Stopwatch, Sampling and Learning Curves

- When we study operations, we quickly find a need to have an estimate of times needed to complete tasks. Unless the tasks are done by machines, we may have to use a stopwatch or sampling.

- Precision: \[ \frac{zs}{\sqrt{n}} \]
  - for stopwatch we get \( s \) from the collected data
  - for sampling we use \( \sqrt{p_i(1 - p_i)} \)

- If precision given, solve for \( n \)

- When is one method preferred over the other?
  - motivational reasons (both ways)
  - statistical reasons

- Do a pilot study to get sample size estimates (you can use the pilot data as well).
Learning Curves

- Time estimates for task completion are not necessarily valid over long periods of time.

- Learning (and forgetting) can be important

\[ T_n = T_1 n^b \]

- for a 100L per cent learning curve \( b = \ln(L)/\ln(2) \).

- Strategic implications?

- Implications for one line versus two (or one team versus two)

- Forgetting and changeover times?