Performance Characteristics of Infrastructure Investments

August 2007

Table of Contents:

Prepared By:

Asieh Mansour
RREEF Alternatives
Chief Economist & Strategist
San Francisco
USA
(415) 262-2044
asieh.mansour@rreef.com

Hope Nadji
RREEF Research
Director
San Francisco
USA
(415) 262-2022
hope.nadji@rreef.com

Introduction

Over a short two year period, infrastructure has evolved as one of the hottest alternative asset classes. Institutional investors, searching for higher-yielding and stable investments, have flocked to this space globally. For pension funds, in particular, the long duration, inflation hedging and steady cash flow nature of infrastructure investments holds considerable appeal.

At the same time, governments, facing fiscal budgetary constraints, are raising much needed revenue through the monetization of their existing infrastructure assets, thereby increasing the supply of such investments. There are many secular drivers for increased infrastructure privatizations, including demographic growth, years of deferred maintenance and the growing need for governments to find alternative sources to fund new infrastructure projects and repair existing infrastructure. The drivers of infrastructure investment opportunities have been well documented in past RREEF Research publications[1].

Responding to institutional demand for such investments, there now exists an increasing number of vehicles to access infrastructure including direct investments, unlisted infrastructure funds, listed infrastructure funds, and unlisted infrastructure securities funds. Despite institutional interest and the emergence of a variety of vehicles, the characteristics of infrastructure investments and their historical performance are not yet widely understood nor documented empirically. With increased allocations to private infrastructure, in particular, either through direct investments or investments in unlisted vehicles, institutional investors are requiring better transparency and the development of appropriate benchmarks.

Most of the new interest in infrastructure investments has been targeted to private, less volatile, unlisted vehicles. A broad, global benchmark for such unlisted investments does not currently exist. The case for including private infrastructure investments in a multi-asset portfolio has been rationalized using unlisted returns data from Australia. What does the Australian experience reveal? Is it appropriate to apply the Australian results to private investments all over the world? Or perhaps one solution is to use the listed benchmarks as a proxy for the performance of private infrastructure similar to how securitized public real estate is used as a proxy for private real estate investments.

An alternative to using listed indices as benchmarks is to create a private benchmark based on a combination of returns from traditional and alternative assets. Since infrastructure is a hybrid asset class, sharing common traits with bonds, private equity, and real estate, investors could potentially create a blended return series from these comparable asset classes to create a composite benchmark for private infrastructure investments.

[1] "Opportunities in Private Infrastructure Investments in the US," RREEF publication, September 2006

In this report, these issues are addressed systematically. First, the conceptual characteristics of infrastructure are revisited. Much of this analysis centers on the traits and unique characteristics of private infrastructure assets with implications for investors. This is followed by a comparative analysis of infrastructure assets relative to other alternative and traditional assets. A review of the empirical evidence on infrastructure returns for both listed and unlisted assets is discussed next. Empirical evidence on private infrastructure based on the Australian experience and a hypothetical model portfolio created for Europe by RREEF is also presented.

This is followed by an analysis of two newly developed listed benchmarks, where historical performance of infrastructure investments relative to other assets is documented empirically. Recently, UBS in conjunction with Standard & Poor's (UBS) has created a listed infrastructure and utilities index for the globe and major regions of the world. This new listed index is emerging as one potential benchmark for listed infrastructure investments. In addition to the UBS index, RREEF commissioned Moody's Economy.com to create a separate infrastructure index for listed US infrastructure securities. This index covers a widely different universe than that captured by the UBS US-only index. This should provide additional insight into the performance of infrastructure investments. The Economy.com index is also used to highlight underlying characteristics of infrastructure assets that may not be gleaned through the UBS index alone.

The paper next examines the performance of infrastructure sub–sectors. The infrastructure asset class is an amalgamation of different sectors ranging from utilities to transport to communications networks. Each industry performs differently and for this, the UBS sub–sector indices are used to highlight these differences systematically. In addition, the UBS indices are examined to better understand regional variations around the globe. This is followed by concluding remarks with recommendations for investors.

Conceptual Characteristics

Infrastructure is comprised of highly heterogeneous assets with no two having identical attributes. It is an amalgamation of varying sectors including roads, bridges, dams, ports, airports, power generation and distribution, transmission of electricity, water and gas utilities, and communications. Each sector has its own distinct performance behavior. The performance of infrastructure assets is also closely tied to the stage of the assets lifecycle, i.e. greenfield development versus a mature infrastructure asset with proven demand patterns. Despite these differences, infrastructure assets have certain traits in common, including:

Monopoly: Infrastructure assets are typically large scale investments with very high initial fixed costs. The high initial capital outlays act as a barrier to entry for new entrants. Such barriers to entry block potential entrants from entering the market profitably since incumbents face declining average operational costs. As a result, infrastructure assets have monopolistic or "quasi-monopolistic" characteristics.

Infrastructure assets share common traits with public goods as well since they provide benefits to society as a whole. Public goods are defined as goods that are non-rivalrous and non-excludable. Essentially, the consumption of a public good by one individual does not reduce the amount of the good available for consumption by others and no one can be effectively excluded from using that good.

Traditionally, governments have funded infrastructure through general taxes or the municipal bond market. Recently, mechanisms have been available to exclude users with the ability to charge user fees (i.e. toll roads). In many instances, infrastructure has been

rendered "excludable" and is now being funded through user fees, permitting the transition of infrastructure assets to the private sector. Because of the "quasi-monopoly" and "public good" nature of infrastructure assets, however, their transition to the private sector has been accompanied by a high degree of regulation and government oversight. The utility industry is a prime example of an infrastructure asset that has been privatized but remains highly regulated.

Inelastic Demand: Infrastructure assets provide essential services to the community. Since these services are "necessities", demand does not react to price movements. Demand for these essential services is immune to the broader vagaries of the business cycle. In addition, infrastructure assets have few substitutes and this also contributes to the inelastic nature of demand.

Stable Cash Returns: Since infrastructure assets are monopolies in the provision of essential services demand for infrastructure services is relatively inelastic, rendering them immune to the business cycle, which in turn ensures stable cash returns. The stable cash returns are more a feature of mature infrastructure assets with a proven demand history. The stable cash flow underlying mature infrastructure assets permits relatively high leverage ratios.

Long Duration: Similar to real estate, infrastructure assets are long-lived, often lasting over 50 years. Durable assets that provide the potential for long-term investment horizons are much in demand by institutional investors. Public and corporate pension funds in particular are facing long-term liabilities. The long-duration nature of infrastructure assets is appealing to many plan sponsors.

Inflation Hedge: Infrastructure is a tangible real asset and provides an inflation hedge. In an inflationary environment, the replacement cost of real assets increases, hence protecting the value of existing infrastructure assets. In addition, concessions governing the structure of leases on infrastructure assets permit rent escalations which are usually CPI-linked.

Hybrid Asset: Infrastructure shares many common traits with a variety of assets including real estate, fixed income, and private equity. Investing in a mature, government regulated utility is analogous to a fixed income investment with the upside of having a degree of inflation protection. Developing infrastructure assets in India share common return characteristics and risks to opportunistic real estate development. An infrastructure investment in an airport is common to private equity investing where you are also investing in the operating company.

Such features of infrastructure are attractive to institutional investors, since they set them apart from other asset classes. Their immunity to the business cycle also provides some degree of diversification and risk mitigation. The CPI-linked cash flows have also appealed to many fixed income investors searching for higher yields and inflation protection. The hybrid nature of infrastructure is analyzed in greater detail in the next section.

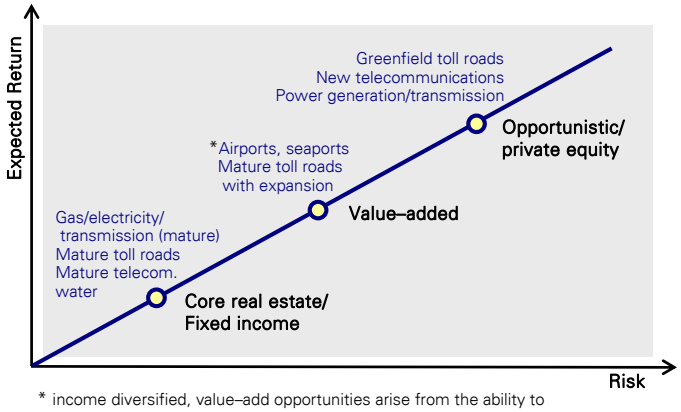
Comparative Analysis

Many institutional investors new to the infrastructure asset class view it as a subset of commercial real estate—physical, real, tangible assets generating cash flows. Others view mature infrastructure as a substitute for long duration bonds with an embedded inflation hedge. The balance of investors regard infrastructure as a private equity play, with the focus on refinancing and restructuring the business to generate capital gains. Infrastructure is a hybrid asset class and does share common characteristics with many traditional and alternative assets.

The bond-like, equity-like or real estate-like feature of any infrastructure investment depends on the individual asset and the stage of the asset's maturity. Depending on the specific sub-sector and stage of development, infrastructure investments may range from a low-risk fixed-income substitute to a higher-risk, more volatile private equity type investment. Essentially, infrastructure assets have analogs to other broad traditional and alternative asset classes.

For each specific type of infrastructure investment, Exhibit 1 provides an analog from the traditional and alternative assets. Since infrastructure is a hybrid asset, constructing an index based on such analogs is one method to benchmark the underlying performance of private infrastructure investments. Investors can also tilt their portfolios to the desired direction to better match their individual risk/return profile and actuarial requirements.

Exhibit 1: Infrastructure Analogs



* income diversified, value–add opportunities arise from the ability to develop land adjacent to port/airport.

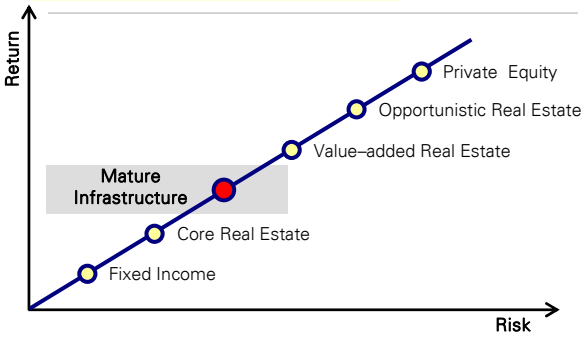
Source: RREEF Research

Exhibits 2a and 2b provide detailed descriptions of two common infrastructure strategies: mature infrastructure and early stage infrastructure. In each case, their differing characteristics, sectors and return expectations are presented. A blended return series is recommended for benchmarking private infrastructure since no one returns series can capture the heterogeneous nature of such investments.

Exhibit 2a: Mature Infrastructure Assets

Characteristics

- Established revenues
- Yield dominates investment return
- Higher leverage (40% - 80%)
- Total return expectations: 10% - 14%



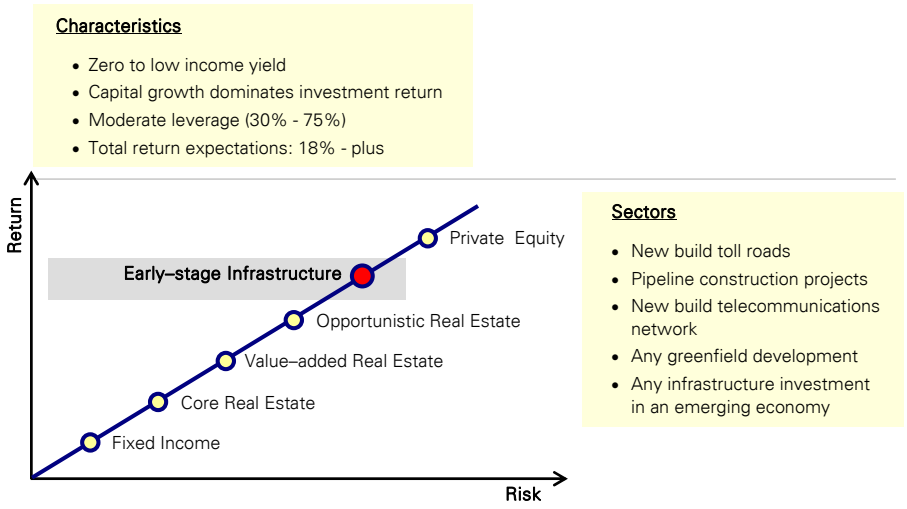
Sectors

- Mature toll roads
- Power generation (mature)
- Distribution
  - gas
  - electricity
- Transmission (mature)
  - gas*
  - electricity
- All regulated
  - utilities
- Established seaports/airports
- Telecommunications
- Water

*gas pipelines with a long-term credit are lower risk with an 8–9% return.

Source: RREEF Research

Exhibit 2b: Early–stage Infrastructure Assets



Source: RREEF Research

Performance Indices: Empirical Evidence

The performance history for infrastructure investments is fairly limited[2]. This is for a variety of reasons. Infrastructure investments are still relatively new, especially in the US, and data collection has been sporadic. Data collection on infrastructure is expensive relative to the size of the market for such data. The data is also often proprietary, reflecting returns of individual investors, and managers are subject to confidentiality agreements. Therefore, there has been a reluctance to report performance measures across the industry. There is also much debate regarding the appropriate benchmark against which to evaluate the performance of infrastructure investments. This has rendered assessments of the existing data less relevant and much less conclusive.

Not only are infrastructure returns not publicly available, but the data on the risk/return characteristics of these assets is relatively short. This makes it even harder to make predictions of future performance based on the limited historical time series. Finally, as outlined above, the risk/return varies significantly by type of investment at different stages. No one return metric can adequately capture the whole infrastructure asset class or strategy.

A review of the existing empirical literature provides some sources of performance data. These are based on four sources including Australian data on unlisted infrastructure, a hypothetical listed model portfolio created by RREEF[3], and two series based on listed vehicles such as the UBS Infrastructure and Utilities index (UBS index) and the Moody's Economy.com Infrastructure Index (Economy.com index).

The Australian Experience

Peng and Graeme (2007) assessed the performance of 19 major unlisted Australian funds. Based on their analysis, unlisted infrastructure was shown to have solid performance, returning 14.1% per year. This trailed only commercial real estate for the

[2] One of the original listed infrastructure indices has been developed by Macquarie in conjunction with FTSE. The index is designed to reflect the stock performance of companies worldwide within the infrastructure industry. (See Macquarie Global Infrastructure Index Series.)

[3] "European Infrastructure Market," RREEF publication, June 2006

same period, but with the added benefit of a moderate 5.8% volatility. Their empirical work also confirmed the portfolio diversification benefits of including unlisted infrastructure in a multi-asset portfolio. In the case of Australia, unlisted infrastructure has general characteristics of solid, long-term, yet less volatile returns, favorably matching the requirements of institutional investors such as pension funds.

CFS (2006) created an unlisted infrastructure series using an unweighted portfolio of five wholesale Australian diversified infrastructure funds with varying inception dates. The series included the AMP Diversified Infrastructure Equity Funds, the CFS Infrastructure Income Fund, the Perpetual Diversified Infrastructure fund, Hastings' The Infrastructure Fund, and the Utilities Trust of Australia. Historical returns for this series averaged 13.5% per year, outpacing all sectors with the exception of listed infrastructure funds and commercial real estate. The unlisted infrastructure series shared many common features to Australian real estate funds.

The Hypothetical Infrastructure Index

RREEF Research constructed a historic return series for the infrastructure market based on a series of representative listed companies in Europe. At this time, the UBS index was not yet widely available on a global and US basis. The method used the UBS-Europe index as a base, but built an infrastructure series with a greater focus on "direct infrastructure". This required stripping out listed infrastructure companies like airlines or logistic companies that did not own infrastructure assets directly. The RREEF index for Europe, hence, focused primarily on pure infrastructure plays or "infrastructure" operating companies.

Since listed companies are used in the RREEF index for Europe, this increased the volatility of the series. This index can be viewed as a measure of "market" performance, comparable to other measures for publicly-traded assets such as equities and securitized real estate. The RREEF constructed hypothetical index returned 12.5% per year with a 13.2% volatility, sitting somewhere between European bonds and European equities.

The UBS Global Infrastructure & Utilities Index

More recently, UBS in conjunction with S&P has calculated a listed benchmark for infrastructure and utilities for the globe and major regions of the world including the US. The global series is based on a group of 85 indices that provide price and accumulation data for listed infrastructure and utilities companies. The UBS index is now 4.6% of the global S&P universe. A more detailed description of the index constituents both on a regional and sub-sector level will be presented later in the report.

The purpose of the index is to provide a benchmark against which the performance of listed infrastructure funds and their various sub-sector constituents can be tracked. Exhibit 3a provides returns on the UBS index and a comparison to other broad asset classes on a global basis. In each case, volatility measures are reported as well. Exhibit 3b plots the major return series on a risk/return spectrum.

On a 10-year basis, infrastructure returns as measured by the UBS index have averaged 12.7%, less than private equity and public real estate, but greater than hedge funds, public equity and fixed income returns. The volatility measure of the UBS index, at 18.3%, has exceeded only that of fixed income and hedge funds, but trails that of public real estate and private equity.

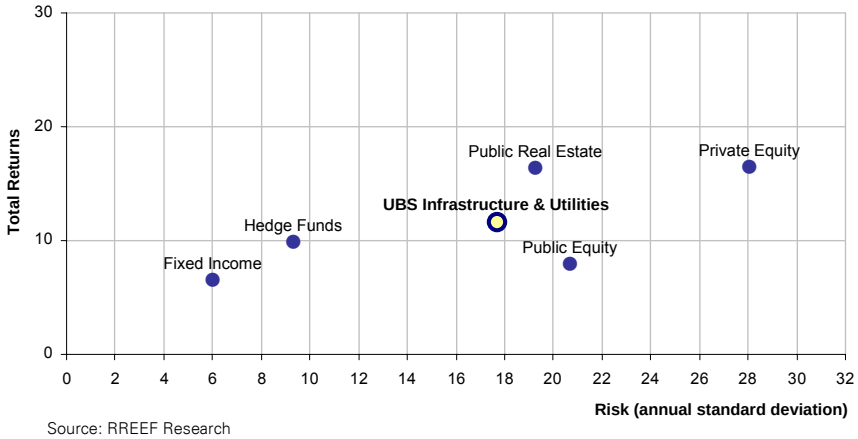
Exhibit 3a: Returns on Global Alternative and Traditional Assets
USD Total Returns
As of March 31, 2007 (ten-year)

	1 Year	3 Year	5 Year	10 Year	10 Year Std Dev
Public Equity					
MSCI EAFE	20.7%	20.3%	16.2%	8.7%	21.0%
Fixed Income					
Lehman Global Aggregate	8.1%	3.4%	8.3%	6.0%	6.2%
Real Estate					
Public (FTSE EPRA/NAREIT)	32.7%	28.5%	27.0%	13.7%	19.5%
Infrastructure					
UBS Infrastructure	42.9%	33.6%	29.7%	14.2%	20.1%
UBS Infrastructure & Utilities	36.5%	26.9%	19.0%	12.7%	18.3%
Hedge Funds					
Credit Suisse/Tremont	11.6%	10.3%	10.4%	10.3%	7.4%
Hedge Fund Research	9.6%	10.1%	9.9%	10.6%	9.3%
Private Equity					
Thomson Venture Economics*	15.7%	19.4%	9.6%	15.0%	27.1%
Cambridge Associates**	25.8%	26.2%	17.9%	15.1%	17.4%

* As of September 30, 2006
** As of December 31, 2006

Source: MSCI Barra, Lehman Brothers, IPD, EPRA/NAREIT, UBS, Credit Suisse/Tremont, Hedge Fund Research, Thomson Financial, Cambridge Associates, Economy.com and Datastream.

Exhibit 3b: Returns on Global Listed Traditional and Alternative Assets



Source: RREEF Research

Correlation coefficients are provided in Exhibit 4. As expected conceptually, the UBS index shows low correlations with the broad asset classes, whether traditional or alternative. This supports the notion that including infrastructure in a portfolio diversifies risk. The correlations with the bond measure are actually negative. This is a positive result for institutional investors since many regard infrastructure as a fixed income substitute. Therefore, not only will investors benefit from higher risk-adjusted and inflation protected returns, but they will increasingly diversify portfolio risk with a combination of infrastructure and other assets. The UBS index has the highest relative correlation (0.60) with public equities and this is expected since the index is comprised of listed companies that are traded in public markets and face the same public market risks.

Exhibit 4: 10-Year Global Return Correlations
Rolling 4-Quarter Basis

		Public Equity	Fixed Income	Public Real Estate	Infrastructure		Hedge Funds		Private Equity	
		MSCI EAFE	Lehman Global Agg	FTSE EPRA/ NAREIT	UBS Infra-structure	UBS Infra-structure & Utilities	Credit Suisse/ Tremont	Hedge Fund Research	Thomson Venture Economics	Cambridge Associates
Public Equity	MSCI EAFE	1.00								
Fixed Income	Lehman Global Agg	(0.16)	1.00							
Public Real Estate	FTSE EPRA/NAREIT	0.64	(0.14)	1.00						
Infrastructure	UBS Infrastructure	0.59	0.39	0.62	1.00					
	UBS Infrastructure & Utilities	0.59	(0.04)	0.58	0.76	1.00				
Hedge Funds	Credit Suisse/Tremont	0.51	(0.28)	0.23	0.07	0.34	1.00			
	Hedge Fund Research	0.72	(0.48)	0.38	(0.00)	0.24	0.80	1.00		
Private Equity	Thomson Venture Economics	0.61	(0.49)	0.09	(0.08)	0.26	0.69	0.86	1.00	
	Cambridge Associates	0.80	(0.34)	0.28	0.34	0.55	0.67	0.72	0.84	1.00

Source: MSCI Barra, Lehman Brothers, IPD, EPRA/NAREIT, UBS, Credit Suisse/Tremont, Hedge Fund Research, Thomson Financial, Cambridge Associates, Economy.com, and I

Moody's Economy.com Infrastructure Index

RREEF commissioned Moody's Economy.com to create a listed infrastructure index for US listed companies. This preceded the UBS-US index which did not exist at that time. The Economy.com index includes all infrastructure and infrastructure related listed companies in the US. It is a much broader and more inclusive index than UBS, reflecting a larger infrastructure universe. Having both set of indices can provide greater insight into the performance of infrastructure in the US, an area where there is limited empirical analysis. The methodology behind the Economy.com infrastructure index is fairly straightforward. The infrastructure stock indices are created using a weighted average of companies' stock prices. All the financial data came from Ipreo LLC (formerly Hemscott). First, companies were sorted based upon their primary six digit North American industry classification codes (NAICs) across five infrastructure sectors:

- Energy & Utility: Electricity (distribution and generation)
- Energy & Utility: Water (treatment and distribution)
- Communications: (cable networks and satellite systems)
- Transport: Roadways, Bridges, Tunnels, Seaports, Airports, Rail, Ferries
- Energy & Utility: Gas (storage and distribution)

Next, each company's weighted contribution to the index was determined using the following formula:

Stock Price x (Company's Market Capital/Total Industry Market Capital)

Finally, the weighted contributions were summed up and the series were rebased so that the base quarter was the first quarter of 2000.

Descriptive statistics for the Economy.com index are presented on the following page. The UBS index for the US is also shown for comparison purposes. Exhibit 5a graphs total returns for both return series back to 1998. The Economy.com infrastructure index has returned 5.3% per year since inception compared to 9.4% for UBS. The Economy.com series, however, has been less volatile. This lower degree of volatility can be explained by the size differences between Economy.com's universe and that of UBS. The Economy.com index covers a larger universe of infrastructure-related activity than UBS, having a greater market capitalization ($1,409.8 billion versus $659.1 billion). The smaller size of the UBS index is one reason for its higher volatility. It is comprised of fewer stocks which can magnify price movements. The Economy.com index, however, covers a much wider universe of stocks and, thus, is much more diversified and not dependent on the variability of a smaller sample size of stocks.

Exhibit 5a: US Infrastructure & Utilities Total Returns
Rolling 4-Quarter Returns

Source: UBS, Economy.com and RREEF Research

Exhibit 5b: US Infrastructure & Utilities Total Returns
As of December 31, 2006

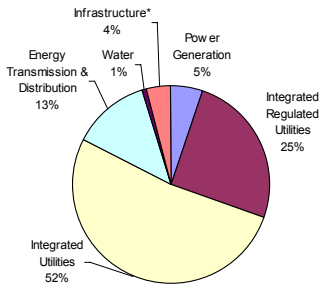
	Average Annual Return					Volatility	
	1 Year	3 Year	5 Year	10 Year	Since Inception	Since Inception	Inception Date
Economy.com	12.5%	11.8%	6.9%	N/A	5.3%	13.1%	7/1/1997
UBS	21.5%	20.8%	10.6%	9.3%	9.4%	19.3%	1/1/1990

Source: UBS, Economy.com and RREEF Research

Exhibit 6 provides the sectoral breakdowns between the Economy.com and UBS indices. The UBS index has a high exposure to utilities.By contrast, the Economy.com index has a greater exposure to the more competitive communication sector. In both cases, however, the indices have minimal exposure to the transport sector. This is a weakness across both series since much of the recent private infrastructure transactions have occurred in the transport sector. In the US, the transport sector has minimal representation in the listed market as many of the assets remain in government hands and privatization of transport assets is just gaining momentum.

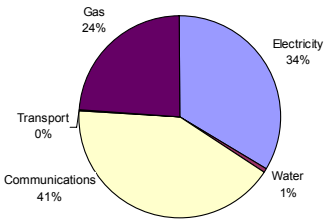
Exhibit 6: UBS and Economy.com Market Cap by Sector

UBS Market Cap by Sector
As of 12/31/2006: $659.1 B



* Infrastructure includes communications and transport.
Source: UBS and RREEF Research

Economy.com Market Cap by Sector
As of 12/31/2006: $1,409.8 B



Source: Economy.com and RREEF Research

Finally, Exhibit 7 presents correlation coefficients for all US based indices including UBS and Economy.com for infrastructure and the various broad measures of traditional and alternative asset classes.

Exhibit 7: Correlation Matrix
US Total Returns, Rolling 4-Quarter Basis
July 1, 1997 to December 31, 2006

	Infrastructure & Utilities: Economy.com	Infrastructure & Utilities: UBS	Public Equity: S&P 500	Fixed Income: Lehman Govt/Credit	Private Real Estate: NCREIF	Public Real Estate: NAREIT	Hedge Funds: Credit Suisse/ Tremont Index	Hedge Funds: Hedge Fund Research Composite	Private Equity: Cambridge Associates
Infrastructure & Utilities: Economy.com	1.00								
Infrastructure & Utilities: UBS	0.84	1.00							
Public Equity: S&P 500	0.60	0.49	1.00						
Fixed Income: Lehman Govt/Credit	(0.32)	(0.10)	(0.57)	1.00					
Private Real Estate: NCREIF	0.65	0.55	0.40	(0.33)	1.00				
Public Real Estate: NAREIT	0.41	0.42	0.04	(0.13)	0.05	1.00			
Hedge Funds: Credit Suisse/Tremont Index	0.23	0.33	0.44	(0.36)	0.11	0.33	1.00		
Hedge Funds: Hedge Fund Research Composite	0.27	0.27	0.65	(0.68)	0.07	0.18	0.81	1.00	
Private Equity: Cambridge Associates	0.60	0.54	0.80	(0.66)	0.64	0.12	0.66	0.72	1.00

Source: UBS, Economy.com, Standard & Poor's, Lehman Brothers, NCREIF, NAREIT, Credit Suisse/Tremont, Hedge Fund Research, Cambridge Associates, and RREEF Research

In general, the UBS index shows lower correlations with other asset classes than the Economy.com index. However, the Economy.com index is much more negatively correlated with bonds. In both cases, however, the results support the portfolio diversification benefits of listed infrastructure.

The performance of any of the series summarized above reveals that the variation in return characteristics of any of the indices is strictly a function of the underlying constituents. Understanding the sectoral and geographic composition of each index can only add to our knowledge of infrastructure performance. The current UBS index has been recently extended to cover a wide range of sectors and regions. An analysis of sub-sector and regional performance based on the UBS index is provided below.

UBS Sub-sector Performance Analysis

Infrastructure is not a homogeneous asset, comprised of different industries and sectors. Each sector has different return characteristics. In addition, infrastructure assets across different regions of the world may also have different return attributes. In this section, the UBS index is disaggregated to its regional and sector components. Each sector is defined in detail while providing a brief review of the UBS methodology. Quantitative analysis is used to differentiate performance across regions and sectors. Each sector and region of the globe provides a different risk–return profile. Investors interested in the broad infrastructure category should refrain from looking at total return performance alone since this masks significant differences in sub–sector performance.

Sub-sector Descriptions

The infrastructure sectors defined in Exhibit 8 are broadly classified into two distinct sub-sectors, Infrastructure and Utilities. For purposes of the UBS Indices, Infrastructure represents all traditional classes of infrastructure, including transport-related sectors, social infrastructure, and communications, but excludes Utilities. The utilities sector is considered a subset of infrastructure because of its large size and relative maturity as an asset.

Exhibit 8: Sub-sector Descriptions

	Constituents of UBS Infrastructure Index
Index Name	**Description of Assets**
UBS Toll Roads	C/L/F of a toll road
UBS Airports	C/L/F of an airport
UBS Rail	C/L/F of rail infrastructure
UBS Ports	C/L/F of a sea port
UBS Communications	C/L/F of broadcast, mobile towers, satellites, fiber optics & copper
UBS Social Infrastructure	C/L/F of a hospital, prison, school, etc.
UBS Diversified Infrastructure	Two or more subsectors where EBITDA from any one <50%

	Constituents of UBS Utilies Index
Index Name	**Description of Assets**
UBS Integrated Utilities	Integrated utility business subject to competition
UBS Regulated Integrated Utilities	Integrated utility business subject to regulation
UBS Transmission & Distribution	Electricity transmission towers, pipelines, and distribution networks
UBS Generation	Unregulated generation, like an Independent Power Producer (IPP)
UBS Water	Operation of water transmission, distribution and retailing
UBS Diversified Utilities	Portfolio of utility businesses, nor related or integrated

Note: C/L/F refers to a concession, lease or freehold

Source: UBS Infrastructure & Utilities Index, 4 August 2005

Geographic Distribution of Constituent Companies

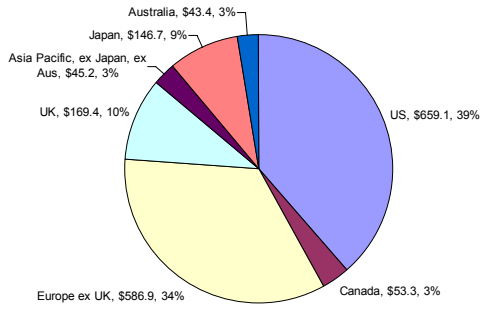
Exhibit 9 displays the geographic distribution of the UBS index, with the total market capitalization for each region, followed by the percentage share of global market capitalization of $1,704.0 billion. Four regions comprise 92% of the indices' market capitalization, with the US displaying the largest market cap of $659.1 billion, or 38% of the index, followed by Europe ex-UK at 34%, the UK and Japan account for another 10% and 9%, respectively.

Exhibit 10 also illustrates global market share by the number of constituents, or companies and funds listed on the UBS index. The US has 100 companies, or 41.2% of the 243 listed companies in the Index, followed by Europe ex-UK at nearly 24%.

Exhibit 9: Listed Benchmark Geographic Composition

UBS Global Infrastructure & Utilities Index

Note: Market Cap, Percentage of Global Market Cap ($US billion)



Source: UBS Global Infrastructure & Utilities Index, 9 January 2007

Exhibit 10: Geographic Composition of Listed Market
Global = $1704.0 bn USD

	Total Market Cap ($ bn USD)	Weight % of Global	# of Listed Operating Companies	% of Total Listed Companies
US	$659.1	38.7%	100	41.2%
Canada	$53.3	3.1%	20	8.2%
Europe ex UK	$586.9	34.4%	58	23.9%
UK	$169.4	9.9%	15	6.2%
Asia Pacific, ex Japan,	$45.2	2.7%	11	4.5%
Japan	$146.7	8.6%	16	6.6%
Australia	$43.4	2.5%	23	9.5%
Global Market Cap	$1,704.0	100.0%	243	100.0%

Note: As of 31 December 2006

Source: UBS Global Infrastructure & Utilities Index, 9 January 2007

Regional Returns and Variations Across Sectors

Exhibits 11 and 12 present the total and risk-adjusted performance returns for the 11 infrastructure sub-sectors over a one-, three- and five-year period as well as a comparison of regional performance.

Exhibit 11: Performance of UBS Global Index to December 31, 2006, US$

Asset Class	Mkt Cap	Weight	Std Dev (3 Year)	Sharpe Index	Total Return 1-Year	Total Return 3-Year	Total Return 5-Year
Global							
Toll Roads	77.1	4.5%	13.6%	1.72	33.8%	28.7%	32.0%
Airports	15.3	0.9%	16.5%	1.74	63.0%	33.9%	26.0%
Communications	33.4	2.0%	53.7%	0.78	32.3%	46.9%	21.7%
Ports	4.0	0.2%	15.8%	2.07	76.4%	38.0%	33.2%
Diversified Infrastructure	7.8	0.5%	44.4%	-0.25	73.7%	-5.7%	-10.8%
Integrated	843.8	49.5%	15.8%	1.64	40.0%	31.1%	18.6%
Integrated Regulated	436.7	25.6%	9.1%	1.57	28.4%	19.6%	16.1%
Transmission & Distribution	162.7	9.5%	10.8%	1.44	30.6%	20.8%	16.3%
Generation	91.8	5.4%	38.9%	0.74	42.2%	34.0%	5.0%
Water	25.0	1.5%	13.0%	2.34	44.9%	35.8%	30.1%
Diversified Utilities	6.4	0.4%	17.7%	1.27	9.8%	27.8%	25.7%
Utilities	**1566.4**	**91.9%**	**12.4%**	**1.70**	**35.7%**	**26.4%**	**17.4%**
Infrastructure	**137.6**	**8.1%**	**11.9%**	**2.16**	**44.3%**	**31.0%**	**27.7%**
Infrastructure & Utilities	**1704.0**	**100.0%**	**12.3%**	**1.74**	**36.2%**	**26.6%**	**17.9%**

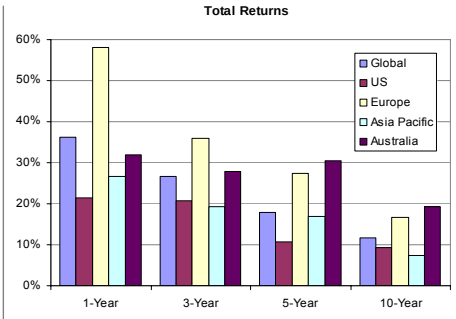
Source: UBS Global Infrastructure & Utilities Index, 9 January 2007 and RREEF Research

On a one-year basis, ending 2006, ports, diversified infrastructure and airports outperformed the other sectors by a wide margin. (Please see Exhibit 11.) The returns across all sectors vary widely, ranging between 9.8% (Diversified Utilities) and 76.4% (Ports). On a five-year basis, returns fall significantly, but ports still top the list at 33.2% followed by toll roads and water. The spread between the highest and lowest returns tightens, clustering between 16.1% and 33.2%, with two outliers, generation (5.0%) and diversified infrastructure (-10.8%). A comparison of the regional indices is presented in Exhibit 12.

Exhibit 12: Performance of UBS Global Infrastructure & Utilities Index Series to Year End 2006

Exhibit

Asset Class	Mkt Cap	Weight	Std Dev (3 Year)	Sharpe Index
Global				
UBS Global Utilities	1566.4	91.9%	12.4%	1.70
UBS Global Infrastructure	137.6	8.1%	11.9%	2.16
UBS global Infrastructure & Utilities	1704.0	100.0%	12.3%	1.74
US				
UBS US Utilities	632.6	96.0%	15.3%	1.00
UBS US Infrastructure	26.5	4.0%	55.0%	0.83
UBS US Infrastructure & Utilities	659.1	100.0%	15.3%	1.01
Europe				
UBS US Utilities	670.8	88.7%	14.5%	2.16
UBS US Infrastructure	85.5	11.3%	11.6%	2.32
UBS US Infrastructure & Utilities	756.3	100.0%	13.8%	2.23
Asia Pacific				
UBS US Utilities	210.5	89.4%	11.0%	1.24
UBS US Infrastructure	24.9	10.6%	17.5%	1.10
UBS US Infrastructure & Utilities	235.3	100.0%	10.9%	1.30
Australia				
UBS US Utilities	22.4	51.6%	0.0%	n.a.
UBS US Infrastructure	21.0	48.4%	18.9%	1.05
UBS US Infrastructure & Utilities	43.4	100.0%	0.0%	n.a.



Source: UBS Global Infrastructure & Utilities Index, 9 January 2007 and RREEF Research

The following are some notable observations:

- The European constituents posted the highest total one-year returns for the combined Infrastructure & Utilities sector at 58.1% followed by Australia at 31.8% and Asia Pacific at 26.7%.
- The US posted some of the lowest regional returns at 21.5%. The UBS-US market is comprised mostly of the regulated and more mature utilities sector.
- General infrastructure comprised a much higher percentage of the regional index for

those regions posting the higher returns. For example, in Europe, Australia and the Asia Pacific regions, general infrastructure comprises 11.6%, 48.4% and 10.6%, respectively compared to the US, where general infrastructure is a relative newcomer to the listed infrastructure market, comprises only 4.0%. In the US, the existence of pure infrastructure listed companies is relatively rare. Much of the US-UBS index includes the highly regulated and mature utilities index. The underperformance of the US can be attributed to lack of representation by the higher return infrastructure sector.

- Volatility is also less significant in the European listed market, in part due to market maturity and its broader base of general infrastructure, and renders a significantly higher Sharpe Ratio value, 2.23 compared to 1.01 for the US and 1.74 for the Index as a whole.

Risk Adjusted Returns and Volatility

Volatility measures also vary considerably by underlying industry. One of the most commonly used measures of risk is variance, the dispersion of an investment's returns from their mean. Certainly, the most mainstream risk measure is the Sharpe Ratio, which uses the standard deviation to measure the return per unit of risk. A high Sharpe Ratio indicates greater return per unit of risk. In the calculation of this value, however, no distinction is made between upside and downside deviation. Therefore, an investment with returns of -5% and +5% will have the same variance as another investment that is flat and then +10%. Since the Sharpe Ratio uses a non directionally-biased measurement of volatility to adjust for risk, this concept has been criticized as it may penalize a fund for periods of exceptionally high performance.

An alternative risk measure is the Sortino Ratio, which uses downside semi-variance instead of standard deviation in the denominator. This is a measure of return deviation below a minimal acceptable rate; it measures return per unit of risk on the downside. Funds that cite their Sortino Ratio have traditionally been those with the least tolerance for risk. A high Sortino Ratio indicates a low risk of large losses occurring.

Exhibit 13 ranks the UBS Index by the five-year risk-adjusted returns using the Sharpe and Sortino Ratios.

Exhibit 13: UBS Infrastructure & Utilities Index
Total USD Returns
as of March 31, 2007

	Market Cap		Returns			Risk Measures, 5 Year		
	Total ($ Bn)	% of Index	1 Year	3 Year	5 Year	Std Dev	Sharpe Ratio	Sortino Ratio
GLOBAL								
Infrastructure	**152.8**	**8.6%**	**42.9%**	**33.6%**	**29.7%**	**17.1%**	**1.91**	**6.77**
Infrastructure & Utilities	**1781.0**	**100.0%**	**36.5%**	**26.9%**	**19.0%**	**23.3%**	**1.10**	**2.43**
Utilities	**1628.2**	**91.4%**	**36.0%**	**26.4%**	**18.4%**	**23.5%**	**1.06**	**2.29**
Toll Roads	86.8	4.9%	45.1%	33.7%	34.3%	14.5%	1.95	7.01
Water Util	28.1	1.6%	35.3%	34.4%	29.4%	9.7%	1.67	6.07
Ports	4.3	0.2%	60.8%	36.4%	32.9%	25.1%	1.60	5.48
Integrated Regulated Util.	455.8	25.6%	28.4%	18.9%	16.6%	14.0%	1.36	3.74
Airports	17.0	1.0%	48.1%	36.1%	26.0%	25.3%	1.24	3.90
Transmission & Distribution	170.4	9.6%	36.7%	21.0%	16.6%	19.2%	1.08	2.92
Diversified Util.	7.5	0.4%	18.8%	24.6%	24.4%	24.6%	1.05	2.79
Integrated Util.	867.0	48.7%	40.1%	31.4%	19.6%	30.2%	0.94	1.85
Communications	36.5	2.0%	25.9%	43.7%	38.8%	47.6%	0.86	1.69
Generation	99.5	5.6%	35.3%	36.4%	9.4%	51.0%	0.39	0.65
Diversified Inf.	8.2	0.5%	47.7%	(1.7%)	(9.0%)	61.6%	0.04	0.16
US								
Infrastructure	**28.7**	**4.1%**	**22.2%**	**47.4%**	**41.3%**	**51.6%**	**0.90**	**1.77**
Infrastructure & Utilities	**693.5**	**100.0%**	**32.1%**	**22.1%**	**11.6%**	**27.2%**	**0.57**	**1.06**
Utilities	**664.8**	**95.9%**	**32.7%**	**22.0%**	**11.5%**	**27.3%**	**0.56**	**1.06**
Water	5.3	0.8%	(9.1%)	15.6%	15.1%	22.2%	0.72	1.86
Integrated Regulated	172.8	24.9%	24.5%	15.6%	11.2%	19.7%	0.65	1.47
Integrated	359.7	51.9%	36.6%	27.0%	12.9%	31.5%	0.58	1.05
Transmission & Distribution	85.0	12.3%	29.3%	13.8%	9.2%	21.1%	0.53	1.16
Generation	42.0	6.1%	54.7%	31.0%	(4.3%)	61.3%	0.24	0.42

Source: UBS, Standard & Poor's and Bloomberg

Measuring the broadest components, global infrastructure with a Sharpe Ratio value of 1.91 is nearly twice as high as the utilities component at 1.06. Toll roads, water utilities and ports reflect the highest risk adjusted return vis a vis Sharpe Ratio values, while diversified infrastructure and generation reflect the lowest risk adjusted returns. Following are additional observations:

- The global infrastructure component of the Index has a Sortino Ratio of 6.77, approximately three times higher than utilities at 2.29.
- Further analysis by sub-sector reveals findings similar to Sharpe Ratios: toll roads, water utilities and ports out-perform other sectors by a wide margin with values of 7.01, 6.07 and 5.48.
- Diversified infrastructure and generation yield the lowest Sortino Ratios.
- The sectors with the highest risk-adjusted returns fall within the general infrastructure component of the global index. Yet, general infrastructure represents only 8.6% of the index.
- Further, the top performers represent a very small share of the overall index: toll roads (4.9%), water utilities (1.6%) and ports (0.2%).

Fewer constituents in the index and the strong performance of the sector on a risk adjusted implies that pricing for these assets may often be justifiably higher, as they tend to be more scarce. It also suggests that fewer constituents means few data points to analyze, i.e., the smaller sample set results in less transparency and caution is warranted against extrapolating these favorable results to individual transactions.

Risks

After reviewing the conceptual characteristics and performance of infrastructure, should such investments be included in a pension fund's asset allocation? It appears that returns are compelling on a risk-adjusted basis as compared to other assets. Inclusion of infrastructure in a multi-asset portfolio also lowers the risk. Plan directors should not look at historical or theoretical risk-return characteristics, but ought to be aware of the different nature of risks connected with infrastructure projects as well. These are:

1. Construction risk
2. Operational risk
3. Leverage/interest rate risk
4. Regulatory risk
5. Legal risk
6. Political risk

Delegating to skilled and experienced managers should help mitigate such risks. Given the variability of sub-sector and regional returns, plan sponsors should also diversify across projects, sectors and countries. Other considerations for plan sponsors include:

- Liquidity. It is often difficult to liquidate infrastructure investments similar to commercial real estate investments. The secondary market for infrastructure investments is relatively immature at this moment.
- Pricing. Valuation of individual projects is complicated and similar to private equity.
- Benchmark. What should be an appropriate benchmark to assess success or failure? We have identified some—albeit not perfect—solutions to the issue of benchmarks.

Concluding Remarks and Implications for Investors

Institutional investors continue to increase allocations to "alternative assets" in efforts to boost yields and diversify portfolios. One area now attracting a lot of institutional interest is infrastructure investments. Australia and Canada are quite advanced in investing in infrastructure. US investors, however, have been slow to embrace the infrastructure asset class, but interest is growing rapidly.

As interest in infrastructure investments grows, there is an increasing need for greater transparency of the asset class. Historical evidence on the performance characteristics of infrastructure is limited, though. Benchmarks are also needed to allow investors to compare the performance of infrastructure to other asset classes as well as assess success or failure of different managers. Currently, no widely accepted industry benchmark exists.

In this paper, we reviewed the risk-return characteristics of infrastructure and its sub-sectors, provided a summary of their conceptual characteristics, and compiled the various infrastructure performance measures currently available to investors. The limited public data on infrastructure performance was broadly categorized into two complementary groups as described below.

Listed Infrastructure: Listed infrastructure funds invest in a portfolio of listed shares in infrastructure companies and offer quicker access to infrastructure investments, expose the investor to a broader range of assets, provide greater liquidity and better immediate prospects for benchmarking performance. The down side to listed infrastructure investments includes a lower risk-adjusted return, given significantly higher volatility, and a higher correlation with public equities. Listed return series, including the UBS Index, have been recently developed to benchmark listed infrastructure vehicles and funds. Institutional investors that prefer listed vehicles to access infrastructure have various listed benchmarks at their disposal. Investors should use caution in using the total index, however, as infrastructure is not a homogeneous asset class. Further, some listed sectors have few constituents. The performance of one or a couple of constituents could bias results, favorably or unfavorably, and thus offer ambiguous and potentially misleading results. As noted earlier, the performance of the underlying sub-sectors differs widely; this may be partially affected by equity market "noise" rather than reflect a re-rating of fundamental asset values.

Unlisted Infrastructure: Unlisted infrastructure funds, which invest directly in a variety of infrastructure assets or operating companies, can offer a higher, risk-adjusted return due to its lower volatility and low correlation with equity and bond markets. However, these investments are relatively scarce, fairly illiquid, require a significant outlay of up-front capital, and may take longer to realize cash flow, depending upon the maturity of the assets included in the fund. Importantly, a key feature of infrastructure assets is that as an asset matures, its risk profile declines and valuation increases, ceteris paribus. No broadly accepted benchmark for unlisted infrastructure currently exists. And although listed infrastructure has posted stronger deal flow in the last decade than unlisted investments, the recent spate of unlisted funds coming to market may help hasten the creation of an unlisted performance benchmark. Based on our analysis, we conclude that investors have three options at their disposal:

1. They could use the listed benchmarks as a proxy for unlisted infrastructure, correcting for volatility of returns, sectors and leverage ratios. The listed benchmarks are much more volatile than what would be expected from unlisted investments. This is a very similar approach adopted in the late 1970s by real estate investors. As the real estate asset class has matured over the past three

decades, numerous listed and unlisted return series and benchmarks have been developed.

2. Investors could use the Australian historical unlisted series as a benchmark. This assumes, however, that no regional variation exists around the world. This is unrealistic as revealed by the analysis of the UBS series disaggregated by the broad regions of the world. Evidence indicates that there can be significant disparity in regional performance.

3. Finally, investors could create a blended benchmark based on the risk-return profile of their infrastructure investments. As noted, investing in infrastructure has elements of investing in private equity and traditional equity, real estate and bonds. As a result, depending on how investors tilt their portfolios, a benchmark can be created based on a blend of these traditional and alternative asset classes.

As interest in infrastructure grows and the asset class matures, a third party organization such as NCREIF (National Council for Real Estate Investment Fiduciaries) in the US or IPD (International Property Data) for the rest of the world can be organized by industry participants to systematically databank the returns and standardize how performance is measured and reported. This will require an industry wide and global effort and will require the maturation of the asset class and the recognition that infrastructure is a unique and distinct investment.

References

CFS, Infrastructure research paper, *Investing in Infrastructure–The Australian Experience.* Issue Date: 3 November 2006.

CFS, Infrastructure research paper, *A Guide to Infrastructure Investments*. Issue Date: 29 September 2006.

Peng, Hsu Wen and Graeme Newell, *The Significance of Infrastructure in Investment Portfolios*, Pacific Rim Real Estate Society Conference. 21-24 January 2007, Fremantle.

RREEF Research, Understanding Infrastructure, A Burgeoning Global Asset Class. December 2005.

RREEF Research, European Infrastructure Market: Exploring Current Trends in a Changing Market. June 2006.

RREEF Research, Opportunities in Private Infrastructure Investments in the U.S. September 2006.

RREEF Research, U.S. Infrastructure Privatization and Public Policy Issues. September 2006.

Peng, Hsu Wen and Graeme Newell, The Role of Infrastructure in Investment Portfolios, University of Western Sydney, unpublished manuscript.

UBS Investment Research, Q-Series: Infrastructure & Utilities. Issue dated: 31 January 2007.

Mas, Ignacio (1996). Financial Policy Issues in Infrastructure Financing. Presentation to the World Bank/IFC Workshop on Advanced Topics in Private Participation in Infrastructure and Infrastructure Regulations.

Orr, R.J. (2006), "Investing in Infrastructure: The Legacy & Lessons of Distressed & Failed Projects," Collaboratory for Research on Global Projects, Stanford University.

ANALYST CERTIFICATION

The views expressed in this report accurately reflect the personal views of the undersigned lead analyst. In addition, the undersigned lead analyst has not and will not receive any compensation for providing a specific recommendation or view in this report.

Asieh Mansour
Managing Director, Chief Economist and Strategist

Hope Nadji
Director

Main Offices

San Francisco
101 California Street
26th Floor
San Francisco, CA 94111
USA
Tel: (415) 781-3300

Chicago
875 N. Michigan Avenue
41st Floor
Chicago, IL 60611
USA
Tel: (312) 266-9300

New York
280 Park Avenue
40th Floor
New York, NY 10017-1270
USA
Tel: (212) 454-3900

London
1 Appold Street
Broadgate
London, EC2A 2HE
United Kingdom
Tel: +44 20 7545 8000

Eschborn
Mergenthalerallee 73-75
65760 Eschborn
Germany
Tel: +49 69 71704 906

Publication Address:
101 California Street
26th Floor
San Francisco, CA 94111
USA

Internet:
www.rreef.com

RREEF Real Estate Research

101 California Street, 26th Floor, San Francisco, CA 94111 Tel: (415) 781-3300

RREEF

Alan Billingsley
Head of North America Research
(415) 262-2017

Hope Nadji
Director
(415) 262-2022

Andrew J. Nelson
Vice President
(415) 262-7735

Stephen Newbold
Vice President
(415) 262-2040

Western Europe

Peter Hobbs
Global Head of Real Estate and Infrastructure Research
+44 20 7547 4855

Brenna O'Roarty
Vice President
+44 20 7545 6099

Maren Väth
Vice President
+49 69 717 04 204

Susannah Hunter
Assistant Vice President
+44 20 7547 3305

Lonneke Löwik
Assistant Vice President
+44 20 7545 6328

Henry (Wei) Chin
Assistant Vice President
+44 20 7545 6611

Ermina Topintzi
Associate
+44 20 755 6674