

Economies of Scale

Base case: M/M/*N* with parameters λ, μ, N

Scenario: $\lambda \rightarrow m\lambda$ ($R \rightarrow mR$)

	Base Case	Efficiency-driven	Quality-driven	QED
Offered load	$R = \frac{\lambda}{\mu}$	mR	mR	mR
Safety staffing	Δ	Δ	$m\Delta$	$\sqrt{m}\Delta$
Number of agents	$N = R + \Delta$	$mR + \Delta$	$mR + m\Delta$	$mR + \sqrt{m}\Delta$
Service grade	$\beta = \frac{\Delta}{\sqrt{R}}$	$\frac{\beta}{\sqrt{m}}$	$\beta\sqrt{m}$	$\boxed{\beta}$
Erlang-C = P{Wait>0}	$P(\beta)$	$P\left(\frac{\beta}{\sqrt{m}}\right) \uparrow 1$	$P(\beta\sqrt{m}) \downarrow 0$	$\boxed{P(\beta)}$
Occupancy	$\rho = \frac{R}{R + \Delta}$	$\frac{R}{R + \frac{\Delta}{m}} \uparrow 1$	$\boxed{\rho = \frac{R}{R + \Delta}}$	$\frac{R}{R + \frac{\Delta}{\sqrt{m}}} \uparrow 1$
$\widetilde{\text{ASA}} = \text{E}\left[\frac{\text{Wait}}{\text{E}(S)} \mid \text{Wait} > 0\right]$	$\frac{1}{\Delta}$	$\boxed{\frac{1}{\Delta} = \widetilde{\text{ASA}}}$	$\frac{1}{m\Delta} = \frac{\widetilde{\text{ASA}}}{m}$	$\frac{1}{\sqrt{m}\Delta} = \frac{\widetilde{\text{ASA}}}{\sqrt{m}}$
$\widetilde{\text{TSF}} = \text{P}\left\{\frac{\text{Wait}}{\text{E}(S)} > T \mid \text{Wait} > 0\right\}$	$e^{-T\Delta}$	$\boxed{e^{-T\Delta} = \widetilde{\text{TSF}}}$	$e^{-mT\Delta} = (\widetilde{\text{TSF}})^m$	$e^{-\sqrt{m}T\Delta} = (\widetilde{\text{TSF}})^{\sqrt{m}}$