Making Sense of the NCREIF Property Index:
A New Formulation Revisited

by

by

Michael S. Young

35 Creekside Drive, San Rafael, California 94903
phone: 415-499-9028 / e-mail: mikero1@mac.com

Making Sense of the NCREIF Property Index:
A New Formulation Revisited

by
Michael S. Young,

Executive Summary. Since its inception, the NCREIF Property Index (NPI) has achieved preeminence as an indicator of the investment performance of institutionally-held commercial property in the United States. The NPI is widely-reported and used by real estate investment owners, investors, managers, consultants and academics. This paper examines several modifications to the current formulas that have been proposed to correct problems in the NPI, which can be used to expand our understanding of the behavior of equity real estate as an investable asset class.

Since its inception over twenty-five years ago, the NCREIF Property Index (NPI) has achieved preeminence as an indicator of the investment performance of institutionally-held commercial property in the United States. The NPI is widely-reported and used by real estate investment owners, investors, managers, and consultants as well as by academics. It has become the de facto yardstick that the industry uses for a variety of performance and analytical purposes. Nonetheless, the formulas used by NCREIF to calculate performance measures, especially the income and capital components:

- Differ from performance measures used in stocks and bonds in important ways (REIT returns, for example, use formulas typical of stock returns);
- Are difficult to explain to investors, lay persons, and even industry participants;
- Fail to shed light on the sources of real estate investment performance;
- Offer little insight into performance differences among different property types; and
- Are often misunderstood or misinterpreted.

Thus, several new formulas have been proposed—actually, modifications to the current formulas—to correct these problems and to expand our understanding of the behavior of equity real estate as an investable asset class.

New Real Estate Performance Measurement Formulas

With relatively minor changes in the NPI formulas proposed by Young, Geltner, McIntosh, and Poutasse (1995 and 1996)[1], the information content of the components of *total return*: the *income return* and the *capital return* can be improved. Also, by defining explicitly a *current capitalization rate* statistic, the confusion that permeates everyday conversation and academic writing about the meaning of the *income return* component of the NPI can be avoided.[2] When

---

[1]   Curiously, on the NCREIF Web site (www.ncreif.org) there are nearly 60 research "white papers" covering published and unpublished articles involving the NPI going back decades, yet neither of these published references is cited.

[2]   Misunderstanding of the NCREIF income return is often evident in articles and marketing presentations that compare REIT dividend yields with NCREIF income returns.

investors hear the phrase "income return," they have a tendency to believe that this is the rate at which income will be generated or earned by the property investment and ultimately that income will be extracted as cash.

Apart from the *current capitalization rate* statistic, some readers may be inclined to say that the new formulas are just what is reported today. Granted, the names may be the same, but the formulas and, more importantly, the notions behind the formulas are clearly different, and convey more useful information about equity real estate investment performance.[3] The new definition of *income return* reflects the cash flow from property available for distribution to investors rather than the current formula that most real estate practitioners would recognize as a current capitalization rate expressed (erroneously) as a quarterly "return." The new definition of *capital return* isolates the change in property value from period to period, irrespective of the capital expenditures that have been made, which is a more strict and unambiguous measure of capital value change.

Exhibit 1 highlights the differences between the current and the new formulas. Changes in the definitions of the NPI performance measures reflected in the new formulas are:

1 The denominator of all return measures is redefined as the previous period's market value thereby eliminating the fractional shares of capital improvements, partial sales, and net operating income;

2 Capital improvement expenditures during the current quarter are subtracted from the numerator of the *income return* rather than from the numerator of the *capital return*[4] (leaving the numerator of the *total return* unchanged from the current definition of *total return*); and

3 The *current capitalization rate* statistic expressed as an annual figure which, apart from the more simplified denominator, is similar to the current (misnamed) income return.

The first change (the *denominator change*) negligibly affects the total return and its two component returns: income and capital. The second change (the *numerator change*) results in substantial revision in the two components of *total return* each period relative to the current formulas, but does not change the *total return*, because the numerator has all the same variables as the current formula.

Rationale for the Denominator Change

In most indices of returns covering a short time interval, the denominator over which the return is measured is simply the asset value at the end of the previous period. Thus, for the return during

---

[3]   The current NCREIF formulas for income and capital return are "accounting-based." In this article, the formulas are more "financial-economics-based" as originally proposed in Young, Geltner, McIntosh, and Poutasse (1996). See also Young, Geltner, McIntosh, and Poutasse (1995) for an alternative exposition of these different views.

[4]   On the NCREIF Web site, registered members have the opportunity to create custom queries of the database. One query option allows the computation of income return based either on Net Operating Income (NOI, the default choice) or Cash Flow (the second choice not defined or described anywhere on the site). This second choice is, however, the subtraction of capital improvements from NOI. When chosen, this option also changes the capital return formula, naturally. There is no option to change the denominator and all the returns generated on the NCREIF site are quarterly returns using the complex denominator discussed in the following section.

period t the denominator is defined as V_{t-1}, the asset value at the end of period t-1. The denominator employed in the NPI, on the other hand, is:

$$V_{t-1} + (\tfrac{1}{2})CI_t - (\tfrac{1}{2})PS_t - (\tfrac{1}{3})NOI_t \qquad\qquad \text{Expression (1)}$$

The reason to define the denominator as in Expression (1) was a desire to approximate an internal rate of return (IRR) for a calendar quarter while recognizing the monthly or mid-quarter timing of property cash flows.

While this mathematical sophistication is laudable, and might matter over longer holding periods (i.e., if the NPI were reported less frequently than quarterly), Exhibit 2 demonstrates that there is no practical quantitative difference in a quarterly index. Thus, there seems to be no compelling reason to remain wedded to Expression (1) when a much simpler, easily-explained alternative produces virtually identical results. Furthermore, using V_{t-1} as the denominator brings the NPI into closer conformity with the way indices are defined in other financial markets. [5]

Additionally, the current denominator is inextricably tied to quarterly returns while the new, simpler denominator, V_{t-1}, can be used for any time period: daily, monthly, quarterly, annually, etc.[6]

Effects of the New Formulas

When the new formulas are applied to the raw data in the NCREIF database there are three principal effects:

1   A reduction in the periodic *income return*,
2   An increase in the periodic *income return* dispersion, and
3   An increase in the periodic *capital return*.

One additional effect is notable by its absence: namely, the *total return* is virtually unchanged in any period despite the seemingly radical change to the denominator.

The effects of these changes can be seen in Exhibit 2, quarterly return statistics for the three return series, and Exhibit 3, quarterly return graphs for the entire property database for the three return series using both the current and the new formulas.

Exhibit 2 shows the quarterly time-series sample statistics for the historical NPI from its inception in 1978 through the fourth quarter of 2004, under the current definition and under the new definition with both the *numerator* and *denominator changes*.

Comparing statistics under the current and new formulas shows clearly that the new *denominator change* causes a negligible difference in the total return versus the current definition, while giving the NPI returns a denominator more similar to that employed by securities indices. The mean quarterly return over twenty-seven years is 2.31% (quarterly standard deviation 1.67% and quarterly median 2.39%) using the current formula versus 2.30% (quarterly standard deviation 1.66% and quarterly median 2.38%) using the new formula.

---

[5]   As examples, Morningstar, Russell, Standard & Poor's, and NAREIT all use this simple denominator in their return formulas.

[6]   The author is personally aware of computer applications used by investment managers that mistakenly use the current NCREIF quarterly denominator in computations for periods other than calendar quarters.

The substantively important difference between the new formulas and the current formulas is seen clearly in Exhibit 3, affecting only the *income* and *capital return* components, while the *total return* results remain virtually unchanged regardless of which of the two definitions is used. As seen in the middle graph of Exhibit 3, the new formula produces an *income return* component notably smaller and more volatile than the current formula. On the other hand, as the bottom graph of Exhibit 3 shows, the new formula causes the *capital return* component of the NPI to display more growth—or less loss—of capital value over time. This, we believe, is a more accurate depiction of the affect of capital expenditures that is absent from the current formulation.

The difference between the two yield or *income return* measures depicted in the middle graph of Exhibit 3 is the capital improvement expenditures each quarter as a fraction of market value. This averages 62 basis points, or the equivalent of about 2.5% of property value per year, a sizable amount. The capital improvement expenditures represent property cash flow not available for distribution to property owners or investors, because the typical practice in the institutional real estate investment management business is to pay for capital improvements out of operating cash flow rather than financing them via new equity capital from the investors or debt. In commercial real estate investment, capital improvements or capital expenditures are needed to maintain or enhance value and to attract and retain tenants over a property's lifecycle. Thus, it is entirely appropriate that the financing of capital expenditures happens routinely just like most other operating expenses. Because the new formulation of *income return*, which subtracts capital expenditures from net operating income each period, acknowledges the reality of commercial real estate investment, it enables the *income return* component to reflect the cash flow potentially available for distribution to the investor as a fraction of asset value.

As stated previously, the new formula corresponds more closely to the *income return* portrayed in securities indices, including REIT indices, where the *income return* is defined as the dividends paid out as a fraction of share price. REITs (like other common stocks) must devote some of their operational income to paying for capital improvements to the physical assets they own, and dividends are generally paid from the cash flow remaining after capital improvement expenditures have been made. Indeed, in the long run, no company can afford to pay out dividends in excess of its net cash flow less capital expenditures without either returning capital to investors (i.e., self-liquidation of the asset) or relying on external sources for the capital expenditure amounts (i.e., issuance of new equity shares or the issuance of debt). In the case of institutionally-managed real estate, investment managers generally use external financing only for major new property acquisitions or redevelopment, not for routine small-scale capital improvements, tenant improvement allowances, and leasing commissions. Thus, if capital expenditure is removed from the *income* component of the return, and not from the *capital* appreciation component, a more accurate representation of cash flow available for distribution is obtained.[7]

As comparisons and joint analyses of NPI and REIT returns become more common and more important to investors, the current definition of *income return* may mislead unwary analysts many

---

[7]   An exception might be made when the capital expenditure exceeds some fairly large fraction of the property's value, as that would likely reflect a case of major redevelopment of the property. Nonetheless, it is difficult for an index like the NPI, which is an aggregate of statistics of properties rather than a statistical summary of individual property performance results, to adjust for this condition. Mechanical filter rules, for example, could be criticized even if they captured a majority of major redevelopments or expansions.

of whom naturally equate the NPI *income return* to, for example, the NAREIT Index *income return*. However, under the current definition, such comparison, without adjustment, is clearly "apples vs. oranges." Furthermore, unless analysts adjust for the capital improvement expenditure component, the two statistics are not comparable. For these reasons, it makes sense to redefine the *income return* as suggested.

Return Differences by Property Type

NPI results have always shown differences in total returns among various property-type subsets. The current formula for the *income return*, however, did not show much difference in average returns or variability of returns among property types. The new formulas show greater differences that result from differences in capital improvement costs for particular property types. These differences can help investors understand the risks and opportunities of spreading or concentrating investment along the property-type dimension.

Exhibit 4 tabulates the annual mean and standard deviation of *total*, *income*, and *capital returns* for both the current and new formulas for all properties and for each property type subindex in the NPI. Historically, the Industrial property type showed the highest average *income return*: 8.49% under the current formula. However, when we apply the new formula to the data, the Apartment property type shows the highest average *income return*, 6.55% versus 5.79% for Industrial. This is directly attributable to the fact that it takes more capital improvements to maintain an Industrial property than it does for the typical institutional-grade Apartment property.[8] Similarly, under the current formula, Apartments seemed to show the highest average annual capital growth of 3.28% per annum. However, if we apply the new formula, Retail properties show a nearly identical average annual capital growth of 4.70% versus 4.73% for Apartments. The sizeable relative gain by Retail properties is attributable to successful capital expenditures designed to upgrade tenancy and add leaseable space. Thus, the new formula for *capital return* is a better representation of the success or failure of capital expenditures as a means of producing capital gains.

Investors may wish to construct portfolios to capture differences in distributable income or capital gains. By applying the new formulas to the NCREIF data, we get a clearer, more realistic picture of property-type differences along these dimensions.

Exhibit 5 shows rolling four-quarter (annualized) *income returns* for all properties and for each property type subindex in the NPI. Several differences among property-type *income returns* are evident in the new formulation:

1. There are real and substantial differences among *income returns* by property type. Apartment properties devote less of their net operating income to capital improvements than all other types, about 20%. By contrast, Office and Retail properties are at the other end of the spectrum devoting roughly 50% to 55% of their average annual net operating income to capital improvements.

---

[8]   There is an interesting accounting anomaly between the Apartment type and the Office, Industrial, and Retail types. In particular, leasing costs are treated as an operating expense for Apartments while leasing commissions are treated as a capital expense for the other three property types. If the accounting treatment were the same for all property types in the NPI, the change capital returns for Apartments between the current and new formulations would be more similar to the roughly 2.5% change evidenced by the other types. This is a research question worth investigation.

2. The pattern of income returns is considerably more volatile with the new formulation. This volatility better reflects the real world of real estate investment performance as a source of cash flow. Income-generation in real estate is not a steady, predictable process. Income distributable from real estate investment will fluctuate with net cash flow that takes into account all the expenses needed to sustain a property, not just those commonly called operating expenses.

3. The current income return formula obscures the relatively low correlation of distributable cash flows evident in the patterns of *income return* under the new formulation. The correlations of rolling four-quarter *income returns* computed with the current and new formulas are shown in Exhibit 6.

A natural consequence of the change in the *income return* formula is the change in the *capital return*. Capital improvements subtracted from the *income* and removed as a subtraction from *capital*. Over the long term we see that capital improvements add to the value of the underlying property, which is satisfying considering how much property cash flow is needed for capital improvements. At best, the current formula of *capital return* obscures this effect. However, the new formula makes it quite clear that capital improvements have, in general, been productive for owners and investors such that property values have increased as a consequence of this investment.

Exhibit 7 shows rolling four-quarter (annualized) *capital returns* for all properties and for each property type subindex in the NPI. Capital expenditures are necessary and required of all properties to attract and hold tenants and to prevent deterioration of the asset. Additionally, investment managers typically make capital expenditures to increase market value. The current NPI *capital return* formula makes it appear that capital expenditures have had little beneficial impact upon value. As the graphs of Exhibit 7 and the table of Exhibit 4 show, capital expenditures computed by the new formula have produced positive capital growth over most of the history of the NPI at an overall average rate of 3.96% per annum versus the meager 1.47% produced computed by the current formula.

Capitalization Rates

Changing the *income return* formula will eliminate what is better described as a *current capitalization rate* by retaining the basic idea with the new formulation of the denominator, again to conform to common practice and assumed definition in everyday use. The formulation of *current capitalization rate* measure is simply net operating income before capital improvements are removed divided by the value at the end of the prior period. An annualization of the quarterly net operating income divided by the value gives a statistic directly comparable to the "overall rate" or "capitalization rate" used widely by appraisers as a rough indicator of property value and market sentiments.

Capitalization rates for all properties of the NPI and for each individual property-type subindex are shown graphically in Exhibit 8. In this exhibit, a rolling four-quarter average rate line has been fitted that, for the period shown, presents a good approximation to the long-term trend in *capitalization rates*. The patterns for all property types are remarkably similar.

Conclusion

The NCREIF Property Index and its various subindices are often used to understand the financial and economic performance of institutional-grade commercial property. Investors, investment advisors, consultants, and appraisers rely upon the NPI as a yardstick of performance and often probe beyond the *total returns* into its components, the *income* and *capital returns*, to set expectations about future performance and to distinguish the relative return-generating potential of one property type from another.

Unfortunately, the current formulas have a variety of shortcomings that may lead to erroneous conclusions or misinterpretation of real estate's economic behavior. With relatively minor modifications to the formulas applied against the NCREIF data, our understanding of the real estate asset class can be enhanced. Additionally, a reformulation permits better comparison between real estate and other asset classes and allows the differences among property types to become clear.

By moving the capital improvements figure from the current formula's *capital return* component to the *income return* component, the *income return* is more closely aligned with what investors typically receive as distributed cash flow from their real estate assets. Also, with the new formula, the *capital return* is strictly the change in property value without the distorting effect of deducting the costs of maintaining the asset or adding to its market value. Thus, the new, alternative definitions produce a more realistic picture of the performance of equity real estate and are more in line with the performance formulas used in financial markets.

References

Young, M.S., D.M. Geltner, W. McIntosh, and D.M. Poutasse, Defining Commercial Property Income and Appreciation Returns for Comparability to Stock Market-Based Measures, *Real Estate Finance*, 1995, 12:2, 19-30.

Young, M.S., D.M. Geltner, W. McIntosh, and D.M. Poutasse, Understanding Equity Real Estate Performance: Insights from the NCREIF Property Index, *Real Estate Review*, 1996, 25:4, 4-16.

<div align="center">

Exhibit 1
Current and New Formulas

</div>

Current Formulas	New Formulas
Total Return = $$\frac{NOI_t + V_t - V_{t-1} - CI_t + PS_t}{V_{t-1} + (\gamma_2)CI_t - (\gamma_2)PS_t - (\gamma_3)NOI_t}$$	*Total Return =* $$\frac{NOI_t + V_t - V_{t-1} - CI_t + PS_t}{V_{t-1}}$$
Income Return = $$\frac{NOI_t}{V_{t-1} + (\gamma_2)CI_t - (\gamma_2)PS_t - (\gamma_3)NOI_t}$$	*Income Return =* $$\frac{NOI_t - CI_t}{V_{t-1}}$$
Capital Return = $$\frac{V_t - V_{t-1} - CI_t + PS_t}{V_{t-1} + (\gamma_2)CI_t - (\gamma_2)PS_t - (\gamma_3)NOI_t}$$	*Capital Return =* $$\frac{V_t - V_{t-1} + PS_t}{V_{t-1}}$$
	Current Capitalization Rate = $$\frac{4(NOI_t)}{V_{t-1}}$$

where:
  V_t and V_{t-1} are the values in the current and prior period,
  NOI_t is the net operating income in the current period,
  CI_t is the capital improvements in the current period, and
  PS_t is the partial sales in the current period.

<div align="center">

Exhibit 2

Quarterly Return Statistics Using Current and New Formulas

NPI, All Properties, 1978:1 to 2004:4

</div>

	Total Return		Income Return		Capital Return	
	Current	New	Current	New	Current	New
Mean	2.31%	2.30%	1.95%	1.33%	0.37%	0.98%
Standard Dev.	1.67	1.66	0.18	0.30	1.61	1.61
Maximum	6.19	6.16	2.29	2.06	4.03	4.77
Minimum	−5.33	−5.32	1.56	0.39	−7.01	−6.31
Percentiles:						
95th	5.10%	5.09%	2.21%	1.75%	3.18%	3.64%
75th	3.08	3.07	2.11	1.54	1.19	1.71
50th (median)	2.39	2.38	1.96	1.35	0.37	0.96
25th	1.66	1.65	1.80	1.12	−0.26	0.37
5th	−0.31	−0.80	1.62	0.85	−2.23	−1.34
Interquartile range	1.43%	1.42%	0.30%	0.43%	1.45%	1.56%
Correlation:						
Current formula	1.000	1.000	1.000	0.746	1.000	0.991
New formula	1.000	1.000	0.746	1.000	0.991	1.000

Exhibit 3
NPI, All Property Quarterly Returns, 1978.1 to 2004.4
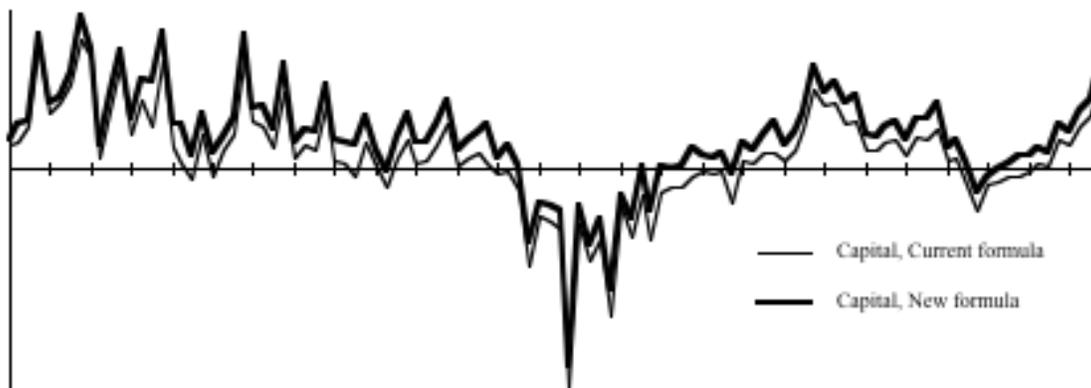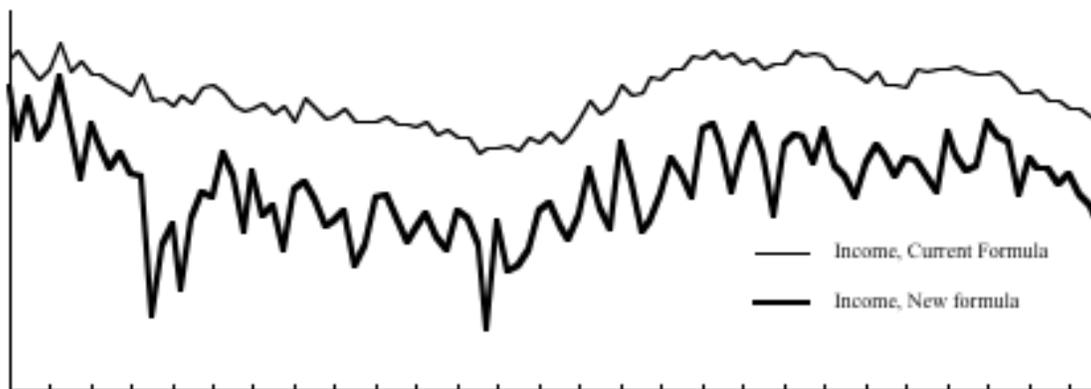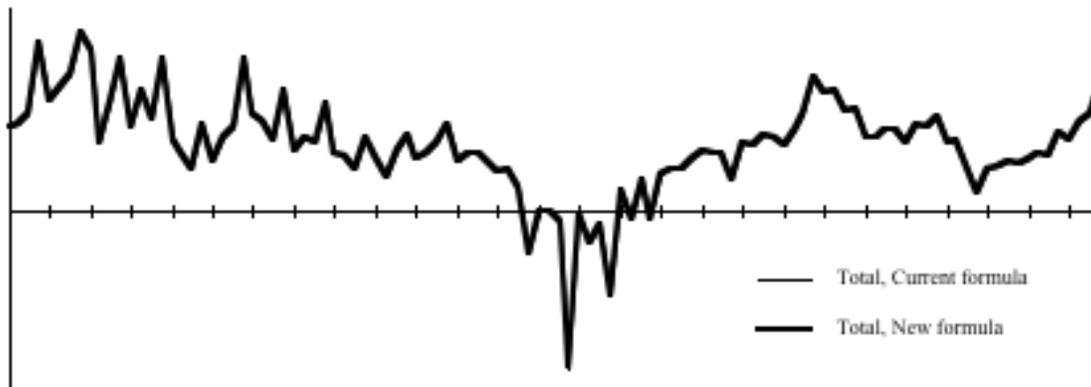
Exhibit 4
Annualized Return Statistics Using Current and New Formulas
NPI by Property Type and All Properties, 1978:1 to 2004:4

	Total Return		Income Return		Capital Return	
	Current	New	Current	New	Current	New
Office:						
Mean	8.72%	8.67%	7.94%	5.24%	0.74%	3.31%
Standard Dev.	5.17	5.15	0.48	0.70	5.07	4.99
Retail:						
Mean	9.97	9.91	7.88	5.04	1.97	4.70
Standard Dev.	3.30	3.27	0.41	1.10	3.24	3.40
Industrial:						
Mean	9.98	9.92	8.49	5.79	1.40	3.96
Standard Dev.	3.18	3.16	0.36	0.82	3.10	3.24
Apartment:						
Mean	11.58	11.51	7.90	6.55	3.48	4.73
Standard Dev.	3.27	3.25	0.43	0.54	3.22	3.20
All Properties:						
Mean	9.59%	9.53%	8.03%	5.42%	1.47%	3.96%
Standard Dev.	3.34	3.32	0.37	0.61	3.23	3.21

Exhibit 5
Rolling Four-Quarter Income Returns
NPI, All Properties and by Property Type, 1978.4 to 2004.4

All Properties, Current formula
All Properties, New formula

Office Properties, Current formula
Office Properties, New formula

Retail Properties, Current formula
Retail Properties, New formula

Industrial Properties, Current formula
Industrial Properties, New formula

Apartment Properties, Current formula
Apartment Properties, New formula

Exhibit 6
Correlations of Rolling Four-Quarter Income Returns

	Current Formula:					New Formula:				
	All	Office	Retail	Indust.	Apt.	All	Office	Retail	Indust..	Apt.
All	1	0.93	0.80	0.90	0.67	1	0.85	0.83	0.70	0.56
Office	0.93	1	0.65	0.91	0.62	0.85	1	0.59	0.39	0.52
Retail	0.80	0.65	1	0.55	0.19	0.83	0.59	1	0.48	0.19
Industrial	0.90	0.91	0.55	1	0.75	0.70	0.39	0.48	1	0.44
Apartment	0.67	0.62	0.19	0.75	1	0.56	0.52	0.19	0.44	1

Exhibit 7
Rolling Four-Quarter Capital Returns
NPI, All Properties and by Property Type, 1978.4 to 2004.4

All Properties, Current formula
All Properties, New formula

Office Properties, Current formula
Office Properties, New formula

Retail Properties, Current formula
Retail Properties, New formula
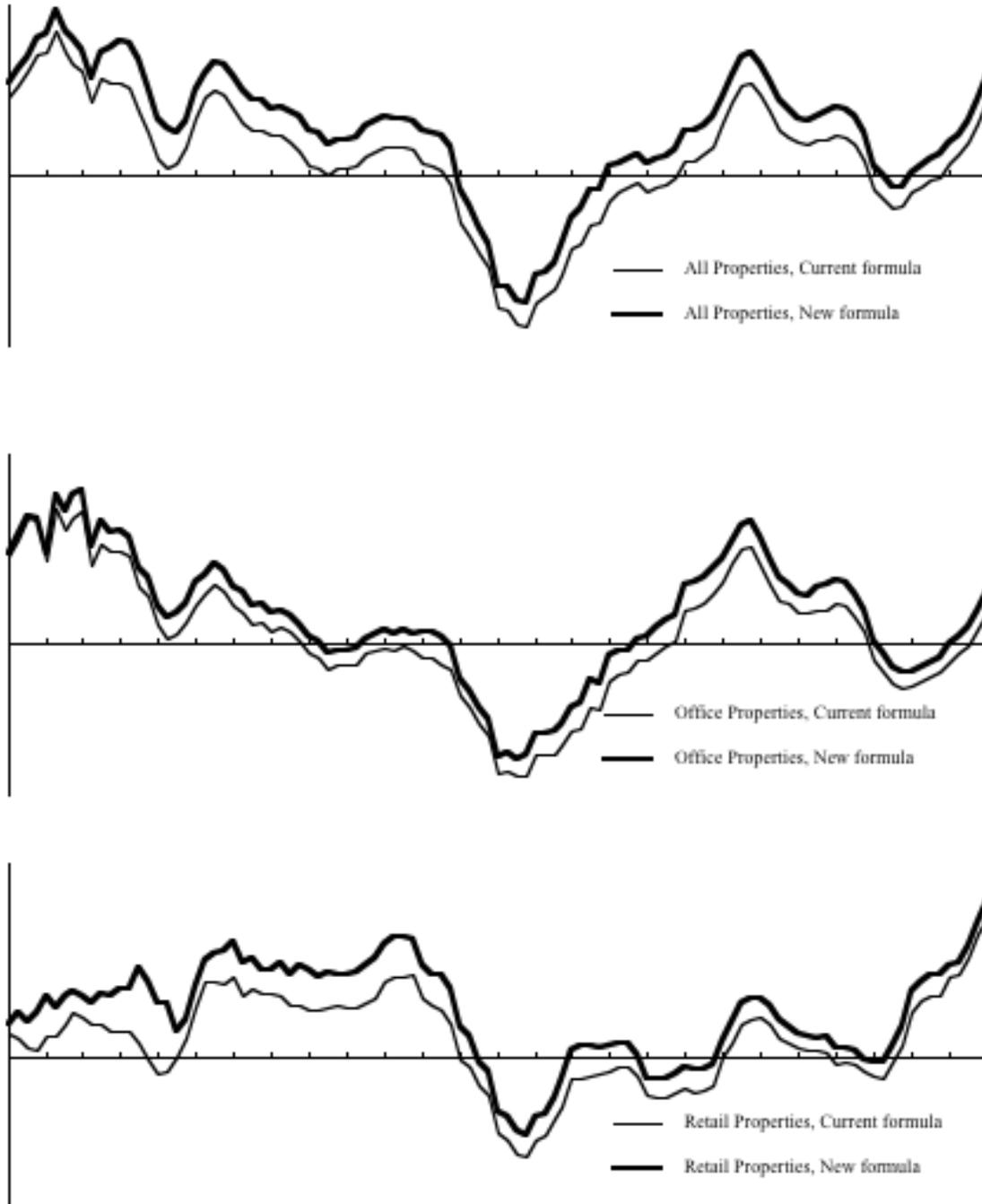
Exhibit 7 (continued)
Rolling Four-Quarter Capital Returns
NPI, All Properties and by Property Type, 1978.4 to 2004.4

Industrial Properties, Current formula
Industrial Properties, New formula

Apartment Properties, Current formula
Apartment Properties, New formula
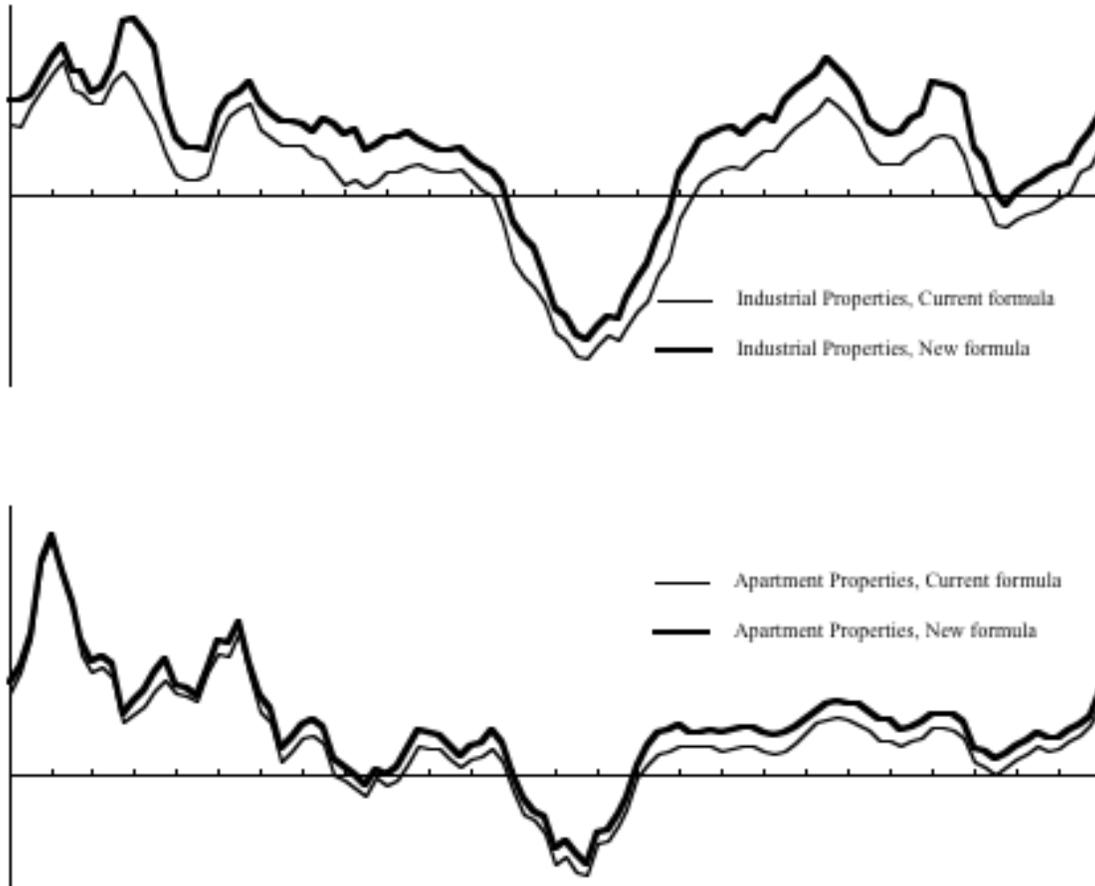
Exhibit 8
Capitalization Rate
NPI, All Properties and by Property 1978.1 to 2004.4