Portfolio Upside and Downside Risk – Both Matter!

by

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Abstract

Traditional performance measures do not distinguish between “upside risk” and “downside risk.” Downside risk is based on returns that are either below a target rate, below zero, below average or below a benchmark and vice versa for upside risk.

Downside risk measures and the “duality” of beta have been discussed extensively in literature related to public markets but have not been applied to the analysis of private equity real estate in the academic literature. This article examines the measures that can distinguish between upside and downside risk that are commonly used in public markets, such as upside and downside beta and the Sortino ratio for downside analysis and applies them to different property sectors and Core Based Statistical Areas (CBSAs) in the NCREIF Property Index (NPI). In addition, these measures are used to analyze gateway vs. non-gateway markets’ historical performance on both an upside and downside risk basis. The same techniques are applied to perform an attribution analysis of a portfolio’s alpha into upside and downside components.

In public markets, analysts often use downside risk measures such as the Sortino ratio[1] or use both upside and downside beta to compare stocks or stock portfolios.[2] Case (2019) argued that REITs protect against market declines because they tend to have a higher upside beta than the downside beta. A high ratio of upside to downside beta suggests that returns are more likely to be magnified on the upside but become defensive on the downside. These measures are commonly used in public markets, whereas in private real estate markets the more traditional measures, such as the Sharpe ratio and traditional beta that do not distinguish between upside and downside risk and return, are typically used to evaluate portfolios.

Measures of downside risk consider whether returns are either below average, below a target rate, below zero or below a benchmark and vice versa for upside risk measures such as upside beta. By using the upside and downside betas, the expected upside and downside returns can be calculated and compared to actual returns to determine the upside and downside alphas.

This article examines the upside and downside risk of different property sectors and Core Based Statistical Areas (CBSAs) in the NCREIF Property index (NPI)[3] and decomposes Jensen's alpha into upside and downside components. The performance of gateway vs. non-gateway markets is also analyzed using this methodology. This provides insight as to whether the performance of portfolios consisting of different property sectors and locations are more likely to be impacted by upward or downward moves in the market or an appropriate benchmark. A portfolio's ex-post alpha can also be decomposed into that which was contributed by upside and downside returns to complement traditional attribution analysis.

Downside Risk Measures

The most common measures of downside risk include the Semi-variance, the Sortino ratio, and downside beta. The semi variance is like the variance but only uses returns that are below average. The square root of the semi variance is the semi-standard deviation or simply semi deviation. The equation for the semi-standard deviation is as follows:

$$\text{Semi deviation} = \sqrt{\frac{1}{n} \times \sum_{r_t < \text{Average}}^{n} (r_t - \text{Average})^2} \tag{1}$$

Where:

[1] For example, see the Rollinger (2013) and Hoffman paper produced by Red Rock Capital "Sortino: A 'Sharper' Ratio."
[2] For example, see Guy (2015), Abbas et. al. (2011), Ang and Xing (2006), Bawa (107), Estrada (2002) and Galagedera and Brooks (2005).
[3] The NCREIF Property Index tracks the performance of investment grade commercial real estate managed by institutional investment managers. The index includes over 9,000 properties with a market value over $700 billion as of the 4th quarter of 2020 including about $300 billion in so called "gateway markets." For further information see www.NCREIF.org.

n = total number of observations below the mean

r_t = observed return where returns < average return

The semi deviation measures the variability of the downside returns. This only considers risk without considering the return. The next step therefore is to determine the measure of return per unit of risk. The Sharpe ratio is such a measure that uses the standard deviation of the returns (or excess returns over the risk-free rate). The Sortino ratio is a similar measure using only the semi deviation in the denominator.

The equation for the Sortino ratio is as follows:

$$\text{Sortino ratio} = \frac{R_p - r_f}{\sigma_d} \tag{2}$$

Where:

R_p = actual or expected portfolio return (or excess return)

r_f = risk-free rate

σ_d = standard deviation of the downside returns or semi deviation.

A slight variation of the semi deviation (or semi standard deviation) is often used for the Sortino ratio as follows:

$$\text{Semi deviation} = \sqrt{\frac{1}{n} \times \sum^{n} (r_t - \text{target})^2} \tag{3}$$

Where:

n = total number of observations below target

r_t = min (observed value, target return)

target = a target rate of return which can be zero

The target return could be the average return over the period being analyzed but can be some other return including zero depending how one wants to define the downside returns.[4]

[4] The authors thank Michael Shanks with Principal Real Estate Investors for suggesting that the NCREIF database be used to compare different property sectors and CBSAs using the Sortino Ratio which inspired us to explore this and other measures of downside risk using the NCREIF data.

Downside Beta

Another approach to measuring downside risk is referred to as "downside beta." It is like the traditional beta but only uses a measure of downside returns. There are at least three ways of defining downside returns in the academic literature that have been used. These are as follows:

- Portfolio returns below a benchmark return.
- Returns below a target return.[5]
- Returns below an average return.[6]

Each of these approaches or methods has some subtleties as to how they are calculated.

Portfolio returns below a benchmark return. In this case, the downside returns are defined as periods when the portfolio returns are less than those of the benchmark for the same period. E.g., for private equity funds the NCREIF Property Index (NPI) or the NCREIF Open End Diversified Core Equity Index (ODCE) could be used as the benchmark. Excess returns over the risk-free rate are usually used.

The downside beta is calculated as follows:

$$\beta^- = \frac{\mathrm{COV}(r_p, r_B)}{\mathrm{VAR}(r_B)} \qquad \text{Where } r_p < r_B \tag{4}$$

Where:

r_p = excess return of portfolio p

r_B = excess return of the market (benchmark)

Returns below a target return. This method uses returns below a target return (which can be zero) for the portfolio and benchmark.

The downside beta is calculated as follows:

$$\beta^- = \frac{\mathrm{COV}(r_p, r_B)}{\mathrm{VAR}(r_B)} \qquad \text{Where } r_p < r_T \tag{5}$$

where r_T is the target return.

Returns below average return. When using the returns below average return methodology, the downside periods are defined as periods when the benchmark return is below the average return for the benchmark. Then the portfolio return for that period is used whether it is above or below the portfolio average. That is, downside periods are identified only by the benchmark returns

[5] Estrada (2002) uses a target of zero.
[6] See Bawa and Lindenberg (1977).

being above or below average. This is different than the portfolio returns below benchmark return methodology where downside periods are simply determined when the portfolio return is less than the benchmark return for that period.

$$\beta^{-} = \frac{\mathrm{COV}(\mathrm{r_p}, \mathrm{r_B})}{\mathrm{VAR}(\mathrm{r_B})} \qquad \text{Where } \mathrm{r_B} < Ave\ (\mathrm{r_B}) \tag{6}$$

There is no “right answer” as to which methodology is best. As is the theme of this article, it depends on what risk you want to measure and avoid. Many fund managers are benchmarked against the NCREIF property index (NPI) or NCREIF ODCE fund index (NFI-ODCE). Thus, the relevant downside risk to that investor may be how volatile the portfolio returns are when the portfolio return is below the benchmark return. A lower beta would suggest that the fund is more defensive when the market is relatively weak.

Defining risk as returns below a target might be more of a concern to investors who have an absolute benchmark rather than a relative benchmark. E.g., if they are expected to beat a target return of 2% per quarter, the target return for the downside risk would be 2%. Note that zero can be a target return, reflecting aconcern about having negative returns.

Because private real estate equity funds – especially funds that are more core in nature – tend to only have negative returns during a significant recession, using a target of zero may not result in enough downside returns unless the recession is included in the analysis. Thus, returns below a benchmark or a positive target number might be more appropriate.

Returns below the average (benchmark) return is in a sense a variation of returns below a target return where the target is the average return over the analysis period. So, the target is relative to the time period being analyzed. This would help measure the risk when the market is weak as measured by below average market (benchmark) returns.

What about the Upside Returns?

The next question for each approach described above for defining downside returns is how the corresponding upside returns are defined. There are two approaches that are used in practice:

1. Replace the corresponding upside returns with a blank, i.e., ignore those periods.
2. Replace the corresponding upside returns with a zero.

The first approach is what was suggested by the formulas for the downside beta discussed above. The second approach appears to be the one that is most accepted in the finance literature.[7] Adding zeros does not impact the calculation of beta because it has the same impact on both the covariance in the numerator and variance in the denominator. Thus, the beta is exactly the same.

[7] E.g., see Estrada (2002).

As an example, using the second approach (zeros for the upside returns), the equation for the downside beta when downside returns are defined as portfolio returns below the benchmark can be written as follows:

$$\beta^{-} = \frac{\mathrm{COV}(r_p, r_B)}{\mathrm{VAR}(r_B)} \quad \left. \begin{array}{l} \text{Where } r_p = r_P \;\&\; r_B = r_B \text{ if } r_p < r_B \\ \qquad r_p = 0 \;\&\; r_B = 0 \text{ if } r_p \geq r_B \end{array} \right. \tag{7}$$

In the special case of using returns below a target return with a target return of zero, the formula for beta can be written as follows:

$$\beta^{-} = \frac{\mathrm{COV}(r_p, r_B)}{\mathrm{VAR}(r_B)} \quad \left. \begin{array}{l} \text{where } r_p = r_P \text{ if } r_p < 0 \\ \qquad r_p = 0 \text{ if } r_p \geq 0 \\ \qquad r_B = r_B \text{ if } r_B < 0 \\ \qquad r_B = 0 \text{ if } r_B \geq 0 \end{array} \right. \tag{8}$$

which can simply be written as follows:

$$\beta^{-} = \frac{\mathrm{COV}(\min(r_p, 0), \min(r_B, 0))}{\mathrm{VAR}(\min(r_B, 0))} \tag{9}$$

Thus, the lower of the actual portfolio return (which would be negative) or zero would be used and similarly for the benchmark return.

Duality of Beta: Upside and Downside Betas

For each of the approaches of calculating the downside beta discussed above, there is a corresponding upside beta. The upside beta mirrors the calculation of the downside beta. E.g., if the downside beta used the equation above, the corresponding upside beta would be as follows:

$$\beta^{+} = \frac{\mathrm{COV}(r_p, r_B)}{\mathrm{VAR}(r_B)} \quad \left. \begin{array}{l} \text{Where } r_p = r_P \;\&\; r_B = r_B \text{ if } r_p > r_B \\ \qquad r_p = 0 \;\&\; r_B = 0 \text{ if } r_p \leq r_B \end{array} \right. \tag{10}$$

The upside and downside betas are interpreted the same as regular betas. The difference is that they measure the sensitivity of the fund or portfolio's return to an index that captures just upside or downside movements in the benchmark as discussed previously. The benchmark upside or downside index still has a beta of one. While it is possible theoretically to have a negative beta, that is rare in practice. E.g., when the portfolio returns are below the benchmark as a measure of downside beta, they could also be below zero whereas the benchmark returns are still positive resulting in a negative beta.

Expected Rates of Return

The upside and downside betas alone are very informative as part of an attribution analysis of past ex post returns. But the betas can be used to calculate an expected upside or expected downside rate of return for a fund. This can be done with the capital asset pricing model (CAPM) by using the upside or downside beta in place of the overall traditional beta. E.g., the expected downside return can be calculated as follows:

$$E(r_p^-) = r_f + (r_B^- - r_f) \, x \, \beta^- \tag{11}$$

Note that the mean of the benchmark downside returns is used in place of the market portfolio in this modified CAPM. Similarly, the mean of the upside returns, and upside beta can be used to calculate the expected upside return.

Upside and Downside Alphas

The expected upside and downside returns can be calculated for ex post returns for a portfolio to determine what the returns *should* have been based on the upside and downside risk. The expected returns can then be subtracted from the actual historical return to determine if the portfolio earned alpha over the period being analyzed. That is, downside alpha is equal to actual downside return minus the expected downside return and vice versa for upside alpha.[8] The overall alpha (Jensen's alpha) based on using the overall beta will be roughly equal to the sum of the downside and upside alphas.[9]

Sector Upside and Downside Alphas and Betas

Using the methodology discussed above, the upside and downside alphas and betas can be calculated for any portfolio. These measures can also be determined for property sectors and CBSAs using the historical returns. The NCREIF Property Index (NPI) is well suited for this analysis because it has quarterly return data starting in 1978 and covers two major recessions. It is an appraisal-based index which could be lowering the risk measures due to "appraisal smoothing" but the relative amounts of upside and downside risk compared to the overall risk is most relevant, therefore it is still an apples-to-apples comparison.

Following in Exhibit 1 are the results for each property sector in the NCREIF Property Index over the history of the index from 1978 through 2020. Downside returns are based on MIN (actual

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[8] This assumes that investors care about both upside and downside risk, but these two components of risk may have impacted the portfolio differently. That is, the sensitivity of returns to changes in the market on the upside differs from its sensitivity on the downside.

[9] The upside and downside betas will only be additive if the downside and upside returns are perfectly correlated which is very unlikely. The lower the correlation, the more the overall beta will differ from the weighted average of the upside and downside betas. Similarly, the upside and downside alphas will not add exactly to the overall alpha when the upside and downside returns are not perfectly correlated.

return, 0) and vice versa for upside returns. When calculating the Sortino ratio, zero as the target was used, so the semi deviation was based on returns below zero in later exhibits.

Exhibit 1: Betas and Alphas using Below Zero Target Method					
Method	Property Type	Downside Beta	Upside Beta	Downside Alpha	Upside Alpha
Below Zero Target	Apartment	0.92	0.89	0.13%	2.03%
	Industrial	0.96	0.82	-0.04%	2.95%
	Office	1.24	1.22	-0.26%	-2.42%
	Retail	0.68	0.79	-0.13%	1.98%

Exhibit 1 reflects the betas and alpha for the "below zero target" method. The office sector has the highest upside and downside betas but did not deliver an actual return over the history of the NPI that compensates for the higher beta risk on either the upside or downside as indicated by its negative downside and upside alphas. Somewhat surprising is that most of the poor office performance (negative alpha) was on the upside, i.e., when office returns were positive but less than the benchmark after adjusting for risk. It may be surprising that retail properties had the lowest downside and upside betas but this is over the entire history of the NPI through two major recessions with ups and downs for all property sectors. The story might be different for retail alpha for, say, the past 10 years.

Exhibit 2 shows the same calculations of betas and alphas using the methodology of downside returns being below the benchmark NPI. The results will not necessarily be the same because instead of looking at negative vs. positive returns, the focus is returns above or below the benchmark. This may be more relevant when the benchmark is used for incentive fees.

Exhibit 2: Betas and Alphas Using Below Benchmark Method					
Method	Property Type	Downside Beta	Upside Beta	Downside Alpha	Upside Alpha
Below Benchmark	Apartment	0.86	1.10	-0.21%	1.53%
	Industrial	1.00	1.09	-0.26%	1.37%
	Office	0.89	1.25	-1.67%	-0.18%
	Retail	1.01	1.05	-0.34%	1.75%

Office again has the highest upside and downside beta, and retail has the lowest. The alphas for office are again negative. It may seem strange that each of the downside alphas are slightly negative in this case. This can happen because the historical time periods when each sector over or under performed the benchmark NPI will be different. But when each had returns below the benchmark, its return was just slightly less than what would have been expected based on the downside beta.

Sortino Ratio for Each Sector. The Sortino ratio, a risk/reward measure similar to the Sharpe ratio, can be calculated for each property sector, as discussed earlier. The following Sortino ratios are based on a target return of zero: Apartments 4.78, Industrial 4.76, Office 2.96 and Retail 5.50. Again, over the history of the NPI, retail had the highest (best risk-reward) Sortino ratio and office had the lowest (worst risk-reward). Judgement should be used in deciding what historical period might be most appropriate to measure these risk measures. That depends to some extent on whether you think most of the ups and downs are cyclical or secular.

Ranking of CBSAs

To see how the different risk measures might impact different CBSAs, CBSAs were selected that had data for the entire history of the NPI that were also large based on property market values in that CBSA. A ratio often used in public markets is the ratio of upside beta to downside beta. The larger that ratio, the more that beta is helping increase returns on the upside while not magnifying the decrease in returns on the downside. Exhibit 3, sorted by CBSA, shows the results when using the above and below the benchmark methodology to calculate the upside and downside betas and related alphas.

Exhibit 3: Selected CBSAs Betas and Alphas

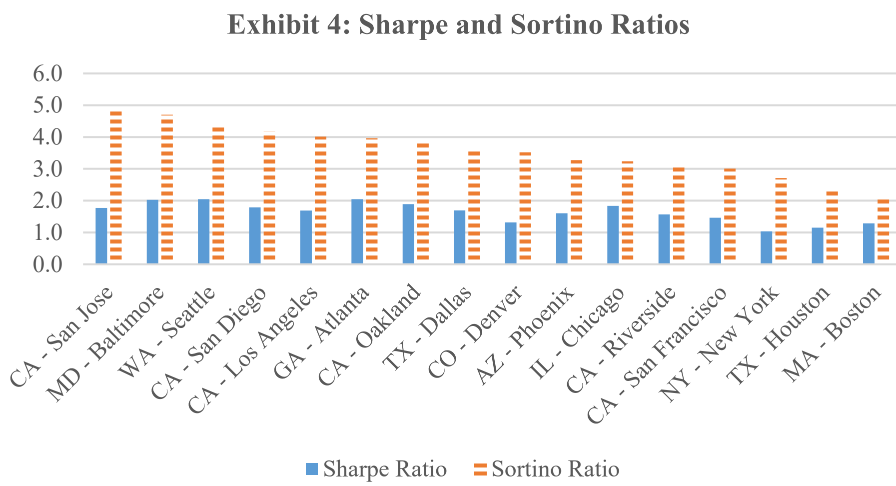
CBSA	Downside Beta	Upside Beta	Upside / Downside Beta	Jensen's Alpha	Downside Alpha	Upside Alpha
AZ - Phoenix	0.87	1.30	1.48	-0.86%	-1.72%	1.14%
CA - Los Angeles	0.93	1.42	1.53	-0.93%	-0.95%	-0.10%
CA - Oakland	0.81	1.29	1.59	0.62%	-1.15%	1.02%
CA - Riverside	1.00	1.29	1.29	0.49%	-1.70%	2.19%
CA - San Diego	0.84	1.17	1.40	0.66%	-0.98%	1.87%
CA - San Francisco	0.90	1.45	1.62	-1.86%	-2.01%	0.77%
CA - San Jose	0.83	1.42	1.71	0.85%	-1.12%	1.86%
CO - Denver	0.75	1.30	1.74	-1.19%	-1.41%	1.04%
GA - Atlanta	0.77	1.10	1.42	0.78%	-0.66%	1.18%
IL - Chicago	0.83	1.06	1.28	-0.24%	-1.11%	0.87%
MA - Boston	0.98	1.37	1.40	-1.60%	-2.66%	1.70%
MD - Baltimore	0.79	1.09	1.39	2.14%	-0.73%	2.11%
NY - New York	1.09	1.86	1.70	-4.61%	-2.43%	-1.37%
TX - Dallas	0.69	1.11	1.61	0.57%	-0.68%	1.32%
TX - Houston	0.63	1.12	1.76	-0.85%	-2.22%	1.84%
WA - Seattle	0.76	1.13	1.49	1.76%	-0.59%	1.73%

Over the history of the NPI, TX-Houston has the largest ratio, 1.76, of upside to downside beta as shown in Exhibit 3. Its upside beta is relatively low at 1.12 and its downside beta is only 0.63. So, it has an upside beta just slightly above the benchmark beta of 1.0 but when its return falls below the benchmark, its volatility declines significantly.

Analysis of beta is only part of the story, however. It does not tell us how the CBSA performed relative to its expected return based on its risk. Exhibit 3 also shows Jensen's alpha, the Downside Alpha and Upside Alpha for the same CBSAs. Although TX-Houston had a very low downside beta of 0.63, it has a downside alpha of -2.22%. So, even though TX-Houston is much less risky than the benchmark on the downside its return was still lower (on a beta risk-adjusted basis) than it should have been. This really hurt TX-Houston's overall performance. The downside alpha more than offset the upside alpha resulting in Jensen's alpha of -0.85%.

The CBSA with the highest Jensen's alpha was MD-Baltimore with an alpha of 2.14% which came from an upside alpha of 2.11% and a downside alpha of only -0.73%.

It is also informative to consider the ranking of CBSAs by their Sortino ratio. In Exhibit 4 below the same CBSAs are ranked from left to right by their Sortino ratio. As shown, CA-San Jose has the highest Sortino Ratio followed by Baltimore, Seattle, and San Diego. The lowest Sortino ratios were NY-New York, TX-Houston, and MA-Boston. It is also noteworthy that the Sharpe ratio rankings are not the same, which does not distinguish between upside and downside risk. CA-San Jose is not one of the highest Sharpe ratios despite having the highest Sortino ratio.



Combination of CBSA and Property Type

Portfolio analysis is typically more meaningful when location (CBSA) and property type sectors are combined. Exhibit 5 shows the top 20 CBSA and property type sectors ranked by ratio of upside to downside beta. In this case, returns for the period 2005 to 2020 were used to capture a more recent period when there is also more data in the NCREIF index to slice into CBSA and property type combinations. The highest upside/downside beta ratio is PA-Philadelphia Office. The lowest upside/downside beta ratio, DC – Washington Industrial, has the highest Sortino ratio. For many of the other sector combinations there tends to be a difference in ranking depending on which ratio is used.

Exhibit 5: Risk Measures for CBSA & Property Type Sector Ranked by Upside / Downside Beta Ratio						
CBSA	**Property Type**	**Sortino Ratio**	**Upside/Down-side Beta Ratio**	**Upside Alpha**	**Downside Alpha**	**Jensen's Alpha**
PA - Philadelphia	Office	2.58	4.19	4.94%	-0.97%	3.55%
FL – Tampa	Industrial	3.01	2.55	3.83%	-1.53%	1.06%
MA – Boston	Industrial	2.26	2.26	3.02%	-1.09%	1.65%
NC – Raleigh	Office	2.35	2.05	3.03%	-2.24%	1.33%
MO - St. Louis	Office	1.57	1.89	1.66%	-1.04%	0.00%
TX – Houston	Office	2.99	1.87	3.03%	-1.33%	1.03%
MD – Baltimore	Office	1.13	1.85	2.38%	-3.98%	-1.37%
MO - St. Louis	Industrial	2.94	1.83	2.37%	-0.09%	1.77%
MA – Boston	Apartment	2.62	1.80	1.80%	-0.26%	0.91%
WA – Tacoma	Industrial	4.00	1.80	4.09%	-0.44%	4.20%
MA - Cambridge	Industrial	1.93	1.75	3.00%	-2.63%	0.87%
FL – Orlando	Apartment	2.78	1.75	2.02%	-1.85%	0.22%
TN – Nashville	Industrial	3.29	1.71	4.23%	-1.13%	3.45%
CA - San Diego	Industrial	3.47	1.71	3.15%	-1.36%	2.65%
TN – Memphis	Industrial	3.53	1.69	3.23%	-0.40%	3.24%
TX – Houston	Retail	3.49	1.66	5.55%	-2.45%	3.26%
NY – Nassau	Retail	2.50	1.66	4.02%	-2.22%	2.38%
OR – Portland	Industrial	4.06	1.62	4.00%	-0.67%	4.22%
NC – Charlotte	Industrial	3.30	1.62	3.87%	-1.00%	3.55%
DC - Washington	Industrial	4.24	1.60	3.48%	-0.49%	3.18%

Ultimately what matters is whether a CBSA and property type sector produced a positive alpha after adjusting for risk. In Exhibit 6 the top 20 CBSAs are ranked by Jensen's alpha. The composition of that alpha in terms of upside and downside alpha can therefore be examined. As shown, CO-Denver Industrial properties had the highest alpha which consisted of both a positive upside and positive downside alpha. It also had a relatively high Sortino ratio. Its upside beta is also 1.58 times its downside beta indicating beta is helping more on the upside.

A different story emerges for TX-Houston Retail. It made the top 20 in terms over overall alpha. But that is because its upside alpha of 5.55% offset its downside alpha of -2.45%. Its Sortino ratio is near the low of the ones shown in the exhibit.

Exhibit 6: Risk Measures for CBSA & Property Type Sector Ranked by Jensen's Alpha						
CBSA	**Property Type**	**Sortino Ratio**	**Upside/Downside Beta Ratio**	**Upside Alpha**	**Downside Alpha**	**Jensen's Alpha**
CO – Denver	Industrial	5.24	1.58	4.80%	0.19%	5.88%
TX - Fort Worth	Apartment	6.62	1.56	4.53%	0.08%	5.65%
NJ – Camden	Industrial	3.90	1.29	4.63%	-1.11%	4.81%
TX – Austin	Industrial	4.28	1.19	4.56%	-0.55%	4.80%
CA - San Francisco	Industrial	3.06	1.10	6.57%	-2.14%	4.48%
WA – Seattle	Industrial	3.83	1.24	4.17%	-0.63%	4.41%
TN - Nashville	Apartment	4.22	1.00	4.34%	-0.90%	4.41%
NY - New York	Industrial	3.72	1.36	3.90%	-0.60%	4.31%
OR - Portland	Industrial	4.06	1.62	4.00%	-0.67%	4.22%
WA - Tacoma	Industrial	4.00	1.80	4.09%	-0.44%	4.20%
TX – Houston	Industrial	3.96	1.02	3.47%	-0.40%	4.14%
TN - Nashville	Office	4.32	1.34	3.27%	-0.37%	3.71%
PA - Philadelphia	Office	2.58	4.19	4.94%	-0.97%	3.55%
NC - Charlotte	Industrial	3.30	1.62	3.87%	-1.00%	3.55%
CA - Los Angeles	Industrial	3.50	1.18	3.36%	-0.52%	3.50%
NC – Durham	Apartment	3.92	1.57	3.10%	0.03%	3.47%
TN - Nashville	Industrial	3.29	1.71	4.23%	-1.13%	3.45%
CA - San Diego	Retail	4.03	1.05	3.41%	-0.80%	3.43%
KY - Louisville	Industrial	3.57	1.45	3.23%	-0.34%	3.42%
TX – Houston	Retail	3.49	1.66	5.55%	-2.45%	3.26%

Next, the bottom 20 CBSA and property type sector combinations are reviewed based on Jensen's alpha in Exhibit 7. NY-New York Apartment had the worst Jensen's alpha at -6.42%. NJ-Newark Office follows as the second worst performing on the list. In fact, most of these in the worst performing group were hurt due to their negative downside alpha. Keep in mind that downside alphas can be positive as they were for many, but not all, of the top performing CBSA and property type sectors. Kansas City Office was the third worst performer in terms of overall alpha but the worst in terms of downside alpha and the Sortino ratio. It did have a decent upside alpha of 1.92% but its downside performance more than offset the positive upside performance.

Exhibit 7: Risk Measures for CBSA & Property Type Sector with Lowest Jensen's Alpha						
CBSA	Property Type	Sortino Ratio	Upside/Downside Beta	Upside Alpha	Downside Alpha	Jensen's Alpha
NY - New York	Apartment	0.87	1.11	0.31%	-5.78%	-6.42%
NJ - Newark	Office	0.50	0.81	0.46%	-6.53%	-5.19%
MO - Kansas City	Office	0.23	1.11	1.92%	-6.86%	-4.18%
NY - New York	Office	1.58	1.10	0.62%	-3.29%	-3.88%
IL - Lake County	Retail	0.90	1.42	1.80%	-4.37%	-3.43%
FL - West Palm Beach	Office	1.19	1.39	0.98%	-4.00%	-3.39%
MA - Boston	Office	1.42	1.42	0.30%	-3.60%	-3.37%
AZ - Phoenix	Office	1.57	1.56	0.86%	-3.35%	-3.32%
FL - Tampa	Retail	1.28	1.32	1.66%	-4.16%	-2.84%
FL - West Palm Beach	Retail	1.24	0.91	1.58%	-4.51%	-2.81%
CA - San Diego	Office	1.65	1.25	0.85%	-2.72%	-2.23%
MN - Minneapolis	Retail	1.34	0.79	1.24%	-4.52%	-2.18%
CA - Sacramento	Office	1.35	1.37	1.45%	-3.20%	-1.96%
MD - Baltimore	Apartment	1.68	1.31	1.62%	-3.22%	-1.90%
MN - Minneapolis	Office	1.70	1.06	1.35%	-3.64%	-1.72%
CA - Los Angeles	Apartment	1.82	1.45	0.66%	-2.45%	-1.66%
FL - West Palm Beach	Apartment	1.93	1.51	2.21%	-3.28%	-1.56%
GA - Atlanta	Retail	1.96	1.27	1.32%	-2.40%	-1.52%
MD - Baltimore	Office	1.13	1.85	2.38%	-3.98%	-1.37%
FL - Miami	Apartment	1.64	1.35	2.57%	-3.72%	-1.30%

Gateway vs. Non-gateway Markets

There is a lot of interest in recent years on the performance of gateway vs. non-gateway markets. Pagliari (2021) questions whether the gateway markets are overpriced. The risk models discussed in this paper can be applied to help answer this question by seeing if they earned upside and / or downside alpha. Following Pagliari, the gateway or "Tier I" markets that were chosen are Boston, Chicago, Los Angeles, New York, San Francisco, and Washington, DC. These markets were examined for the period from 2000 through the end of 2020. During this period, the time weighted return (TWR) for Gateway markets was 8.63% and it was 8.41% for the non-gateway (all other) markets. The benchmark NPI over this period was 8.44%. So, it appears that the gateway cities slightly outperformed the non-gateway cities. But this does not consider any risk differences.

Exhibit 8 is a summary of the risk measures of the gateway and non-gateway CBSAs using the below benchmark methodology for defining upside vs. downside returns:

Exhibit 8: Below Benchmark Beta 2000 to 2020									
Market	TWR	Sharpe Ratio	Sortino Ratio	Traditional Beta	Upside Beta	Downside Beta	Jensen's Alpha	Upside Alpha	Downside Alpha
NPI (benchmark)	8.44%	1.85	3.04	1.00	1.00	1.00	NA	NA	NA
Gateway	8.63%	1.66	2.70	1.13	1.12	1.06	-0.94%	0.10%	-0.94%
Non-Gateway	8.41%	1.99	3.34	0.92	0.96	0.93	0.65%	0.49%	-0.05%

The differences are rather striking. Gateway markets have a Sharpe ratio of 1.66 vs 1.99 for non-gateway markets. This would be return per unit of total risk. Using the Sortino ratio of return per unit of downside risk the gateway markets have a ratio of 2.70 vs. 3.34 for the non-gateway markets. Thus, the non-gateway cities performed even better in terms of return per unit of downside risk.

Gateway markets have a higher beta, 1.13 vs. the non-gateway markets of 0.92 which would suggest that the gateway markets have greater systematic risk than the benchmark NPI, whereas the non-gateway markets have less systematic risk. Of course, systematic risk can be good if it is magnifying returns in the up market. The overall beta does not tell us how sensitive the portfolio is to downward movements in the market. For both the gateway and non-gateway markets the upside beta is a little higher than the downside beta which is good. Perhaps most important is whether the gateway and non-gateway markets earned a return that would have compensated investors for the risk that they took.

Jensen's alpha is -0.94% for the gateway markets which means its actual return was less than would have been expected for its beta risk. In contrast, non-gateway markets have a Jensen's alpha of 0.65% so they earned more than the expected return. Looking at the split between the upside and downside alphas, the gateway markets had a downside alpha of -0.94% vs. a downside alpha of -0.05% for the non-gateway markets. So even though the downside alpha was slightly negative for the non-gateway markets, it was a lot higher (much less negative) than the gateway markets. Finally, the upside alpha for the gateway markets was only 0.10% versus 0.49% for the non-gateway markets. Thus, it appears that, at least for the period examined, non-gateway markets performed much better than gateway markets considering all the different risk measures and risk-adjusted returns.

Caveats and Conclusion

Examining downside risk as well as using the duality of betas to decompose the risk into upside and downside components provides additional insight into what drove historical portfolio performance and whether any alpha was due more to upside or downside returns. The authors demonstrated how this can be applied to different CBSAs and property sectors as well as gateway vs. non-gateway markets. Applying this analysis to a portfolio to decompose alpha into its upside and downside components complements Brinson attribution analysis that breaks down alpha (simple or risk-adjusted) into allocation and selection components. The alphas can be thought of as simply risk-adjusting the actual return to determine what it would be if it had the same risk as the benchmark. Subtracting the benchmark return from this risk-adjusted return results in the risk-adjusted alpha. Fisher and D'Alessandro (2019) show how to risk-adjust a portfolio return such that it has the same risk as the benchmark to do risk-adjusted attribution analysis. The difference between that risk adjusted return and the benchmark is Jensen's alpha. This article showed how to further decompose Jensen's alpha into that due to upside vs. downside risk.

The analysis discussed in this paper can also be considered an additional tool to use as part of top-down portfolio analysis by deciding what markets or sectors (or combinations of markets and sectors) might be more likely to provide upside vs. downside beta. While the future may differ from the past, risk is analyzed using historical data as a starting point. Knowing what drove past performance may help project future performance.

The authors noted that there are different approaches to defining up vs down returns used for the risk measures such as above or below a benchmark, and above or below an average, a target rate or zero. These can result in different up and down betas. One approach is not necessarily better than the other – it is more a question of how one wants to think about the risk. If a core fund is being benchmarked against the NCREIF property index (or NFI-ODCE index) then they may be most concerned about returns being less than the benchmark. An opportunity fund may be more concerned about returns being negative or below a target return. The risk measures can be calculated using several different methodologies and evaluated as part of the risk strategy or for risk attribution analysis.

The different risk measures such as the upside and downside betas and the resulting alphas will also depend on the time-periods selected and will be most reliable for larger sample sizes. Betas tend to be stable for larger CBSAs or when combining CBSAs such as all gateway markets – especially over longer time periods. It could be argued, however, that the most recent period is what is most relevant to what might happen in the future. Clearly there have been shifts in the relative performance of sectors such as retail and industrial properties. On the other hand, the future is unknown. History could repeat itself. So perhaps using the entire history of the NCREIF property index which spans two major recessions, the tech bust and the more recent impacts of COVID-19 on property values is more appropriate for risk measures.

Because private market returns like the NCREIF indices are appraisal based, so called "appraisal smoothing" could lower the volatility of returns which might impact measures such as the Sortino ratio. Since the smoothing would impact both the portfolio and the benchmark, and both upside and downside return, this may not be a significant issue since the relative risk measures are being compared within the private real estate equity asset class. In other words, the public and private market returns are not being compared to each other. It has also been suggested that appraisals may be stickier on the downside although that was probably truer in the past when there was less data available to appraisers. Furthermore, even if they are sticky, the reported appraisal returns are what are used to benchmark managers, calculate incentive fees, etc. So, appraisal-based returns are reality, relevant and therefore used for analysis.

As a final comment, although betas are based on a theoretical model, the CAPM, they can also be interpreted as simply measuring the sensitivity of a portfolio to move up or down as the benchmark moves up or down. They measure the elasticity of the portfolio return with respect to changes in the benchmark return. All the betas shown in this paper can be calculated by a simple linear regression of the property sector or CBSA returns against the benchmark NPI return, whether the returns are upside returns, downside returns, or both. This is true no matter which approach is used to define the upside and downside returns. The point is that you do not have to accept the CAPM or downside CAPM as being valid for the betas to have a meaningful indication of how you might expect a portfolio to move up or down with the market.

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