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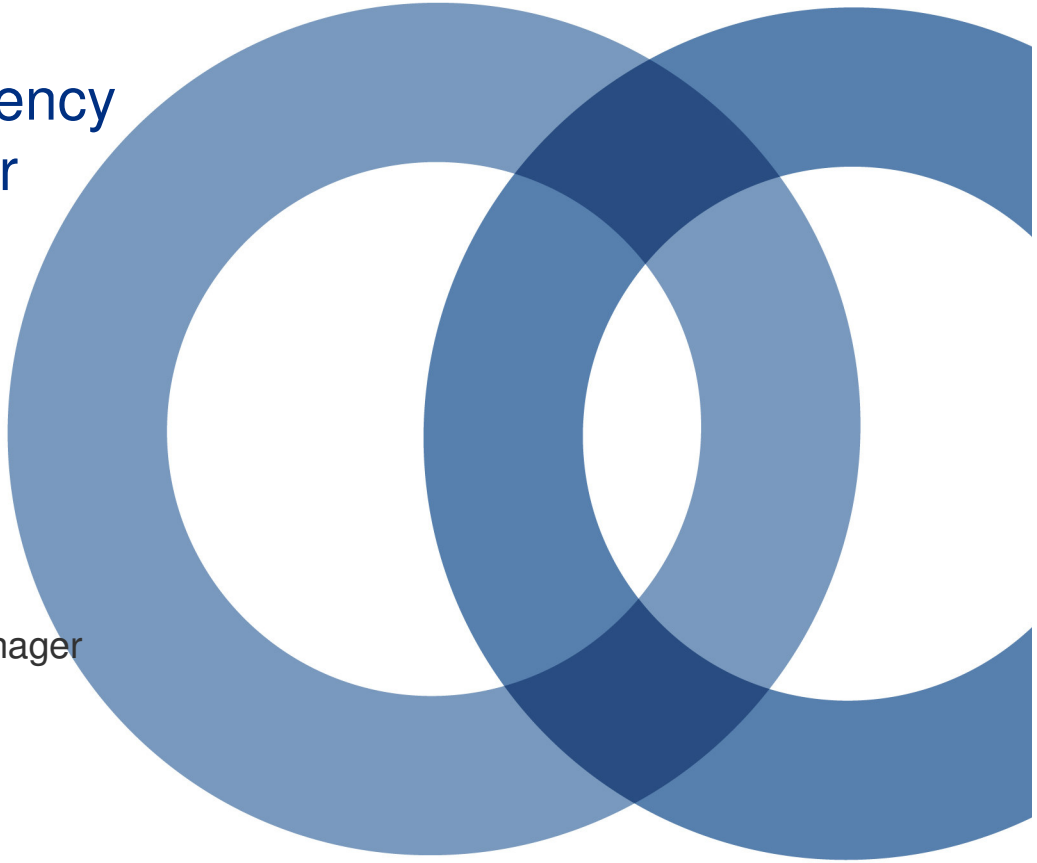
Portfolio Construction

Measuring and Targeting Efficiency to Optimise the use of Turnover



Ganesh Suntharam - Quantitative Portfolio Manager

Vasant Khilnani - Senior Portfolio Manager

Eric Demoiseau - Senior Quantitative Analyst

November 2007

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- **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)

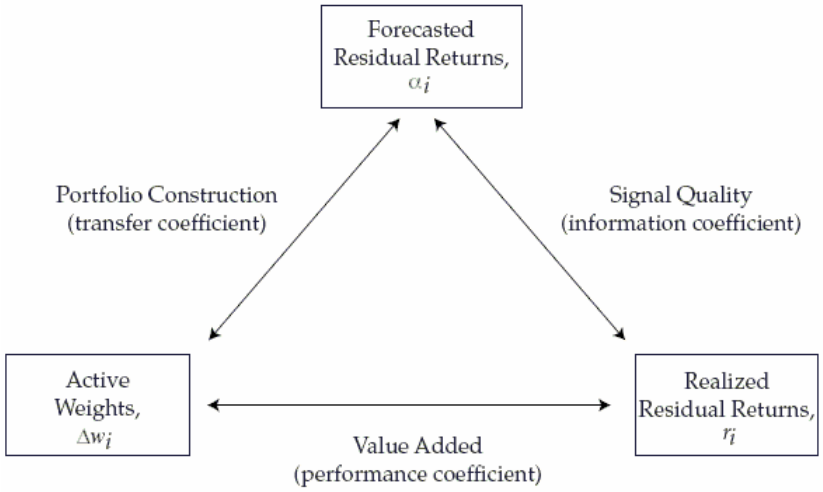
- **Targeting efficiency** was intuitively appealing:
  - allows us to vary our use of turnover to better capture our alphas
  - the amount of **turnover is driven by changes in our underlying alphas** (rather than being fixed to some arbitrary pre-defined amount)
  - the level of efficiency could be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

* Portfolio Constraints and the Fundamental Law of Active Management
Roger Clarke, Harindra de Silva, and Steven Thorley
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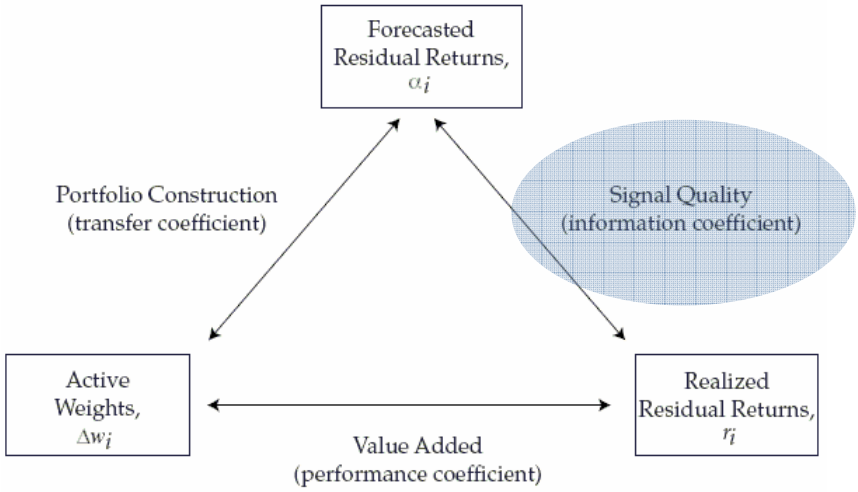

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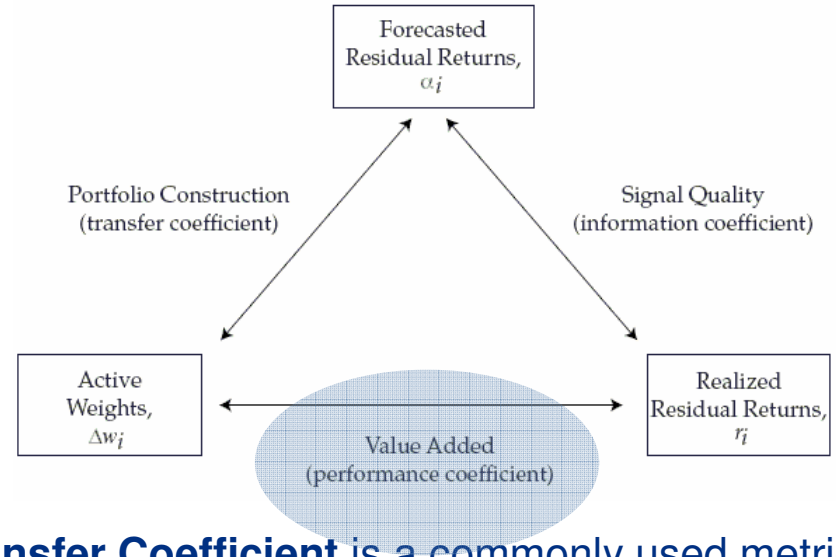

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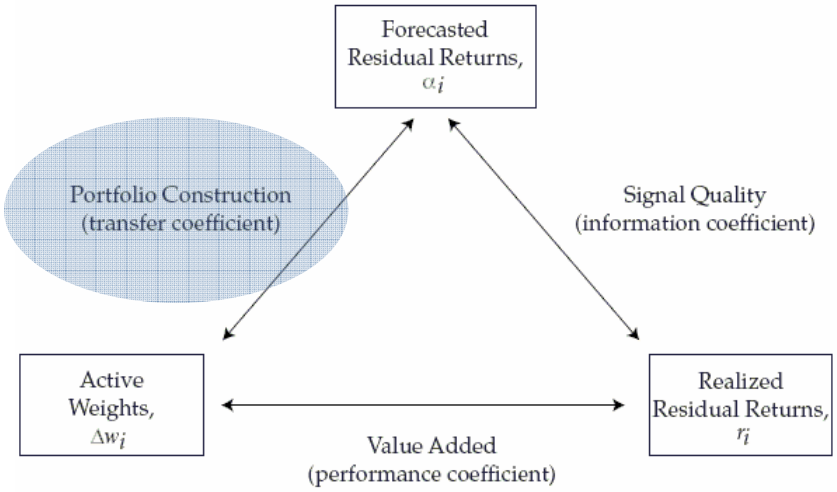

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Transfer Coefficient – A Three Stock Example

- A three stock portfolio of Australian mining stocks

Stock	Alpha	Risk	Wgt-LS	Implied-LS
FMG	10%	61%	18%	9.13%
BHP	5%	28%	82%	4.13%
RIO	-5%	28%	-100%	-4.49%

Corr Mtx	FMG	BHP	RIO
FMG	**1.00**	*0.36*	*0.31*
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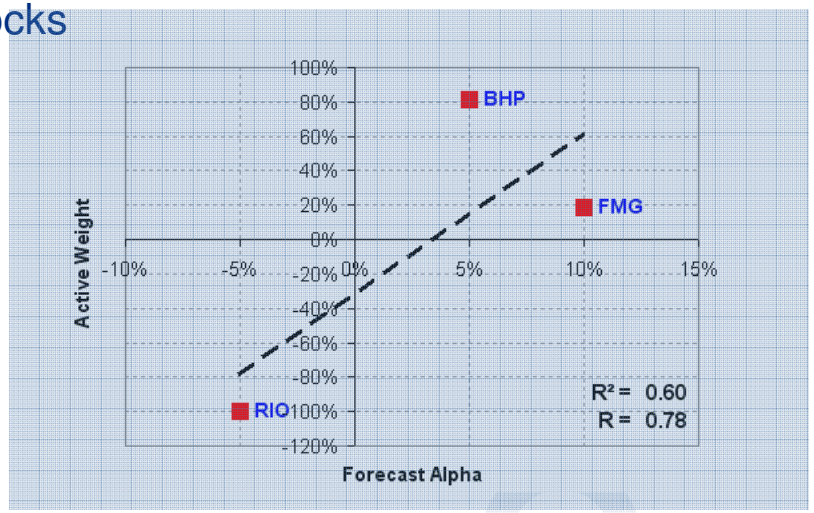

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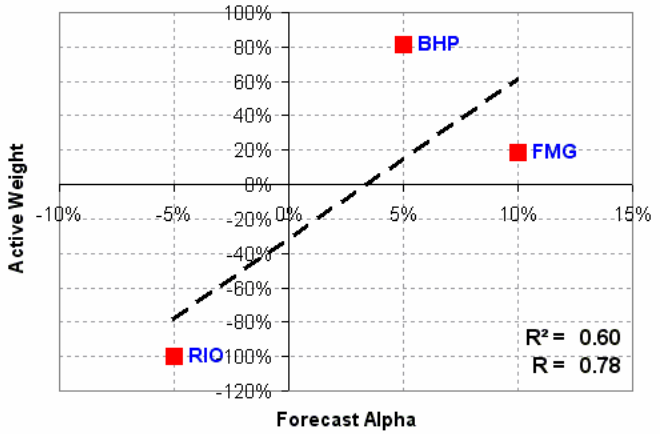

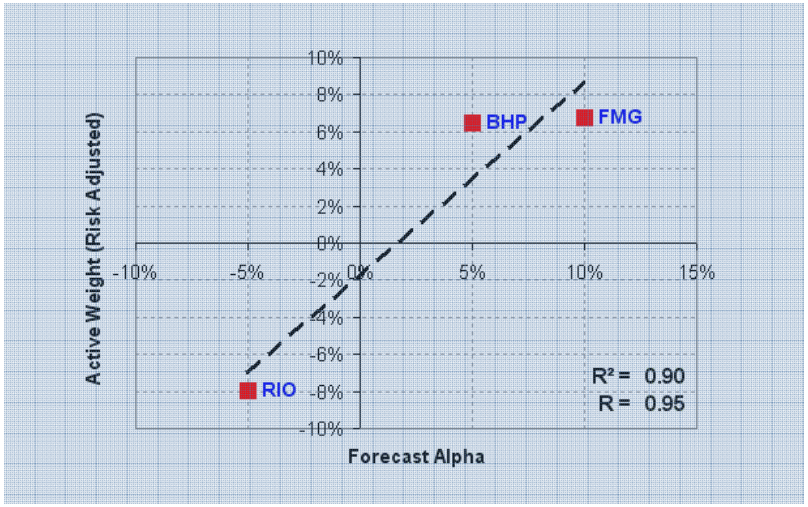

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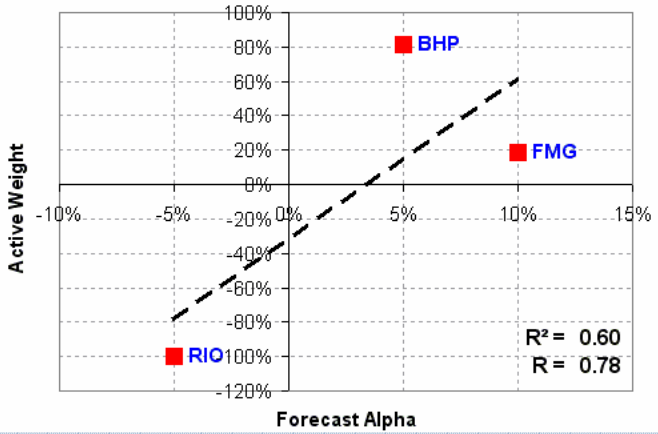
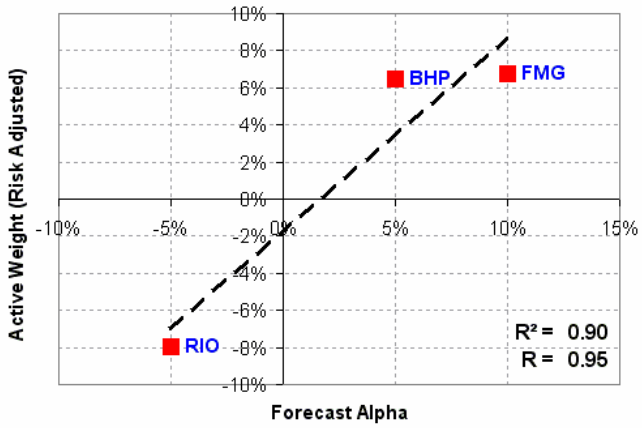
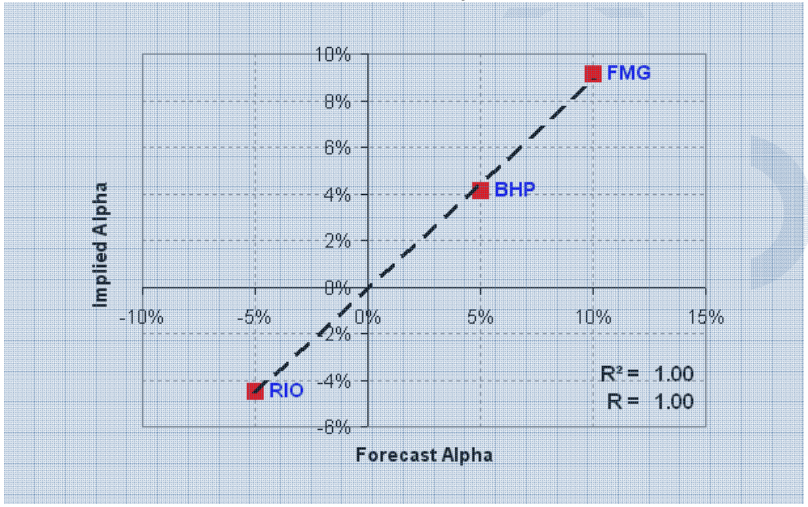






Measuring Efficiency (cont)

- 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:

$$V_{i,j} = 0 \qquad \text{if } i \neq j$$

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

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

$$\text{Efficiency} = \frac{\alpha^T \alpha_i}{\sqrt{\alpha^T \alpha} \cdot \sqrt{\alpha_i^T \alpha_i}}$$

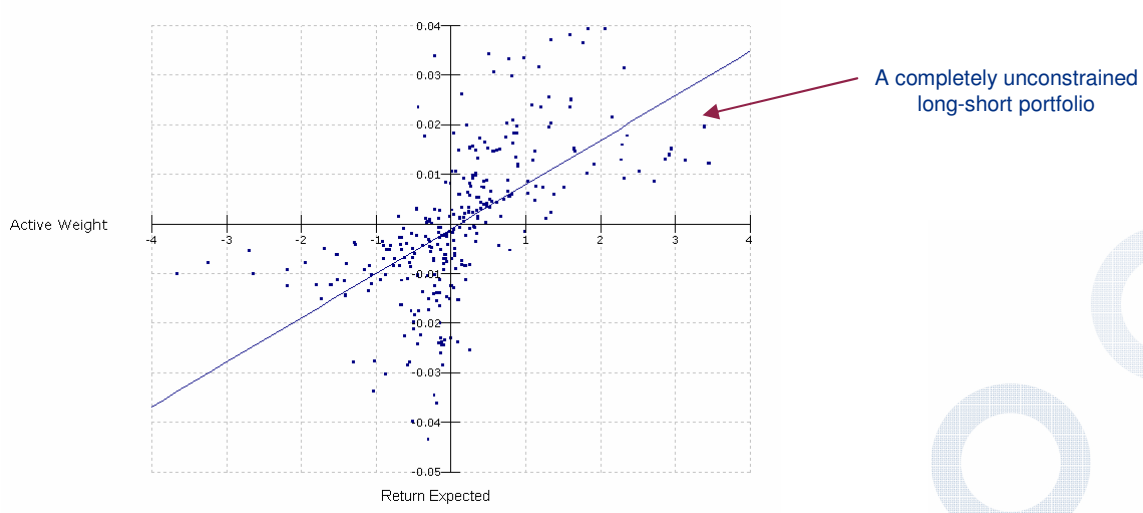
where, $\alpha_i = implied\ alpha$

The two are equivalent when assuming that

$$V_{i,j} = 0 \qquad \text{if } i \neq j$$

Should I Correlate Alphas with Active Weight?

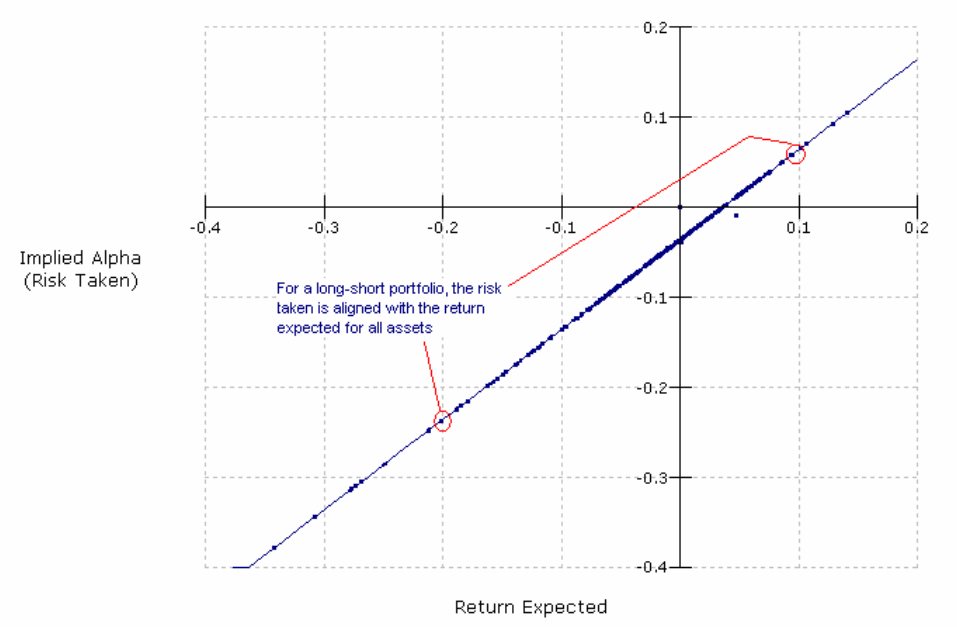
- Correlations are **best used when a linear relationship exists** between the two variables being correlated
- A linear relationship **does not exist** between return expectations and the active weight in a portfolio



- 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

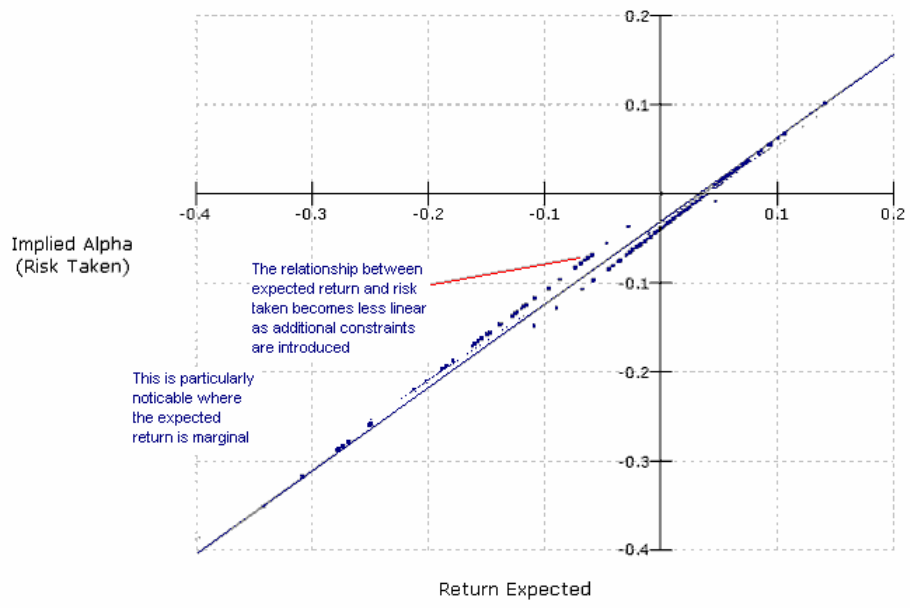
- In the absence of all constraints there is a **direct linear relationship** between the return expectation (the quantitative alpha) and the risk taken in the optimisation process
- The strength of this linear relationship is measured by **efficiency** and is calculated using standard correlation analysis



Implied Alpha = 2 * Risk Aversion * Portfolio Risk * Marginal Contribution to Risk

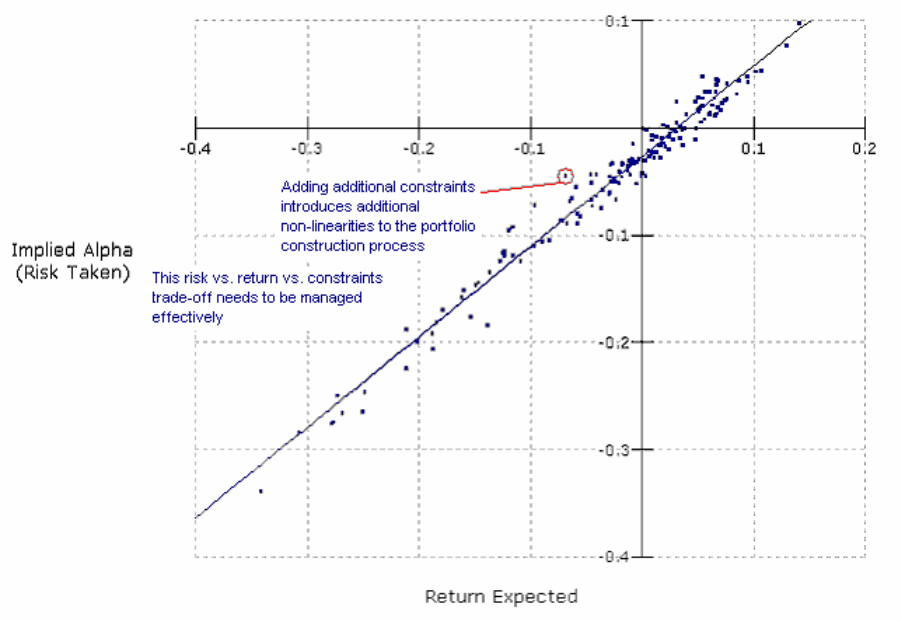
Introducing Transaction Costs

- **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

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

where,

IR is the expected information ratio of the portfolio

$E(R_A)$ is the expected active return of the portfolio

σ_A is the active risk of the portfolio

IC measures the ability of the quantitative forecasts to explain future returns

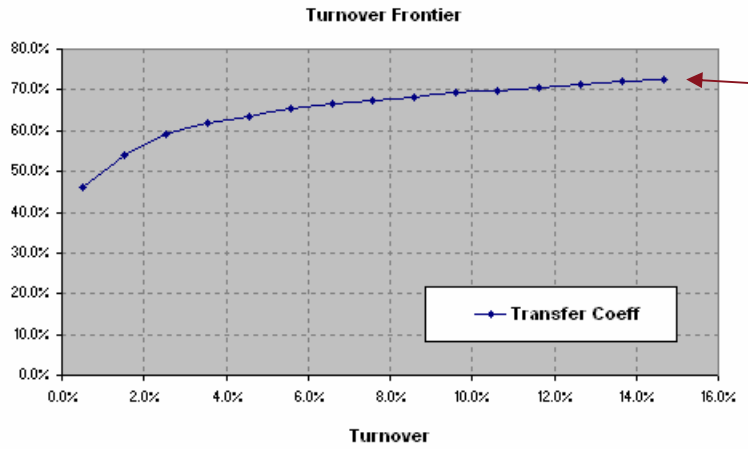
N measures the number of independent bets over which the forecast is applied, and

TC is the expected information ration 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**



Inefficiency may exist for valid reasons

In this example, the long only constraint limits further increases in efficiency with additional turnover

  - 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

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

- 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**

$$IR_{pre\ Cost} \approx TC \cdot IC \cdot \sqrt{N}$$

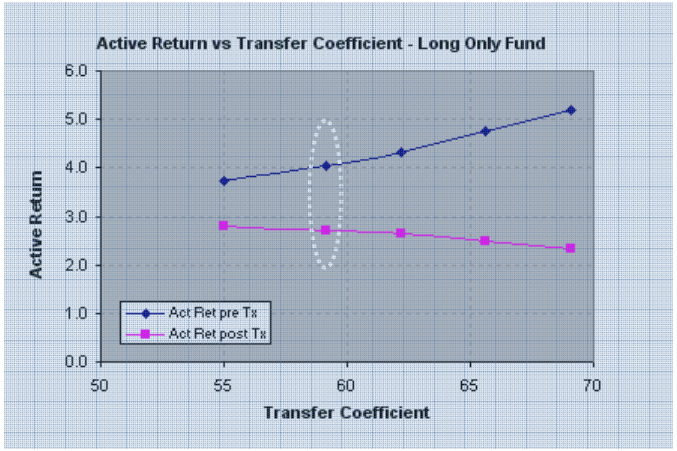
TC	IC	N	IR
50%	10%	100	0.50
60%	10%	100	0.60
70%	10%	100	0.70
50%	10%	150	0.61
60%	10%	150	0.73
70%	10%	150	0.86
50%	10%	300	0.87
60%	10%	300	1.04
70%	10%	300	1.21

* 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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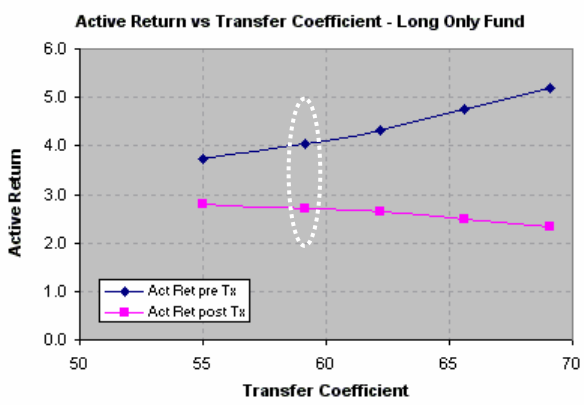

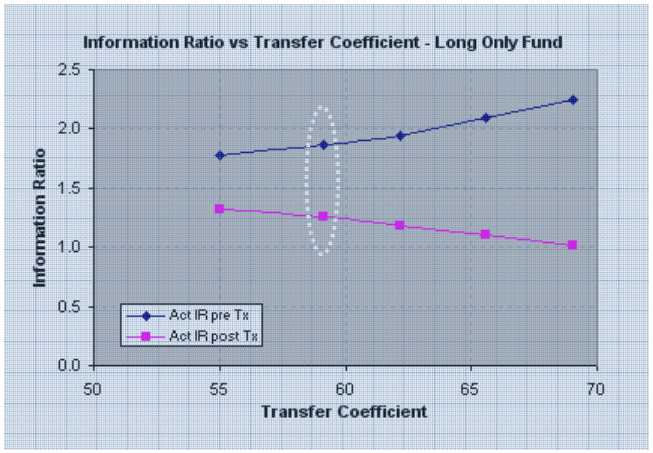

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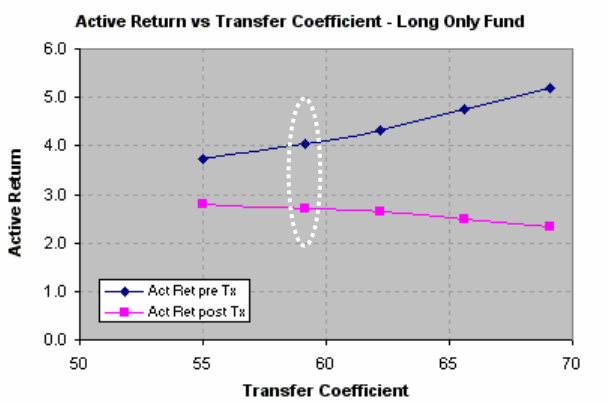

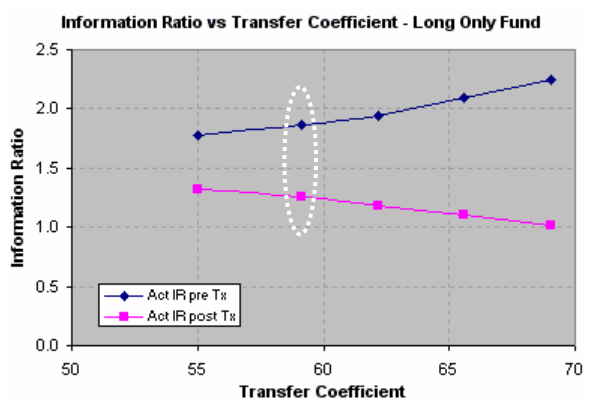

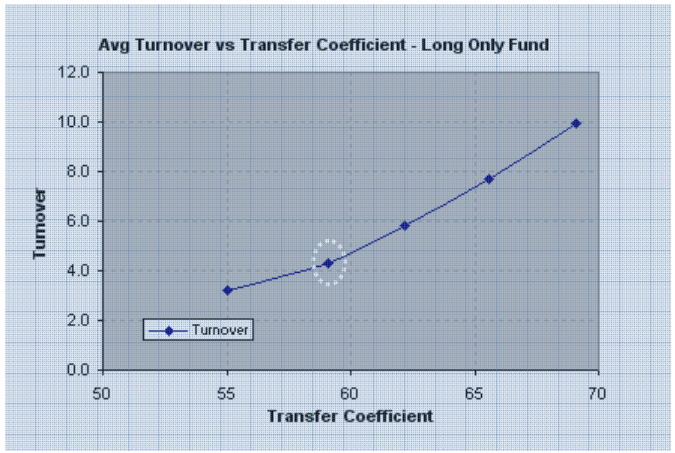

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Discussion

- 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 account for the realities of portfolio construction (trading volumes and constraints)
- This additional functionality leads to better outcomes from our current portfolio construction framework