Portfolio Construction
Measuring and Targeting Efficiency
to Optimise the use of Turnover

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Vasant Khilnani - Senior Portfolio Manager
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November 2007
Perpetual

- Australian Company

- Listed on the Australian Stock Exchange – ASX/S&P100

- Predominantly a **Funds Management** Business covering:
  - Australian Equities
  - Global Equities
  - Quantitative Equities
  - Cash & Fixed Income
  - Mortgages
  - Direct Property
  - Listed Property

- $40 billion in Funds Under Management

- **Quantitative Funds**: long-only, 140/40 & market neutral funds
Background

- Our primary objective was to investigate and develop ideas which would allow us to **create better portfolios**

- Backtesting software typically comes with **many options for portfolio construction**
  - risk targeting,
  - leverage targeting,
  - market neutrality, etc

- However, options relating to the **optimal use of turnover** are quite limited
Turnover Alternatives

- Employ a fixed amount of Turnover
  - Pros: easy to implement
  - Cons: potential erosion of alphas

- Precisely model Transaction Costs
  - Pros: turnover can vary to better capture alpha
  - Cons: multi-period effects, opportunity costs, fluctuations in daily liquidity

- Target a fixed Return Expectation
  - Pros: turnover can vary to better capture alpha
  - Cons: scaling of alphas & transaction costs still play a part
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Turnover Alternatives (cont)

- **Targeting efficiency** was intuitively appealing:
  - allows us to vary our use of turnover to better capture our alphas
  - the amount of turnover is driven by changes in our underlying alphas
    (rather than being fixed to some arbitrary pre-defined amount)
  - the level of efficiency could be tied back to the information ratio of the portfolio
Presentation Overview

■ Measuring Efficiency
  – How should we measure efficiency?
    ▪ Should I correlate my Alphas with Active Weight?
    ▪ Important to measure it correctly before it can be targeted
  – Efficiency of an Unconstrained Portfolio
  – Efficiency and the Introduction of Constraints

■ Targeting Efficiency
  – Targeting Efficiency
  – How Much Efficiency Do I Need?
  – Simulations from a Long-Only Portfolio
  – Simulations from a Long-Short Portfolio
Measuring Efficiency

- Efficiency measures **attempt** to quantify the extent to which your stock-specific beliefs have been appropriately reflected in the live portfolio.

- **The Correlation Triangle** (as presented by Clarke, De Silva & Thorley*).

- **The Transfer Coefficient** is a commonly used metric of most quantitative managers.

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* Portfolio Constraints and the Fundamental Law of Active Management
Roger Clarke, Harindra de Silva, and Steven Thorley
Financial Analysts Journal, Volume 58, Number 5
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Transfer Coefficient – A Three Stock Example

A three stock portfolio of Australian mining stocks

<table>
<thead>
<tr>
<th>Stock</th>
<th>Alpha</th>
<th>Risk</th>
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Measuring Efficiency

- R² = 0.60
- R = 0.78
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Measuring Efficiency

Active Weight vs. Forecast Alpha

R² = 0.60
R = 0.78

Active Weight (Risk Adjusted) vs. Forecast Alpha

R² = 0.90
R = 0.96

Implied Alpha vs. Forecast Alpha

R² = 1.00
R = 1.00
Measuring Efficiency (cont)

- The Clarke, De Silva & Thorley paper makes a number of **simplifying assumptions** in order to derive a conceptual framework.

- One key assumption to be aware of is:

\[ V_{i,j} = 0 \quad \text{if } i \neq j \]

- It is just **important for practitioners to:**
  - understand these assumptions
  - be practical in the implementation of the underlying idea

Transfer Coefficient = \( \frac{\alpha^T w}{\sqrt{\alpha^T V^{-1} \alpha} \cdot \sqrt{w^T V w}} \)

Efficiency = \( \frac{\alpha^T \alpha_i}{\sqrt{\alpha^T \alpha} \cdot \sqrt{\alpha_i^T \alpha_i}} \)

where, \( \alpha_i = \text{implied alpha} \)

The two are equivalent when assuming that

\[ V_{i,j} = 0 \quad \text{if } i \neq j \]
Should I Correlate Alphas with Active Weight?

- Correlations are **best used when a linear relationship exists** between the two variables being correlated.
- A linear relationship **does not exist** between return expectations and the active weight in a portfolio.

![Graph showing the relationship between return expected and active weight.](image)

- A linear relationship **does exist** between return expectations and risk taken.
- Need to ensure that the efficiency measure is aligned with the objectives of the portfolio construction process.
An Unconstrained Portfolio

- In the absence of all constraints there is a **direct linear relationship** between the return expectation (the quantitative alpha) and the risk taken in the optimisation process.

- The strength of this linear relationship is measured by **efficiency** and is calculated using standard correlation analysis.

\[
\text{Implied Alpha} = 2 \times \text{Risk Aversion} \times \text{Portfolio Risk} \times \text{Marginal Contribution to Risk}
\]
Introducing Transaction Costs

- As constraints are introduced, the relationship between return and risk starts to deviate from its optimal linear form.
Industry Neutrality

- The more restrictive the constraint, the greater the deviation from the optimal position
Limitations in using Efficiency

Some key points:

- Inefficiency may exist for valid reasons
  - lack of stock liquidity
  - mandated industry limits
  - long-only constraint
  and this distinction is difficult to measure

- There are always limitations in using any one single number to measure the efficiency of an entire portfolio
  - use additional measures such as alpha/signal exposures
Targeting Efficiency

- Targeting efficiency was **intuitively appealing** because the level of efficiency could be tied back to the information ratio of the portfolio.

\[ IR \equiv \frac{E(R_A)}{\sigma_A} \approx \sqrt{TC} \cdot IC \cdot \sqrt{N} \]

where,

- IR is the expected information ratio of the portfolio
- \( E(R_A) \) is the expected active return of the portfolio
- \( \sigma_A \) is the active risk of the portfolio
- IC measures the ability of the quantitative forecasts to explain future returns
- N measures the number of independent bets over which the forecast is applied, and
- TC is the expected information ratio of the portfolio

- We will **vary turnover to achieve desired efficiency outcome**
Inefficiency Induced by Mandated Constraints

- Inefficiency may exist for valid reasons

- Typical relationship between turnover and **efficiency for a long-only fund**

  ![Turnover Frontier](image)

  - this relationship will change based on a manager’s constraints
  - this relationship will change based on a manager’s return expectations
  - incremental gains in efficiency will come at an increasing transaction cost
How Much Efficiency Do I Need?

- The fundamental law of active management* and subsequent discussions** essentially lead to the following relationship describing the expected information ratio of a portfolio:

\[ IR = \frac{E(R_A)}{\sigma_A} \approx TC \cdot IC \cdot \sqrt{N} \]

- Holding IC and N fixed, we can vary TC to get a sense for its influence on the IR of the portfolio.

- Breadth is a very contentious issue.

<table>
<thead>
<tr>
<th>TC</th>
<th>IC</th>
<th>N</th>
<th>IR</th>
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* Richard Grinold and Ronald Kahn
** Roger Clarke, Harindra de Silva, and Steven Thorley
Simulations from a Long-Only Portfolio

- Results from a long-only fund with a fixed tracking error target
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Discussion

- Efficiency targeting has been implemented as an additional capability in QI’s historical portfolio testing systems.

- The benefit of its inclusion is that it provides a more intuitive alternative for varying turnover with changing return expectations.

- This benefit is best utilised when making use of shorter term trading indicators and/or event driven signals.

- Inefficiency can exist for valid reasons - some refinement required to account for the realities of portfolio construction (trading volumes and constraints).

- This additional functionality leads to better outcomes from our current portfolio construction framework.