Measuring the Value Added of REIT Managers Using MSA Benchmarks: A Return-Based Attribution Analysis Approach

Walter I. Boudry Ph.D.
*Cornell University*, wb242@cornell.edu

Crocker H. Liu Ph.D.
*Cornell Universtiy*, chl62@cornell.edu

Andrey Ukhov Ph.D.
*Cornell Universtiy*, au53@cornell.edu

Follow this and additional works at: https://scholarship.sha.cornell.edu/crefpubs

Part of the Portfolio and Security Analysis Commons

Recommended Citation

This Article is brought to you for free and open access by the Center for Real Estate and Finance at The Scholarly Commons. It has been accepted for inclusion in Center for Real Estate and Finance Reports by an authorized administrator of The Scholarly Commons. For more information, please contact hotellibrary@cornell.edu.

If you have a disability and are having trouble accessing information on this website or need materials in an alternate format, contact web-accessibility@cornell.edu for assistance.
Measuring the Value Added of REIT Managers Using MSA Benchmarks: A Return-Based Attribution Analysis Approach

Abstract
An interesting, important, and challenging financial question both in academic research and in practice is how to determine asset managers' investment performance. That is, how much can be attributed to luck or serendipitous timing and how much is skill? In this paper we demonstrate how return-based style analysis, known as attribution analysis, can be used to ascertain the extent to which managers of REITs add value to their firm's stock returns. Developed by William F. Sharpe, a Nobel Laureate, the attribution analysis technique was originally used to analyze a manager's investment style based on the individual's equity portfolio (e.g., large cap growth versus large cap value) by comparing returns on various indices. The manager's style would be inferred according to the extent to which a weighted combination of indices most closely replicated the actual performance of the manager's portfolio over a specified time period. In this way, a fund manager's style is determined by finding the mix of indices that provides returns that are the most similar to the manager's portfolio's returns. The manager's performance can then be assessed from the resulting benchmark portfolio, which is constructed using the various indices. The unmanaged benchmark reflects how an investor would do if he or she owned a portfolio comprising the same indices but didn't have the manager.

Keywords
Cornell, real estate, finance, REIT, portfolio

Disciplines
Portfolio and Security Analysis

Comments
Required Publisher Statement

© Cornell University. This report may not be reproduced or distributed without the express permission of the publisher.
Measuring the Value Added of REIT Managers Using MSA Benchmarks
A Return-Based Attribution Analysis Approach

by Walter I. Boudry, Ph.D., Crocker H. Liu, Ph.D., and Andrey Ukhov, Ph.D.
Vol. 2 No. 1
CREF Advisory Board

Arthur Adler
Managing Director and CEO-Americas
Jones Lang LaSalle Hotels

Richard Baker
President and CEO
National Realty & Development Corp

Michael Barnello
President & COO
LaSalle Hotel Properties

Scott Berman
Principal, Industry Leader
PricewaterhouseCoopers

Vernon Chi
Senior Vice President
Wells Fargo

Howard Cohen
President & Chief Executive Officer
Atlantic | Pacific Companies

Jeff Dallas
Senior Vice President, Development
Wyndham Hotel Group

Joel Eisenmann
SVP & CEO
InterContinental Hotels Group

Kevin Fitzpatrick
Managing Director
Spring Bay Property Company

Russell Galbut
Managing Principal
Crescent Heights

Kate Henriksen
Senior Vice President Investments
RLJ Lodging Trust

Nancy Johnson
Executive Vice President
Carlson Rezidor Hotel Group

Rob Kline
President & Co-Founder
The Chartres Lodging Group

Mark Lipschutz
Founder and Chief Executive Officer
Caribbean Property Group LLC

Michael Medzhidov
Chairman & Managing Partner
Watermark Capital Partners

Scott E. Melby
Executive Vice President
Planning & Feasibility
Marriott International

Chang S. Oh
Managing Director
The Mega Company

Michael Profenius
Managing Director
Warburg Pincus LLC

David Rosenberg
Chief Executive Officer
Sawyer Realty Holdings

Steve Rushmore
President and Founder
HVS Global Hospitality Services

Jay Shah
Chief Executive Officer
Hersha Hospitality Trust

J. Allen Smith
Chief Executive Officer
Prudential Real Estate Investors

Robert Springer
Senior Vice President—Acquisitions
Sunstone Hotel Investors

Susheel Torgalkar
Chief Operating Officer
Westbrook Partners

Robert White
President
Real Capital Analytics

Conley Wolfsinkel
Strategic Management Consultant
W Holdings

Dexter Wood
SVP—Business & Investment Analysis
Hilton Worldwide

Daniel Yih
Chief Operating Officer
Starwood Capital Group

Thank you to our Friends

Starwood Capital Group
Chief Operating Officer
Daniel Yih

Hilton Worldwide
President
Conley Wolfsinkel

Real Capital Analytics
President
Robert White

HomeAway Inc.
Executive Chairman
Chadlen Wolfsinkel

Watermark Capital Partners
Chairman & Managing Partner
Michael Medzhidov

Wyndham Hotel Group
President & CEO
Jeffrey Wyeth

Bridge Investment Group
Managing Director
Gary DeSantis

Perseus Capital
Managing Director
Glen S. Grossman

Ashford Hospitality Trust
President
Richard Fe鹤

Center for Real Estate and Finance
Center for Real Estate and Finance Reports, Vol. 2, No. 1 (January 2013)

© 2013 Cornell University. This report may not be reproduced or distributed without the express permission of the publisher.

The CREF Report series is produced for the benefit of the hospitality real estate and finance industries by The Center for Real Estate and Finance at Cornell University

Jan A. deRoos, Executive Director
Jennifer Macera, Associate Director
Glenn Withiam, Director of Publications

Center for Real Estate and Finance
Cornell University
School of Hotel Administration
389 Statler Hall
Ithaca, NY 14853

Phone: 607-255-6025
Fax: 607-254-2922
www.cref.cornell.edu
The purpose of this paper is to demonstrate how return-based style analysis (attribution analysis) can be used to ascertain the extent to which managers of REITs add value to their firm’s stock returns. The only data required to implement this technique are the total returns for the REIT and the returns of a set of passive indexes. In this demonstration, a weighted combination of the passive indexes is used to construct a benchmark portfolio that most closely replicates the actual performance of a manager’s portfolio over a specified time period. Management performance is then measured relative to this benchmark portfolio. The weights used to construct the benchmark portfolio provide an insight into the behavior of the REIT.
ABOUT THE AUTHORS

Wally Boudry, Ph.D., is an assistant professor of real estate in the School of Hotel Administration. Prior to joining the School of Hotel Administration, he taught both undergraduate and graduate real estate courses at the University of North Carolina at Chapel Hill’s Kenan-Flagler Business School and New York University’s Leonard N. Stern School of Business. His research interests include real estate and general finance. His most recent works have focused on Real Estate Investment Trusts (REITs) and have examined their repurchase decisions, dividend payout policy, security issuance decisions and price dynamics. A regular presenter and discussant at the annual AREUEA meetings, his papers have been published in Real Estate Economics, the Journal of Real Estate Finance and Economics, and the Journal of Business Finance and Accounting. He received his bachelor of commerce with first class honors and bachelor of economics from the University of Queensland, Australia, and his MPhil and PhD from New York University.


Andrey Ukhov, Ph.D., is an assistant professor of finance at the Cornell University School of Hotel Administration. His chief research interests are theoretical and empirical asset pricing and risk preferences. Formerly with the Kelley School of Business at Indiana University, his publications include papers in Journal of Financial and Qualitative Analysis, Economic History Review, Review of Finance, and Journal of Financial Research. He has presented at such conferences as the Western Finance Association, ASSA/American Finance Association, and the Econometric Society. He is a referee for the Journal of Finance, Review of Finance, and Journal of Empirical Finance, among others.

Acknowledgments

We wish to thank Siheng Han for her research assistance and Glenn Withiam for copyediting this manuscript.
An interesting, important, and challenging financial question both in academic research and in practice is how to determine asset managers’ investment performance. That is, how much can be attributed to luck or serendipitous timing and how much is skill? In this paper we demonstrate how return-based style analysis, known as attribution analysis, can be used to ascertain the extent to which managers of REITs add value to their firm’s stock returns. Developed by William F. Sharpe, a Nobel Laureate, the attribution analysis technique was originally used to analyze a manager’s investment style based on the individual’s equity portfolio (e.g., large cap growth versus large cap value) by comparing returns on various indices. The manager’s style would be inferred according to the extent to which a weighted combination of indices most closely replicated the actual performance of the manager’s portfolio over a specified time period. In this way, a fund manager’s style is determined by finding the mix of indices that provides returns that are the most similar to the manager’s portfolio’s returns. The manager’s performance can then be assessed from the resulting benchmark portfolio, which is constructed using the various indices. The unmanaged benchmark reflects how an investor would do if he or she owned a portfolio comprising the same indices but didn’t have the manager.

This type of return-based style analysis can be applied to management of real estate investment trusts (REITs). Instead of equities, we are interested in the management of the REIT. A REIT is analogous to a stock mutual fund in the sense that it is a portfolio of direct real estate investments of various types in various locations. A particular limitation relating to measuring REIT performance is that, in contrast to stocks, bonds, and cash indices, whose returns are available at high frequencies, returns for underlying real estate indices are only available on a quarterly basis. Moreover, indices for direct real estate investment are typically not available for an MSA or city, although that is the measurement we seek to make in this study.

Our analysis focuses on geographical REIT portfolios. While one can use REIT indices for various property types, this approach does not allow one to look at REIT performance in terms of MSA (city) exposures. A possible solution to address this issue is to compare the REIT’s performance to an index that includes a portfolio of publicly traded stocks that act as a proxy for the local economy. Since real estate is fixed in location, we argue that the revenue and net income from a given property is tied to the health of the local economy as well as the health of the tenants who are a part of that economy. Property value is also partly tied to the local economy in addition to the national economy. For example, we implicitly assume that real estate in Detroit, Michigan, or in Silicon Valley is tied to the health of the automotive industry in one case and high tech manufacturing in the other. A study by Coulson, Liu, and Villupuram provides evidence that is consistent with this view.

Like other investment analysis techniques, return-based style analysis depends on the correct selection of passive indices, the time frame (window) used, and the return frequency chosen. Return-based analysis also requires a reasonably long time span to detect major changes. Advantages of this type of style analysis are that it is neither expensive nor labor intensive.

For purposes of illustration, we use a hotel REIT, Hersha Hospitality Trust, whose properties are located primarily in the following six MSAs: Boston, Los Angeles, Miami, New York, Philadelphia, and Washington (District of Columbia). Our chief goal is to show the usefulness of attribution analysis in evaluating management performance. This demonstration of attribution analysis also shows the extent to which management adds value by measuring the difference in REIT returns relative to returns on a benchmark portfolio that we construct from cash, investment grade bonds, and the MSA indices. We do not employ a real estate index in our analysis because intuitively the reference indices should be based on asset classes the manager has discretion over. That is, including the FTSE/NAREIT index would simply answer the question, does Hersha look like a REIT?

We include cash because Hersha lists cash and cash equivalents as part of their balance sheet. As for including bonds in the comparison index, certain elements of a hotel investment are not unlike bonds. While Hersha does not hold investment grade bonds, the trust does invest in institutional grade hotels in central business districts, suburban office markets, and stable destinations and secondary markets in the Northeast, as well as selected markets on the West Coast. Moreover, Hersha focuses on high quality upscale hotels in high barrier-to-entry markets. This suggests that the return on these hotels should at least equal to, if not exceed, BBB investment grade bonds, since institutional grade hotels are riskier and thus demand a higher risk premium. For this reason, it is important to add returns on a bond portfolio as one of the indices in the attribution analysis.

It is well known that real estate returns have both a fixed-income-like component (a flow of rents) and an equity-like (property value appreciation) aspect. Real estate’s fixed-income investment properties are not the only reason that including a bond return index into attribution analysis is important. This method applies to real estate in general, and thus a general set of benchmarks should be included. Finally, we note the empirical issue regarding the use of fixed-income returns. If the returns generated by a manager do not behave in a fixed-income-like fashion, then the attribution analysis will assign a low weight to the fixed income index, reflecting this property of returns.

While there is no absolute standard regarding the appropriate time frame necessary to analyze a fund manager, we use a five-year (20 quarter) rolling window of quarterly...
returns since real estate holding periods tend to be at least five years in duration. Another, more practical reason for choosing this time frame is that it reflects the limited time series data available on our MSA indices.

To conduct the attribution analysis, we assume the return on the REIT is equal to the weighted returns on the passive MSA indices plus some random error:

\[ R_t = w_{1t}R_{1t} + w_{2t}R_{2t} + w_{3t}R_{3t} + \ldots + w_{Nt}R_{Nt} + e_t \]  

where \( R_t \) is the return on the REIT during period \( t \), \( w_{jt} \) is the weight of index \( j \), \( R_{jt} \) is the return on index \( j \) during period \( t \), and \( e_t \) is the residual for period \( t \); for \( w_{jt}, j = 1, \ldots, N \), representing the weights on the 1st through \( N \)th indices. \( N \) is the total number of passive benchmark indices. This specification assumes that returns on indices, \( R_{jt} \), drive returns on the real estate portfolio, \( R_p \), with weights \( w_{jt} \) capturing the contribution of different indices to the return on the portfolio. The return on the real estate portfolio is the weighted average of returns on indices plus an error term, which represents return on the real estate portfolio that cannot be explained by returns on the indices.

To create the benchmark passive portfolio return, we need to estimate the \( w \) term in equation (1), that is, the weight that each passive index has in the portfolio. To do this, we need a sensible criterion upon which to base the estimate. The approach we take is to find the portfolio weights that minimize the sum of the squared deviation between the REIT return and the passive indices.\(^8\) Following this approach will allow us to estimate the weights that create the portfolio that most closely matches the REIT’s historic performance.

In order for the portfolio weights to make economic sense, we must impose two restrictions on the values that the \( w \)’s can take in equation (1). First, the weights must sum to 1, since the portfolio weights sum to 100 percent, and, second, each weight must have a value between 0 and 1 (this implies no short sales.) Estimating the weights subject to these constraints is a simple case of constrained optimization:

\(^8\) This criterion follows the same logic as a standard ordinary least squares (OLS) regression.

---

**Exhibit 1**

**Changing weights on the benchmark portfolio (quarterly returns)**
with equation (1) identifies how the returns on our benchmark portfolio tracked the REIT’s actual performance over the 2004Q1–2012Q1 period. We then use the constructed passive benchmark portfolio returns to examine the value added of the REIT’s management.

Data

We obtained monthly return data for the hotel REIT from the Center for Research in Security Prices (CRSP)\(^\text{10}\) with monthly yields on a constant-maturity 10-year Treasury bond and yields on a BBB corporate bond taken from the Federal Reserve website.\(^\text{11}\) To construct the city indices for Boston, Los Angeles, Miami, New York, Philadelphia, and the District of Columbia. The return associated with our hotel REIT and for the eight indices are reported in Appendix A. The R-squared statistic associated

An attribution analysis spreadsheet is available on the CREF webpage,\(^\text{9}\) and Appendix A in this study shows how to implement this approach by hand using an Excel spreadsheet. For our example, we use the following eight indices: cash, investment grade corporate bonds, and the regional stock indices for Boston, Los Angeles, Miami, New York, Philadelphia, and the District of Columbia. The return associated with our hotel REIT and for the eight indices are reported in Appendix A. The R-squared statistic associated

---

\(^\text{9}\) The spreadsheet simply requires a target asset and reference indices. As such, it could be used for any attribution analysis problem, not only the one discussed in this paper.

\(^\text{10}\) For practitioners who don’t have access to CRSP, returns can be downloaded through a downloadable Bloomberg terminal.

Exhibit 3

Percentage of hotel rooms in each MSA for our hotel REIT

Exhibit 1 (page 7) shows the changing weights or exposures to the eight indexes that we used to create a benchmark portfolio for the purpose of attribution analysis (also known as an exposure distribution area graph). The graph represents one of the easiest ways to assess a REIT’s stability, that is, to gauge the stability of its exposure with respect to the eight indices over time.

Quarterly Analysis

Exhibit 1 (page 7) shows the changing weights or exposures to the eight indexes that we used to create a benchmark portfolio for the purpose of attribution analysis (also known as an exposure distribution area graph). The graph represents one of the easiest ways to assess a REIT’s stability, that is, to gauge the stability of its exposure with respect to the eight indices over time.

We use quarterly returns in our analysis to match the quarterly frequency of most commercially available databases on institutional fund managers, including NCREIF. In addition to this, the model implicitly assumes a normal distribution of returns, and quarterly returns are more likely to be normally distributed. Moreover, changes in real estate holdings are only reported in the 10Q on a quarterly basis at best. While we could have used monthly returns in lieu of quarterly returns, Lieberman shows there is little difference in monthly versus quarterly style classifications if enough data are available. She further argues that results must be consistent using either monthly or quarterly data for return-based analysis to be useful. To convert monthly returns to quarterly returns, we used the following calculation: add 1 to each of the monthly returns for three successive months and then multiply the three terms together, subtracting 1 from the result and converting to percentage:

\[ R_Q = \frac{(1+R_{t1})(1+R_{t2})(1+R_{t3}) - 1}{*100\%} \]

For example, suppose that the return is -0.0384 for month 1, 0.0672 for month 2, and -0.1362, for month 3. Then the return for the first quarter is -11.36 percent, as follows:

\[ R_{Q1} = (1-0.0384)(1+0.0672)(1-0.1362) - 1 = -0.1136 \]

(*100 percent)

Results

An alternative set of indices would be the Bloomberg regional indices for these markets. The tickers for the Bloomberg regional indices are BBNX for Boston, BOCX for Los Angeles, BMHX for Miami, BCNY for New York, INQB for Philadelphia, and BDCAX for Washington, DC.

Looking at Exhibit 2 (page 8), which reports the actual weights in conjunction with Exhibit 1, the benchmark portfolio in our example for the first quarter of 2004 (2004Q1) consists of 65.1 percent BBB investment grade corporate bonds, 2.3 percent District of Columbia, 21.1 percent Los Angeles, and 11.5 percent Miami. This benchmark portfolio represents a reasonable passive alternative to the REIT manager’s active management. This suggests that over this period, the REIT’s institutional grade hotels exhibited similar performance behavior to BBB investment grade corporate bonds. Notice that the exposure to various indices changes over time. Early on, the benchmark portfolio had large exposures to BBB investment grade corporate bonds and Washington, D.C. (2004Q1 to 2007Q2). Subsequent to 2007Q2, when other markets were in recession, a large portion of the hotel REIT returns is attributable to the Boston and D.C. local economies (2007Q3 to 2008Q3). A large vacillating exposure to either the New York City or Boston economy followed during the 2008Q4 to 2011Q4 period with more recent exposure to the economies of Miami and Philadelphia in 2012Q1. Thus, it appears that the investment grade hotels acquired over time outperformed BBB investment grade corporate bonds, with the exposure to the six MSA economies changing over time.

The change in the exposure to local economies is partly the result of when hotels in a given MSA were acquired or sold, in addition to the average daily rate setting in each of the local economies. Exhibit 3 (page 9) provides the percentage of hotel rooms in each MSA for our hotel REIT which is constructed from the REIT’s various 10Ks and annual reports. A comparison of Exhibit 3 with the exposure distribution graph in Exhibit 1 reveals that the percentage distribution of hotel rooms differs from MSA exposures in terms of the benchmark portfolio. What is not available from SEC filings is the contribution that hotels in aggregate for each MSA make to the profits (and RevPAR) of the hotel REIT.\(^{14}\) This information provides a better basis for comparison with Exhibit 3.\(^{15}\)

---

\(^{14}\) The level of financial disclosure made by REITs with respect to portfolio cash flows is quite varied. While all firms report company level cash flows, the granularity with which they disclose segment level cash flows (i.e., market by market) in their financial supplements differs widely. Due to Regulation FD, if these data are not disclosed in the firm’s financial supplement, it is unlikely the investor could readily obtain them from the company or other sources.

\(^{15}\) Attribution analysis is especially useful when geographical mix of properties is available for the company being researched, but one cannot obtain the figures for profit contribution from different geographical areas.
Given these weights in time period $t$ (say, 2004Q1), we can compare the performance of the benchmark portfolio to that of the actual REIT over a subsequent time period, say, the next quarter (2004Q2). That is, we compare returns for the eight indices with the returns for our REIT, one quarter ahead. (See Appendix A for a description of how to calculate these returns.) If we assume that our chosen set of passive indices fully captures both the MSA exposures (inclusive of cash and investment grade bond weights) and the manager’s style, and if we also assume that there was no change in style in the five-year period used to create the benchmark portfolio (in this example, the second quarter of 1999 (1999Q2) to the first quarter of 2004 (2004Q1)) and the evaluation period (in this example, 2004Q2), the difference in returns between this benchmark and the actual fund represent the return arising from the manager’s active strategies regarding the setting of daily rents (since it is a hotel REIT), along with acquisitions and disposal of hotel properties. The intuition for using weights calculated in the prior five-year period and applied to returns in the subsequent quarter meets the criteria for measuring the manager’s performance. In particular, the benchmark portfolio is easily constructed, identifiable in advance, and represents a viable alternative to investing in the REIT. The method allows for the weights to vary according to time—that is, estimated weights can change from quarter to quarter. To the extent that managers may be engaged in picking markets in which they operate—and therefore changing their exposure to different real estate markets—by allowing the estimated weights to change from period to period our proposed measurement approach captures and reflects this variability in exposure to different markets.

Exhibit 4 shows the quarterly return performance of our hotel REIT relative to the benchmark portfolio, while Exhibit 5 summarizes the difference in performance that is shown in Exhibit 4. This represents the REIT management’s value added return. On average, the management adds value to the tune of 1.51 percent per quarter or 6.2 percent per annum.\textsuperscript{16} During periods when the REIT’s management outperformed the benchmark, they generally did so by a large amount.

\textsuperscript{16}To calculate the per annum return, we compound the quarterly returns: $(1+.0151)^4 − 1 = .0620$ or 6.2%
The $R^2$ statistic identifies how well the constant allocation (portfolio weights) tracked our REIT’s actual performance over each five-year period (rolling by quarter). Stated differently, the higher the percentage value of the $R^2$, the better, as this indicates that the benchmark portfolio more consistently accounts for the long-term behavior of the REIT. In this case, the weighted allocation was associated with 36.6 percent of the variation in the REIT manager’s actual performance (weighted as given in Exhibit 2, 2004Q1), as follows: 10-year Treasury bond, 0; BBB investment grade corporate bond, .651; Washington DC, .023; New York City, 0; Los Angeles, .211; Miami, .115; Boston, 0; and Philadelphia, 0. The remaining 63.4 percent is attributable to some combination of the manager’s exposure to MSAs other than the six included in this analysis, the manager’s acquisition and disposal of (hotel) properties, daily rent-setting behavior, efficiency of operations (control of expenses), market timing, or statistical error. Exhibit 6 shows the time series portion of the quarterly returns attributed to REIT management relative to the benchmark portfolio. On average, 42 percent of the REIT performance is attributable to the style behavior of the REIT manager with a low of 30 percent occurring during the 2007 to 2009Q2 period and nearly 50 percent after 2009Q4.

Summary

We demonstrate how to evaluate whether REIT management adds value to their firm’s stock performance using attribution analysis, a technique developed by William F. Sharpe. To achieve this, a benchmark portfolio is constructed using a weighted combination of indices that most closely replicates the actual performance of a manager’s portfolio over a specified time period. The benchmark reflects how an investor would do if he or she didn’t have the manager. The novel feature of this analysis is that we look at REIT performance in terms of MSA exposures using city-level stock indices which represent a portfolio of publicly traded stocks as a proxy for the local economy. Comparing a hotel REIT to indices for cash, BBB investment grade corporate bonds, and MSA indices for Boston, Los Angeles, Miami, New York, Philadelphia, and Washington, D.C., we show that management of our hotel REIT does add value. The resulting weights from this attribution analysis reveal the style behavior of the REIT manager and which local economies where properties are located in are the primary drivers of REIT returns since hotels are fixed in location.
Appendix: Sharpe Return Based Attribution Analysis Using Excel

Suppose that we have the following returns on a hotel REIT together with returns for cash (yield on a constant maturity 10-year Treasury bond), for a BBB quality corporate bond, and for a value weighted portfolios of common stocks whose firms have a major presence in Boston, Los Angeles, Miami, New York, Philadelphia, and Washington, D.C.

Exhibit A: REIT Return Data
Using the return data in Exhibit A, we wish to determine the extent to which this REIT’s actual performance is replicable using the Solver subroutine in Microsoft’s Excel software to reveal the implicit management style of the REIT.

**Step 1:** Open the Excel Spreadsheet and using the information given in Exhibit A, perform the following operations (an example of what your spreadsheet should resemble follows):

Enter your returns in column B through column J after the third row

Put the initial weights above each return column excluding the REIT return column. Set each weight equal to 1/n where n = 8 asset classes or 1/8 (.125). Notice that the weights sum to 1 and that each weight is between 0 and 1.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Weights</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Date</td>
<td>Hotel REIT</td>
<td>Rtn(10YTB)</td>
<td>Rtn(BBB)</td>
<td>Rtn(DC)</td>
<td>Rtn(NY)</td>
<td>Rtn(LA)</td>
<td>Rtn(Miami)</td>
<td>Rtn(Boston)</td>
<td>Rtn(Phil)</td>
</tr>
<tr>
<td>3</td>
<td>1999.02</td>
<td>0.0988</td>
<td>0.0654</td>
<td>0.0774</td>
<td>0.0562</td>
<td>0.0693</td>
<td>0.1028</td>
<td>0.1783</td>
<td>0.0540</td>
<td>0.1870</td>
<td>0.007522</td>
</tr>
<tr>
<td>4</td>
<td>1999.03</td>
<td>-0.1111</td>
<td>0.0688</td>
<td>0.0810</td>
<td>-0.0794</td>
<td>-0.0626</td>
<td>-0.0704</td>
<td>-0.2257</td>
<td>-0.0112</td>
<td>-0.0647</td>
<td>0.003522</td>
</tr>
<tr>
<td>5</td>
<td>1999.04</td>
<td>0.0360</td>
<td>0.0614</td>
<td>0.0824</td>
<td>0.1505</td>
<td>0.1323</td>
<td>0.1700</td>
<td>0.2175</td>
<td>0.4068</td>
<td>0.0958</td>
<td>0.016677</td>
</tr>
<tr>
<td>6</td>
<td>2000.01</td>
<td>0.0300</td>
<td>0.0848</td>
<td>0.0833</td>
<td>-0.0236</td>
<td>0.0223</td>
<td>0.1520</td>
<td>0.1084</td>
<td>0.1066</td>
<td>-0.0667</td>
<td>0.006027</td>
</tr>
<tr>
<td>7</td>
<td>2000.02</td>
<td>0.1235</td>
<td>0.0619</td>
<td>0.0859</td>
<td>-0.0447</td>
<td>-0.0394</td>
<td>-0.0812</td>
<td>-0.2324</td>
<td>0.0059</td>
<td>-0.1355</td>
<td>0.028989</td>
</tr>
</tbody>
</table>

Set cell K2 equal to K27 (=K27) and set cell L2 equal to L27 (=L27)

In cell B25 (column B, row 25), use the AVERAGE command in Excel to calculate the average REIT return (average of column B) of cell B4 through cell B23

In cell L4 (column L, row 4), subtract the REIT return in cell B4 from the average (mean) of the REIT return that is located in cell B25 (cell B25 =AVERAGE(B4:B23)). Square this difference e.g., input into cell L4 the following:

\[(B4-B_{25})^2\]

In cell K4 (column K, row 4) subtract the sum of the weights multiplied by the returns on each asset (index) class from the REIT return in cell B4. Square this difference e.g., input into cell K4 the following:


In cell L4 (column L, row 4), subtract the REIT return in cell B4 from the average (mean) of the REIT return that is located in cell B25 (cell B25 =AVERAGE(B4:B23)). Square this difference e.g., input into cell L4 the following:

\[(B4-B_{25})^2\]

In cell K4 (column K, row 4) subtract the sum of the weights multiplied by the returns on each asset (index) class from the REIT return in cell B4. Square this difference e.g., input into cell K4 the following:


In cell L4 (column L, row 4), subtract the REIT return in cell B4 from the average (mean) of the REIT return that is located in cell B25 (cell B25 =AVERAGE(B4:B23)). Square this difference e.g., input into cell L4 the following:

\[(B4-B_{25})^2\]
Copy and paste the contents of cell K4 into cell K5 through cell K23. Using the same logic process, copy and paste the contents of cell L4 into cell L5 through cell L23.

In cell J25 (column J, row 25), use the SUM command in excel to sum the weights located in cell C2 through cell J2. Recall that the sum of the weights equal 1 (w1 + w2 + … + wN = 1).

In cell K25, use the SUM command in excel to sum the residuals that you calculated in cell K4 through cell K23. In a similar fashion, in cell L25, use the SUM command in excel to sum the squared differences that you calculated in cell L4 through cell L23.

In cell K27, calculate the R-squared (the percentage of the variation in REIT returns that our set of cash, bond, and MSA equity indices accounts for). R-squared is calculated as 1 minus the ratio of the sum of squared residuals (SS(Resid)) located in cell K25 to the sum of squared total (SS(Total)) located in cell L25. In cell L27, calculate 1 minus the R-squared which is equal to the portion of the REIT return that reflects management’s value added arising from their active management strategies such as changes in their rental rates, acquisitions and/or dispositions of properties, etc (portion of the return that is not attributable to the cash, bond, and MSA indices).
Following is what your completed spreadsheet should look like using 5 years of quarterly returns (20 quarters of data):

<table>
<thead>
<tr>
<th>Date</th>
<th>Weights</th>
<th>Rtn(10YTB)</th>
<th>Rtn(REIT)</th>
<th>Rtn(DBB)</th>
<th>Rtn(10YCY)</th>
<th>Rtn(LA)</th>
<th>Rtn(Miami)</th>
<th>Rtn(Philadelphia)</th>
<th>Rtn(Residual)</th>
<th>R²</th>
<th>1-R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-02</td>
<td>0.096</td>
<td>0.0554</td>
<td>0.0774</td>
<td>0.0562</td>
<td>0.0593</td>
<td>0.1028</td>
<td>0.1783</td>
<td>0.0540</td>
<td>0.0000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>1999-03</td>
<td>-0.1111</td>
<td>0.0569</td>
<td>0.0810</td>
<td>-0.0794</td>
<td>-0.0826</td>
<td>0.0704</td>
<td>-0.2267</td>
<td>-0.0112</td>
<td>0.001247</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999-04</td>
<td>0.0360</td>
<td>0.0614</td>
<td>0.0824</td>
<td>0.1505</td>
<td>0.1326</td>
<td>0.1700</td>
<td>0.2175</td>
<td>0.0468</td>
<td>0.001677</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-01</td>
<td>0.0360</td>
<td>0.0648</td>
<td>0.0833</td>
<td>-0.0296</td>
<td>0.0228</td>
<td>0.1520</td>
<td>0.1084</td>
<td>0.1065</td>
<td>0.00269376</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-02</td>
<td>0.1235</td>
<td>0.0618</td>
<td>0.0859</td>
<td>-0.0447</td>
<td>-0.0304</td>
<td>-0.0612</td>
<td>-0.2324</td>
<td>0.00659</td>
<td>0.00156741</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-03</td>
<td>0.1365</td>
<td>0.0569</td>
<td>0.0832</td>
<td>-0.0264</td>
<td>0.0296</td>
<td>0.0604</td>
<td>0.0270</td>
<td>0.1325</td>
<td>0.009530222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-04</td>
<td>-0.0429</td>
<td>0.0567</td>
<td>0.0821</td>
<td>-0.1764</td>
<td>-0.0218</td>
<td>-0.2549</td>
<td>-0.1650</td>
<td>-0.2974</td>
<td>0.002302272</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-01</td>
<td>0.0211</td>
<td>0.0505</td>
<td>0.0706</td>
<td>-0.1070</td>
<td>-0.1015</td>
<td>-0.1554</td>
<td>-0.0702</td>
<td>-0.0310</td>
<td>0.0013193254</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-02</td>
<td>0.1236</td>
<td>0.0527</td>
<td>0.0804</td>
<td>0.0492</td>
<td>0.0760</td>
<td>0.1276</td>
<td>0.3145</td>
<td>0.0999</td>
<td>0.0065625332</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-03</td>
<td>-0.0700</td>
<td>0.0456</td>
<td>0.0796</td>
<td>-0.1405</td>
<td>-0.1050</td>
<td>-0.2560</td>
<td>-0.3258</td>
<td>-0.3356</td>
<td>0.0021625767</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-04</td>
<td>0.0389</td>
<td>0.0477</td>
<td>0.0792</td>
<td>0.0693</td>
<td>0.1069</td>
<td>0.2230</td>
<td>0.1553</td>
<td>0.2556</td>
<td>0.001842677</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-05</td>
<td>0.1719</td>
<td>0.0508</td>
<td>0.0796</td>
<td>-0.0532</td>
<td>0.0288</td>
<td>0.1817</td>
<td>-0.0421</td>
<td>-0.0595</td>
<td>0.0029888073</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002-01</td>
<td>-0.1085</td>
<td>0.0510</td>
<td>0.0802</td>
<td>-0.0711</td>
<td>-0.1743</td>
<td>-0.1346</td>
<td>-0.1462</td>
<td>-0.2440</td>
<td>0.005303054417</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002-02</td>
<td>0.0000</td>
<td>0.0426</td>
<td>0.0763</td>
<td>-0.1457</td>
<td>-0.1637</td>
<td>-0.1712</td>
<td>-0.1768</td>
<td>-0.2267</td>
<td>0.0014102677</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002-03</td>
<td>0.0064</td>
<td>0.0401</td>
<td>0.0760</td>
<td>0.0679</td>
<td>0.1097</td>
<td>0.0473</td>
<td>0.0765</td>
<td>0.1937</td>
<td>0.59341E+08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-01</td>
<td>0.0018</td>
<td>0.0392</td>
<td>0.0712</td>
<td>-0.0329</td>
<td>-0.0383</td>
<td>0.0146</td>
<td>-0.0489</td>
<td>-0.0110</td>
<td>0.0008278974</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-02</td>
<td>0.2104</td>
<td>0.0362</td>
<td>0.0647</td>
<td>0.1606</td>
<td>0.1536</td>
<td>0.1730</td>
<td>0.3182</td>
<td>0.2796</td>
<td>0.0020241677</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-03</td>
<td>0.1652</td>
<td>0.0423</td>
<td>0.0681</td>
<td>0.0600</td>
<td>-0.0045</td>
<td>0.0588</td>
<td>0.0831</td>
<td>0.0302</td>
<td>0.0012294943</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-04</td>
<td>0.1347</td>
<td>0.0429</td>
<td>0.0666</td>
<td>0.1383</td>
<td>0.1117</td>
<td>0.1461</td>
<td>0.1602</td>
<td>0.1138</td>
<td>0.000693748</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004-01</td>
<td>0.0673</td>
<td>0.0402</td>
<td>0.0627</td>
<td>-0.0143</td>
<td>0.0201</td>
<td>0.0700</td>
<td>0.0629</td>
<td>0.0368</td>
<td>0.0008253429</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SumWts</th>
<th>SS(Resid)</th>
<th>SS(Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0000</td>
<td>0.162734269</td>
<td>0.14515711</td>
</tr>
<tr>
<td>0.0000</td>
<td>1.000</td>
<td></td>
</tr>
</tbody>
</table>

**Step 2:** Click on the **Data** tab in Excel 2007 and select the **Solver** option (see circled areas below).

If you do not see the **Solver** option, you will need to install it using the following procedure. Click on the **Office Button** located in the upper left corner of the Excel 2007 spreadsheet.
You should see the following window. At the bottom of this window, click on the button labeled Excel Options.

Click on Add-Ins located in the left side box. The following box should now appear. At the bottom of the page, click on the Go... button.
This should bring up the **Add-Ins** box. Select the **Solver Add-in** box by clicking in the box next to it and then click the OK button. When you now click on the **Data** tab you should now see the **Solver** option (see circled areas below). Clicking on the Solver subroutine should bring up the following box.

![Add-Ins and Solver Parameters](image)

Fill in the boxes as follows:

- **Set Target Cell**: $K25$ The target cell is the cell you’re minimizing
- **Equal to**: Min (You’re minimizing the sum of the squared residuals)
- **By Changing Cells**: $C2$:$J2$ (These are the cells containing the initial weights = .125)

Subject to the Constraints: $J25 = 1$ Note: you need to click on the **Add** button to add this constraint. The cell reference is $J25$, pull down the arrow and choose $=$, then type 1 in the constraint: box. Click on the **OK** button.

- $C2 \geq 0$ The % invested in Cash (10 Year Treasury bond) is $\geq 0$
- $D2 \geq 0$ The % invested in BBB Investment Grade Corporate Bond is $\geq 0$
- $E2 \geq 0$ The % invested in a portfolio of Washington DC stocks is $\geq 0$
- $F2 \geq 0$ The % invested in a portfolio of New York City stocks is $\geq 0$
- $G2 \geq 0$ The % invested in a portfolio of Los Angeles stocks is $\geq 0$
- $H2 \geq 0$ The % invested in a portfolio of Miami stocks is $\geq 0$
- $I2 \geq 0$ The % invested in a portfolio of Boston stocks is $\geq 0$
- $J2 \geq 0$ The % invested in a portfolio of Philadelphia stocks is $\geq 0$
Click on the **Solve** button should yield the following output with the revised set of weights which minimize the sum of squared residuals:

These are the weights associated with 2004Q1. To calculate the weights for 2004Q2, replace cell A4 through cell J23 with return data from 1999.03 through 2004.02 e.g., replace 1999Q2 – 2004Q1 with 1999Q3 – 2004Q2. We are dropping one quarter and adding one quarter of data so that we are using a 5 year (20 quarter) moving window.
To calculate the weights for 2004Q2, your new setup should resemble the following:

### Step 3: Calculating the return on the benchmark portfolio.

Recall that the return on a portfolio is

\[ R_t = w_1 R_{1t} + w_2 R_{2t} + w_3 R_{3t} + \ldots + w_N R_{Nt} \]

where \( w_j \), \( j = 1, \ldots, N \) represents the weights on the 1st through Nth indices.

\( R_{jt} \), \( j = 1, \ldots, N \) represents the returns on the 1st through Nth indices; \( N \) is the total number of passive benchmark indices. \( N = 8 \) indices in our example. From our example, the weights for the first quarter, 2004Q1 are

### Portfolio Weights from Attribution Analysis

<table>
<thead>
<tr>
<th>2004.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>10YrTBond</td>
</tr>
<tr>
<td>0.651</td>
</tr>
</tbody>
</table>

And the corresponding returns on the 8 indices for the subsequent quarter, 2004Q2, are

### Returns on Eight Indices

<table>
<thead>
<tr>
<th>2004.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rtn(10YTBond)</td>
</tr>
<tr>
<td>0.0460</td>
</tr>
</tbody>
</table>

So it follows given the formula above that the return on the benchmark portfolio for 2004Q2 is 1.85%.
In addition to the world’s leading faculty and hospitality management content, Cornell’s General Managers Program has allowed us the opportunity to surround ourselves with international peers where the networking opportunities alone open your eyes to new ideas and challenges.

Kerry Jayne Watson
Group Operations Manager
Inverlochy Castle Management International, Scotland

Gain the leading edge in hospitality management.

Cornell University’s General Managers Program (GMP)
The GMP is an intensive, operations-level education experience designed to help hospitality professionals hone their tactical leadership skills and develop the strategic vision to pioneer unparalleled success. Join us and gain an invaluable connection to the industry’s most influential network of elite hoteliers.

Learn more at hotelschool.cornell.edu/execed/gmp13