10.5 Supply chains

Name: _____ Class: _____ Date: _____ **Total: 15 marks**

KEY WORDS risk pooling • postponement

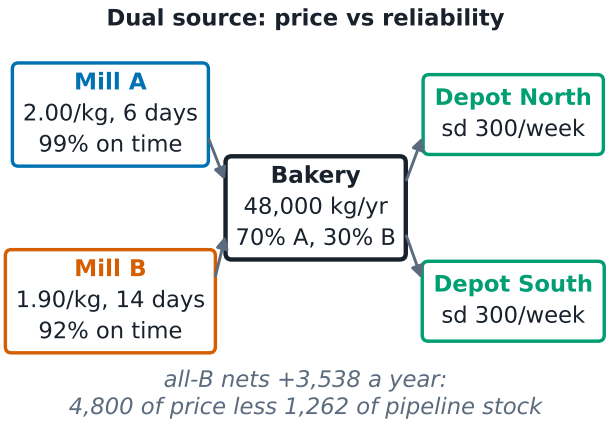
Objective

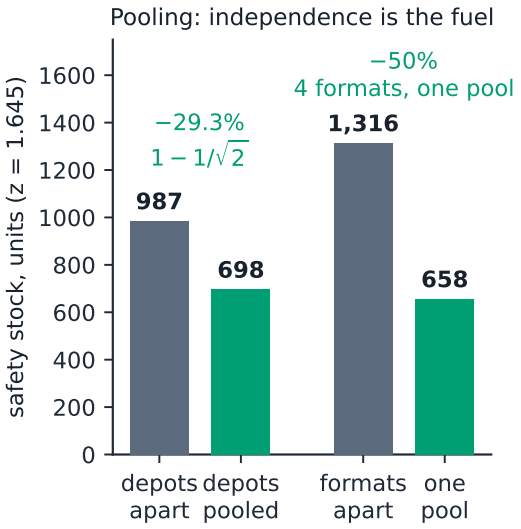
Price a supplier trade-off, apply the square-root law to pooling and postponement, and put a number on reliability.

1 Key knowledge and worked examples

The square-root law

Independent demands: $\sigma_{sum} = \sqrt{\sum \sigma_i^2}$, so n equal sources pooled save $1 - 1/\sqrt{n}$ of safety stock. Lead time is pipeline stock: $d \times LT$.





Pooling cuts safety stock by $1 - 1/\sqrt{n}$

Worked example. Two depots

Each $1.645 \times 300 = 494$; pooled $1.645 \times 424.3 = 698$ - 29.3% saved ✓. Mill B nets +3,538 but is 92% on time ✓.

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2 Practice

2.1 Three depots, each weekly sd 200, independent, $z = 1.645$, one-week lead. Safety stock separate and pooled, and the saving in units and per cent. [4]

2.2 A supplier offers 1.42 a kg against 1.50 on 20,000 kg a year, but lead time 12 days against 4; holding 1.60 a kg a year. The price saving, the extra pipeline stock and its cost, and the net. [4]

2.3 Five pack formats, each sd 150 a week. Safety stock held per format against one generic pool ($z = 1.645$), and the cut. [3]

2.4 The cheap supplier is 95% on time against 99.5%; 24 deliveries a year; a miss costs 2,500. Expected misses and cost for each; verdict on the net from 2.2. [4]

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Solutions

2.1

- Separate $3 \times 1.645 \times 200 = 987$.
- Pooled $1.645 \times 200\sqrt{3} = 570$; saving $417 = 42.3\% = 1 - 1/\sqrt{3}$.

2.2

- Price $0.08 \times 20{,}000 = 1{,}600$ saved.
- Pipeline $8 \times 20{,}000/365 = 438$ kg at $1.60 = 701$; net $+899$.

2.3

- Per format $5 \times 1.645 \times 150 = 1{,}234$; generic $1.645 \times 150\sqrt{5} = 552$.
- Cut $55.3\% = 1 - 1/\sqrt{5}$.

2.4

- Misses $24 \times 0.05 = 1.2$ against $24 \times 0.005 = 0.12$.
- Cost 3,000 against 300: the 2,700 difference wipes out the 899 net - stay, or dual-source.