Infrastructure research note

Allocating capital between Australian listed and direct infrastructure investments

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Executive summary

- A simple allocation model is proposed for allocating investor capital across direct (unlisted) and listed infrastructure investments. This is motivated by their distinctive different risk-return profiles.
- The analysis highlights the potential for diversification benefits when jointly investing in direct and listed infrastructure rather than in each infrastructure investment segment individually.
- This model is considered a valuable tool in formulating strategies for hybrid infrastructure investment structures which jointly invest in listed and direct asset markets.
- Estimated target allocations, based on historical ten year returns, for direct and listed infrastructure are 60% and 40% respectively.
- Tactical allocations will be influenced by varying market conditions. In times of excess listed market volatility, such as the present period, the model suggests a greater allocation to direct infrastructure in the order of 75%.

1. Introduction

One main class of tools used in the wealth management industry relates to asset allocation models. These models provide guidance on how capital can be effectively allocated across various asset classes so that investors reap diversification benefits.

Such models can also be constructed at a sector level for a given asset class. With reference to infrastructure investment, distinctive characteristics are exhibited between direct and listed infrastructure. The following note outlines a simple allocation model for allocating investor capital across Australian direct and listed infrastructure investment.

2. Features of direct and listed infrastructure investment

A central feature of the infrastructure allocation model involves the construction of an efficient portfolio frontier via an application of an optimisation procedure. To undertake the optimisation procedure, three pieces of information are required for each infrastructure asset class. These include an estimate of: i) the expected return; ii) expected covariance of returns and, iii) the correlations between returns. Estimates for these three information sets are commonly based on historical values. Adopting this approach, estimates are based on a historical rolling ten year time period using monthly returns.

A brief discussion of each of these three information sets is given below.

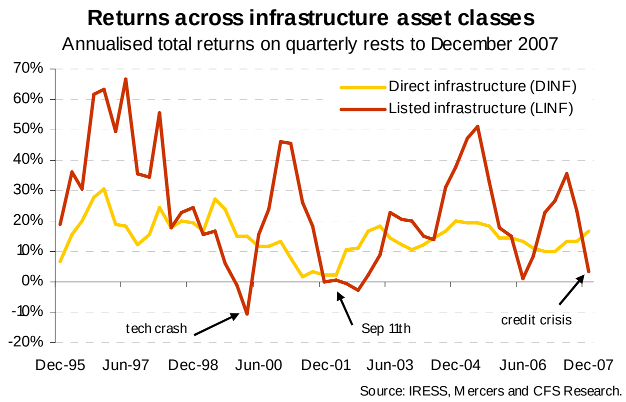
Returns: listed versus direct infrastructure

Investment in direct infrastructure delivers investors two main return attributes. Firstly, it provides investors with a consistent income stream (partly based on monopolistic rents). Secondly, it provides investors with capital growth, via asset value appreciation, underpinned by economic growth and associated macro-economic drivers, such as population growth and wealth generation. In contrast to direct infrastructure, listed infrastructure relates to infrastructure assets held in listed companies which are traded on a public stock exchange.

Figure 1 shows rolling annual returns for direct and listed infrastructure. The unlisted infrastructure return series is a simple average of five wholesale Australian diversified infrastructure fund returns with varying inception dates. These are the AMP Diversified Infrastructure Equity Fund (Sept 1995), the CFS Infrastructure Income Fund (Oct 2003), the Perpetual Diversified Infrastructure Fund (Jan 2005), Hastings' The Infrastructure Fund (Oct 2000), and the Utilities Trust of Australia (Dec 1994). The return profile for listed infrastructure is based on the UBS Infrastructure and Utilities Accumulation Index (sourced from IRESS, stock code SIINFUAI).

Figure 1 shows that listed infrastructure returns have demonstrated greater volatility than direct (unlisted) infrastructure returns. This highlights the lack of exposure by unlisted infrastructure to general listed market volatility, the difference in valuation methods (appraisal-based for unlisted infrastructure) and varying repricing profiles.

Figure: 1



Volatility: the covariance matrix

The second information set refers to variance information for the two infrastructure asset classes. When this variance information is grouped together, it is often referred to as the covariance matrix. The covariance matrix denotes the joint risk across infrastructure returns. For instance, high values imply high risk while low values imply lower risk. The estimated joint risk across the two infrastructure classes is reported in the covariance matrix presented in Table 1. Note

DS refers to 'de-smoothed' returns. Unlisted infrastructure tends to exhibit relatively smooth returns as a result of the appraisal based valuation system used. The return series is de-smoothed in an attempt to characterise the structure of the data in a similar manner as that of listed infrastructure returns. This series is denoted as DINF(DS).

Table: 1

COVARIANCE MATRIX

Last 10 years ending Dec-2007

	DINF(DS)	LINF
DINF(DS)	**0.00608**	**0.00225**
LINF	0.00225	**0.01707**

Table 1 highlights that direct infrastructure investing delivers lower return volatility than listed infrastructure as the variance of listed infrastructure is about three times as large as that of direct infrastructure. The greater volatility exhibited by listed infrastructure is attributable to share market volatility and is the 'price' of liquidity.

Return correlations

The third piece of information is the correlation matrix. The correlation value between two series is commonly given by the correlation coefficient which is a number between -1 and 1. It measures the strength of the linear relationship between the two variables. A value of 1 implies perfect positive correlation, -1 implies perfect negative correlation, while 0 implies no correlation.

The correlation matrix is important as it gives rise to diversification benefits. Diversification benefits arise when the portfolio risk can be reduced beyond that of any individual portfolio assets. Hence, efforts to achieve such benefits commonly involve mixing asset classes with different risk and return characteristics such that they exhibit negative or low correlation values. To illustrate the diversification potential of a portfolio, we observe the portfolio variance (σ_p^2) based on two assets, which can be expressed as

$$\sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho\sigma_1\sigma_2 \qquad \text{... (1)}$$

where w_1 and w_2 are the weights of assets 1 and 2 respectively, and σ_1 and σ_2 denote standard deviations for sectors 1 and 2 respectively, and ρ is the correlation coefficient.

An inspection of equation (1) highlights that diversification is driven by the covariance term $2w_1w_2\rho\sigma_1\sigma_2$. More importantly, the portfolio variance is minimised when the covariance term is minimised. This occurs when the correlation coefficient is at its maximum negative value of -1.

A review of Figure 1 shows that the time series return profiles for direct and listed infrastructure display distinctly different co-movement behaviour. This divergence in the two infrastructure cycles can be attributable to different underlying drivers.

Table 2 reports the estimated correlation value for the two infrastructure asset classes over the last ten years ending December 2007. The correlation value is not negative but low at 0.22. This suggests that diversification benefits are obtainable by holding a mixture of direct and listed infrastructure exposure as it mitigates the portfolio risk.

Table: 2

CORRELATION MATRIX

Last 10 years ending Dec-2007

	DINF(DS)	LINF
DINF(DS)	**1.000**	**0.221**
LINF	0.221	**1.000**

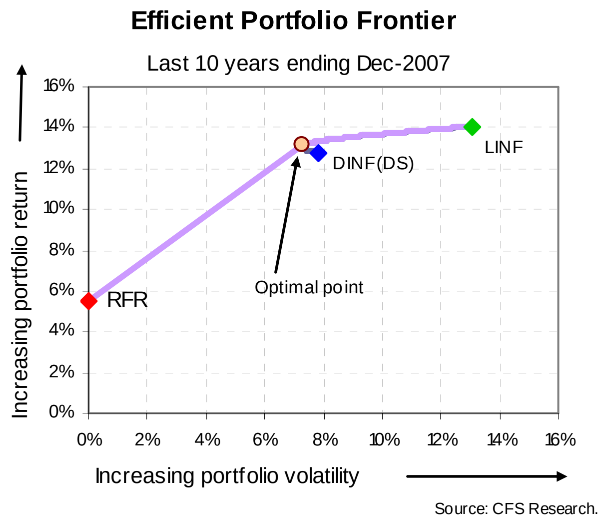
3. Portfolio construction

Based on the three information sets, one can now engage in the estimation of the portfolio frontier using an optimisation procedure. Note, the objective of the optimisation procedure is to produce a set of weights when the portfolio variance is minimised subject to a set of allocation constraints for a given portfolio return.

Portfolio frontier

The estimated portfolio frontier is shown in Figure 2. The efficient frontier is represented by the curved purple line. As expected, the frontier bulges in towards the vertical axis, reflecting the lower return correlation between the two infrastructure classes. The frontier is augmented with the risk-free rate (RFR) which extends the frontier to the vertical line.

Figure: 2



Strategic allocations

The estimated portfolio frontier can now be used to determine appropriate strategic allocations between the two infrastructure classes. Strategic asset allocation refers to the process of selecting a target asset allocation.

In this study use is made of a risk-adjusted performance measure. The appealing feature of a risk-adjusted performance measure is that it attempts to encapsulate the trade-off between risk and return. Risk-adjusted return quantifies a given unit of return per unit of risk. Whilst a portfolio may have a very high total return, the associated risk with that return is also of importance when considering an investor's risk tolerance. One such measure is the Sharpe ratio (SR). The SR is calculated by taking the quotient of the excess portfolio return to the portfolio standard deviation. The SR is calculated as

$$SR = (r_p - r_f)/\sigma_p \qquad . . . (2)$$

where σ_p is the portfolio standard deviation, where r_f is the risk-free rate (i.e., average bond rate over the respective period) and r_p is the expected portfolio return.

With reference to the efficient frontier, the strategic allocation can be determined by finding the maximum value of the SR ratio along the frontier. This is shown in Figure 2 and often referred to as the 'optimal' allocation. Based on this criterion, estimated optimal weight allocations for direct and listed infrastructure investment for various sample periods are reported in Table 3. For the ten year sample period ending December 2007 optimal allocations between direct and listed are approximately 75% and 25% respectively.

Table: 3

Portfolio performance for selected time periods

estimates based on historical ten year sample periods

Portfolio statistics	Period ending Dec-07	Dec-06	Dec-05	Dec-04
Return				
DINF(DS)	12.8%	13.1%	14.4%	13.8%
LINF	14.1%	18.4%	20.5%	21.4%
Optimal weight				
DINF(DS)	75%	61%	58%	54%
LINF	25%	39%	42%	46%
Sharpe ratio				
DINF(DS)	0.94	0.92	1.00	0.95
LINF	0.66	0.95	1.07	1.12
Combined	1.05	1.17	1.30	1.32

Source: CFS Research.

To gauge the robustness of these optimal weights, the exercise was repeated for sample periods ending December 2006, 2005 and 2004. Based on these estimates, optimal weights for direct and listed infrastructure investments are, on average, 60% and 40% respectively. The increased allocation to direct infrastructure over the sample period ending December 2007 reflects the recent marked downturn in the listed sector (as noted in Figure 1) and increased volatility in the general listed equity markets associated with the credit crisis. With the credit crisis considered to present a short-term deviation from the longer term performance of the infrastructure sector, then one may consider the estimated optimal allocations for the earlier periods (2004-2007) as target weights.

Furthermore, Table 3 also highlights the potential for diversification benefit in a portfolio context. Looking at the Sharpe ratio statistics, one notes that this measure is higher when both infrastructure segments are combined. This suggests that investors seeking risk-adjusted return will enhance their investment objective by having exposure to infrastructure across both investment segments.

4. Summary remarks

A simple allocation model was proposed for allocating investor capital across listed and direct infrastructure. This model is considered a valuable tool, providing a basis for formulating allocation strategies across infrastructure investment classes to reap out-performance based on diversification benefits. The model, while basic, can be modified for liquidity and capital constraints. Estimated target allocations, based on historical returns, for direct and listed infrastructure are 60% and 40% respectively. Short-term tactical allocations can be made which differ to these target weights as dictated by the prevailing market conditions for each class of the infrastructure investment landscape.

5. Research team

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