

## **Portfolio Management: 549B**

**William N. Goetzmann, Instructor**

### **Spring, 2003 Final Exam**

The exam is due at Will Goetzmann's office at 46 Hillhouse on Monday May 12 at 5:00 PM. As indicated in class, you may work with your group on the analysis of the case, however the written portion of your exam must be your own. You may use graphs and tables that you work on jointly, but the writing cannot be done together.

#### **Part 1: Real estate in the investment portfolio.**

Andy Alpha is currently invested in 30% U.S. Equities, 30% U.S. Bonds, 30% international equities and 10% gold. He would like to know whether diversifying into real estate would improve his portfolio.

Look at two real estate series' in the U.S. Capital Markets portion of the Analyzer.

**NCREIF** represents investment in commercial property portfolios as reported by their institutional holders. Capital appreciation returns are based upon appraisals of the properties in the portfolios every 4 to 6 quarters. **NAREIT** represents investments in real estate investment trusts.

**NAREIT-Equity** represents REITs invested in commercial property. Graph the series' and look at the summary statistics – including autocorrelation.

Q1: Why do you think the time series for NAREIT-equity and NCREIF behave differently?

Q2: Which series should Andy use to evaluate the role of real estate in the portfolio? Discuss the pros and cons of your choice.

Q3: Which series is riskier? To address this, consider how should you think about risk for a long horizon investor.

Q4: Simulation. Build a simulation model of future NAREIT and NCREIF returns based on the bootstrap procedure for autocorrelated series.' Calculate the risk of both series' at the 1,5, and 10 year horizon.

#### **Part 2: Commingled Institutional Funds**

PRISA is the oldest of all large, co-mingled real estate accounts managed by an insurance company. Prudential RE Investors: PRISA data is in the analyzer is in the section Comm Open-End Real Estate Funds. PRISA is organized as an open-end fund – like a mutual

fund – that allowed institutional investors to buy and sell shares. Its properties are evaluated by appraisal methods.

Q5: How has PRISA performed relative to the NCREIF benchmark? What is the alpha, beta and R-square?

Q6: How did PRISA do in periods of distress for real estate? Does it have a different “up” beta, vs. “down” beta? Evaluate PRISA’s timing skill with respect to the NCREIF real estate index. You may use the Ibbotson software output to address this question.

### **Part 3: Hedging**

Andy Alpha is interested in determining whether commercial real estate is a good hedge against inflation and other factors. For this he plans to use the NAREIT-equity index and the Ibbotson Style Analyzer.

Q7: Compared to the S&P 500, is the NAREIT-equity index more or less exposed to inflation?

Q8: Compared to the S&P 500, what systematic risk factors is NAREIT-equity relatively more exposed to?

Q9: What is the best set of factors that explain the performance of NAREIT-equity?

Q10: How does real estate do in a stock market decline? Is it a good insurance against a crash?

Q11: How has NAREIT’s exposure to systematic risk factors changed through time? What economic fundamental might explain these changes?

### **Part 4: Optimization**

Andy cannot invest in PRISA or a NACREIF proxy, but he can invest in REITs. Thus he wants to see how adding a REIT index to his portfolio might affect his efficient frontier.

Q12: Construct an efficient frontier for Andy using his current allocation, historical data, and an allocation with the possibility of investing in NAREIT-equity. How does the frontier change?

Q13: How sensitive are your results to the last three years of data in the sample?

Q14: Historical data may not be the best basis for examining the benefits of a re-allocation. Construct a set of inputs you believe to be the most meaningful for a forward-

looking asset allocation recommendation for Andy. Assume that he wants to basically keep his current risk level.

Q15: Based upon your analysis in Questions 1 through 14, do you think that allocating a portion of the investment portfolio to real estate makes sense from an institutional and an individual point of view?