An REIT Futures Hedge?

*Youguo Liang**

*Arjun Chatrath***

Abstract. **This study examines the ability of existing futures contracts to hedge the returns on real estate investment trusts (REITs). The results from various hedging strategies suggest that existing futures contracts do not provide the means to effectively hedge REIT returns. REITs could remain unhedgeable until futures contracts written specifically on REITs are developed.**

Introduction

The characteristics of real estate investment trusts (REITs) and the behavior of REIT returns have been well documented. Notable contributions have also been made in assessing REITs' abilities to hedge inflation, but thus far, there is little evidence on whether REIT returns can be hedged. This study examines the ability of some important futures contracts to hedge three classes of REITs: all REITs, equity REITs and mortgage REITs.

Such an investigation is important as it brings us closer to understanding the feasibility of and the need for futures contracts written on indices that track the performance of REITs. The existing stock index futures contracts are widely employed by fund managers to dynamically hedge their equity portfolios. Dynamic hedging strategies provide a floor to a portfolio's value while allowing for some capture of a market upturn (*e.g.*, see Black and Jones, 1987). In contrast, individuals and institutions with large REIT holdings must currently rely on very basic hedging strategies. For instance, they can protect their investments by selling REITs and reversing the transaction after the downward movement in prices has occurred. Alternate strategies with similar effects could involve short selling the REIT holdings. Frequent actions of this kind will involve high transaction fees. More importantly, the success of these strategies will depend on the market-timing abilities of investors. Hence, real estate fund managers are limited in their portfolio insurance strategies as there exist no liquid derivative instruments that are designed specifically to track the performance of REITs.[1]

This article can be considered an extension of Oppenheimer (1996). The author investigates whether a synthetically constructed index of ten REIT stocks is hedgeable using futures contracts written on the S&P 500 Index, Treasury bonds, Treasury bills

*Prudential Investments, Parsippany, NJ 07054 or youguo.liang@prudential.com.
**Department of Finance, Hawaii Pacific University, Honolulu, HI 96813 or mseiler@hpu.edu.
**School of Business Administration, University of Portland, Portland, OR 97203 or chatrath@uofport.edu.

and Treasury notes. The Oppenheimer study is based on twelve months data sampled from January 1993 through December 1993. The current investigation employs a set of widely employed REIT indices and a more comprehensive set of futures contracts. The study employs twelve years data to explore the effectiveness of ex-ante and naive hedging strategies over the interval, July 1986 through December 1994. The evidence suggests that existing futures contracts, written on financial instruments or commodities, are limited in their ability to hedge the returns on REITs on an ex-ante basis. The results provide strong indications that investors and fund managers will benefit from futures contracts written specifically on REITs.

Selecting Futures Contracts

The ideal REIT hedging vehicle would be one which has a strong positive or negative correlation with REIT returns. Based on this notion, four categories of futures contracts are considered to hedge the REIT indices. These are stock index futures (S&P 500 and Value Line), interest rate futures (T-bill and T-bond), commodity futures (lumber and crude oil) and precious metal futures (gold).

Stock Index Futures

Since REITs are stocks, a strong correlation between the REITs and stock indices is to be expected. Giliberto (1993) finds that the returns of equity REITs and the S&P 500 Index are highly correlated. Liang, Chatrath and McIntosh (1996) find that apartment REIT returns are also closely related to this index. Giliberto and Liang et al. suggest that REIT returns contain a large stock market influence that must be eliminated to evaluate the relationship between the performance of REITs and appraisal based real estate. The authors calculate hedged REIT indexes via a series of estimated spot hedge ratios.[2] Due to the established relationships between REIT and the S&P 500 returns, the S&P 500 futures contract is selected as a candidate to hedge REIT returns. The Value Line futures is selected as an alternate stock index contract. The candidacy of the Value Line index contract is motivated by the fact that REITs are primarily small stocks (*e.g.*, Liu and Mei, 1992; and Han and Liang, 1995), and that the index, which comprises about 1,700 stocks, is known to better track the performance of small stocks.

T-Bill and T-Bond Futures

REITs are referred to as pass-through vehicles as they distribute at least 95% of their earnings in dividends in order to avoid corporate taxes. In a stable earnings environment, the stream of payments will be similar to the stream of cash flows associated with fixed income securities. Titman and Warga (1986), Chen and Tzang (1988) and Liang and Webb (1995) find that REITs, especially mortgage REITs, are interest-rate sensitive. They also determine that REITs are sensitive to long-term as well as short-term interest rate changes. Thus, Treasury bills and bonds are considered in the hedging exercise.[3]

Crude Oil, Lumber and Gold Futures

Commodity futures are typically employed to hedge against inflation. The consensus is that inflation, anticipated and unanticipated, also effects REIT returns (*e.g.*, Gyourko and Linneman, 1988; Goebel and Kim, 1989; Murphy and Kleiman, 1989; and Park, Mullineaux and Chew, 1990). Thus, the inflation sensitive crude oil, gold and lumber futures contracts are selected as candidates to hedge REIT returns.

Factors other than general price levels also motivated the selection of these commodity futures. The price of heating oil, an important bi-product of crude oil, is known to be influenced by trends in residential construction and weather conditions, itself an important determinant of housing starts.[4] Lumber futures are also selected based on the rationale that there exists a relationship among real estate activity, REIT returns and the price of construction materials.

Data

The return data spans July 1982–December 1994, restricted by the availability of prices for stock index futures prior to 1982.[5] Monthly returns for the all REIT, equity REIT and mortgage REIT indices are obtained from the *National Association of Real Estate Investment Trusts* (NAREIT) *Handbook* (1995). The indices are value weighted aggregates and are classified by NAREIT as equity REITs if they hold at least 75% of their assets in real estate properties, and as mortgage REITs if they hold at least 75% of their assets in mortgage loans. All REITs include equity REITs, mortgage REITs and hybrid REITs (REITs that are neither equity nor mortgage REITs).[6] Returns for each of the REIT indexes given by $(P_t - P_{t-1} + D_t)/P_{t-1}*100$, where P_t is the value of the REIT index at month ending t, and D_t are the dollar dividends between $t - 1$ and t.

Return levels for the seven futures contracts are computed from the data base supplied by the Futures Industry Institute, Washington, DC.[7] Returns for the futures contracts are calculated in identical fashion to the REIT returns.[8] With the exception of crude oil futures for which trading began in April 1983, the other contracts were traded prior to June 1982. To obtain a time series of returns for S&P 500 and Value Line futures, each futures contract is followed until the day prior to the expiration month, at which point the data switches to the next nearby contract. For instance, for the S&P 500 contract which has the expiration cycles of March, June, September and December, the September 1990 contract is employed to compute the returns for June, July and August of 1990. Similarly, the returns for September, October and November 1990 are computed employing the December 1990 contract. Returns are computed in identical fashion for the T-bill and T-bond futures which also expire four times per year. For gold and lumber futures, which expire six times per year, each contract is employed to generate the prior four months' returns.[9] Similarly, for crude oil futures, which expire every month, each contract is used to obtain the returns for three prior months.[10]

Methodology

The hedging methodology employed in this study is similar to the spot hedging methodology in Giliberto (1993) and Liang, Chatrath and McIntosh (1996). The first step in generating the hedged REIT returns was to perform a 48-month rolling regression of the total returns for each of the three REIT indices on the returns on an appropriate set of futures contracts. The following regression model is estimated:

$$REIT_t = \alpha_i + \beta_{1i}S_t + \beta_{2i}TB_t + \beta_{3i}LM_t + \beta_{4i}CO_t + \beta_{5i}GD_t + \varepsilon_{i,t'}, \quad (1)$$

where, t represents the most recent forty-eight months; i (= 1,2,3) represents the three classes of REITs; *S*, *TB*, *LM*, *CO* and *GD* represent the stock index, treasury, lumber, crude oil and gold futures contracts, respectively; the *a* and *b* are the constant and coefficients to be estimated and *e* is the regression error term. Given the high correlation between the Value Line and S&P 500 Index, and between T-bills and T-bonds, only one of each pair enters the equation at one time. In pretests of the regression model and the hedging techniques discussed later, it was found that the portfolio involving Value Line and T-bond futures was relatively more effective in hedging total REIT returns as compared to the portfolio involving S&P 500 and T-bill futures. Subsequently, the latter two futures contracts are excluded in the final regressions.

For each of the three REIT return series, the rolling regressions provide 102 sets of coefficients that are employed in the final stage of the hedging exercise. By employing stepwise multiple regression for each forty-eight month period, we first isolate regression coefficients significant at the 10% level. Only futures contracts with significant coefficients then enter into the rolling regressions. The estimated coefficients represent the hedge ratios to be used in the final step (*i.e.*, the construction of the hedged REIT returns).[11] The coefficients are the optimal hedge ratio proposed by Figlewski (1985). They are also the minimum-variance hedge ratios that determine the minimum-risk hedge position.[12]

For each REIT index, hedged REIT returns (*HR*) are obtained from the formula:
The β coefficients take on the value of zero if the hedge ratios from Equation (1) were not significant.

$$HR_{i,t+1} = REIT_{t+1} - \beta_{1it}S_{t+1} - \beta_{2it}TB_{t+1} - \beta_{3it}LM_{t+1} - \beta_{4it}CO_{t+1} - \beta_{5it}GD_{t+1}. \quad (2)$$

Equation (2) represents an ex-ante hedging strategy since hedge ratios obtained from historical forty-eight-month intervals are employed to hedge the one period (month) ahead REIT returns.[13]

Alternate hedging strategies involving the Value Line Index futures alone are also deployed. The rolling regression described in Equation (1) is repeated with Value Line futures contracts as the only exogenous variable, and the hedged REIT returns are obtained from the formula:

$$HR_{i,t+1} = REIT_{i,t+1} - \beta_{1it} S_{t+1}, \quad (3)$$

where the β coefficient is assigned the value of zero if the hedge ratios are not significant at the 10% level.

Besides the rolling hedge strategy presented in Equations (1), (2) and (3), naive strategies with predetermined hedge ratios are also employed to hedge REIT returns. Such strategies involve shorting a fixed ratio of the hedge instrument over the sample horizon. The rationale for the naive hedge strategy is that clusters of volatility in the REITs or hedge instruments may cause the rolling hedge strategy to repeatedly underestimate the hedge ratios.

Results

Exhibit 1 reports the means and standard deviations of the returns on the futures contracts considered in the hedging exercise. The means and standard deviations are presented over two intervals since the estimation of the hedge ratios involves futures returns from July 1982 through December 1992, while hedged REIT returns are computed from July 1986 through December 1994. Correlations of futures and REIT returns are also presented.

The mean returns of all but the gold futures are positive over the two intervals. The lumber and crude oil futures were the most volatile, followed by the gold, S&P 500 and Value Line futures. The correlations of the futures returns with the REIT portfolio returns indicate that among the stock index futures, the Value Line futures are more closely related to REITs. This is consistent with the notion that REITs behave more

Exhibit 1
Means and Standard Deviations of Monthly Futures Returns and Correlations with REITs

	7/1982–12/1994		7/1986–12/1994		7/1982–12/1994		
	Mean	Std. Dev.	Mean	Std. Dev.	All REITs	Equity REITs	Mortgage REITs
S&P 500	0.61	5.20	0.23	5.61	0.48	0.47	0.37
Value Line	0.70	4.97	0.54	5.08	0.69	0.67	0.58
T-bills	0.09	0.54	0.01	0.40	0.08	0.02	0.18
T-bonds	0.59	3.45	0.24	2.80	0.34	0.30	0.32
Lumber	0.33	8.21	1.41	8.20	0.16	0.12	0.17
Crude Oil	0.53	8.97	1.25	9.60	−0.22	−0.25	−0.17
Gold	−0.13	5.76	−0.20	3.83	−0.06	−0.03	0.02

July 1982 through December 1994 represents the time interval over which futures returns are employed to obtain hedge ratios; July 1986 through December 1994 represents the interval for which hedged REIT returns are computed. Crude oil futures returns, standard deviations and correlations are evaluated from March 1983.

like small stocks. The T-bond futures are more correlated to REITs than T-bill futures returns, which seem to be related only to the mortgage REITs. Finally, crude oil futures are negatively correlated to all three REITs, while gold futures seem unrelated to REITs in general. The notable correlation coefficients among the returns of the futures contracts (not shown) were .72 for the S&P 500–Value Line pairing, and .56 for the T-bond–T-bill pairing. All other correlations were relatively low, with the highest correlation coefficients being .31 for T-bond–S&P 500, .27 for T-bond–Value Line and .22 for crude oil–T-bond futures. The correlations among the five futures contracts in Equation (1) thus represent acceptable departures from orthogonality.

Exhibit 2 reports the means, standard deviations and frequencies of the significant monthly hedge ratios estimated from Equation (1). The ratios pertaining to the Value Line futures are significant in all 102 regressions for each of the three categories of REITs. The other futures seem relatively less useful in tracking REIT returns in Equation (1). T-bond futures are significant only on 24, 19 and 16 occasions. Crude oil futures are significant for 47 of 102 equity REIT regressions, but are significant on only 7 occasions in the regression involving all REITs and never significant in the mortgage REIT regressions.

Exhibit 3 reports the summary statistics from the solutions to Equations (2) and (3). The statistics for unhedged-REIT returns and for returns produced by the naive hedging strategies are also presented. A comparison is facilitated by the minimum-

Exhibit 2
Means, Standard Deviations and Frequencies of Significant Hedge Ratios for All REITs, Equity REITs and Mortgage REITs from 7/1986 through 12/1994

	Futures Contract				
	Value Line	T-Bond	Lumber	Crude Oil	Gold
Panel A: Hedge Ratios—All REITs					
Mean	0.44	0.13	0.07	−0.05	0.13
Std. Dev.	0.11	0.02	0.01	0.03	0.00
Frequency	102	24	2	7	2
Panel B: Hedge Ratios—Equity REITs					
Mean	0.48	0.14	−0.10	−0.06	0.16
Std. Dev.	0.12	0.04	0.02	0.01	0.05
Frequency	102	19	20	47	17
Panel C: Hedge Ratios—Mortgage REITs					
Mean	0.39	0.17	0.12	na	−0.09
Std. Dev.	0.09	0.13	0.07	na	0.00
Frequency	102	16	2	0	5

Exhibit 3
Means and Standard Deviations (in percentage) of Monthly Unhedged and Hedged Returns for All REITs, Equity REITs and Mortgage REITs from 7/1986 through 12/1994

	All REITs	Equity REITs	Mortgage REITs
Panel A: Unhedged REIT Returns			
Mean	0.47	0.73	−0.18
Std. Dev.	3.34	3.59	3.87
Panel B: Hedged REIT Returns Using Five Futures Contracts[a]			
Mean	−0.16	−0.26	−0.15
Std. Dev.	2.55	2.86	3.08
e^*	0.41	0.36	0.37
Panel C: Hedged REIT Returns Using Only Value Line Futures			
Mean	−0.22	−0.35	−0.22
Std. Dev.	2.41	2.66	3.06
e^*	0.48	0.45	0.37
Panel D: Hedged REIT Returns Using Only Value Line Futures With A Naive-Hedge Ratio of .50			
Mean	−0.05	−0.17	−0.09
Std. Dev.	2.76	3.01	3.27
e^*	0.32	0.30	0.29
Panel E: Hedged REIT Returns Using Only Value Line Futures With A Naive-Hedge Ratio of .25			
Mean	0.04	−0.08	−0.02
Std. Dev.	3.05	3.29	3.44
e^*	0.17	0.16	0.21

[a]The five futures contracts are Value Line, T-bond, lumber, crude oil and fold.
e^* A measure of minimum-variance hedging effectiveness and is equal to $1 - (\text{var}(HR)/\text{var}(UHR))$, where *HR* is the return on the hedged position and *UHR* is the return on the unhedged position.

variance-hedging effectiveness measure, $e^* = 1 - (\text{var}(HR)/\text{var}(UHR))$, where *HR* is the return on the hedged position and *UHR* is the return on the unhedged position.[14]

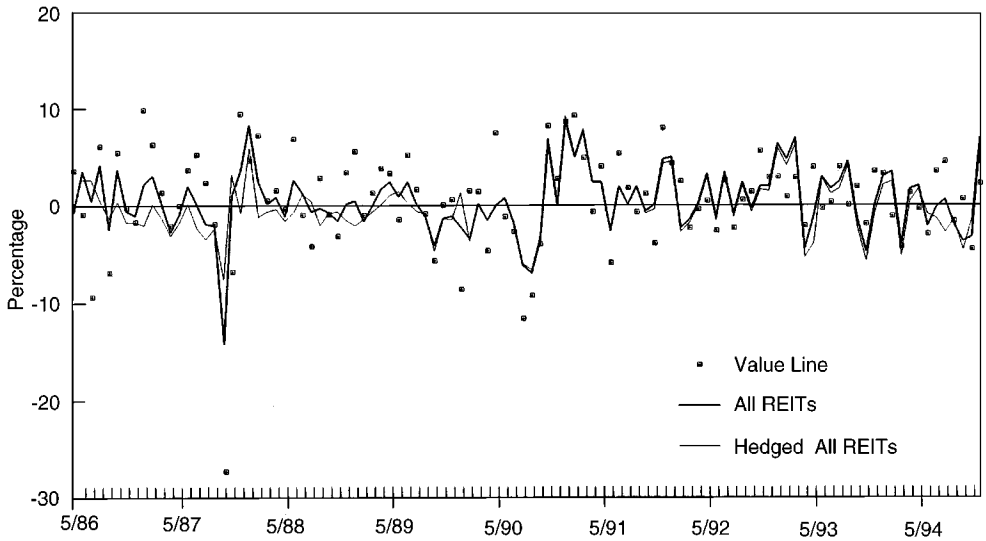
It is evident that the hedging strategies are generally unsuccessful in removing the variability in the REIT returns presented in Panel A. In Panel B, which reports the results from the rolling-hedge exercise that employs all futures contracts, the hedging effectiveness measure ranges from .36 for equity REITs, to .41 for all REITs, indicating that the futures' hedge eliminates only 36% and 41% of the variability in their respective returns.[15] The result from the rolling regression that deploys the Value Line futures alone is presented in Panel C. The results represent an improvement over the application of all futures contracts. The hedging effectiveness ranges from 37%

for mortgage REITs to 48% for all REITs. The rolling-hedge strategy is also superior to the naive hedge strategies. When applying the .5 hedge ratio (Panel D), the variability reduction ranges from 29% to 32%. The strategy employing the naïve-hedge ratio of .25 is the least effective, with only between 16% and 21% of the REITs' variance being eliminated.

In sum, the rolling-hedge ratios from the regression involving the Value Line futures alone produced the largest reduction in risk, and the naive-hedge strategies were the least successful in reducing the variability in REIT returns. However, none of the hedging strategies produced results that suggest that the existing futures contracts provide a satisfactory means to hedge REIT returns. Moreover, it is notable from the results in Exhibit 3 that the hedging efforts also produced the deleterious effect of lower returns for the hedged All REIT and Equity REIT indices.

Further indications of the general inability of existing futures to hedge REIT returns is provided in Exhibit 4 which plots the returns of the Value Line futures, All REITs index and the Value Line-hedged All REITs index.[16] It is clear that the prices of REITs have tended to be stickier than the general market. However, there is little evidence that the Value Line-hedge provides an advantage in either up-or down-markets. During market upturns, the *HR* returns actually had larger standard deviations than *UHR* returns, and only around the Crash (October 1987) did the *HR*s clearly outperform,in the variability sense, the *UHR*s. Furthermore, the hedging inability of the futures contract seems all the more obvious for more recent intervals. For instance, the *HR* return series almost mimics that of the *UHR* returns since 1990.[17] This pattern is consistent with the notion that the relationship between REITs and stock indices

Exhibit 4
Returns on All REITs, Hedged All REITs and Value Line Index



(such as the S&P 500 and Value Line) has deteriorated in recent years. Thus, stock index futures may provide even weaker hedging vehicles for REIT investors in the future.

On a final note, one could make a case that the hedging results incorporate some biases in that the compositions of the NAREIT indexes have undergone change over the interval under study. Thus, we also conducted the above hedging exercises on value-weighted and equally-weighted portfolios of twenty-seven REITs traded continuously from 1982. The results from this alternate sample are consistent with the NAREIT sample in that the futures contracts provided poor hedging vehicles for the REIT portfolios.[18] In sum, the evidence of the poor futures-hedging performance seems robust to the construction of the REIT portfolios.

Conclusion

The purpose of this study was to test the ability of existing futures contracts to hedge the returns of REITs. Minimum variance hedge ratios were extracted from five futures contracts, including the Value Line and T-bond futures, and employed to hedge three types of REITs: all REITs, equity REITs and mortgage REITs. Rolling-hedge and naive-hedge strategies were implemented and their effectiveness was compared. The greatest hedging effectiveness was provided by the deployment of Value Line futures in the framework of a rolling-hedge; naïve-hedging techniques produced the least impressive results. However, none of the hedging strategies produced results that would indicate that the existing futures contracts provide satisfactory means to hedge REIT returns. Thus, there are strong indications that investors and fund managers will benefit from futures contracts written specifically on REITs. The results also suggest that a futures contract written on REITs would have limited competition as there is no evidence of effective cross-hedging between REITs and existing futures.

Why do existing futures contracts represent poor hedging vehicles for REITs? A general answer could lie in the differences in price behavior across REITs and other assets and stock indexes. For instance, REITs are less volatile than stocks and commodity futures in general. More specific answers to the question may lie with the concept of basis risk. While the basis risk tends to be small for financial futures and metal futures, it tends to be relatively large for consumption assets such as lumber and crude oil. Thus, even though REIT prices movements may be continuously related to the cash price movements in inflation or interest sensitive assets, they may only be discontinuously related to their futures prices.

Notes

[1] Over the counter contracts written on REIT stock baskets do currently exist, although with different pricing and liquidity characteristics than exchange-traded contracts. We thank a referee for pointing this out.

[2] To compute the hedged-REIT returns, the authors employ the S&P 500 cash index, not the futures index. The term ‘spot hedge ratios’ is employed here to highlight this distinction.

[3] It is likely that the now failed mortgage-backed futures contracts held very little advantage over the existing treasury instrument futures in terms of the hedging ability of securitized real estate. The GNMA futures contract, traded between 1975 and 1989, was primarily designed for the mortgage lending industry. Once the T-bond futures began trading, it became evident that GNMA securities were effectively hedged employing T-bond futures. The redesigned mortgage-backed futures contract, traded between 1989 and 1992, was also highly correlated to the treasury bond and treasury note futures contracts (see Nothaft, Lekkas and Wang, 1995).
[4] For instance, see the *Commodity Trading Manual*, Chicago Board of Trade (1985:256).
[5] The S&P 500 and Value Line futures contracts were first traded in April 1982 and February 1982, respectively. Price information from June 1982 is employed.
[7] The results for hybrid REIT indexes are similar to those for all REITs. In the interest of brevity, hybrid REITs are excluded from the study.
[8] As futures contracts require no investment, their rate of return remains formally undefined. Nonetheless, the return definition provided here is widely accepted.
[9] These contracts were generally liquid (as measured by volume or volume/open interest) up to four months prior to maturity.
[10] There is little consensus as to which contract rollover methodology is the most appropriate when deriving price series from bundles of futures contracts (*e.g.*, Geiss, 1995). However, this study also considered commodity futures returns derived from following each contract until the month prior to expiration. No notable differences are detected in the results employing either rollover methodology.
[11] This methodology of isolating significant futures contracts is identical to that in Oppenheimer (1996).
[12] For further detail, see Hull (1993: Chap. 2).
[13] Oppenheimer (1996) also presents results from ex-post hedging strategies. As the objective here is to evaluate the effectiveness of hedging strategies employing historic (and hence, concurrently available) information, only ex-ante hedging strategies are dealt with here.
[14] For details, see Daigler (1993).
[15] Using the S&P 500 in place of the Value Line contract actually produced standard deviations that are higher than the *UH* returns. This finding is consistent with the results in Oppenheimer (1996). The author employs the S&P 500 futures index in his ex-ante hedging exercise and also finds *HR* returns to have a higher variance.
[16] Patterns similar to those in Exhibit 1 were also found for the other *HR*s.
[17] Correspondingly, we also found the hedge ratios from the Value Line futures to be substantially smaller for the more recent intervals.
[18] The sample consists of fourteen equity REITs, ten mortgage REITS and three hybrid REITs. In the interest of brevity, we do not present further details on this sample or the results from employing this sample. The sample and results are available upon request.

References

Black, F. and R. Jones, Simplifying Portfolio Insurance, *Journal of Portfolio Management*, 1987, 14, 48–51.

Chen, K. C. and D. D. Tzang, Interest Rate Sensitivity of Real Estate Investment Trusts, *Journal of Real Estate Research*, 1988, 3:3, 13–22.

Commodity Trading Manual, L. Besant, editor, Chicago, IL: Chicago Board of Trade, 1985.

Daigler, R. T., *Financial Futures Markets*, Harper Collins, 1993.

Figlewski, F., Hedging with Stock Index Futures: Theory and Applications in a New Market, *Journal of Futures Markets*, 1985, 5, 183–99.

Geiss, C. G., Distortion-Free Futures Price Series, *Journal of Futures Markets*, 1995, 15, 805–31.

Giliberto, S. M., Measuring Real Estate Returns: The Hedged REIT Index, *Journal of Portfolio Management*, 1993, (Spring), 94–9.

Goebel, P. R. and K. S. Kim, 1989, Performance Evaluation of Finite-Life Real Estate Investment Trusts, *Journal of Real Estate Research*, 1989, 4:2, 57–69.

Gyourko, J. and P. Linneman, Owner-Occupied Homes, Income-Producing Properties, and REITs as Inflation Hedges: Empirical Findings, *Journal of Real Estate Finance and Economics*, 1988, 1:4, 347–72.

Han, J. and Y. Liang, The Historical Performance of Real Estate Investment Trusts, *Journal of Real Estate Research*, 1995, 10:3, 235–62.

Hull, J. C., *Options, Futures, and Other Derivative Securities*, 2nd edition, Englewood cliffs, NJ: Prentice-Hall, 1993.

Liang, Y., A. Chatrath and W. McIntosh, Apartment REITs and Apartment Real Estate, *Journal of Real Estate Research*, 1996, 11:3, 277–89.

Liang, Y. and J. R. Webb, Pricing Interest Rate Risk for Mortgage REITs, *Journal of Real Estate Research*, 1995, 10:4, 461–69.

Liu, C. H., and J. Mei, The Predictability of Returns on Equity REITs and Their Co-Movement with Other Assets, *Journal of Real Estate Finance and Economics*, 1992, 5:4, 401–18.

Murphy, J. A. and R. T. Kleiman, The Inflation Hedging Characteristics of Equity REITs: An Empirical Study, *Quarterly Review of Economics and Business*, 1989, 29:3, 95–01.

Nothaft, F. E., V. Lekkas and G. H. K. Wang, The Failure of the Mortgage-Backed Futures Contract, *Journal of Futures Markets*, 1995, 15, 585–03.

Oppenheimer, P. H., Hedging REIT Returns Using Futures Markets, *Journal of Real Estate Portfolio Management*, 1996, 2:1, 41–53.

Park, J. Y., D. J. Mullineaux and I.-K. Chew, Are REITs Inflation Hedges? *Journal of Real Estate Finance and Economics*, 1990, 3:1, 91–03.

Titman, S. and A. Warga, Risk and the Performance of Real Estate Investment Trusts: A Multiple Index Approach, *Journal of the American Real Estate and Urban Economics Association*, 1986, 14:3, 414–31.