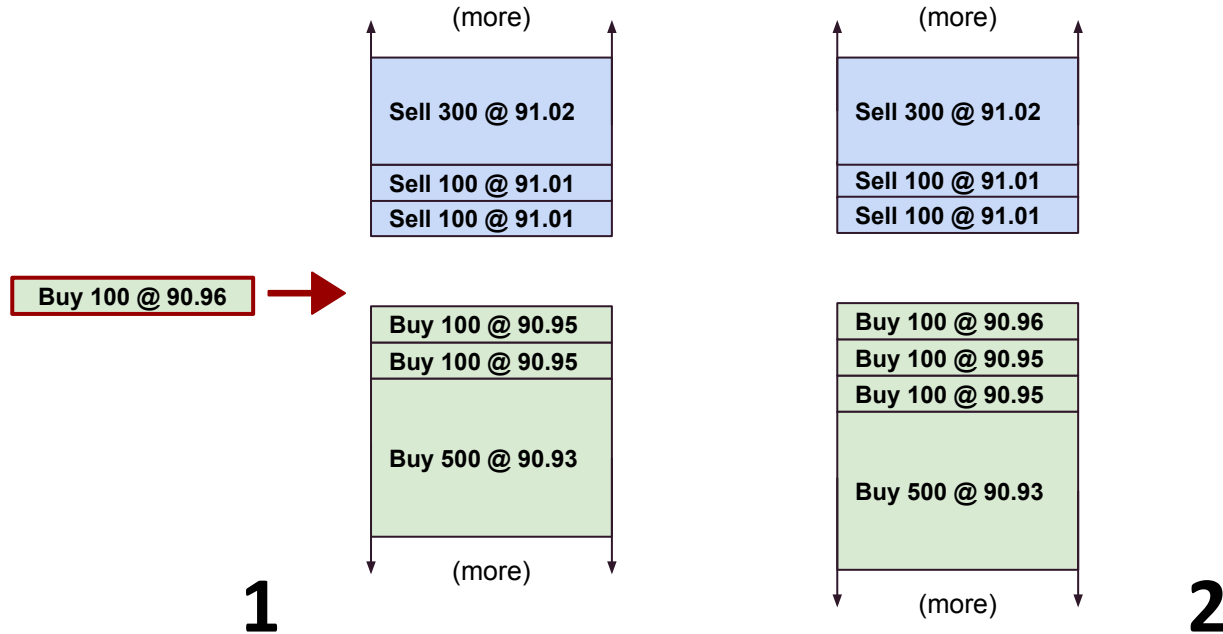# Order book and market impact
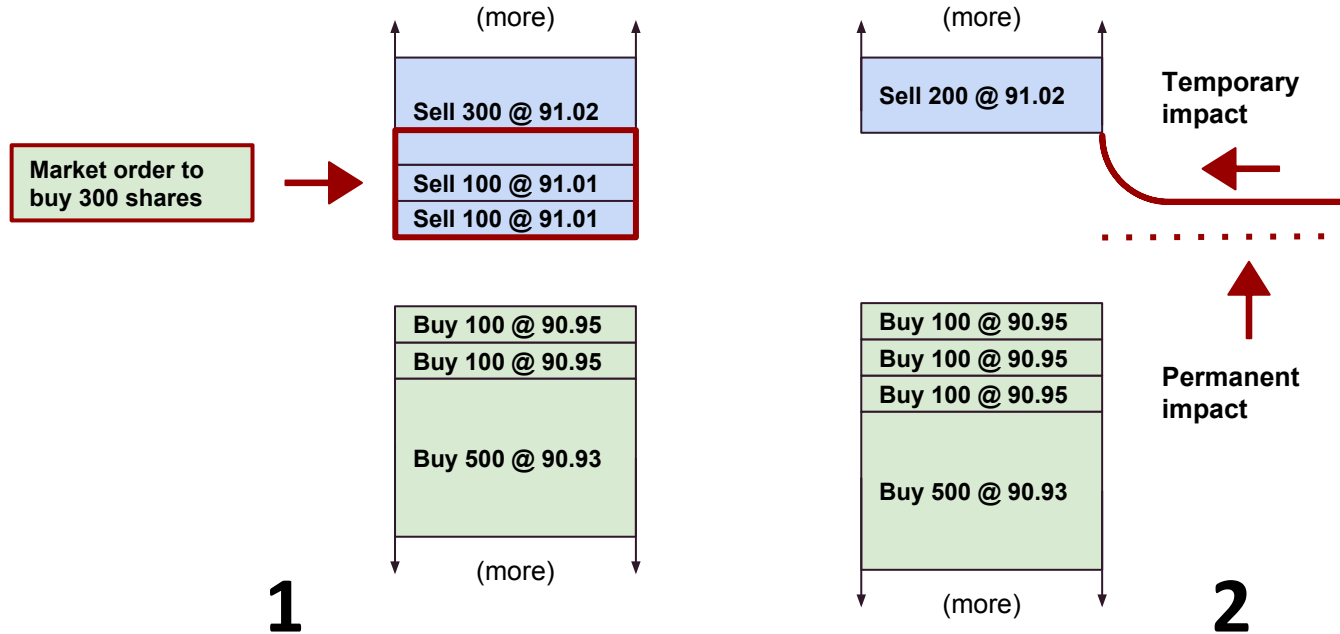
Adding new bid - price priority

(more)
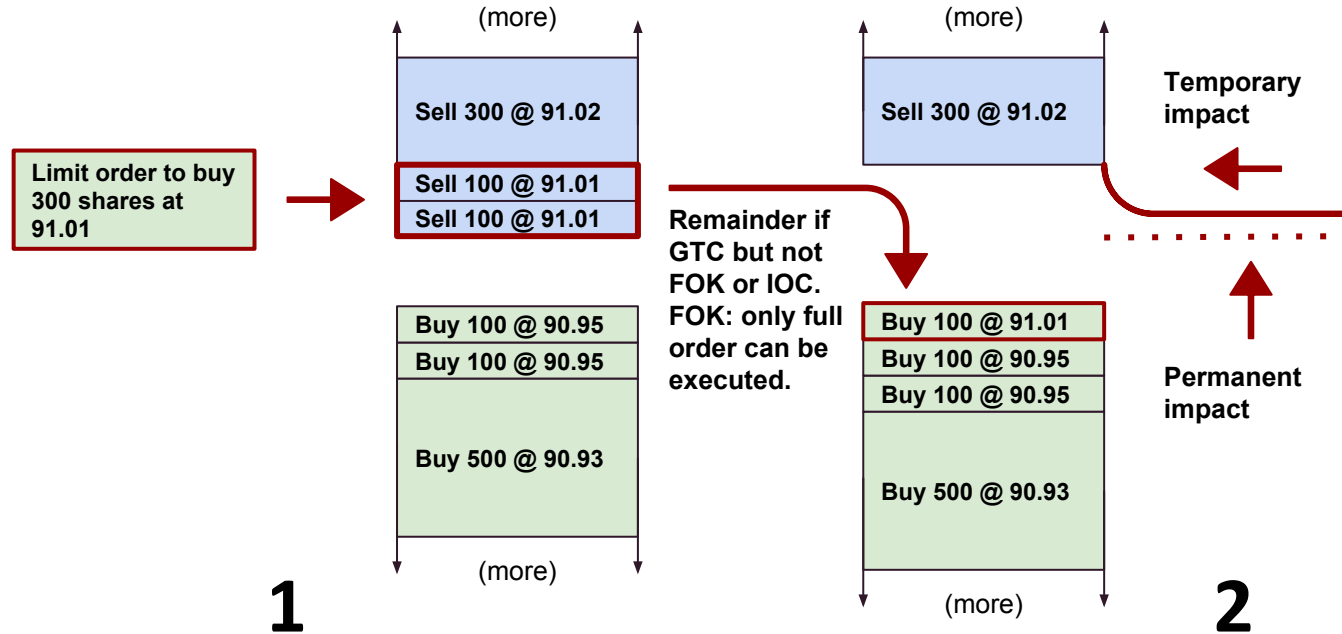
| Sell 300 @ 91.02 |
| Sell 100 @ 91.01 |
| Sell 100 @ 91.01 |

Buy 100 @ 90.96 →

| Buy 100 @ 90.95 |
| Buy 100 @ 90.95 |
| Buy 500 @ 90.93 |

(more)

1

(more)

| Sell 300 @ 91.02 |
| Sell 100 @ 91.01 |
| Sell 100 @ 91.01 |

| Buy 100 @ 90.96 |
| Buy 100 @ 90.95 |
| Buy 100 @ 90.95 |
| Buy 500 @ 90.93 |

(more)

2

Adding new bid - time priority

(more)

| Sell 300 @ 91.02 |
| Sell 100 @ 91.01 |
| Sell 100 @ 91.01 |

Buy 100 @ 90.95 →

| Buy 100 @ 90.95 |
| Buy 100 @ 90.95 |
| Buy 500 @ 90.93 |

(more)

1

(more)

| Sell 300 @ 91.02 |
| Sell 100 @ 91.01 |
| Sell 100 @ 91.01 |

| Buy 100 @ 90.95 |
| Buy 100 @ 90.95 |
| Buy 100 @ 90.95 |
| Buy 500 @ 90.93 |

(more)

2
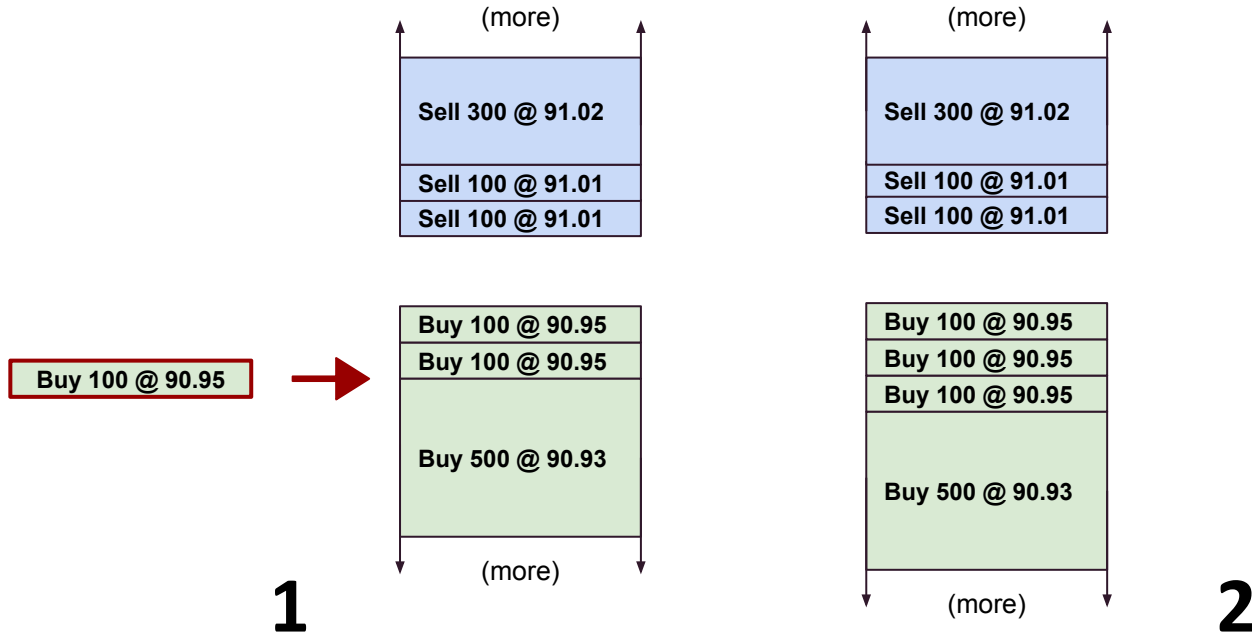
Impact of marketable orders - market

Impact of marketable orders - limit

Limit order to buy 300 shares at 91.01

(more)

Sell 300 @ 91.02
Sell 100 @ 91.01
Sell 100 @ 91.01

Buy 100 @ 90.95
Buy 100 @ 90.95
Buy 500 @ 90.93

(more)

1

Remainder if GTC but not FOK or IOC. FOK: only full order can be executed.

(more)

Sell 300 @ 91.02

Buy 100 @ 91.01
Buy 100 @ 90.95
Buy 100 @ 90.95
Buy 500 @ 90.93

(more)

2

Temporary impact

Permanent impact

Idealized market impact function
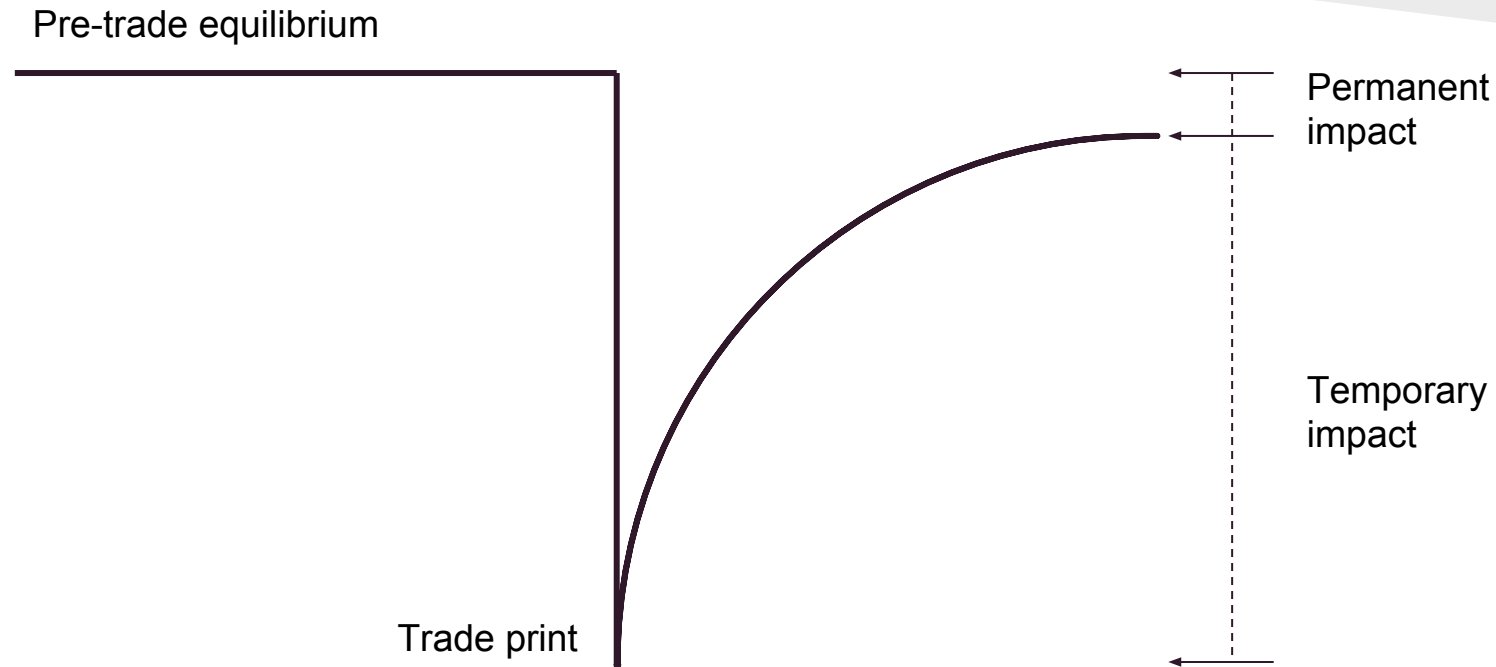
Impact of 2 executions
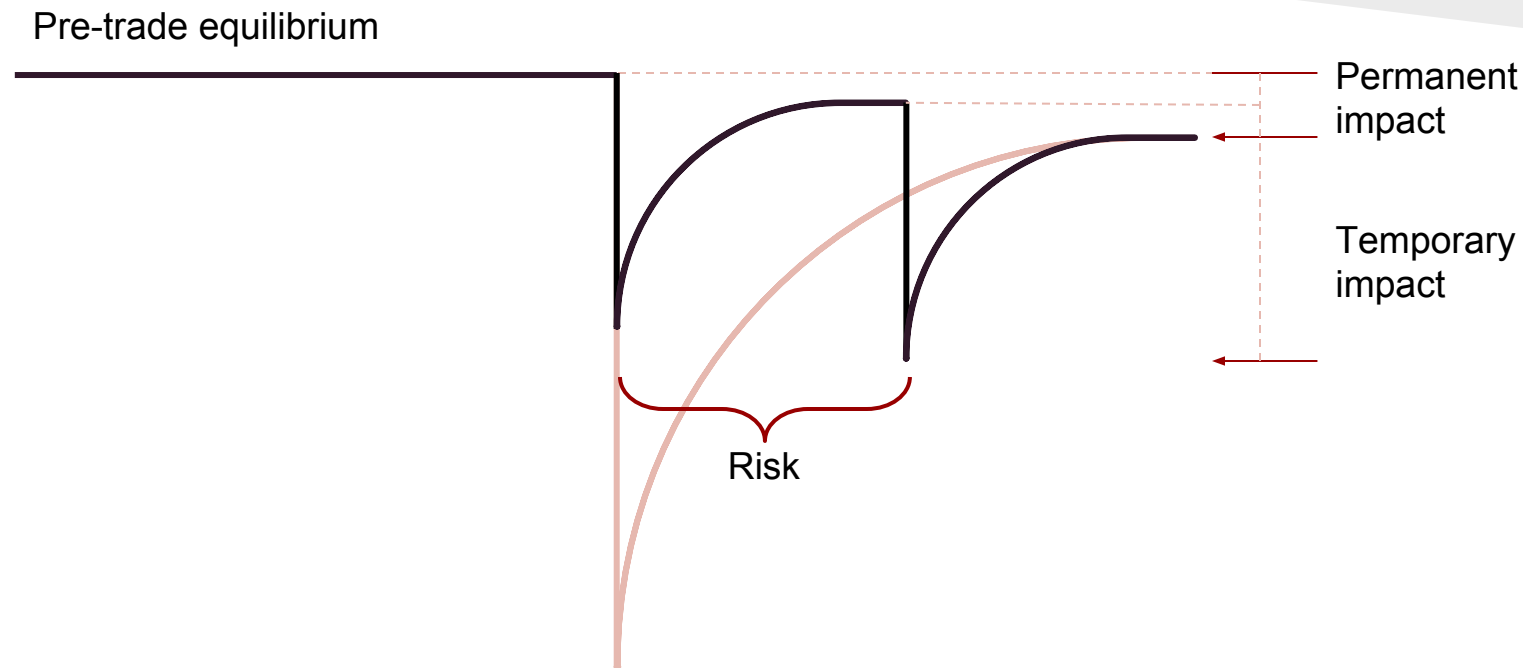
Almgren - Chriss optimization

$$x_k = \frac{\sinh\left(\kappa\left(T - t_k\right)\right)}{\sinh\left(\kappa T\right)} X \quad \text{where} \quad \kappa = \sqrt{\frac{\lambda \sigma^2}{\eta}}$$
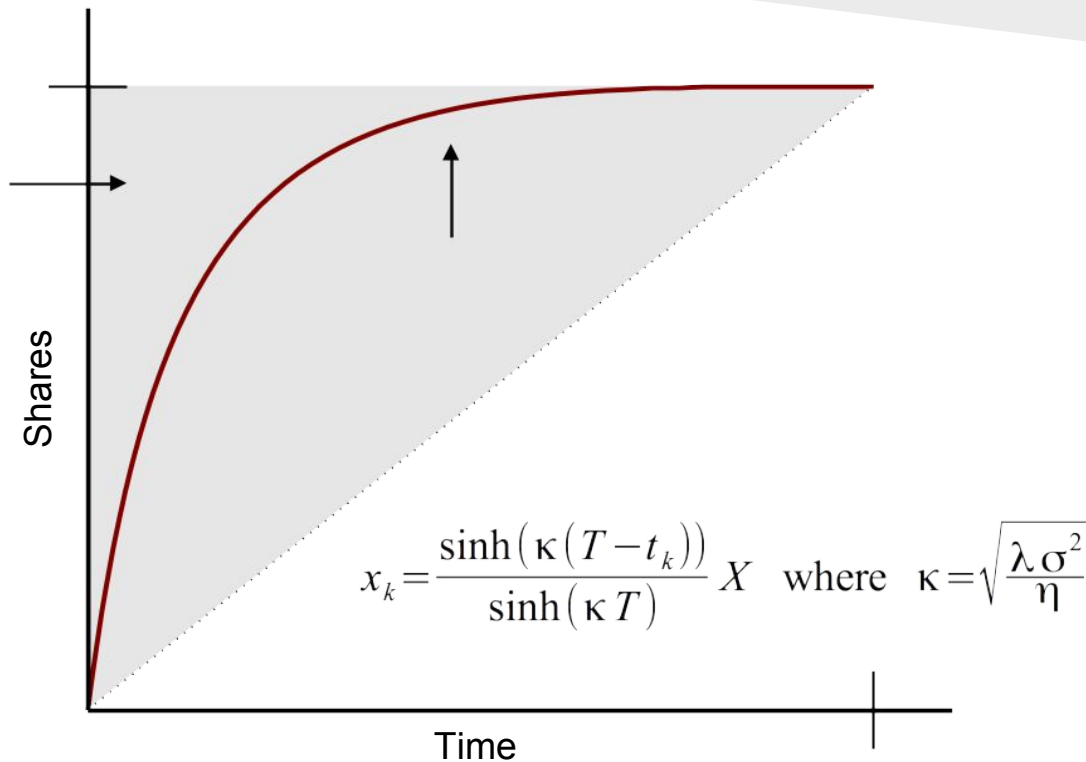
If two executions are better than one…