PROJECT DESCRIPTION

1. **Introduction:**

Long-term investors, such as sovereign funds, have more capacity to invest in private assets and have gradually included private assets in their asset allocation. However, the absence of good quality information on the mark-to-market prices, such as lack of trades or confidentiality, on private assets has led the long-term investors to use appraisals for various investment decisions. In general, academic researchers agree that the use of appraisals understates the true risk of private assets as well as yield inaccurate correlation estimates with other asset classes, and thus the portfolio diversification and relevant analysis. This phenomenon inspires us to study the appraisal mechanism and how to retrieve right information from appraisals for correct investment decisions. Marcato and Key (2007)[1] provide a great discussion about the implication of using appraisal returns for asset allocation.

In this project, we will learn major characteristics of appraisal returns and some practical approaches to resolve the corresponding caveats.

2. **Data for analysis**

1) Download the private real estate appraisal returns (NCREIF Property Index Returns, NPI returns hereafter) from 1978:Q1 to 2015:Q4.
2) Download the Fama and French factor return[2] series from 1978:Q1 to 2015:Q4.
3) Where to download data:
   a. Private commercial real estate appraisal returns: http://www.ncreif.org/property-index-returns.aspx
   b. Fama and French factors: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

3. Analyze appraisal returns and unsmooth appraisal returns

1) Describe the time series characteristics of NPI return series and Fama/French Rm-Rf series;
2) Unsmooth NPI returns based on autoregressive processes[3] and moving average processes[4];
3) Calculate the volatility of the unsmooth return series from 2);
4) Calculate the Sharpe ratios of original and unsmoothed returns that you got from 2);
5) Discuss your results.

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[1] Marcato and Key (2007), "Smoothing and Implications for Asset Allocation Choices", Journal of Portfolio Management, pp. 85-98.
[2] Download the monthly return series and compound them into quarterly returns.
[3] Fisher et al (1994), "Value Indices of Commercial Real Estate: A Comparison of Index Construction Methods", Journal of Real Estate Finance and Economics, pp. 137-164.
[4] Getmansky et al (2004), "An econometric model of serial correlation and illiquidity in hedge fund returns", Journal of Financial Economics, pp. 529-609.

4. Factor loading estimation:

1) Estimating factor loadings of NPI return series against Fama/French three facotrs
2) Estimate factor loadings of the unsmoothed returns against Fama/French factors;
3) Estimate factor loadings using the method of Pedersen et al (2012), "Modeling the Risk Characteristics of Real Estate Investments", PIMCO;
4) Discuss your results.