

# US commercial real estate indices: the NCREIF property index

Jeffrey D Fisher

## Overview of NCREIF

NCREIF is a Not-for-Profit Industry Association that was founded in 1982. Its members include investment managers,<sup>1</sup> pension fund plan sponsors, professionals (eg, real estate appraisers and accountants), and academics. Those members of NCREIF who have qualifying data<sup>2</sup> on properties under management contribute their data each quarter to the NCREIF Property Index (NPI). NCREIF aggregates the confidential individual property data provided by members and provides indices based on aggregate data for use by its members and the real estate industry.

The mission of NCREIF is as follows:

- Collect and validate real estate performance data
- Calculate and publish performance measures
- Promote and publish Real Estate Information Standards
- Foster and support independent research
- Provide education; field of performance measurement

## NCREIF property index

The NCREIF Property Index (NPI) provides returns for institutional grade real estate held in a fiduciary environment in the United States. Properties are managed by investment fiduciaries on behalf of tax-exempt pension funds. As of the second quarter of 2003 the index contains 3,967 properties with an aggregate market value of \$127 billion.

Figure 1 shows the breakdown of the index by property type. Office is the dominant property type at 40% of the market value of the index with apartment, retail and industrial properties being about 20% each.

Figure 2 shows the percentage of properties in each region of the country. The western region has the greatest proportion of properties (34%) followed by the East (29%), South (22%) and Midwest (15%).

---

<sup>1</sup> Also referred to as investment advisers. These include insurance companies and other organisations that specialise in acquisition, management and disposition of real estate income properties purchased in a fiduciary capacity for investors such as pension funds and wealthy investors.

<sup>2</sup> Managers must have at least \$100 million of properties under management that are at least partially held in tax exempt accounts such as open end funds, closed end funds or separate accounts.

Figure 1

**Allocation of NPI by property type**

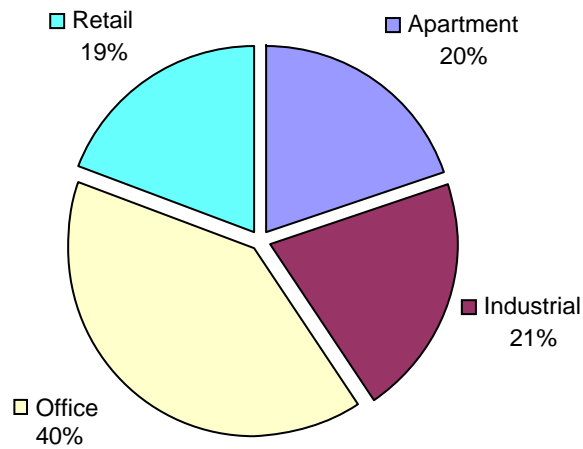
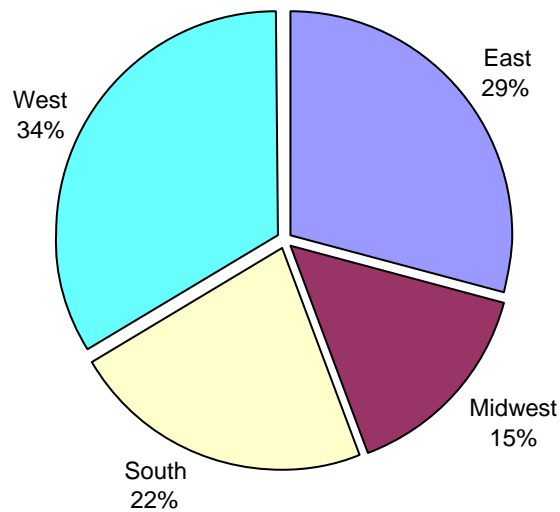


Figure 2

**Allocation of NPI by region**



**Why was the NCREIF index created?**

The NCREIF index was the first available index to measure the performance of income producing real estate and is still the primary index that institutional investors rely on for benchmarking the performance of real estate. It was created to understand how the performance of real estate compares with other asset classes such as stocks and bonds and also to provide a better understanding of the risk and return for commercial real estate.

The index is often used as a basis for developing diversification strategies such as the percentage allocation to real estate to minimise risk for a target portfolio return. Also, sub-indices such as for office, retail, industrial and apartment properties are used to determine how to diversify by property type. Similarly, sub-indices by regions of the country are used for geographic diversification.

Investment managers also use the index as a “benchmark” to evaluate the performance of their portfolio against index. Incentive fees paid by clients to investment managers might be based on out-performing the NCREIF index.

## Calculation of index

In simple terms, the index measures the return each quarter “as if” the property was purchased at the beginning of the quarter at the beginning of quarter appraised value and sold at the end of the quarter at the ending appraised value. The return is the change in value plus the cash flow received for the quarter. Cash flow is net operating income (NOI) less any capital expenditures (Capex).<sup>3</sup> The index is calculated on an “unleveraged” basis, ie, as if the property did not have any debt financing.<sup>4</sup> It is also calculated on a before tax basis. In fact, because the properties in the NPI are held in tax-exempt accounts, federal income taxes would be irrelevant. Returns are calculated for each individual property and then value weighted to produce the index.<sup>5</sup>

## Marked-to-market valuation

Members of NCREIF revalue their properties every quarter because ERISA<sup>6</sup> required pension funds to report the value of investments in retirement plans. As pension funds started adding real estate to their portfolios in the 1970s their real estate investment managers faced the problem that public market pricing wasn’t available for the real estate holdings as was the case for other assets like stocks and bonds. Hence the investment managers used appraisals to mark their properties to market each quarter.

The financial statements that include marked-to-market valuation are in accordance with generally accepted accounting principles (GAAP) except for the valuation of real estate being based on appraisals instead of historical cost less depreciation. However, GAAP allows for use of “prevailing industry practice” in the absence of other guidance. Fair market value accounting for real estate held by pension funds was incorporated into the Real Estate Information Standards (REIS) developed by NCREIF and other organisations.

## Appraisal process for NCREIF

Appraisals are based on “market value”<sup>7</sup> for client reporting. Investment value, which is the value to the particular investment manager, might also be estimated for buy-hold analyses but financial reporting (and the NCREIF index) is based on market value. There is usually an external appraisal at least once per year, which means that an independent appraiser, usually with an MAI designation,<sup>8</sup> does the appraisal. Internal appraisals are usually done the other quarters. The emphasis is on the income approach and use of discounted cash flow analysis (DCF) when doing appraisals for NCREIF

---

<sup>3</sup> Capital expenditures are for items like roof replacement, leasing commissions, tenant improvements, etc that are “capitalised” rather than “expensed” and included in NOI.

<sup>4</sup> Some properties are purchased with loans but the index is calculated as if there was no loan.

<sup>5</sup> Value weighting produces a return for all the properties in the database as if they were a portfolio.

<sup>6</sup> Employee’s Retirement Income Securities Act.

<sup>7</sup> Market value can be thought of as the most probable selling price for the property. In the United States, market value assumes that the property has already been exposed to the market for a reasonable period of time and there is no discounting for time on the market.

<sup>8</sup> The MAI designation means “Member of the Appraisal Institute” and is awarded appraisers after completion of experience, coursework and a demonstration appraisal. See [www.AppraisalInstitute.org](http://www.AppraisalInstitute.org).

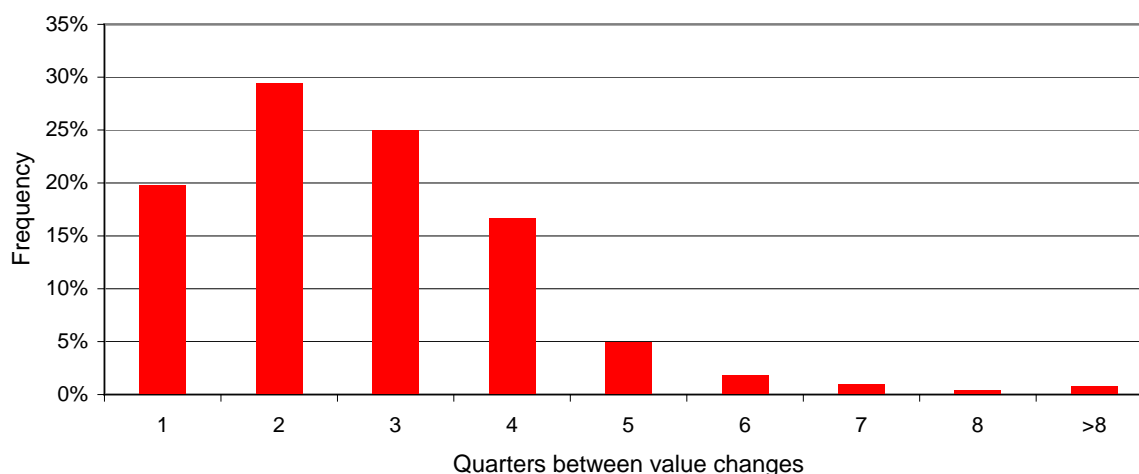
members. The analysis is often done using lease-by-lease financial software such as ARGUS or Dyna<sup>9</sup> that is designed for real estate income property investments with a variety of leases such as office, retail and industrial properties.

## Appraisal issues

As noted earlier, the beginning and ending values used to calculate the NCREIF index are based on appraisals. This is because the real estate in general, and properties in the index do not transact on a regular basis. Thus, appraisals rather than transaction prices are used to calculate the index.

Appraisal based indices such as the NPI tend to have less volatility and lag changes in the market for two reasons: First, all properties are not actually revalued each quarter. Although investment managers report a value every quarter, managers don't always spend the time and money to do a complete revaluation of the property. They may just adjust the value for any additional capital expenditures and have a policy of only revaluing the property if they believe there has been a significant change in value. Figure 3 shows on average how many properties in the NPI are revalued each quarter.

Figure 3  
Average time between revaluations of properties in NPI

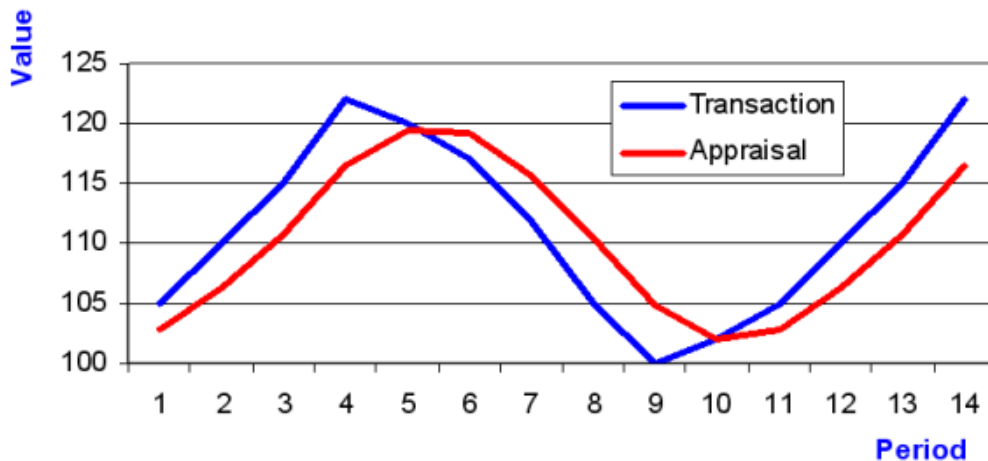


Second, appraisals themselves tend to lag transaction price due to the nature of the appraisal process. Information on transactions is often sparse and by nature historical - especially by the time the data is collected and verified. Market conditions often change more rapidly than can be reflected in data available to appraisers. This causes appraised values to be less than transaction prices in an up market and vice versa. This is illustrated using hypothetical data in Figure 4.

<sup>9</sup> Both ARGUS and Dyna are available from the Realm ([www.Realm.com](http://www.Realm.com)).

Figure 4

Appraised values vs transaction prices



It should be noted that this does not mean the appraiser is not doing the best job possible to estimate value. But the appraiser can not rely just on the most recent comparable sale (comp) because there may be something unusual about that sale that causes it to not be representative of the value of the subject property being appraised. The appraiser needs to receive sufficient evidence that there has been a shift in market prices.

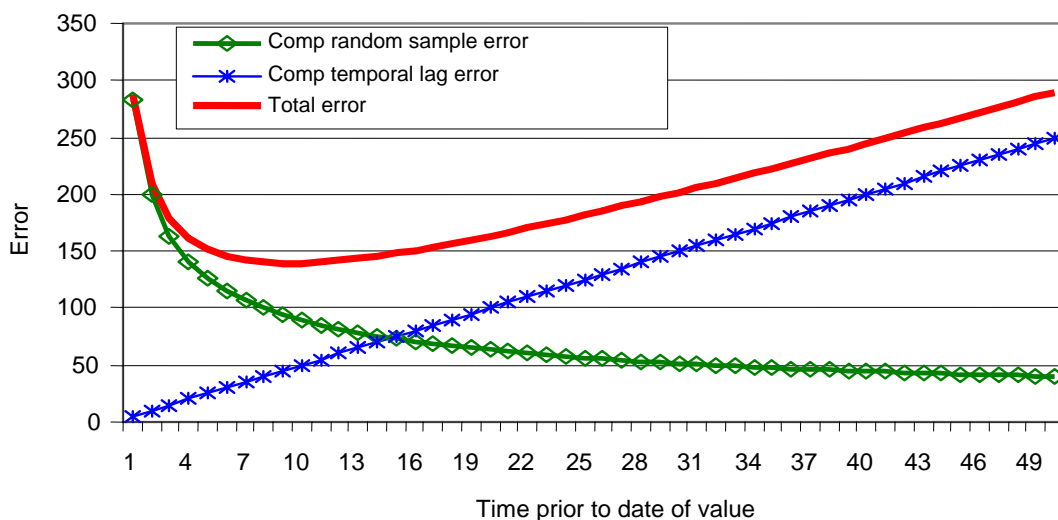
There are two kinds of error in the appraisal of individual properties:

- **Comp sample error.** The comp sample error is due to random differences between the comparable sale (comp) and the subject property.
- **Comp lag error.** This is due to the time that has elapsed since the comparable property (comp) sold and the date of value for the subject property.

There is a trade-off between the reduction in random comp error versus reduction in comp temporal lag error in property value estimation. The appraiser in a sense tries to minimise the sum of the two errors. This is illustrated in Figure 5.<sup>10</sup>

Figure 5

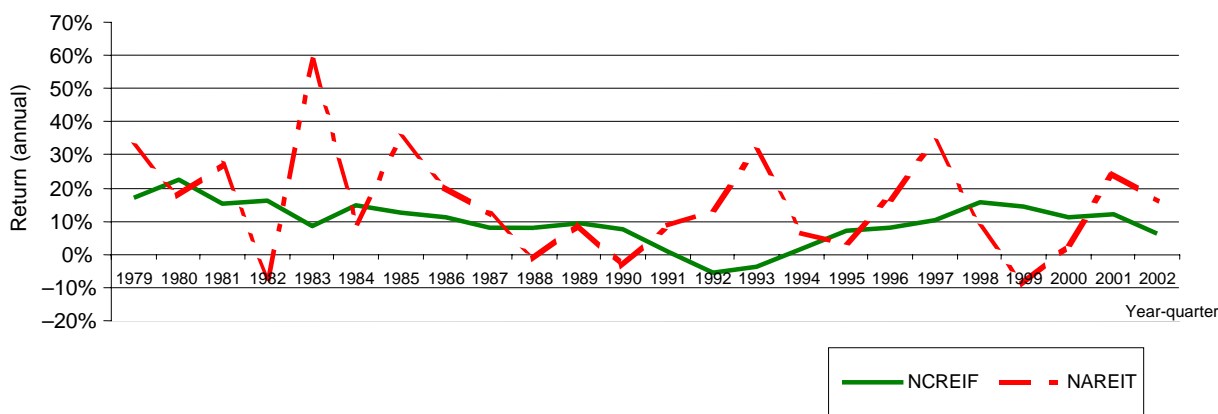
Appraisal error



<sup>10</sup> From Fisher and Ong, "The tradeoff between comp sample error and comp lag error", presented at AREUEA, January 2001.

Figure 6 shows returns for the appraisal based NCREIF Property Index (NPI) versus an index of publicly traded REITs (NAREIT Index) that is based on stock transaction prices. Note the greater volatility of the NAREIT index. Part of the reason for this could be due to REITs being traded in the public market, which has more volatility due to the nature of the market. But the NCREIF index is also smoother due to the use of appraised values.

Figure 6  
Returns for NCREIF property index vs NAREIT REIT index



### Correcting for appraisal lag

Several approaches have been suggested in the literature to “correct” or adjust for the lag inherent in appraisal based indices.<sup>11</sup> The first is to “un-smooth” the index. This approach involves modelling appraisal behaviour and then in effect “reverse engineering” the appraisal process in order to get an unsmoothed index.<sup>12</sup> Appraisal behaviour is modelled as a moving average of the value indicated by current and prior comparable sales (comps) for the reasons discussed earlier. We have

$$V_t^* = \alpha V_t + \alpha(1 - \alpha)V_{t-1} + \alpha(1 - \alpha)^2 V_{t-2} \dots \text{ (moving average)}$$

where

$V_t^*$  is the optimal appraised value in period  $t$

$V_t$  is the value from comps in period  $t$

This reduces to  $V_t^* = \alpha V_t + (1 - \alpha)V_{t-1}^*$

We can now solve for the “true” value as follows:

$$V_t = V_t^* / \alpha - (1 - \alpha) / \alpha V_{t-1}^*$$

Empirical evidence suggests an  $\alpha$  of 0.4 for the NCREIF Property Index (NPI) when estimating annual returns. Thus we can develop a simple unsmoothing model as follows:

$$V_t = V_t^* / 0.4 - (1 - 0.4) / 0.4 V_{t-1}^*$$

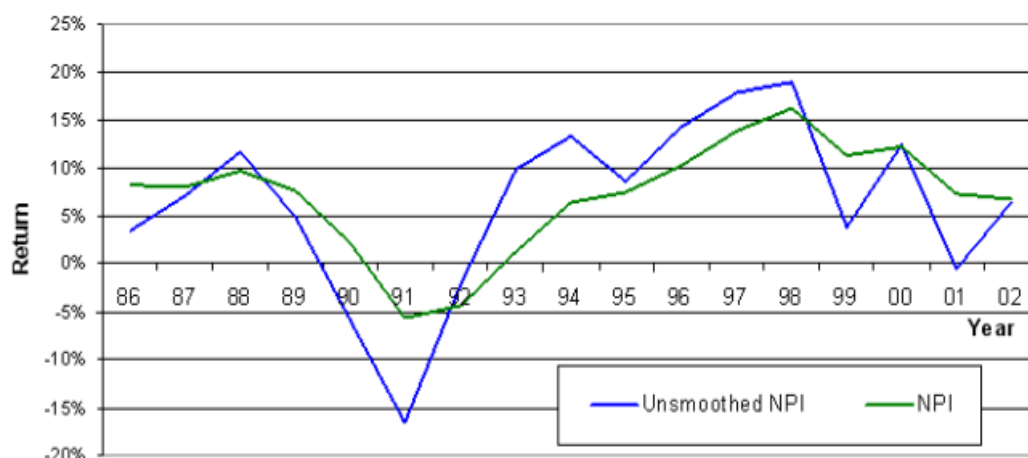
$$V_t = 2.5 V_t^* - 1.5 V_{t-1}^*$$

This adjusts for stale appraisals and lag in the appraisal process. Figure 7 compares the regular NPI with the “unsmoothed” version using the above methodology.

<sup>11</sup> See Quan and Quigley, “Price formation and the appraisal function in real estate markets”, *Journal of Real Estate Finance and Economics*, 1991.

<sup>12</sup> See Geltner and Miller, *Commercial Real Estate Analysis and Investments*, p 684.

Figure 7  
 "Unsmoothed" NPI



### Repeat appraisal methodology

Another approach is to use only the reported appraised values that reflect attempts to revalue the property. That is, instead of using appraised values every quarter, only use quarters that are believed to involve a serious attempt to revalue the property. This is analogous to "repeat sales" indices but uses "repeat appraisals". The problem with this approach is that it is still based on appraised values. So the problem of "stale" appraisals is eliminated, but not the lag due to the appraisal process discussed above. This involves use of an econometric technique (repeated measures regression) to estimate the index because revaluations do not occur every quarter. Figure 8 illustrates this approach with a simplified example. Year zero is the dependent variable in the regressions (even for properties purchased later) and the coefficients of the cash flow estimates for each year provide index levels.

Figure 8  
 Repeat appraisal methodology

Property	Year 0	Year 1	Year 2	Year 3	Year 4
1	-100	10	125		
2	-150	15	18	180	
3	0	-125	15	28	132
4			-130	17	150

Properties 1 and 2 purchased in Year 0, Property 3 purchased in Year 1 and Property 4 purchased in Year 2

$$100 = a_1 10 + a_2 125$$

$$150 = a_1 15 + a_2 18 + a_3 180$$

$$0 = a_1 (-125) + a_2 15 + a_3 28 + a_4 132$$

$$0 = a_2 (-130) + a_3 17 + a_4 150$$

$$a_1 = 1/(1 + R_1)$$

$$a_2 = 1/[(1 + R_1) \times (1 + R_2)]$$

etc.

$$1/a_1 = (1 + R_1)$$

$$1/a_2 = (1 + R_1) \times (1 + R_2)$$

etc.

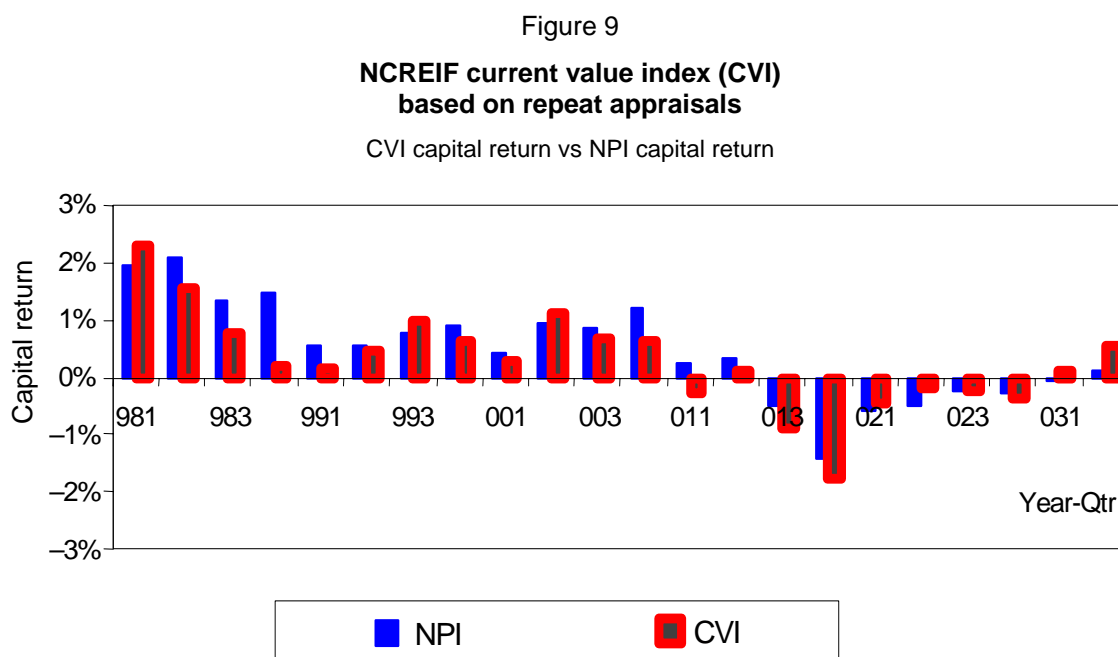
where  $R_1$  is the return for year 1

where  $R_2$  is the return for year 2

index level in year 1

index level in year 2

Figure 9 shows the difference in the capital return (change in value component of the NPI return) using the above methodology versus the capital return for the NPI using the regular quarterly appraised values. NCREIF refers to the index using the repeat valuations methodology as the “Current Value Index” or CVI.



### Transactions indices

A third approach to dealing with the appraisal lag issue is to actually use transaction prices to develop the index instead of appraisals. The disadvantage of this, as noted earlier, is the lack of transactions for the same property. However, if there are a sufficient number of transactions of properties, econometric techniques can be used to estimate an index based on the available transactions. Often this involves the use of “repeat sales” where you have more than one sale of the same property even though there is a significant amount of time between sales. This approach is often used for housing indices where there is a lot of transaction data but is difficult to apply to commercial real estate with less frequent transactions. Another method is to develop “hedonic price indices” that model transaction prices as a function of characteristics of the property such as its size, age, location, quality of construction, etc. This does not require repeat sales of the same property. The date of the transaction is included as a “dummy variable” in the model and the coefficient of this variable is used to develop a price index.

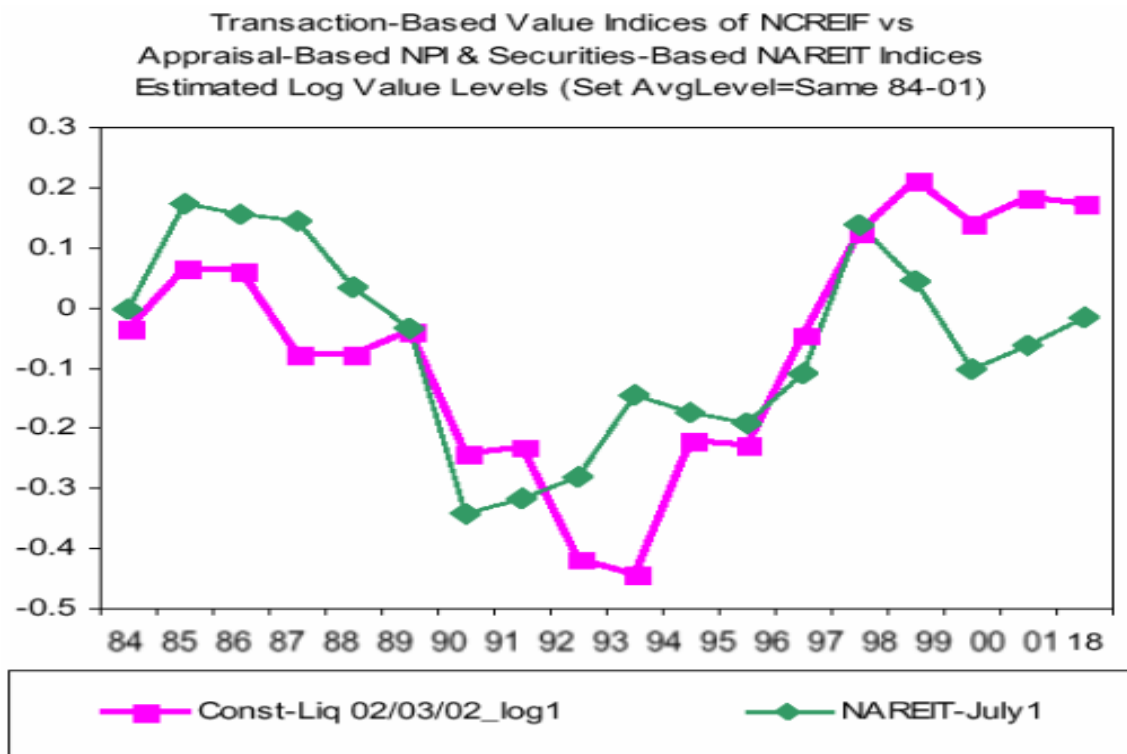
Fisher, Geltner, Gatzlaff and Haurin (FGGH)<sup>13</sup> developed an extension of the hedonic approach that involves (1) controlling for selectivity bias (properties that sell can differ from those that do not sell and we want an index representative of all properties) and (2) adjusting for variations in liquidity over the real estate cycle (properties are more likely to sell and markets are more liquid in an up-market versus a down-market). Details of this methodology are beyond the scope of this paper. Figure 10 compares the FGGH constant liquidity index with the NAREIT index mentioned previously. Note that the constant liquidity index has more volatility and a greater correlation with REITs than suggested by Figure 6 discussed previously.

<sup>13</sup> Jeffrey Fisher, Dean Gatzlaff, David Geltner and Donald Haurin, “Controlling for the impact of variable liquidity in commercial real estate price indices”, *Real Estate Economics*, vol 31, no 2, Summer 2003.



Figure 10

**Comparison of constant liquidity index with NAREIT index**



**Conclusion**

The NCREIF Property Index (NPI) is the primary index used by institutional investors in the United States to analyse the performance of commercial real estate and use as a benchmark for actively managed real estate portfolios. But the use of quarterly appraised values does result in some “smoothing” and lagging of the returns compared to indices based on actual transactions. Several approaches have been used in the literature to deal with the appraisal issues. The most promising is a new methodology that uses sales of properties to develop transaction-based indices for private commercial real estate. As data on transactions becomes more available these indices will become more reliable and allow for better evaluation of the performance of commercial real estate.