Risk Reduction Possibilities From Diversification of Real Estate Portfolios

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Abstract

Using a macro data base not previously examined, this paper investigates the benefits of diversification in real estate portfolios. Results support the findings of Burns and Epley (1982) and Miles and McCue (1984) that large reductions in risk can be achieved by intra regional diversification. But contrary to some previous work, substantial benefits from interregional diversification are also indicated.

Introduction

A great deal of work has been done to confirm and to quantify the benefits of diversification of portfolios of various kinds of assets. Evans and Archer (1968), Lintner (1965), Wagner and Lau (1971) and Elton and Gruber (1977) found that most systematic risk is eliminated from a portfolio with 10 to 15 securities. Similar results are reported for bonds by McEnally and Boardman (1979) and Hill and Schneeweis (1981) and for options by Sears and Trennepohl (1982).

Less attention has been given to the diversification of real estate portfolios. Burns and Epley (1982) report that large reductions in risk are achieved as portfolio size is increased up to three assets, but little reduction is achieved beyond three assets. Miles and McCue (1982) find that diversification by region improves the reward-to-risk ratio, but that this variable is not significant at the 0.05 level. Major data limitations in the study include the necessity (1) of estimating returns by property type and (2) of using a proxy for geographic diversification. In another study, Miles and McCue (1984) find that real estate returns comprise mostly unsystematic risk that can largely (67%) be eliminated with portfolios of 10 or more assets. Large risk reduction potential from diversification is reported even for properties of the same type within the same region, but benefits from interregional diversification are found to be more limited.

Recently, Hartzell, Hekman and Miles (1986) examine the characteristics of diversified real estate portfolios. These authors find that there are attractive diversification benefits from portfolios comprising both real estate and common stocks.

Previous studies rely upon micro returns data of real estate investment trusts (REITs) (Burns and Epley, 1982; Miles and McCue, 1982) and individual properties (Miles and McCue, 1984; Hartzell, Hekman and Miles, 1986). This study examines market indices developed from macro data published by the Institute of Real Estate Management (IREM) and the Bureau of the Census. These data are widely used by real estate professionals, including appraisers and investment analysts. Using the macro data just described, this study investigates the diversification benefits of real estate portfolios. Because of the dearth of real estate micro data, examination of these macro indices can provide insights into real estate markets not otherwise available.

The remainder of this study is divided into three parts. In the next section, the data are discussed. Then, the results are presented. The final section provides a summary.

The Data

This study analyzes a six-year time series of returns for garden-type, unfurnished, residential apartments (GTA) in 18 large United States cities. Annual real estate returns (r) are calculated as the ratio of annual net operating income per square foot to investment per square foot. Returns are computed on a square footage basis (rather than, say, per GTA) to provide greater comparability across locations. Because these data represent market averages, any particular building in a particular city may have a different return from that estimated here. But variations in estimated returns are

expected to represent good indicators of the relative riskiness among the various cities studied.

The IREM publishes a report of the annual income and operating expenses of apartments and office buildings (see references). Data for GTAs are reported for several cities for each year. Net operating income per square foot (NOI) is calculated as the difference between gross operating income per square foot and total operating expenses (including property taxes and insurance) per square foot. NOI data for GTAs are collected for 18 cities for the years 1978-1983 (the latest year available at the time of this study).

For each state containing a city in the net operating income data set, data for use in estimating investment per square foot (I) are derived from Census data for (1) the aggregate valuation of newly-constructed, privately-owned, single-family housing by state (V), (2) the number of new privately-owned, single-family housing units authorized for construction by state (U), and (3) the mean area (in square feet) of privately owned, single-family housing by region (A) (see references).(1)

Investment per square foot is computed by dividing the valuation per unit by the mean area (in square feet) per unit: Ii = (Vj/Uj)/Ar, where Ii = the investment per square foot for city i, Vj = the aggregate value of newly constructed privately owned, single-family housing for state j (which contains city i), Uj = the number of units in state j, and, Ar = the mean area (in square feet) of privately owned, single family housing for region r (which contains state j). Average area of newly constructed housing in a state is assumed to be the same as that of existing housing. Rates of return for asset i are calculated from ri = NOIi/Ii, where NOIi = net operating income per square foot, and Ii = investment per square foot for asset i.

Since the data represent averages of net operating income and investment, the return series is smoother than would be expected for data on individual assets. But returns on common stocks also represent the average return on the collection of assets owned by the firm. The data in this study merely represents aggregation of assets at a greater scale than previous studies. Diversification possibilities for less aggregated data should be at least as great as those identified in this study.

Obviously, these data are not ideal and lead to important limitations of the study. The NOI data are, on the whole, better than the investment data. The investment data are biased to the extent that (1) costs differ for cities in the same state, (2) average building sizes differ by city and state, (3) the ratio of house size by region to the U.S. average varies year by year, (4) single-family housing construction costs differ from multi-family housing construction costs, and (5) true investments differ from the estimated investments. If this study focused on the level of returns by city, these data would not be satisfactory. But this study is concerned primarily with the time series and cross-sectional variability of returns. Hence, as long as these biases affect only the level of returns rather than their year-to-year variability, the results reported here would not be affected. The availability of only six years of data for each time series is also a limitation.

The returns data used in this study differs markedly from those used by Miles and McCue (1984) and Hartzell, Hekman and Miles (1986). As mentioned above, these authors employ total holding period returns (taking into account income, expenses, net investment, disinvestment and unrealized capital gains and losses). Estimation of these returns requires the use of appraised property values since time series of transactions prices are not available for real estate properties. This study uses net operating income. In standard finance theory, asset values are determined by the present value of the asset's expected cash flows (see Haley and Schall, 1979). Hence, to the extent that historical and expected cash flows are correlated, there is reason to believe that changes in net operating income are also highly correlated with both changes in property values and total returns.

Diversification Benefits of Real Estate Portfolios

Table 1 presents returns and standard deviations of returns by city and region. The Northeast and Midwest have the highest returns, followed by almost identical returns for the South and West. The Northeast and South have the highest standard deviation of returns, followed by the West and Midwest.

This section explores the potential risk-reduction benefits of portfolios of real estate assets from several perspectives. The relationship between portfolio size and risk reduction is examined in the next subsection. Then, in the following subsection, interrelationships between returns by city/region are examined.

Variances of Portfolio Returns

A portfolio limited to one asset receives no benefits from diversification. Eighteen such portfolios (one for each real estate asset in the sample) are possible. The average variance of returns on these 18 portfolios is 1.63 X 0.0001 (see Table 2). Following the practice common in previous studies (see Miles and McCue, 1984), an equally-weighted portfolio of each of the 18 assets is used as the bench mark for measuring the maximum gains from diversification; the variance of return for this fully diversified portfolio is 0.54 X 0.0001. Thus, as much as 66.9% ((1.63-0.54)/1.63) of the risk of single-asset real estate portfolios can be diversified away.

Table 1
Mean and Standard Deviation of Returns, By City and Region, 1978-1983

REGION/CITY	Return	Standard Deviation
Midwest	0.0945	0.0053
Chicago	0.0907	0.0123
Detroit	0.0900	0.0056
Minneapolis	0.0916	0.0057
St. Louis	0.0991	0.0109
Northeast	0.1084	0.0108
Boston	0.1094	0.0095
New York	0.1302	0.0239
Philadelphia	0.0856	0.0036
South	0.0887	0.0108
Charleston	0.0834	0.0129
Dallas	0.0915	0.0161
Houston	0.0875	0.0132
Miami	0.0982	0.0104
Richmond	0.0768	0.0049
Washington	0.0885	0.0195
West	0.0894	0.0082
Denver	0.0910	0.0215
Los Angeles	0.0828	0.0075
Phoenix	0.1075	0.0073
San Diego	0.0737	0.0075
San Francisco	0.0909	0.0140

Table 2
Reduction in Return Variance As Portfolio Size Increases

	Mean Variance ($\times 10^{-4}$)	% of Maximum Risk Reduction Achieved
All Assets Individually	1.63	0.0%
Random Portfolios:		
2 Assets	0.97	60.6
3 Assets	0.76	79.8
4 Assets	0.68	84.0
5 Assets	0.63	91.7
10 Assets	0.55	99.1
All Assets	0.54	100.0

The average variances of 5,000 randomly-selected portfolios of size i, i = 2, 3, 4, 5 and 10 are also presented in Table 2. A randomly-selected portfolio of size 2 achieves 60.6% and a randomly selected portfolio of size 10 achieves 99.1% of the total possible risk reduction. In a similar analysis of individual properties, Miles and McCue (1984, p. 64 Table 4) report that the percentage of the maximum risk reduction achieved is 56.9% for portfolios of size 2 and 91.4% for portfolios of size 10. The results of Miles and McCue, obtained with a quite different data set, are remarkably consistent with the results reported here. The results of this study are also consistent with those reported for common stocks by Evans and Archer (1968), Wagner and Lau (1971) and Lintner (1965). This is especially noteworthy since these studies examined the total returns of individual assets rather than the return from net operating income of real estate assets.

Correlations of Portfolio Returns

For each region, for each year 1978-1983, an equally-weighted index of the return series for GTAs for cities in the

region is formed. Coefficients of correlation among the returns for each region over the sample period are then calculated. The higher the correlations between the returns for a given region and another region, the lower the risk reduction benefits of combining the two assets in a portfolio. Therefore, high correlations between regions suggest that diversification across regions would not be a good risk reduction strategy. If, on the other hand, the correlations between the return for two particular regions is low, investors may want to combine assets from both regions in a portfolio. Coefficients of correlation among regions are presented in Table 3. Of the six coefficients, only two (Midwest/South and Northeast/West) are statistically significant at the 0.05 level. Thus, there is substantial potential for risk reduction through interregional portfolio diversification across asset types.

Examination of the correlation coefficients among cities in a region (not shown) reveal substantial potential for intra regional diversification. In every region, there is at least one pair of cities whose returns are negatively correlated.(2) These results showing the potential for significant risk reduction through intra regional diversification are consistent with those of Miles and McCue (1984) who also report large potential gains from diversification within a single region.

Diversification Benefits of Common Stock Portfolios

Before examining portfolios comprising both GTAs and common stock, it may be useful to compare the risk characteristics of common stocks to those of GTAs. The discussion in this section is based on randomly-selected common stocks from the CRSP tapes.(3) Returns include both dividends and capital gains or losses.

Table 4 presents the year-by-year returns for equally-weighted portfolios of real estate and common stocks, respectively. Hartsell, Hekman and Miles (1986) report that the Standard and Poors 500 has lower returns and greater variability of returns than real estate assets. The random sample of NYSE common stocks examined here has both

Table 3
Correlations Among Returns by Region

	Midwest	Northeast	South	West
Midwest	1.0	0.4250	0.8801*	0.3857
Northeast		1.0	0.1982	0.9494*
South			1.0	0.2778
West				1.0

*Significant at the 0.05 level.

Table 4
Returns on Equally-Weighted Portfolios
of Real Estate and Common Stock, By Year

Year	Real Estate Return	Common Stock Return
1978	0.09166	0.17976
1979	0.08815	0.44033
1980	0.08503	0.41743
1981	0.08813	0.06779
1982	0.10326	0.36721
1983	0.10024	0.31975
1984	0.09275	0.29871
Mean:	0.09275	0.29871
Variance:	0.540×10^{-4}	213.5×10^{-4}
Coefficient of Correlation:	0.0943	

higher returns and higher risk than real estate assets.(4) The average return for common stocks over the 1978-1983 period of 0.299 is much higher than the return of 0.093 for GTAs. But it should be pointed out that the real estate returns assume 100% equity, exclude returns from appreciation and do not include any benefits or risks from leverage.

The average of the variances of the returns for 1978-1983 for the sample of stocks (not shown) is 2597.3 X 0.0001, considerably larger than the 1.63 X 0.0001 reported for real estate. The variance of returns for the equally-weighted portfolio of common stocks is 213.5 X 0.0001, compared with the 0.54 X 0.0001 for real estate. Thus, in a manner similar to that for real estate described in the previous section, large risk reduction benefits can be achieved from portfolios of common stocks. In fact, 91.8% of the total risk can be eliminated for this sample of stocks ((2597.3 - 213.5)/2597.3).

Diversification Benefits of Mixed Real Estate and Stock Portfolios

This section explores the risk reduction benefits of combining real estate and common stocks in a portfolio. Thus far, the analysis has focused on portfolios limited to either real estate or common stocks. The equally-weighted portfolio of the real estate assets only and the common stocks only could be combined into a mixed real estate/common stock portfolio. The return and risk of such a portfolio can be calculated using the standard formulas (see Haley and Schall, 1979).

It is now well-known that a major determinant of the risk of a portfolio is the coefficient of correlation between the returns of the assets in the portfolio (see Haley and Schall, 1979). While the coefficient of correlation can range from +1 to -1, negative correlations are rare. The lower the correlation, the greater the diversification benefits from combining two types of assets in a portfolio. As shown in Table 4, for this sample, the coefficient of correlation between GTAs and common stocks is 0.0943. Thus, the benefits of combining real estate and common stocks in a portfolio are quite high.

For example, a portfolio with funds invested one-half in GTAs and one-half in common stocks has one-half of the combined returns of the separate real estate and common stock portfolios, but only one-quarter of the combined risk. For the data used in this study, the variance of the return for a portfolio comprising 50% of the equally-weighted real estate portfolio and 50% of the equally-weighted common stock portfolio is 54.0 X 0.0001 which, of course, is about 25% of the risk of the fully-diversified common stock portfolio of 213.5 X 0.0001. A real estate investor can earn a higher return by investing in common stocks as well. And while the risk of the mixed real estate/common stock portfolio will be higher than the portfolio limited to real estate, the increase in risk will be less than proportional to the increase in return. Hence, depending on individual risk preferences, an investor could easily conclude that the increased return more than compensated for the increased risk. Alternately, the risk of a fully-diversified portfolio of common stocks can be decreased by the addition of real estate assets. The return of the mixed portfolio will also be less than the portfolio limited to common stocks, but the decline in return will be less than proportional to the decline in risk.

Conclusions

This paper investigates the benefits of diversification in real estate portfolios using a macro data base not previously examined. Substantial diversification benefits can be achieved from diversification within a particular region. These results confirm those of earlier studies obtained using entirely different data sets. But contrary to some previous work, substantial benefits from interregional diversification are also indicated.

A combined portfolio of real estate and common stocks has a higher reward to risk ratio than portfolios limited to either real estate or common stocks. For the sample studied here, a portfolio of 50% real estate assets and 50% common stocks has a risk level only 25% of that for a portfolio comprising only common stocks. In a portfolio comprised only of real estate assets, substantial diversification benefits are possible from a careful selection of these assets. Thus, real estate appears to offer common stock investors an effective diversification vehicle.

The authors are equally responsible for the content and remaining errors.

Endnotes

1. The mean area of privately-owned, single family housing requires estimates of missing data for the years 1978, 1979 and 1983. These estimates are made by allocating the U.S. average house size across the regions based upon the 1980-1982 data. For example, the 1978 mean area figure for the NE region is the product of the U.S. average house size for that year and the average ratio of the NE mean area to the U.S. average house size over 19801982. These data are obtained from the U.S. Department of Commerce, Bureau of the Census.
2. Of the six correlations for the Midwest, only those for Chicago/Detroit (-0.8243) and Chicago/Minneapolis (0.8586) are statistically significant and, then, only at the 0.10 level (using a two-tailed test). But the correlation between the returns for Chicago and Detroit is actually

negative. None of the correlations among Boston, New York and Philadelphia are significant at the 0.05 level. In the South, of the 15 correlations, only those for Dallas/Charleston and Dallas/Miami are significant at the 0.05 level. In addition, the correlations for Dallas/Houston and Houston/Washington are significant at the 0.10 level. In the West, of the 10 correlations, only the correlation for San Francisco/San Diego is statistically significant at the 0.05 level.

3. A convenience sample of 72 common stocks available from another study is used. The sample represents a large randomly-selected sample. Elton and Gruber (1977) have shown that the results achieved with a sample of this size closely approximate those obtained with a larger sample.
4. Recall that confidence in the levels of returns for GTAs is less than for variability of returns.

References

1. Burns, W.L. and D.R. Epley, "The Performance of REITs + Stocks." *Journal of Portfolio Management*, Vol. 8, Spring, pp. 37-42, 1982.
2. Elton, E. and M. Gruber, "Risk Reduction and Portfolio size: An Analytical Solution," *Journal of Business*, Vol. 50, October, pp. 415-437, 1977.
3. Evans, E.L. and N. S. Archer, "Diversification and the Reduction of Dispersion: An Empirical Analysis," *Journal of Finance*, Vol. 23, No. 5, pp. 761767, 1968.
4. Fama, E.F, *Foundations of Finance*, Basic Books, 1976.
5. Haley, C.H. and L. D. Schall, *The Theory of Financial Decisions*, 2 ed., McGraw-Hall, 1979.
6. Hartzell, D., J. Hekman and M. Miles, "Diversification Categories in Investment Real Estate.," *AREUEA Journal*, Vol. 14, No. 2, pp. 230-254, 1986.
7. Hill, J.M. and T. Schneeweis, "Diversification and Portfolio Size for Fixed Income Securities," *Journal of Economics and Business*, Vol. 33, Winter, pp. 115-121, 1981.
8. Institute of Real Estate Management, *Income/Expense Analysis: Apartments, Condominiums and Cooperatives*, Yearly, 1979-1984.
9. Lintner, J., "Security Prices, Risk, and Maximal Gains from Diversification," *Journal of Finance*, Vol. 1, 20, No. 5, pp. 587-616, 1965.
10. McEnally, R.W. and C. M. Boardman, "Aspects of Corporate Bond Portfolio Diversification," *Journal of Financial Research*, Vol. 2, No. 1, pp. 27-36, 1979.
11. Miles, M. and T. McCue, "Historic Returns and Institutional Real Estate Portfolios," *AREUEA Journal*, Vol. 10, No. 2, pp. 184-99, 1982.
12. Miles. M. and T. McCue, "Diversification in the Real Estate Portfolio," *Journal of Financial Research*, Vol. 7, No. 1, pp. 57-67, 1984.
13. R. S. Sears and G. L. Trennepohl. Measuring Portfolio Risk in Options. *Journal of Financial and Quantitative Analysis*, Vol. 17, No. 3, pp. 391-409, 1982.
14. U.S. Department of Commerce, Bureau of the Census. Tables: (1) Value of New Construction Put in Place, (2) New Privately Owned Housing Units Authorized by State, (3) Characteristics of New Privately Owned One-Family Houses, and (4) Housing Units-- Characteristics by Square Footage of Floor Space. *Statistical Abstract of the United States*. 1980, 1981, 1982-1983, 19841985.
15. Wagner, W. H. and S. Lau, "The Effect of Diversification on Risk," *Financial Analysts Journal*, Vol. 26, November-December, pp. 2-7, 1971.