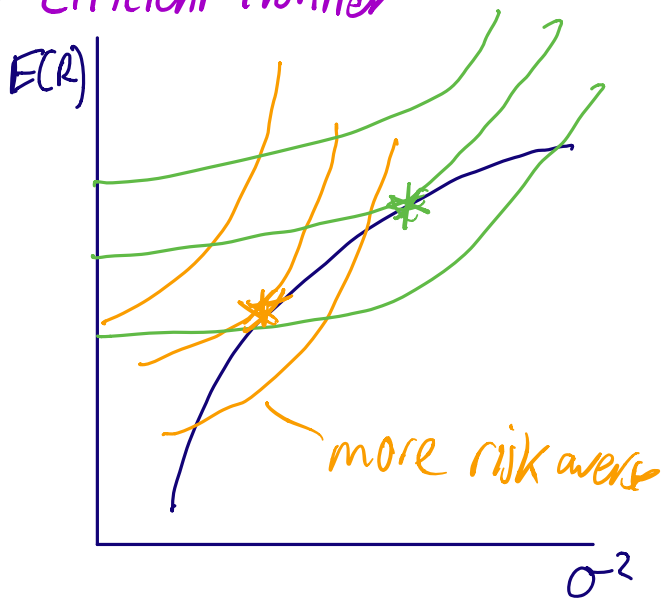
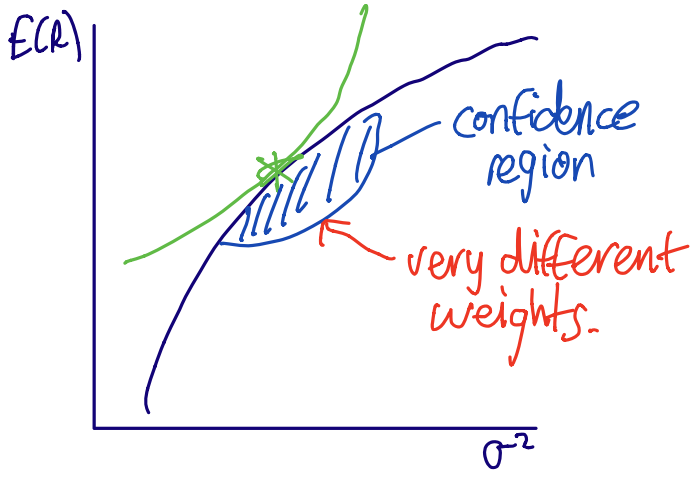
# Is 'Optimised' Optimal - Michaud (1989)

- We can't perfectly estimate $\mu$ or $\sigma$ so MVO often results in error maximisation
- Classical MVO finds the max. expected return for a given volatility. This defines an efficient frontier
- The optimal portfolio for a given investor is tangent to their particular utility curve
- MVO with linear constraints and quadratic utility functions can be solved with QP.




| Pros of MVO | Cons of MVO |
|---|---|
| · Can integrate many client constraints | · Error maximisation<br>↳ sample means are inadmissible |
| · Systematic | · Ignores factors like liquidity |
| · QPs can be solved fast | · Unstable and ill-conditioned |



## Enhancing MVO

- Bayes-Stein shrinkage estimators:
  - shrink sample means to some global mean
  - shrinkage ∝ variance, # assets
- The IC adjustment:
  - can be used to convert forecasts based on other models (e.g intrinsic value) to something on the same scale
- Asset allocation with respect to a benchmark seems to be a much easier task for MV optimisers.

## Alternatives to MVO

- Linear programming:
  - maximise return w.r.t betas / yields
  - results in stable portfolios with intuitive structures (though not MV-efficient)
- Testing discretionary portfolios for MV efficiency within statistically equivalent region

## Specialised applications of MVO

- Tracking funds:
  - set returns to zero and minimise the tracking error w.r.t some target benchmark
  - no error maximisation but still depends on the quality of the risk model.
- Tilted index funds:
  - minimise tracking error while maximising other characteristics (tradeoff)