not fixed

- Requirements are **constantly changing**
  - The (predicted) costs are constantly fluctuating.
  - Planning and costing is akin to **herding cats**.
- However - with rapid iterations…
  - We can collect data rapidly.
  - Can prioritise the least certain items.
  - Can make predictions that are more meaningful.

Gauging Effort - Story Points

- An informal, agile equivalent to Function Points
  - Usually an estimate from 1-10, arrived at by the group
  - Can also use other scales
    - T-Shirt sizes (XS, S, M, L, XL, XXL)
    - Dog breeds (Chihuahua to Great Dane)
    - *We will find out more about scales later on…*

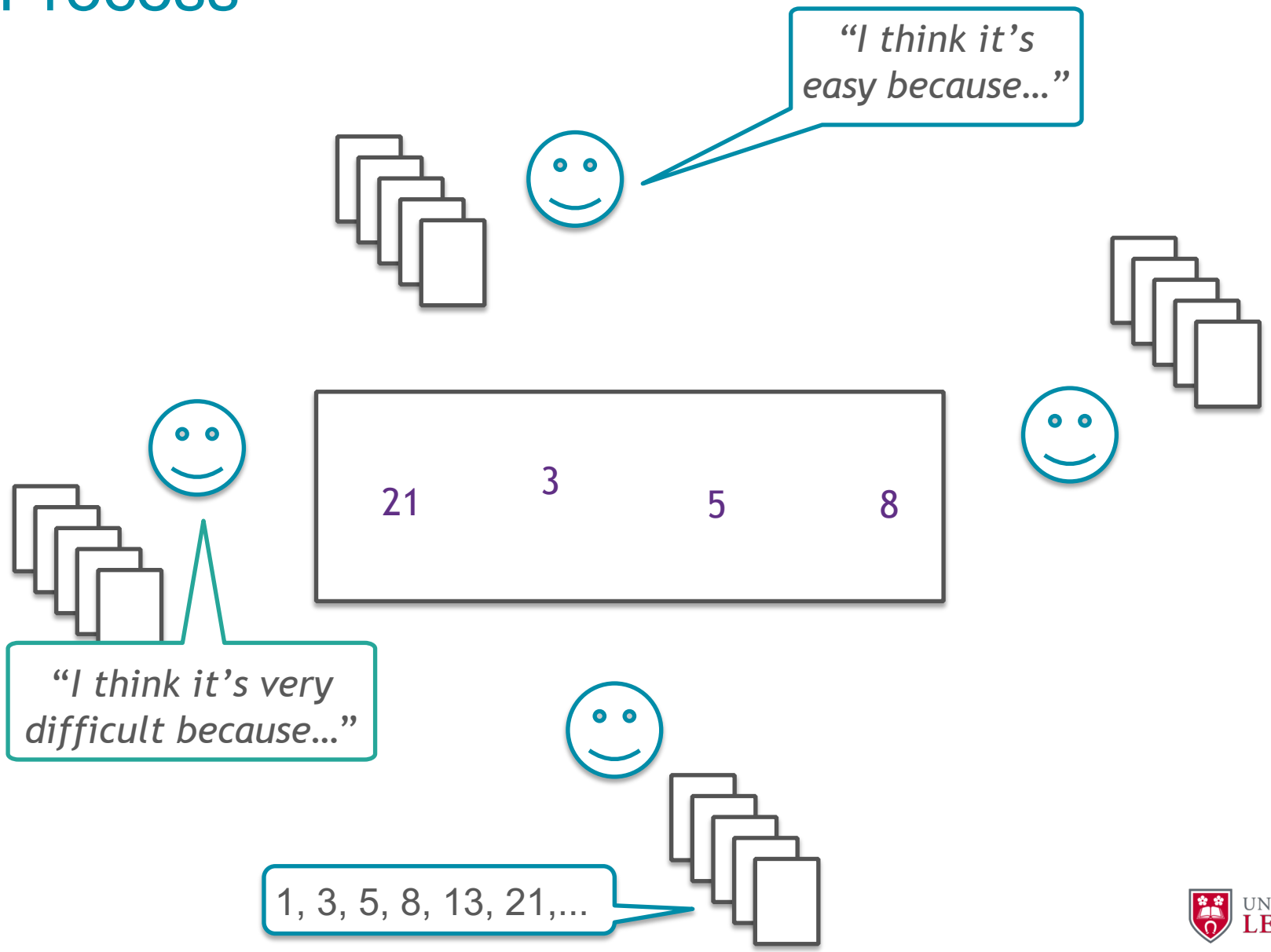
Wisdom of the Crowd

https://www.youtube.com/watch?v=uz5AeHqUtRs

Planning Poker

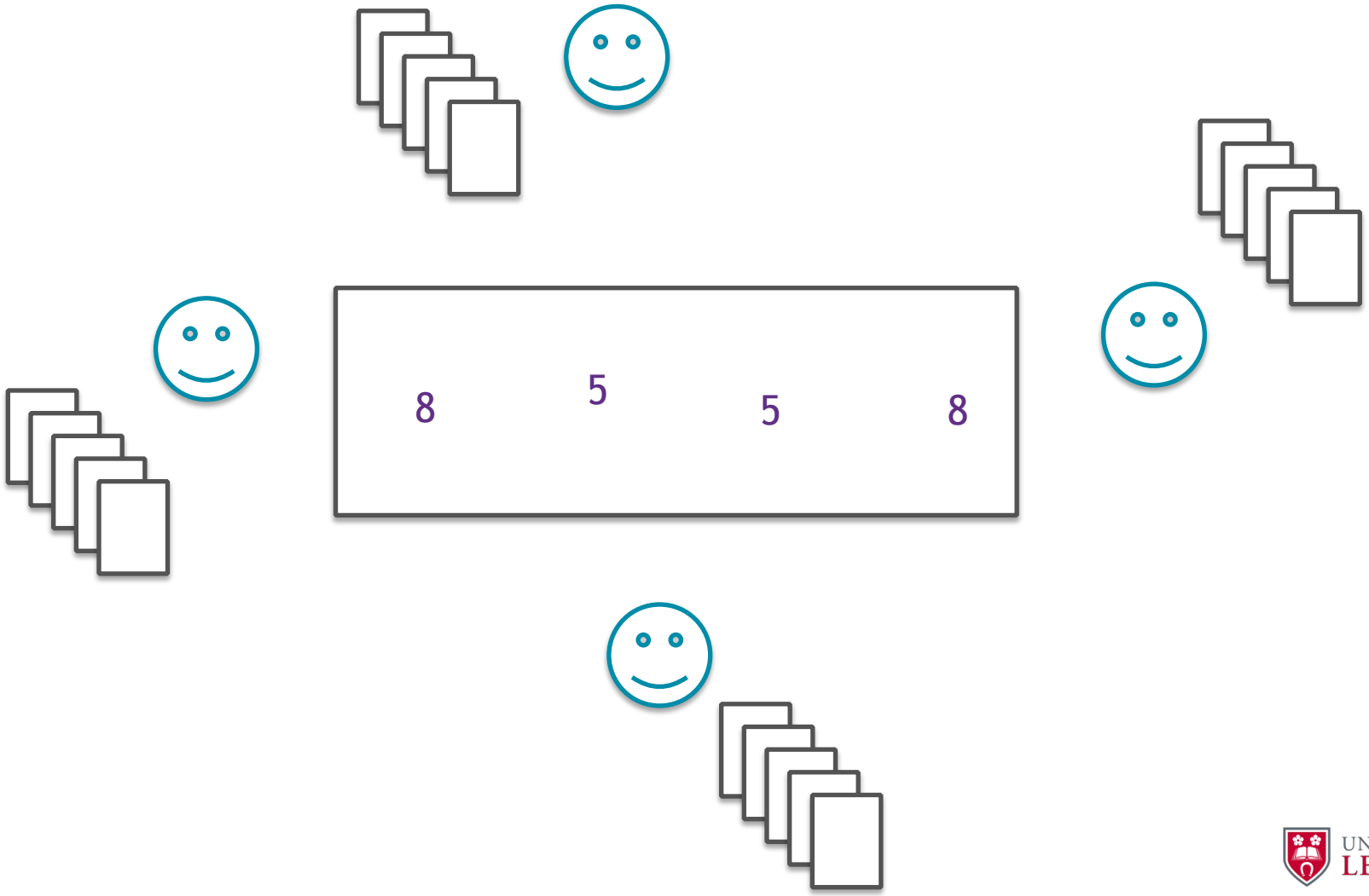
- The whole team is involved
- Each member is given a set of numbered cards.
  - Numbers follow the Fibonacci sequence
- 1, 3, 5, 8, 13, 21,…
- Larger tasks become harder to estimate in exact terms
  - Low values - tasks are trivial to implement
  - High values - tasks are difficult to implement
- Each member is also given a “?” card

Process


"I think it's easy because…"
21
3
5
8
"I think it's very difficult because…"
1, 3, 5, 8, 13, 21,…

Process

Cycle repeats for a maximum of 3 iterations (to avoid infinite loops!)

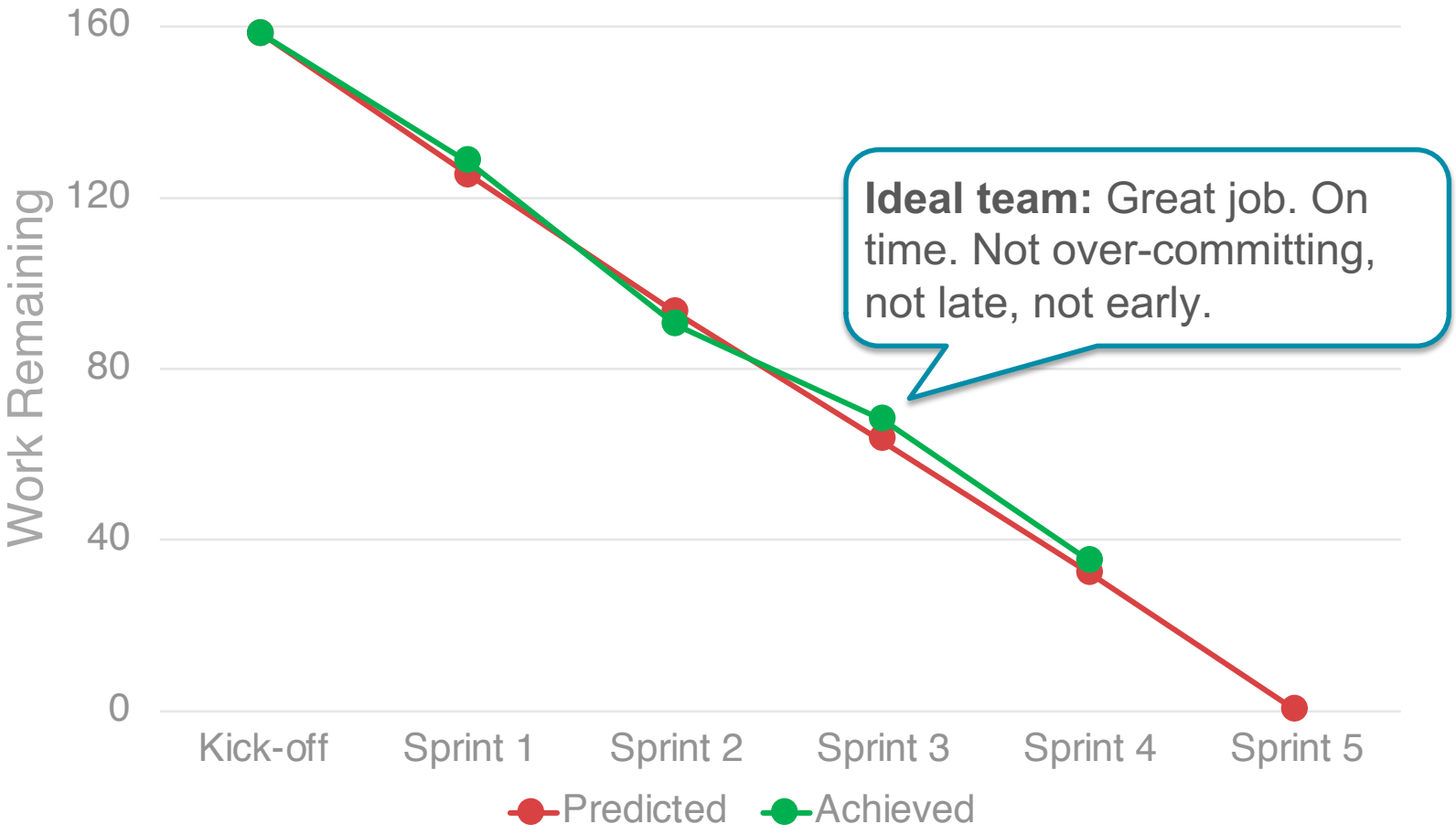


Team Velocity

- Number of (estimated) story points implemented per sprint
- Can be used to estimate the time needed to complete a project
- Estimations become more accurate as project advances
- Example:
  - Requirements are expressed as 53 stories. Planning poker equates this to 158 story points
  - First sprint - team estimates that it will implement 5 stories that amount to 33 story points
  - Only manages to implement 3 stories – 21 points
  - Their **velocity** is 21
  - This can be used to estimate next sprint (and final end-point)

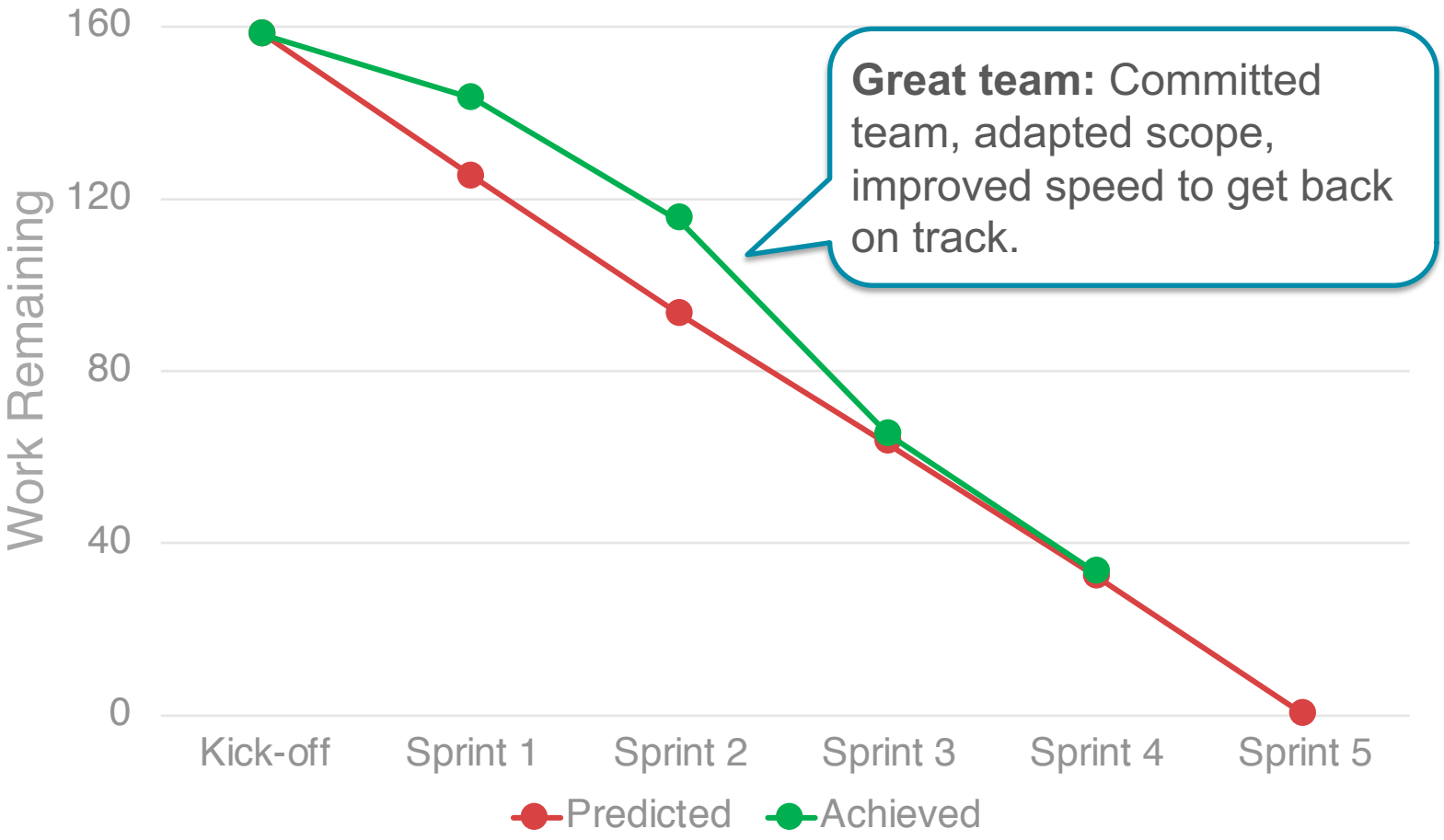
Burndown Charts

Used to capture progress in a project. Trend-lines indicate predicted completion phase.

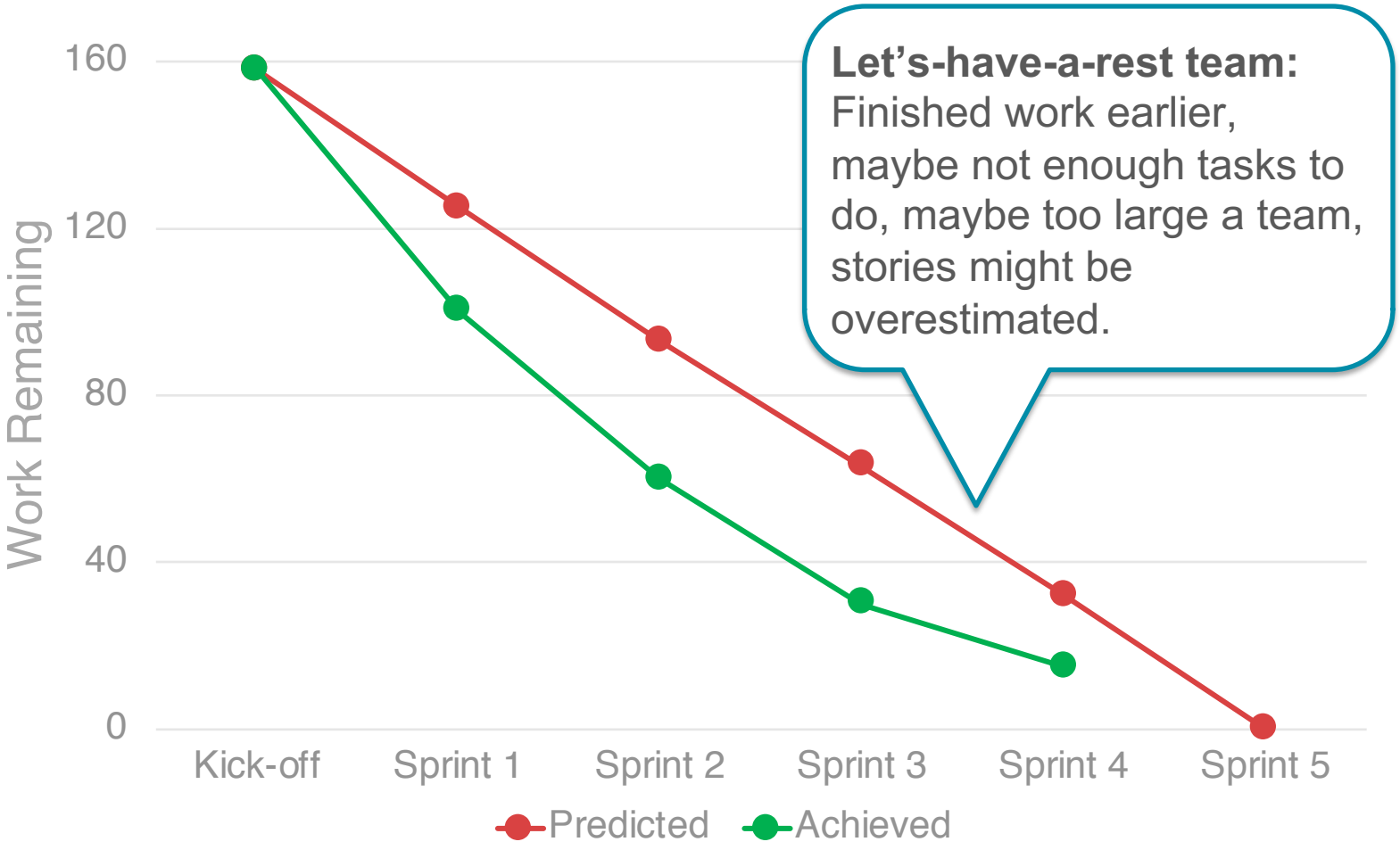


Ideal team: Great job. On time. Not over-committing, not late, not early.

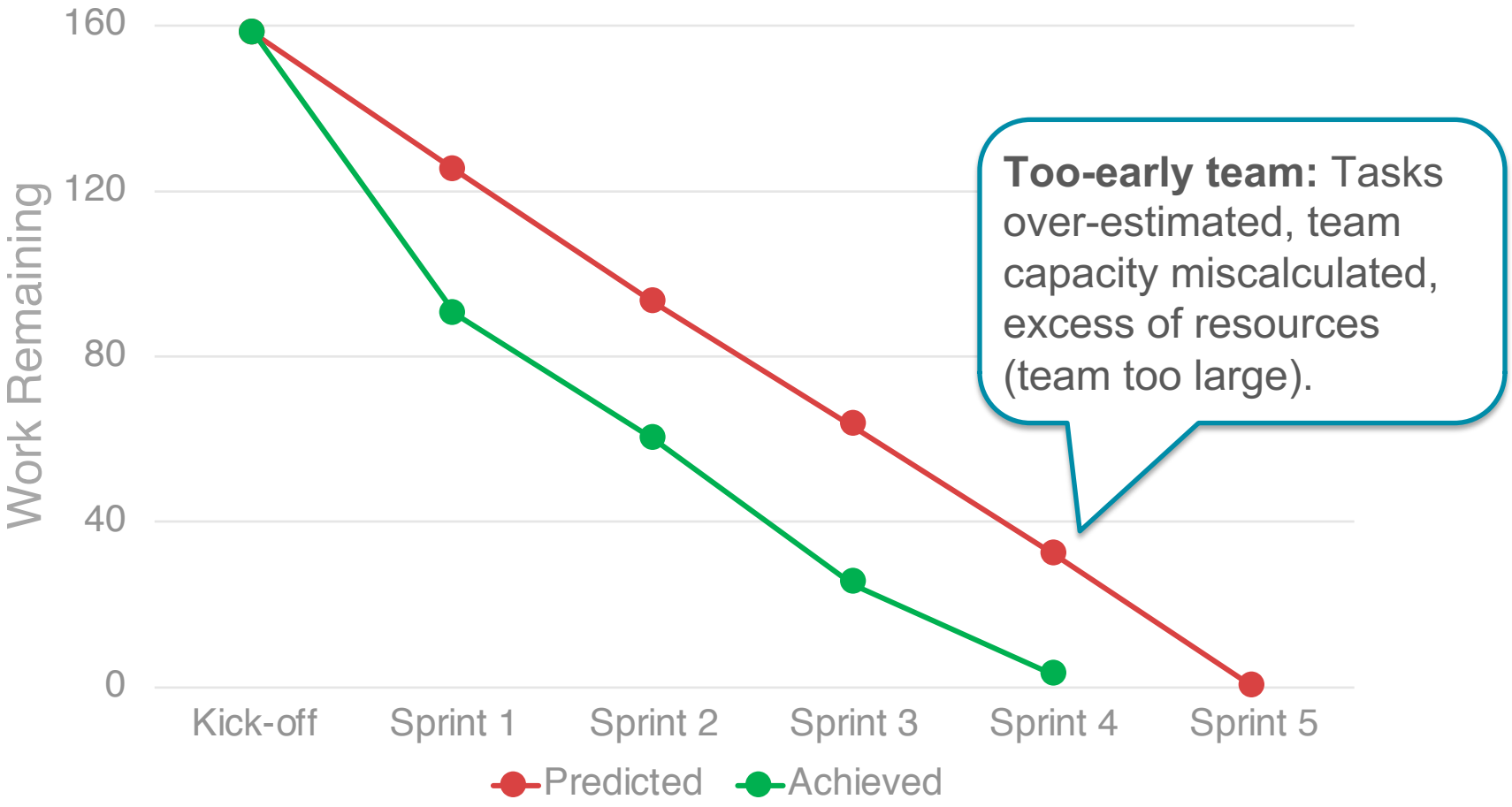
Burndown Charts



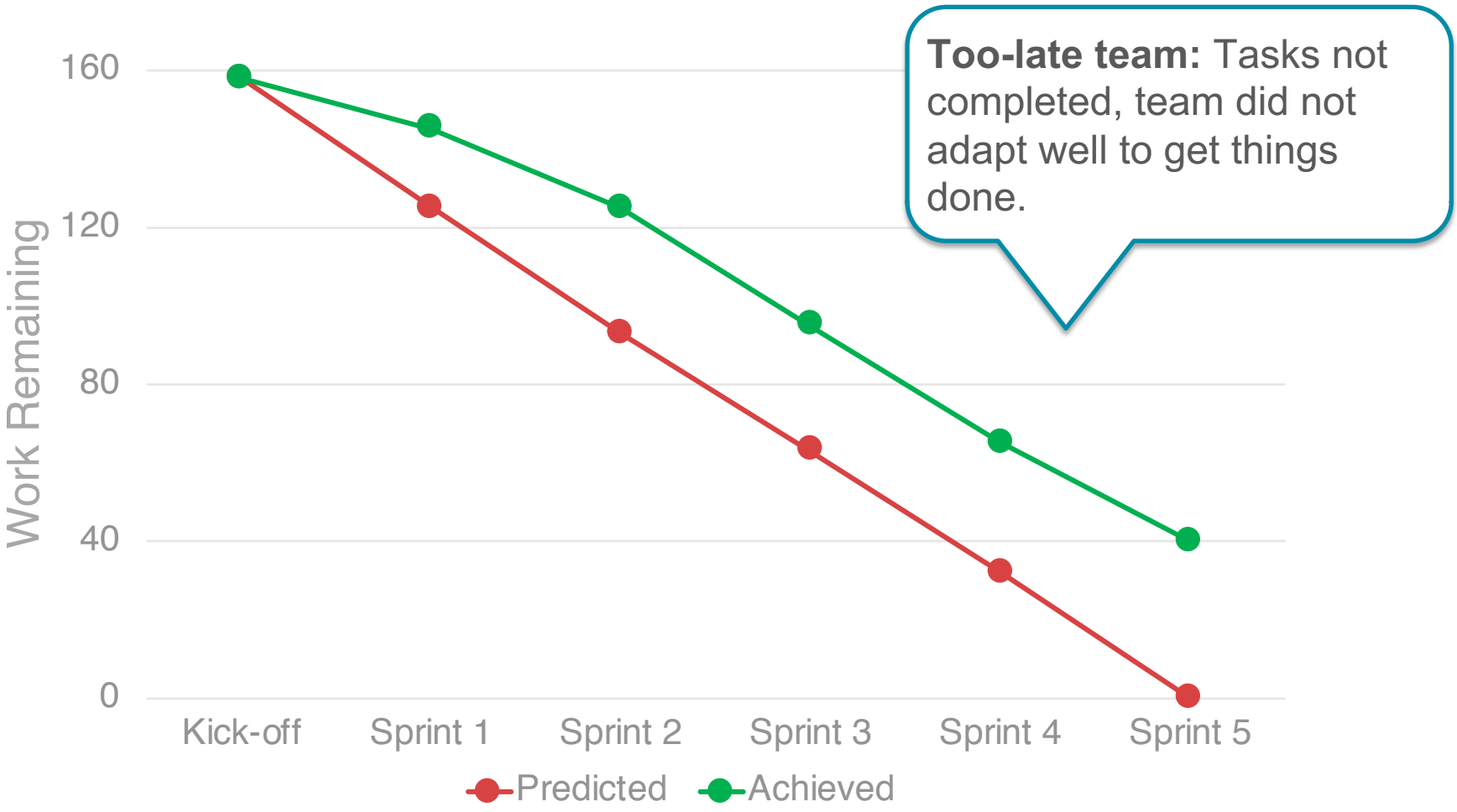
Burndown Charts



Burndown Charts

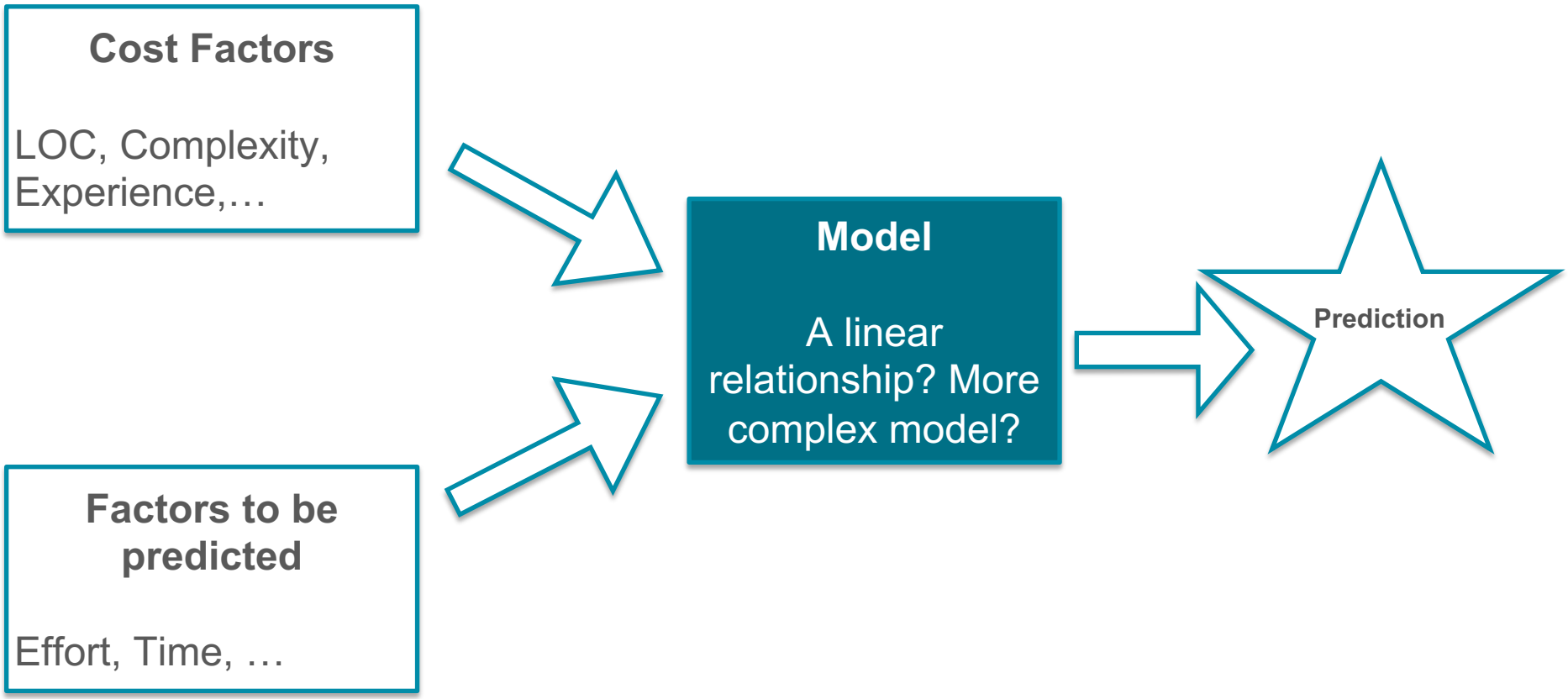


Burndown Charts



Model Based Software Effort Estimation

Approach


Cost Factors
LOC, Complexity, Experience,…
Factors to be predicted
Effort, Time, …
Model
A linear relationship? More complex model?
Prediction

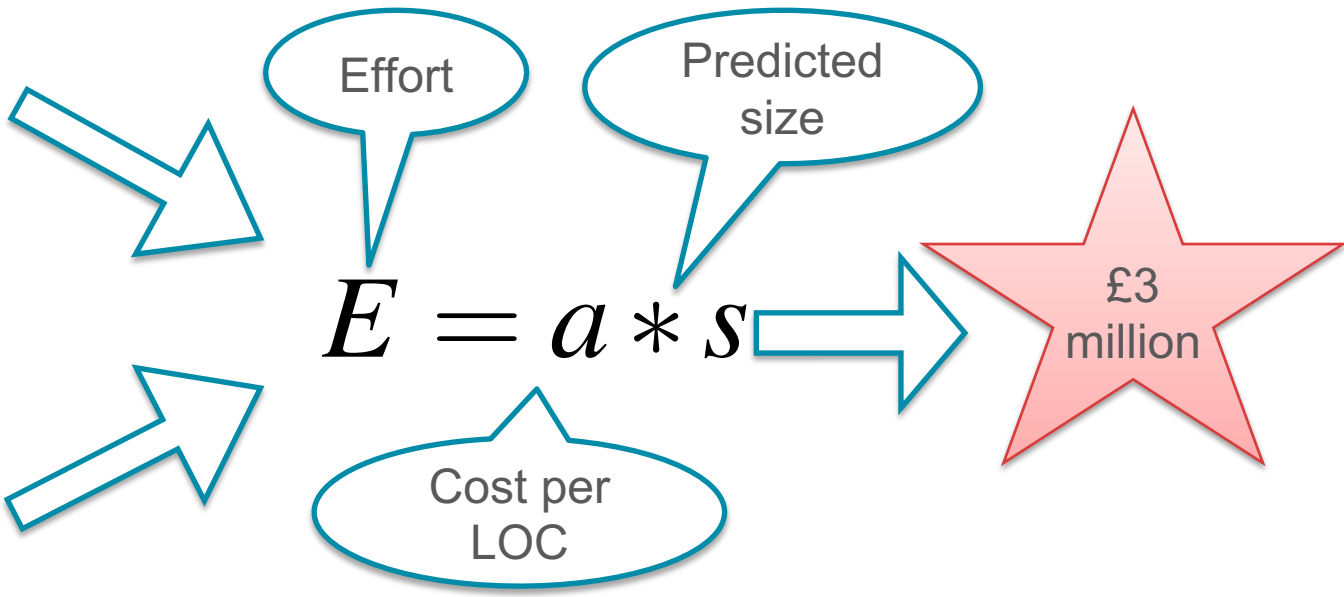
A Simple "Ballpark" Model

Cost Factors

a: Cost per LOC
s: Predicted size

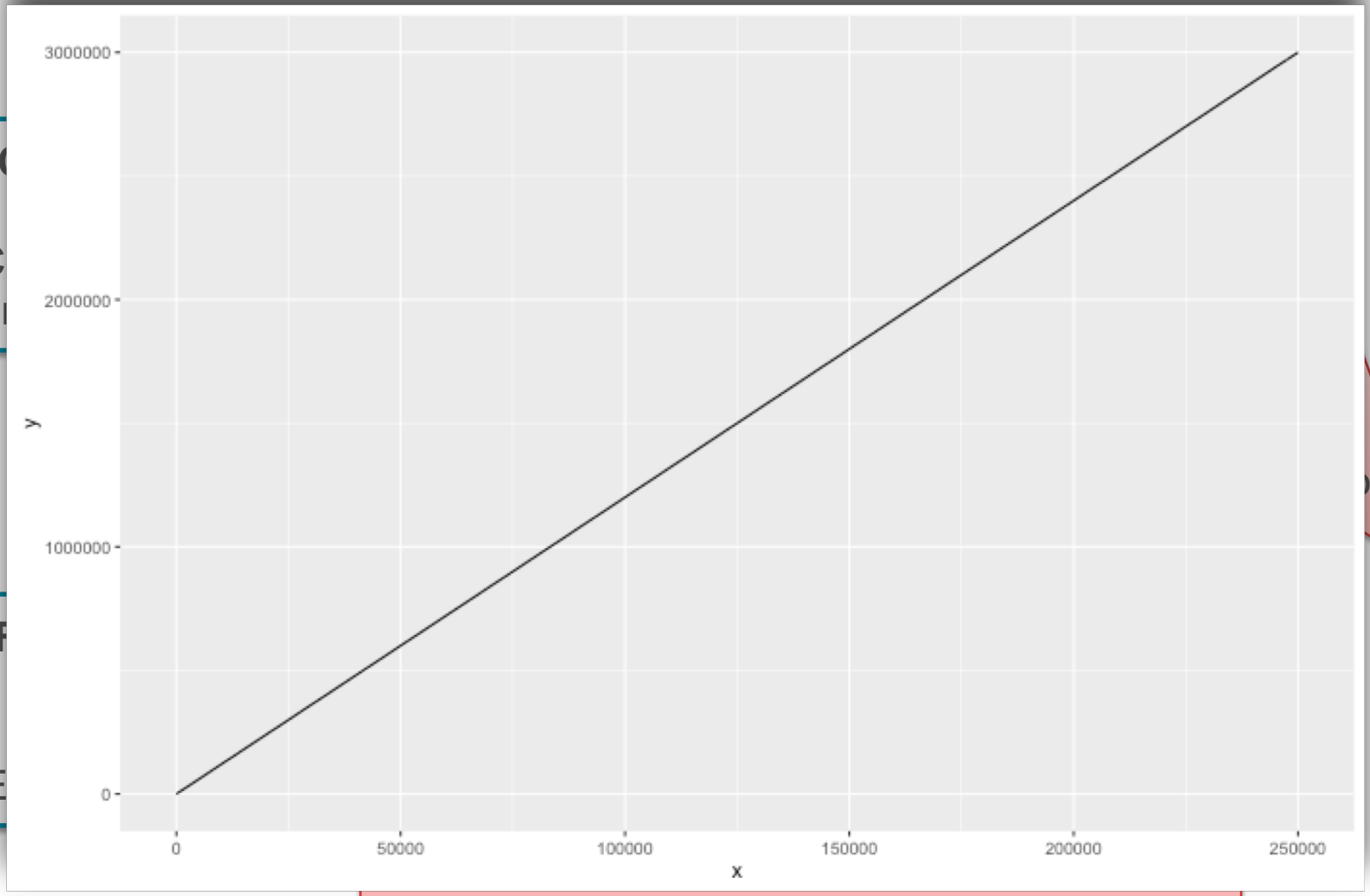
Factors to be predicted

E: Effort



How much for an estimated 250,000 LOC, where cost per LOC is £12?

A Simple “Ballpark” Model



Adding Factors

Cost Factors

a: Cost per LOC
s: Predicted size
c: One-off costs

Factors to be predicted

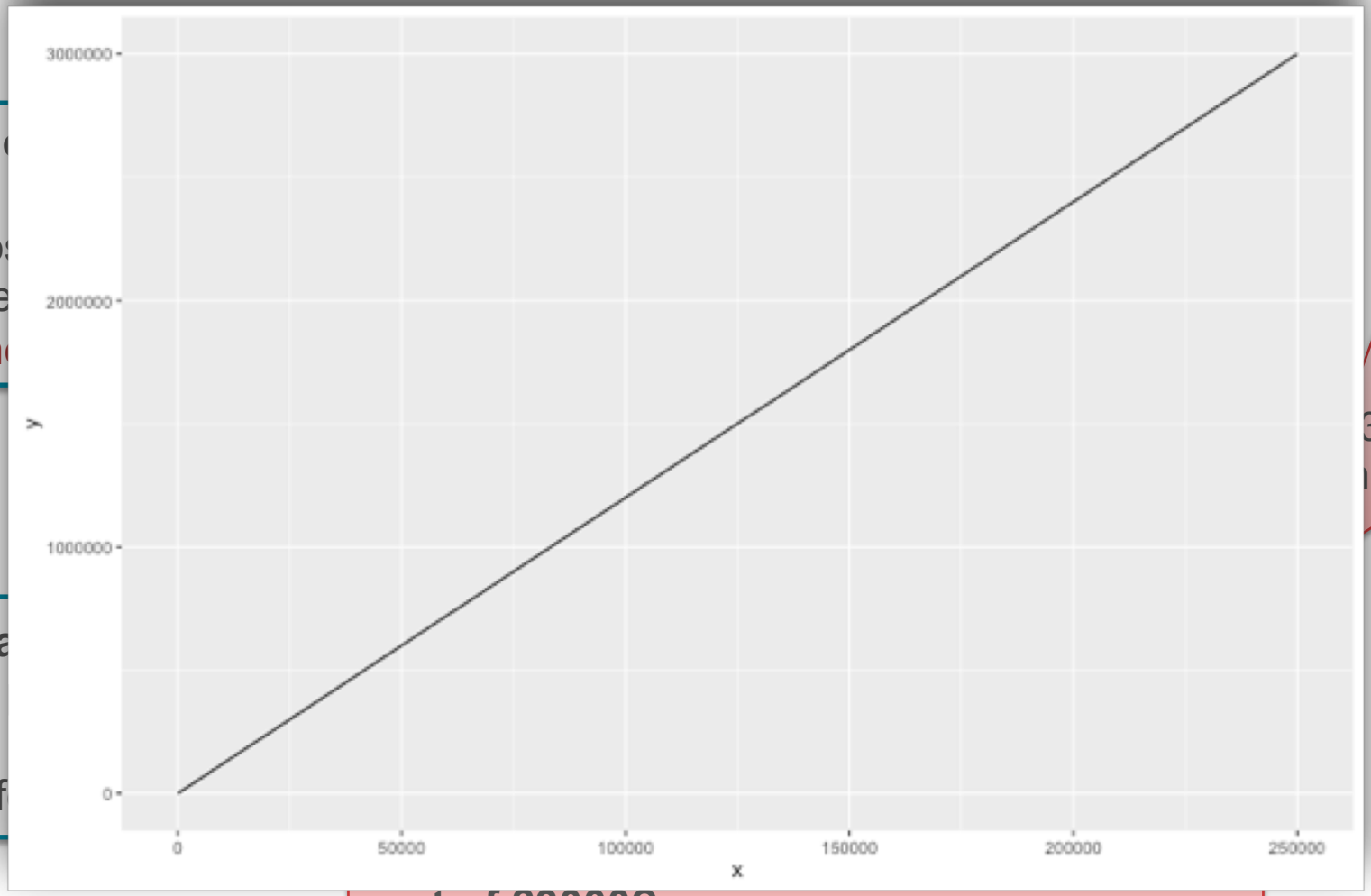
E: Effort

$$E = a * s + c$$

£3.003 million

How much for an estimated 250,000 LOC, where cost per LOC is £12 and a start-up cost of £3000?

Adding Factors



C

a: Co
s: Pre
c: On

3.003
illion

Fa

E: Eff

cost of £3000?

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Scale Factors

- Using size alone can skew models.
  - Relationship between size and cost may be **non-linear**.
- Other factors can play a role in costs.
  - Might apply disproportionately when the project is either small or large.
- Consider:
  - Management costs – may cost disproportionately more for larger projects.
  - Code reuse – could lead to disproportionate cost savings for larger projects.

Adding Factors

b>1 – projects become proportionally more expensive with scale.

b<1 – Cost savings increase with scale.

Cost Factors

a: Cost per LOC
s: Predicted size
c: One-off costs
b: Scale factor

$$E = a * s^b + c$$

~£379 millions

Factors to be predicted

E: Effort

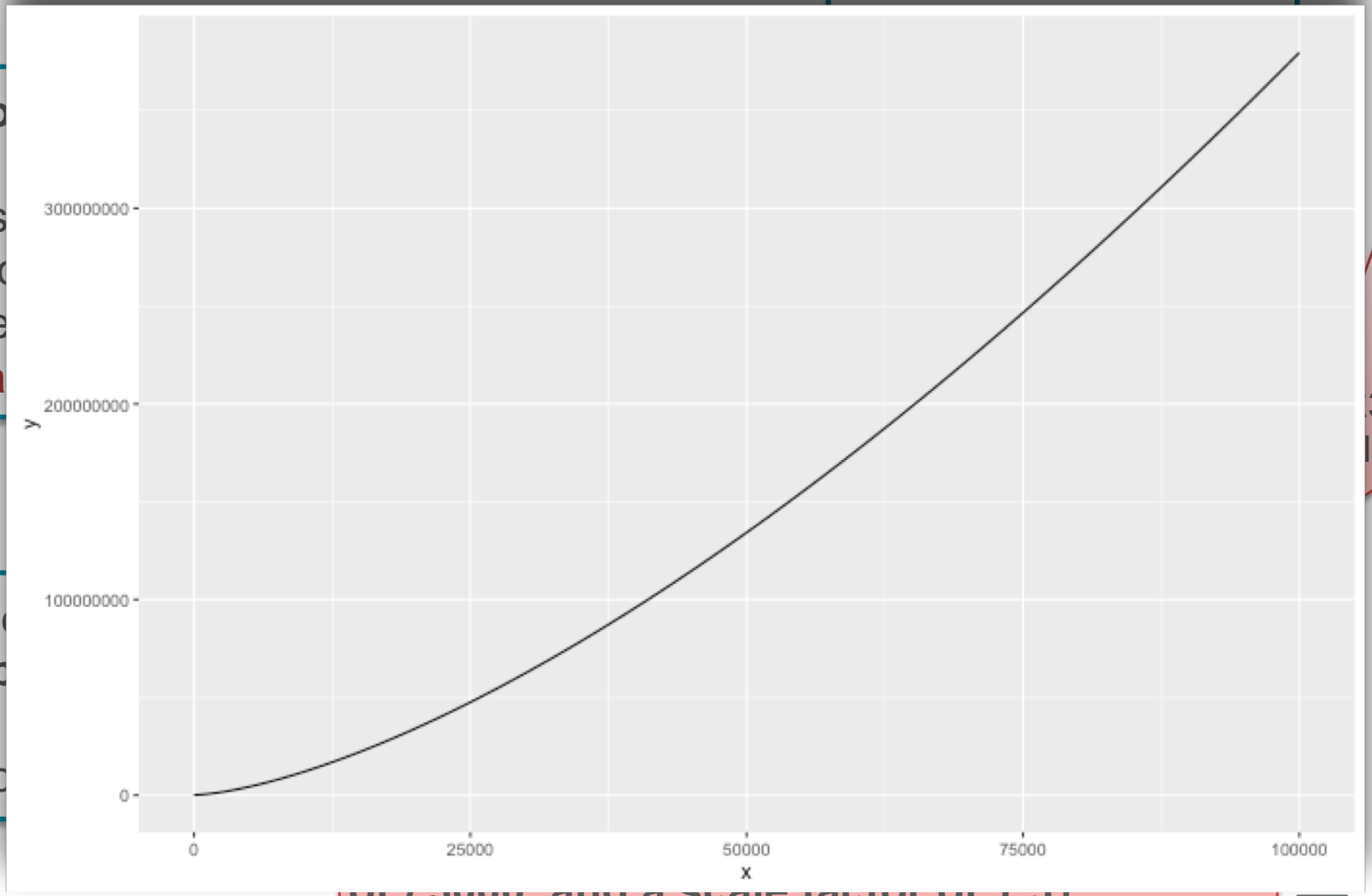
How much for an estimated 100,000 LOC, where cost per LOC is £12, a start-up cost of £3000, and a scale factor of 1.5?

Adding Factors

b>1 – projects become proportionally more expensive with scale.

Co

a: Cos
s: Prec
c: One
b: Sca



379
lions

Fa
p

E: Effo

of 25000, and a scale factor of 1.5?

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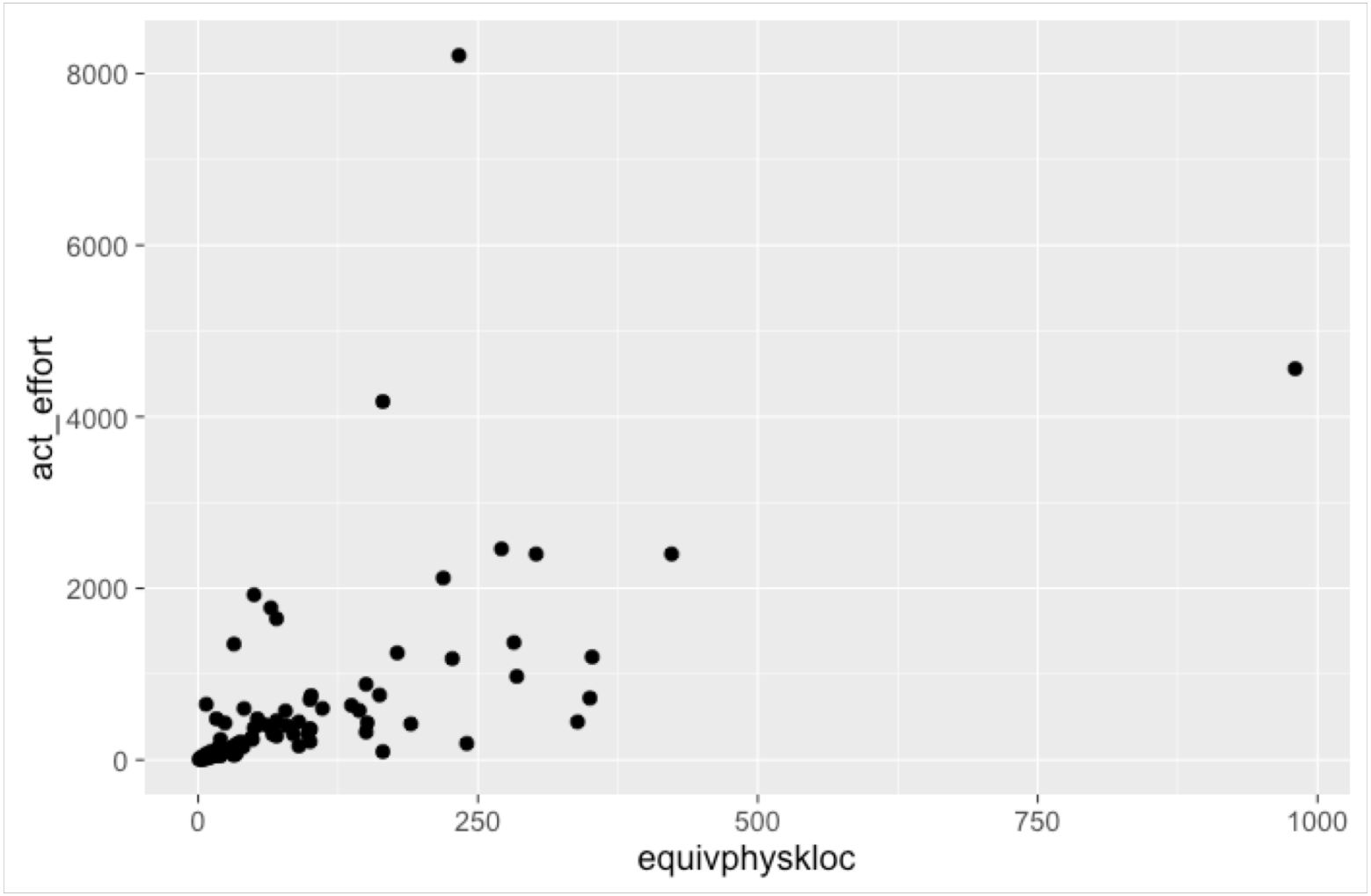
Parameter Fitting

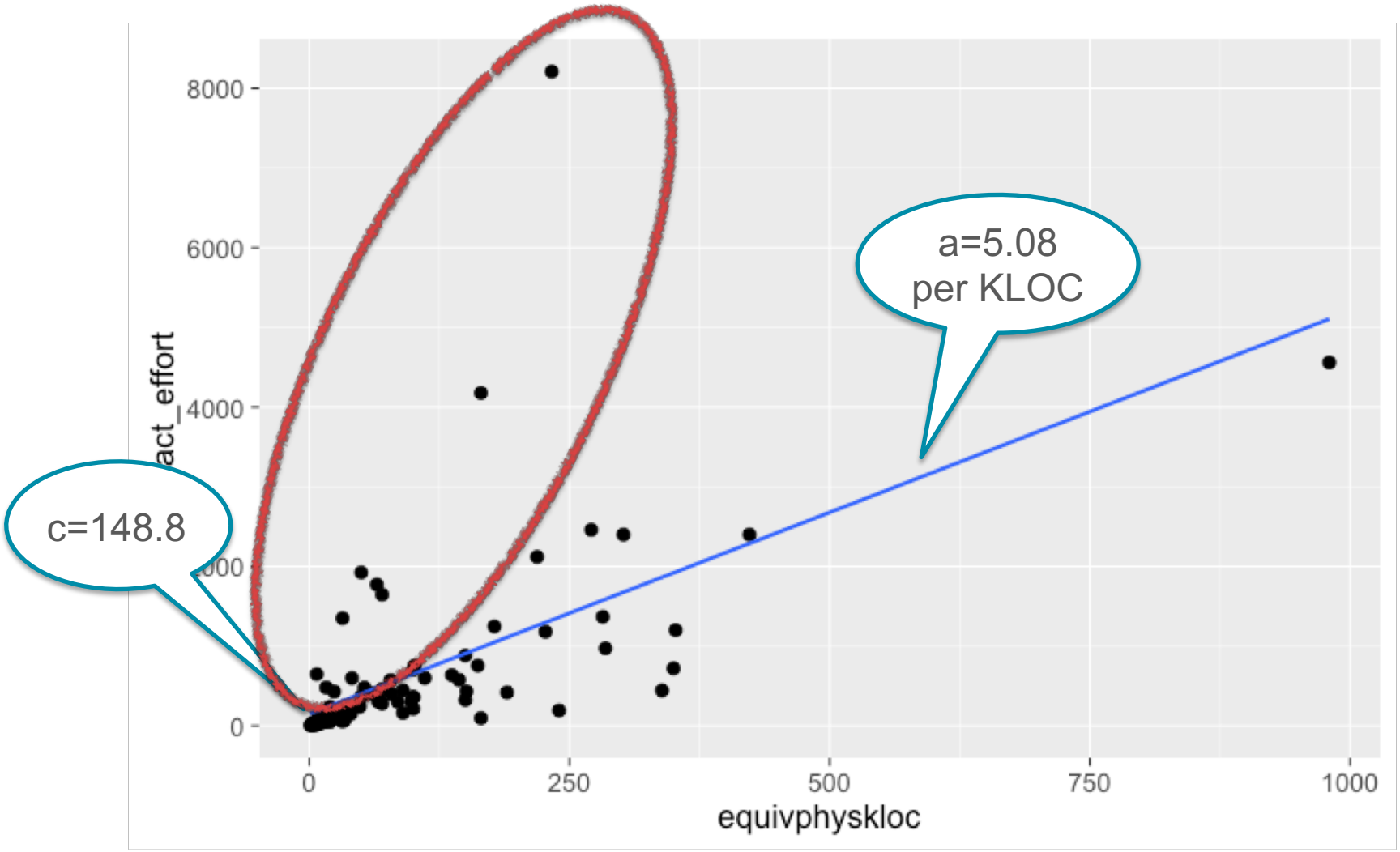
Choice of Parameters is Critical

- How do obtain parameter values?
  - What is the typical cost-per-LOC (a)?
  - What is the typical “scale factor” (b)?
  - What is the normal initial base-cost (c)?
- Can draw upon **historical data** from within organisation.
  - Software process should incorporate metrics and data collection.
  - Can be used to give indicators for these parameters.

Example - NASA project data, collected 1993



Example - NASA project data, collected 1993



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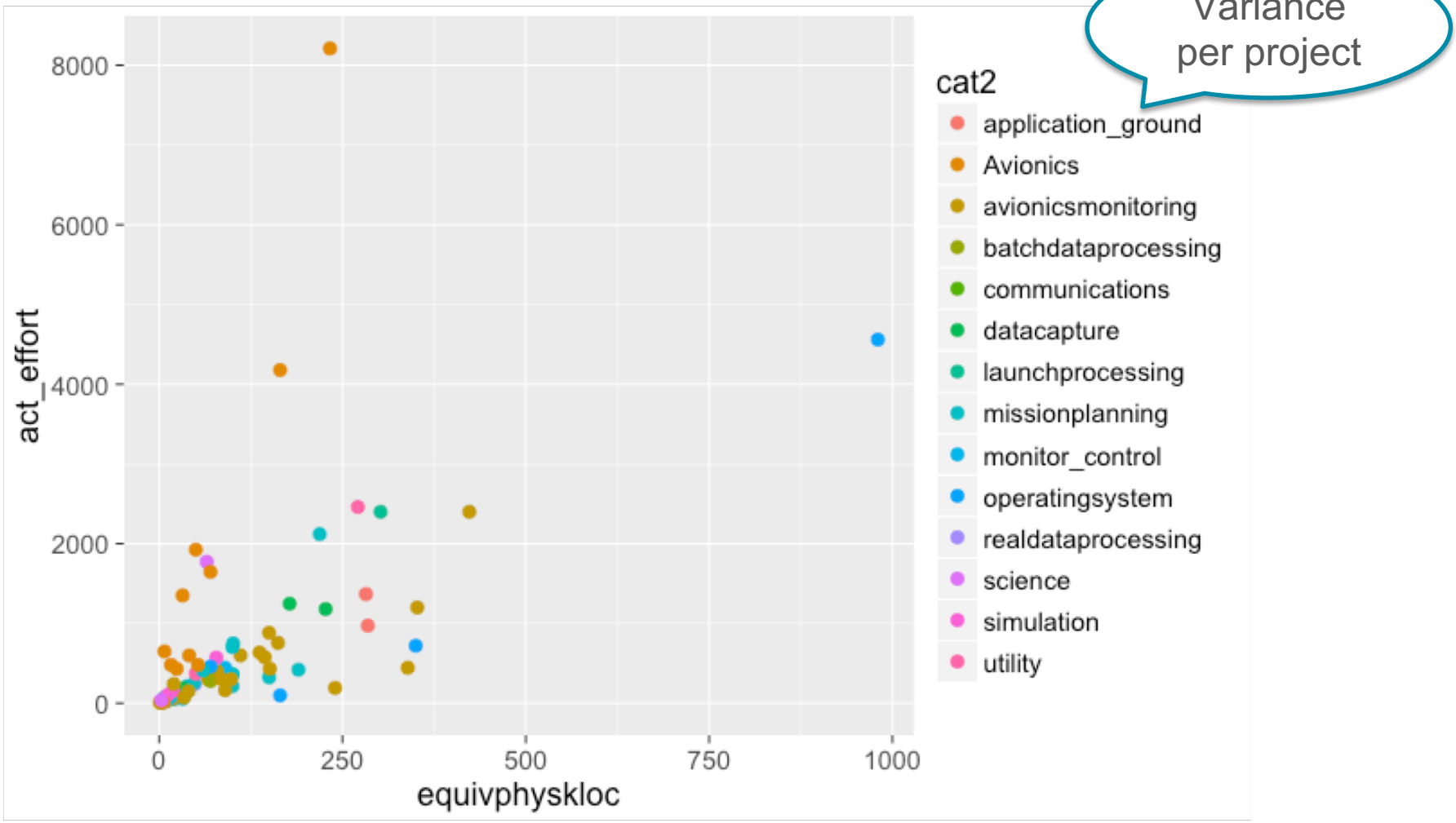

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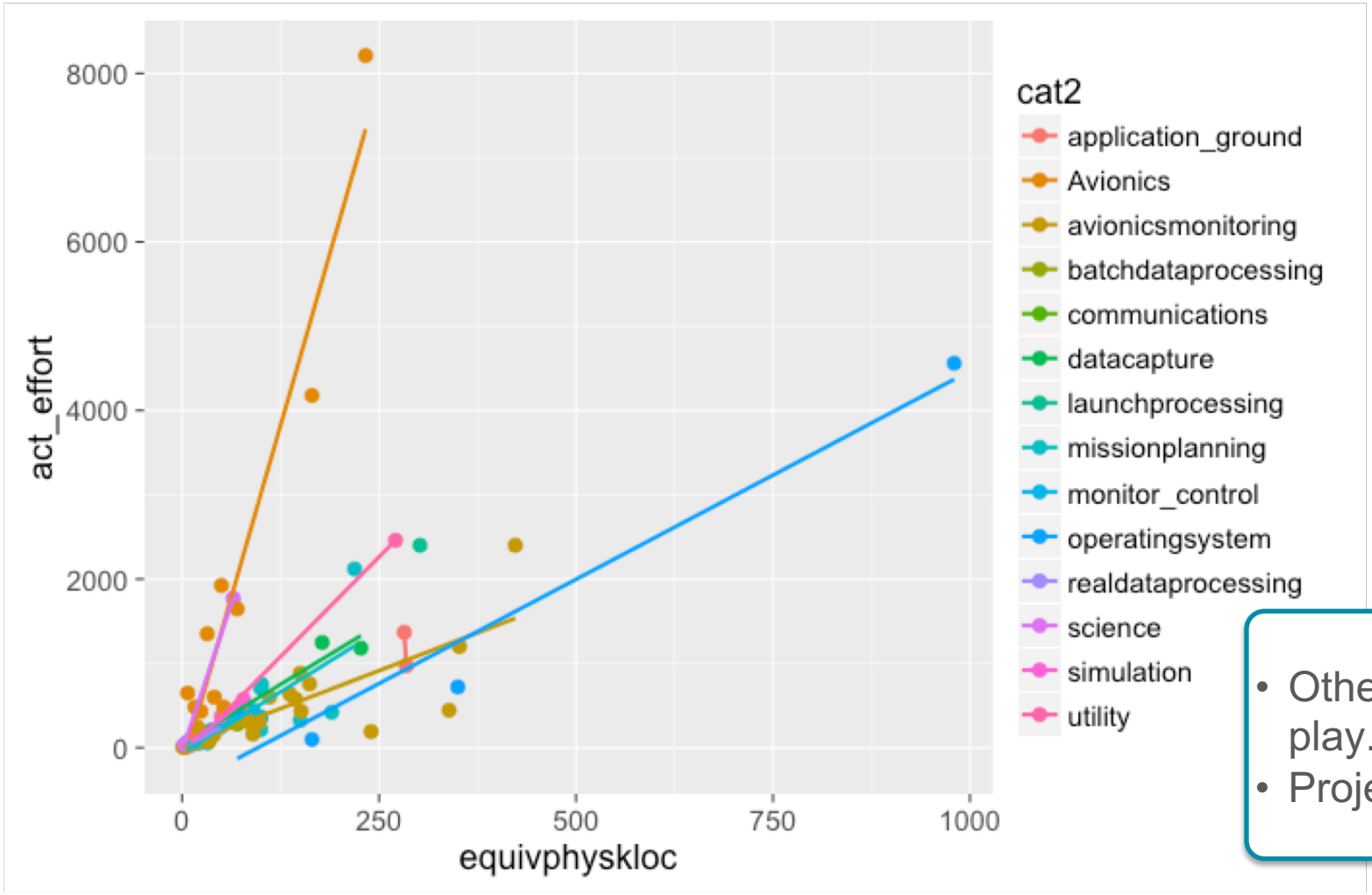

- Other factors at play.
- Project-specific.

Summary

- Cost and effort estimation are crucial.
  - Severe risk that unanticipated factors can lead to cost overrun.
- Have covered basic model-based cost estimation approach.
  - At is simplest, makes assumption of linear relationship between cost and size.
  - Can add “scale factor” to accommodate non-linear elements.
- Have shown how Linear Regression can be used for parameter estimation.