

Problem Set 4

Commingled Real Estate Funds (CREFs)

Objective: The objective of this assignment is to familiarize students with some of the issues associated with commingled real estate funds (CREFs). In particular, we will examine performance related concerns and solutions put forth to deal with them.

Assignment: Download the real estate data from my website (CREF2002.xls) and use the downloaded spreadsheet to answer the following questions. Please highlight your answers in **yellow** and turn in a hard copy of your results. ***This is an individual assignment.***

1. Appraisal Smoothing Bias in CREFs: One of the biggest problems with using real estate returns such as the NCREIF (National Council of Real Estate Investment Fiduciaries) Real Estate Indices is that the returns are based on appraisals and as such, the standard deviation (risk) of real estate is *understated*. The correlation between real estate and other assets might also be understated. Consequently, real estate appears to “outperform” stocks and bonds on a risk-adjusted basis e.g. the mean return divided by the standard deviation (return per unit of risk). Given the NCREIF return data in the “NCREIF Returns” worksheet, calculate the total mean return and standard deviation after adjusting for appraisal smoothing using an AR(4) process. Compare your results to the unadjusted mean and standard deviation of property returns. In addition to this, compare your results to the mean and standard deviation of the quarterly returns on equity reits, S&P500, and Russell 2000. In converting monthly returns to quarterly returns, use the formula $(1+r_1)(1+r_2)(1+r_3) - 1$ where r_n is the return from the n^{th} month of a quarter ($n = 1,2,3$). For example, if the return for month 1 (r_1) is .0390, the return for month 2 (r_2) is .0207, and the return for month 3 (r_3) is .0722 then the quarterly return is $1.0390 \times 1.0207 \times 1.0722 - 1 = 0.137076$. From an intuitive standpoint, is it possible to “bracket” (form a confidence interval) the true volatility of underlying real estate? If so, what should the minimum and maximum volatility of the underlying real estate be?

2. Illiquidity of Real Estate and the Swapping of CREF Cash Flows: One strategy that some investment banks such as Morgan Stanley have proposed to CREF investors who wish to lessen their exposure in real estate but do not want to pay large transaction costs and do not want to turn a “paper” loss into a real loss through a sale of CREF units is to swap CREF returns for risk-free returns on either LIBOR or Treasury bills. Suppose that your firm, who holds units in a CREF, executes a real estate swap for a 3 month Treasury bill. The swap was initiated in the first quarter of 1990 and that the real

estate swap will last for 20 quarters ending in the first quarter of 1995.¹ The terms associated with the swap agreement are as follows:

Initial Appraised Value: \$125,000,000

Discount (of Appraised Value): 20%

Length of Swap (in quarters): 20 quarters (from 1990 Quarter 2 until 1995 Quarter 1)

Spread over 3-month Treasury bill: .125%

Also,

Initial Notional Amount = Initial App Value * (100% - Discount of Appraised Value)

Discount Accretion Amount (per period) = (Initial Appraised Value * Discount of Appraised value)/Length of Swap

Discounted Initial Russell-NCREIF Capital Index Value =(Capital Index Val *(100%-Discount of Appraised value))

Number of Index Units = Notional Amount ÷ Discounted Capital Index Value

Discount Accretion (Percent %) = Discount ÷ Length of the Swap

Fill in the **yellow** highlighted areas in the “Receiver Template (Recv Pty CF” and the “Payer Template (Pays Pty CF)”. The highlighted areas: 1) Show the net cash flows to Party A including all intermediate calculations on a spreadsheet, 2) Show the net cash flows to Party B including all intermediate calculations on a spreadsheet, and 3) Show the cash flows to the financial intermediary who set up the swap agreement including all intermediate calculations on a spreadsheet.

Is the swap a good deal for your firm? Was the swap, in hindsight, a good deal for the other party? Why or why not? If it is not a good deal, explain why it isn't. Plot out the NCREIF returns vs. 3-month Treasury bill.

3. Comparing the Performance of Individual CREFs. Your firm is interested in investing in just one of four CREFs whose quarterly returns are given in the “Individual CREF Returns” worksheet. Three of the four CREFs are open-ended funds and one CREF is a closed-ended fund. All four CREFs have different sponsors. The returns are obtained from the Mobius data (the same returns are also available from Standard and Poors AIM product). The firm has given you the task of ranking the funds and recommending one fund to them along with the accompanying analysis on each fund.

¹In hindsight, the swap was made over a period in which returns on capital appreciation were negative for the most part. Prior to this, real estate was doing fairly well. As such, the other party to the real estate swap agreement would probably be willing to be a party to such as transaction. The question to consider here is how would the party who wants to participate in real estate (receiver of real estate cash flows) have fared over this time period.

- a. As the initial point of departure, calculate the mean, standard deviation and other summary statistics for each fund by using the descriptive statistics option in the Data Analysis section of the Tools menu in Excel. If you do not see the Data Analysis ... section, pull down the Tools menu, select Add-Ins, choose Analysis ToolPak, and then click on the OK button. Next, calculate the Jensen's alpha for each fund using NCREIF as the benchmark portfolio in lieu of the market portfolio.² Which fund would you select? Please give your rationale. Are there any limitations associated with the Fund that you have chosen?
- b. In your analysis, you notice that two of the funds appear to be similar with respect to their first two moments (mean and standard deviation). Which are the two funds? Perform a two-sample F test to see if the variances of these two funds are similar to one another from a statistical perspective. Next, perform a Two-Sample t-Test on the means (which t-test you perform depends on whether the variances are statistically similar to one another). Are these funds in fact similar based on their first two moments? Calculate the correlation coefficient between these two funds. If you had to choose between these two funds, which fund would you choose and why? Would it make a difference if one of the funds were a closed-ended fund?

4. Performance of Debt vs. Equity in Commercial Real Estate. In your CREF presentation to the investment committee, a question is raised regarding whether investing in your recommended CREF would make the pension fund of your firm overexposed to real estate. The argument advanced is that the pension fund already has investments in mortgages on commercial real estate. The benchmark that they use for performance on these mortgages is the Giliberto-Levy commercial mortgage index.³ Another question that is raised is that since the NCREIF index is appraisal based, the returns are believable but not the variance (standard deviation). The committee requests that you investigate this question and report back to them at their next meeting. Calculate the correlation coefficient between the returns on Giliberto-Levy commercial mortgage index and the total returns on NCREIF. Next, plot the returns on the Giliberto-Levy commercial mortgage index relative to the total returns on NCREIF. Why is the correlation between the two indices so low? Are the two return series related? Calculate **and compare** the descriptive statistics for the return on each index. Finally, calculate a Two-Sample t-Test (of the means) Assuming Equal Variances. The rationale for using equal variances is the concern that the volatility for NCREIF is understated. Based on this test and the rest of your analysis of the Giliberto-Levy index, would you still recommend investing in your CREF? Why or why not?

²For further details, see Daniel, K, M. Grinblatt, S. Titman and R. Wermers, 1997, "Measuring Mutual Fund Performance with Characteristic-Based Benchmarks," *Journal of Finance*, vol. 52, no. 3: 1035-1058. For the theory underlying this method, refer to Grinblatt, M. and S. Titman, 1989, "Portfolio Performance Evaluation: Old Issues and New Insights," *Review of Financial Studies*, 2: no. 3: 393-421.

³Information on this index is available on www.jblevyco.com.

5. Imputed Volatility of Real Estate. If you are an investment adviser, you constantly hear concerns about the volatility of real estate due to appraisal bias regarding smoothing. You call your former real estate professor at Stern who suggests that you imputed the volatility to real estate by thinking in terms of modern portfolio theory. More specifically, he points out that REITs represent securitized real estate and as such are a function of both stocks and the underlying real estate. He suggests that as a “quick and dirty” method you regress the returns on equity REITs against the returns on the Russell 2000⁴ (the returns are located in the worksheet “Imputed Volatility Data”). The residuals from this regression represent the returns on real estate holding constant any stock market influence. Next, since the value of the firm consists of the value of its debt + value of its equity, it follows that the volatility of a real estate firm (the variance of the residuals) is also a function of the volatility of its debt and equity. From an MPT perspective, this translates into the following mathematical relationship:

$$\sigma_{RE}^2 = w_{Debt}^2 * \sigma_{Debt}^2 + w_{Equity}^2 * \sigma_{Equity}^2 + 2w_{Debt}w_{Equity} * \rho_{Debt,Equity} * \sigma_{Debt} * \sigma_{Equity}$$

where

σ_{RE}^2 = variance of the residuals from regressing REIT returns on the Russell 2000.

σ_{Debt}^2 = variance of the return on the Giliberto - Levy commercial mortgage index.

σ_{Equity}^2 = variance of the return on commercial real estate equity which is unobservable.

$\rho_{Debt,Equity}$ = correlation of return on debt and equity commercial real estate

w_{Debt} = Debt to total capital ratio of a REIT

$w_{Equity} = (1 - w_{Debt})$

Using the Solver option in Excel, calculate the imputed volatility for the commercial real estate equity using as weights the book value and alternatively the market value of the debt to total capital ratio. As an initial point of departure, put in any positive value e.g., .0003 for the implied real estate volatility (Book Value) and implied real estate volatility (Market Value) since this is what we wish to solve for. Assume that the correlation between real estate debt and equity is the same as the correlation between stocks and corporate bonds (.303257). An analysis of the SNL REIT database reveals that the debt to total capital ratio on a book value basis is 57% and is 48% from a market value standpoint. How do your answers (volatility based on book value and volatility based on market value) compare to the volatility for real estate that you computed in question 1 using an AR(4) process on CREFs? Notice that the present method of imputing volatility does not rely on using CREF returns.

Please turn in a hard copy of your work.

⁴The returns on the Russell 2000 are used instead of the returns on the S&P500 since the 10-20% of the former index consists of REITs. REITs currently are not part of the S&P500.