



Portfolio Construction

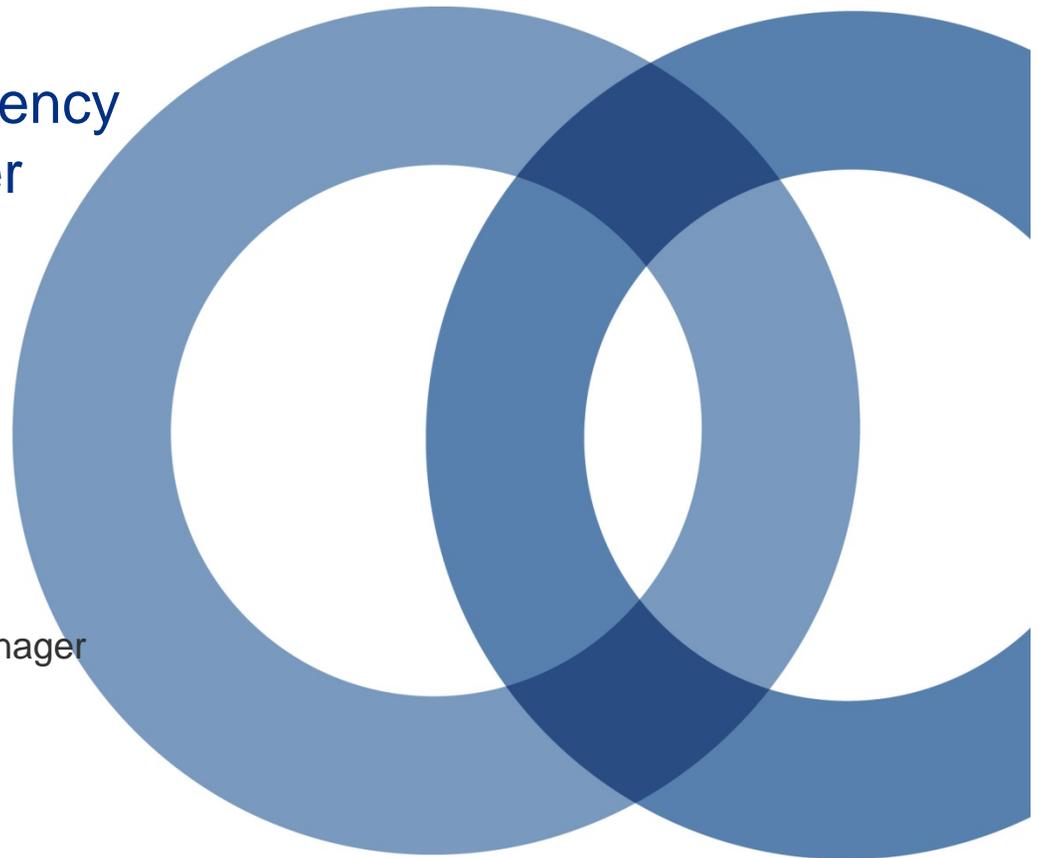
Measuring and Targeting Efficiency
to Optimise the use of Turnover

Ganesh Suntharam - Quantitative Portfolio Manager

Vasant Khilnani - Senior Portfolio Manager

Eric Demoiseau - Senior Quantitative Analyst

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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

The Australian Market

■ Australian Market

- Over 1 trillion AUD, which equates to
- approx 3% of the MSCI World Index

Sector	Weight in ASX/S&P 300 Index
Resources	30%
Industrials	15%
Consumer Goods	15%
Financials	35%
Technology	5%

■ Recent developments

- Off 20% from highs in November 2007
- A number of leverage related corporate disasters (financials / property)
- Uncertainty around US growth impacting resources and consumer goods

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
- The approach we are going to discuss allows us to **align the turnover in our portfolios with the turnover in our alphas**
- This approach is **best utilised when our alphas incorporate aperiodic or event driven components**

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, daily liquidity fluctuations

■ 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

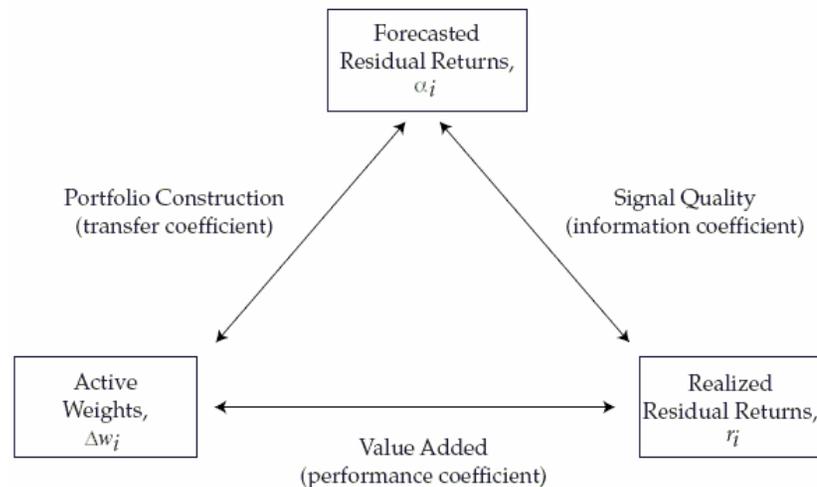
- How should we measure efficiency?
 - Should I correlate my Alphas with Active Weight?
 - Important to measure it correctly before it can be targeted
- Efficiency of an Unconstrained Portfolio
- Efficiency and the Introduction of Constraints

■ 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*)

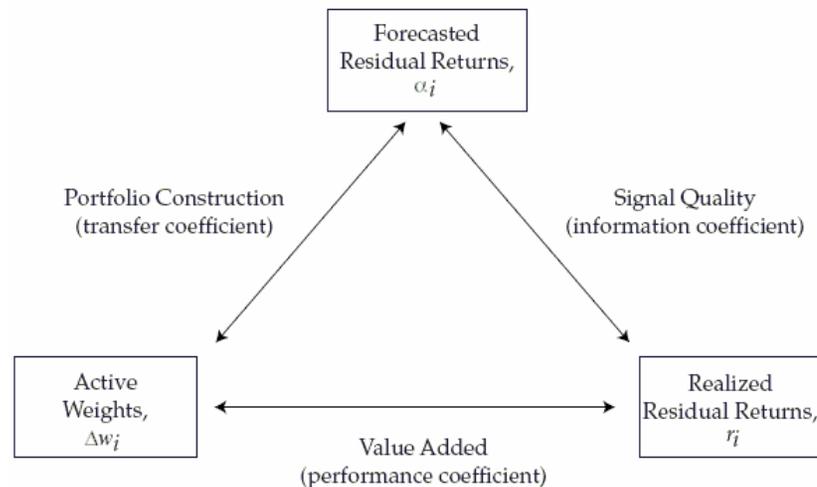


- **The Transfer Coefficient** is a commonly used metric of most quantitative managers

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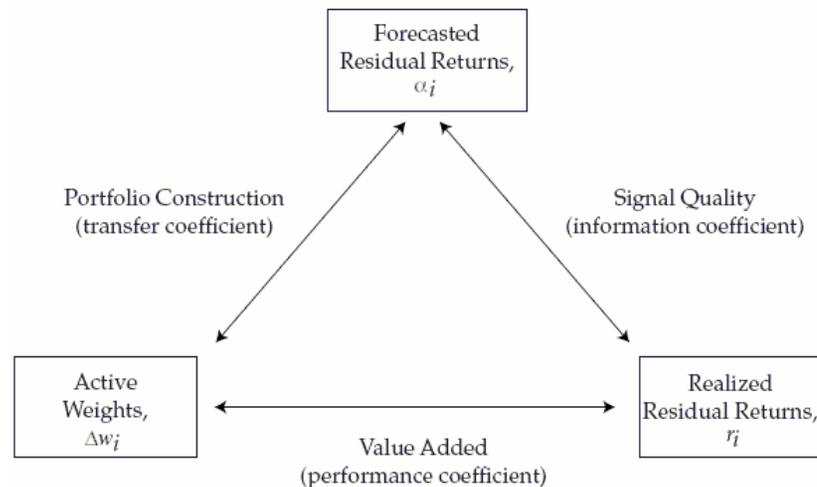


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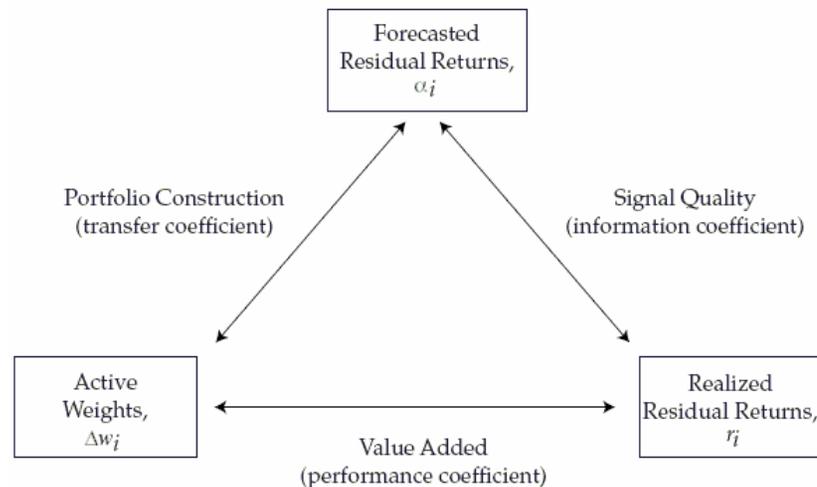


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Transfer Coefficient – A Three Stock Example

- 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%

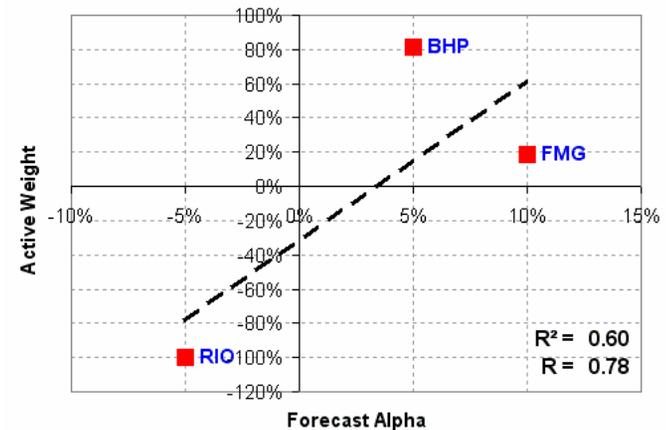
Corr Mtx	FMG	BHP	RIO
FMG	1.00	<i>0.36</i>	<i>0.31</i>
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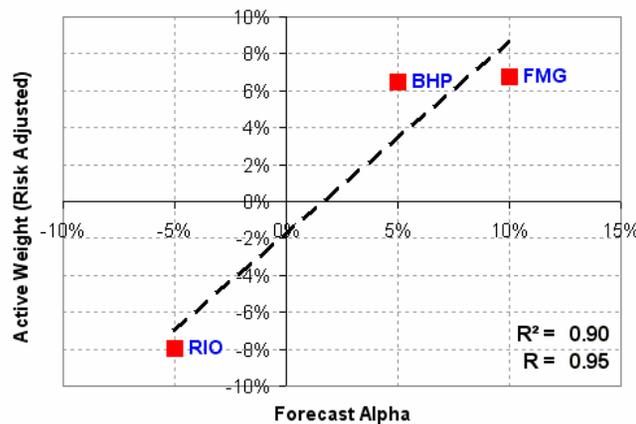
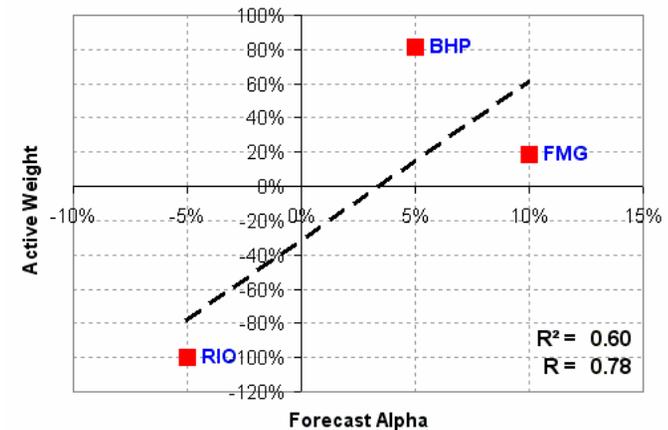


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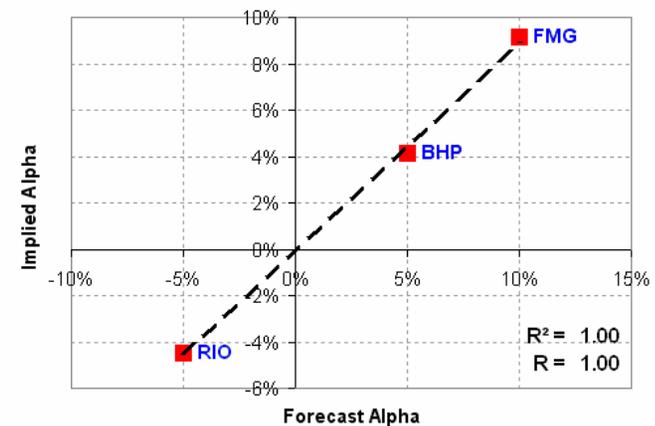
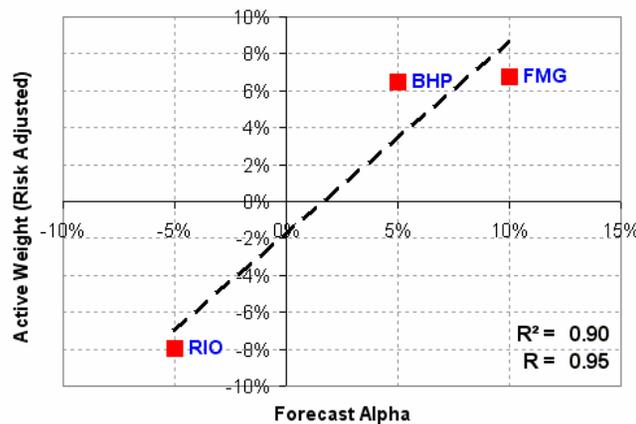
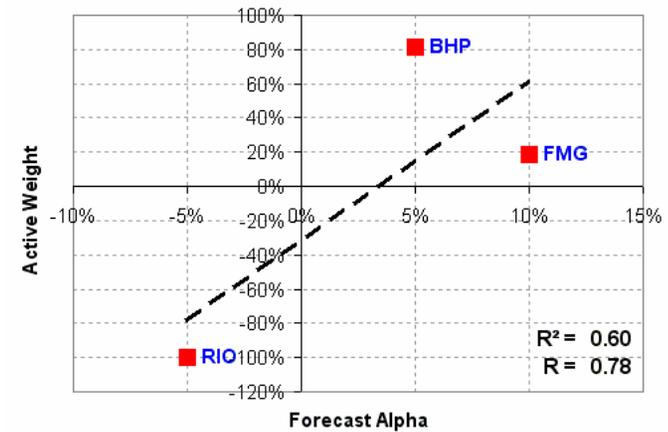


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Measuring Efficiency (cont)

- 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:

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

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

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

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

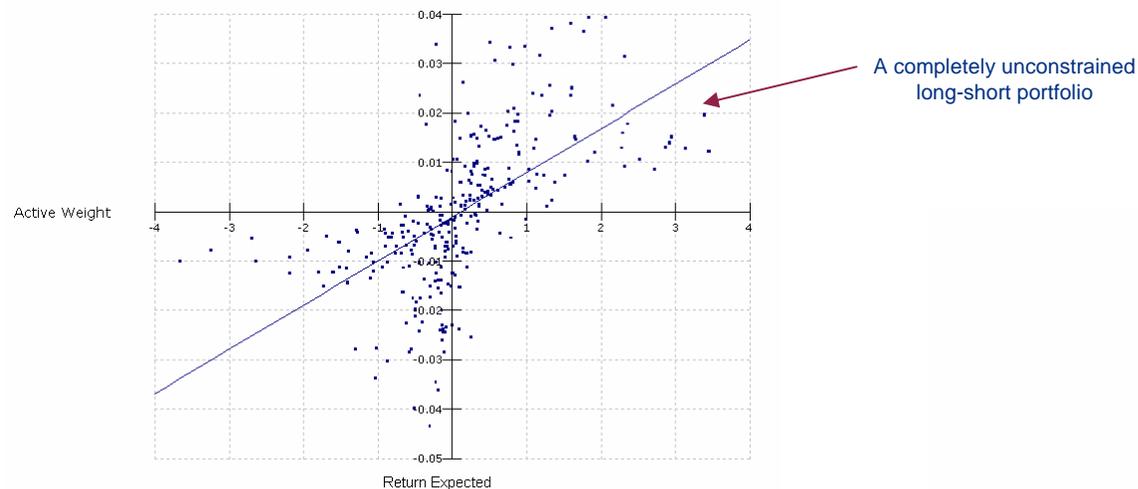
where, $\alpha_i = \text{implied alpha}$

The two are equivalent when assuming that

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

Should I Correlate Alphas with Active Weight?

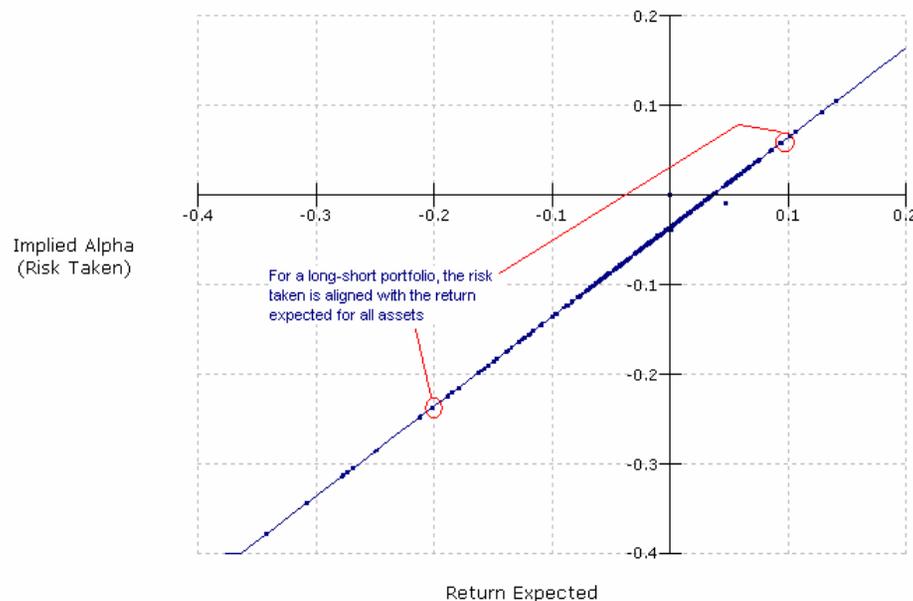
- Correlations are **best used when a linear relationship exists** between the two variables being correlated
- A linear relationship **does not exist** between return expectations and the active weight in a portfolio



- 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

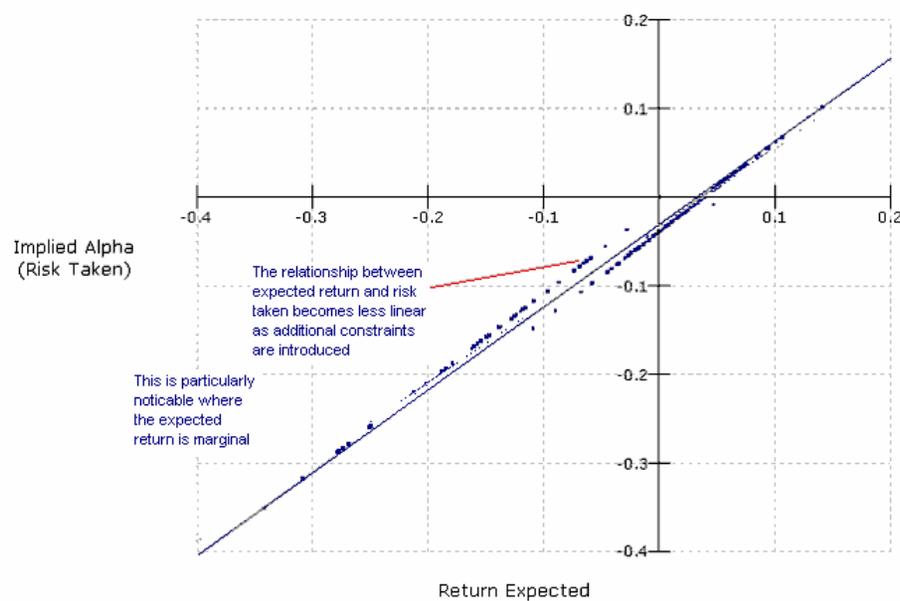
- In the absence of all constraints there is a **direct linear relationship** between the return expectation (the quantitative alpha) and the risk taken in the optimisation process
- The strength of this linear relationship is measured by **efficiency** and is calculated using standard correlation analysis



$$\text{Implied Alpha} = 2 * \text{Risk Aversion} * \text{Portfolio Risk} * \text{Marginal Contribution to Risk}$$

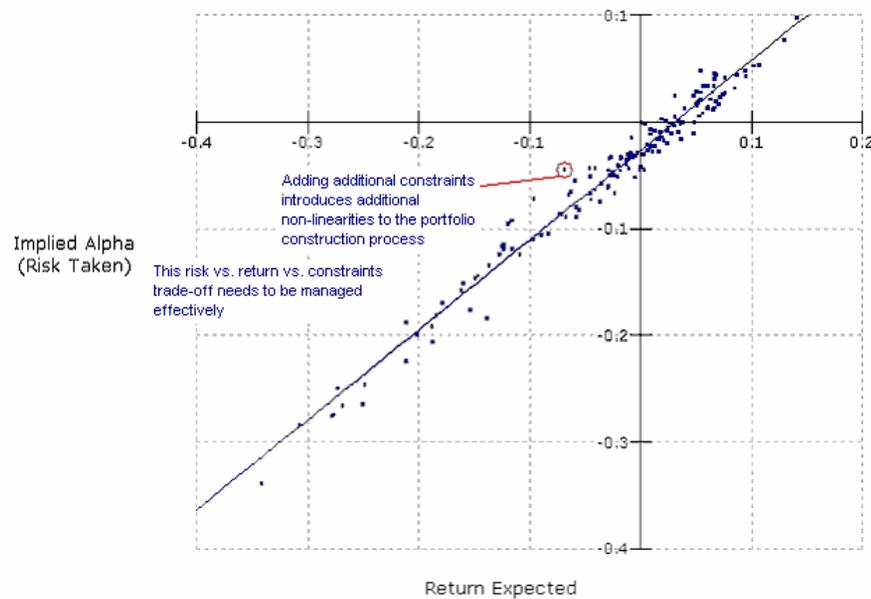
Introducing Transaction Costs

- **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

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

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

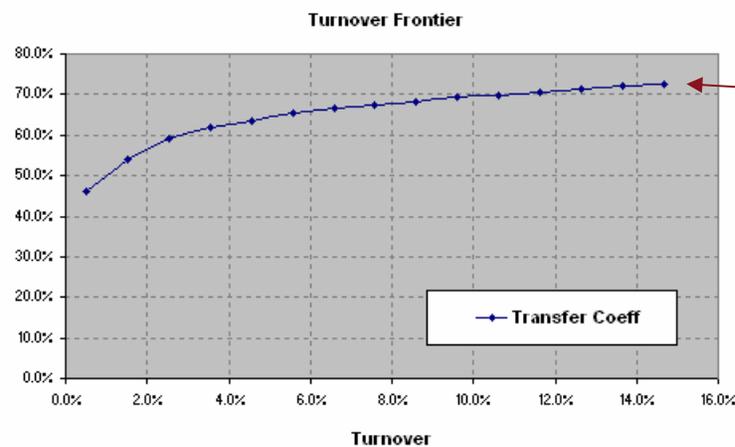
N measures the number of independent bets over which the forecast is applied, and

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**

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

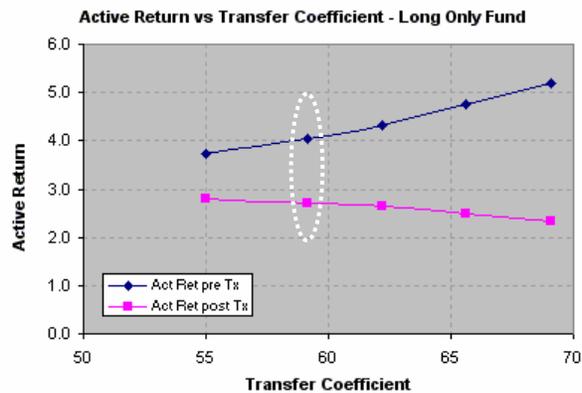
TC	IC	N	IR
50%	10%	100	0.50
60%	10%	100	0.60
70%	10%	100	0.70
50%	10%	150	0.61
60%	10%	150	0.73
70%	10%	150	0.86
50%	10%	300	0.87
60%	10%	300	1.04
70%	10%	300	1.21

* Richard Grinold and Ronald Kahn

** Roger Clarke, Harindra de Silva, and Steven Thorley

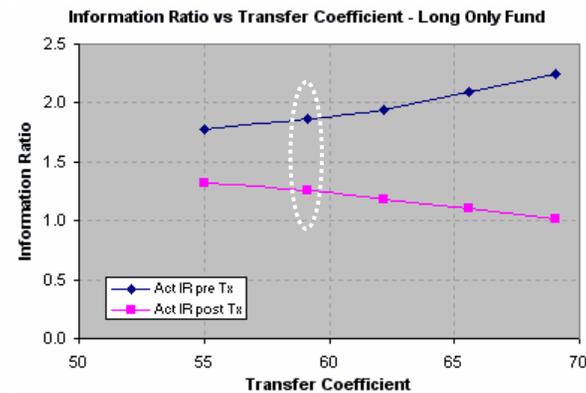
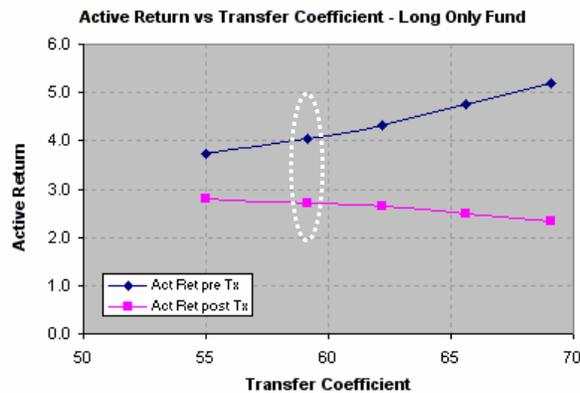
Simulations from a Long-Only Portfolio

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



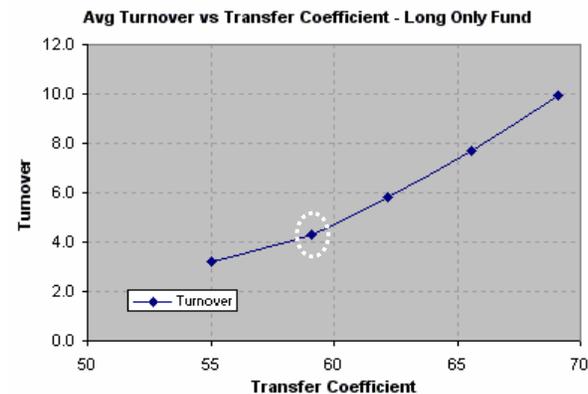
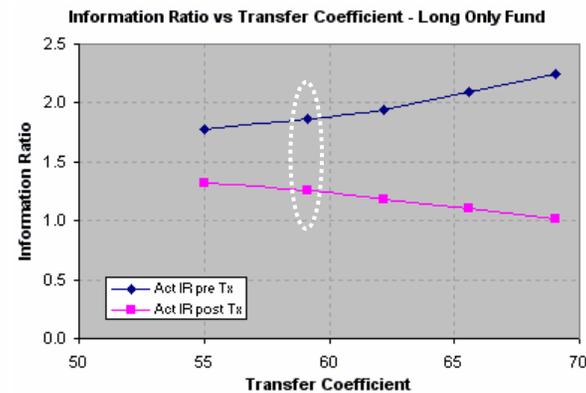
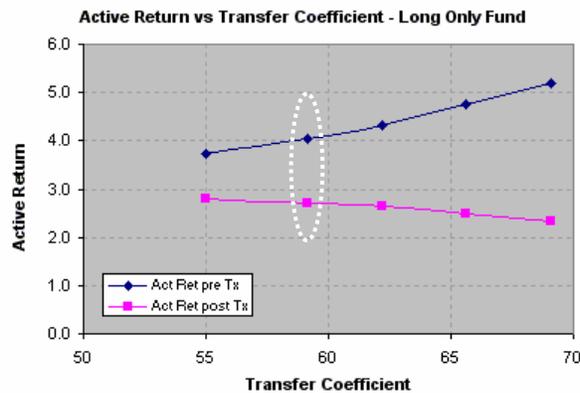
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Simulations from a Long-Only Portfolio

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



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