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INFLATION, LEVERAGE, VACANCIES, TAXES,

AND RETURNS TO OFFICE BUILDINGS

BY

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GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

INFLATION, LEVERAGE, VACANCIES, TAXES,
AND RETURNS TO OFFICE BUILDINGS

by

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Summary and Conclusions

Prices, yields, and discount rates for real estate investments shift sharply as the rates of expected and actual inflation change. Significant differences exist between the expected performance of buildings bought for cash and those leveraged with loans. How the current high level of vacancies and concessions, as well as pressures from tax reform, will impact future yields and prices depends on how much inflation occurs during the holding period of a property as well as on the degree of leverage.

* When cash flow projections are correct, borrowing on a property will normally increase yields, since risk premiums on mortgages (except for very junior ones) are less than on equities. Potential yields rise rapidly, as do risks when equity falls below 50 percent.

* Leverage multiplies the risks from errors in estimating future revenues. Cash flow problems and defaults become more probable. However, if payments can be met, prospects for high yields remain strong over intermediate periods (those in which rents adjust to replacement costs).

* When inflation is correctly anticipated, nominal (dollar) yields rise and fall with the rate of change in the replacement costs of buildings. In contrast, the pre-tax real rate of return remains constant except for minor variations caused by adjustment lags.

* More significant to investors and a prime advantage of owning leveraged real property is that both nominal and real returns

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fluctuate with unanticipated inflation. High leverage leads to large gains if inflation exceeds expectations, and to large losses if it falls short. Since real estate reacts in the opposite way from most financial assets, it has an important role to play in many portfolios.

* Because, in periods of moderate to strong inflation, the share of operating income in the average yield (internal rate of return) is smaller than that from the gains from resale for five-to-ten-year holding periods, either anticipated or unanticipated inflation lowers the risks of unexpected declines in income due to vacancies or concessions. On the other hand, inflation raises the real cost of taxes somewhat, compared to a non-inflationary situation.

Transformations in the Real Estate Environment

Returns to equity and prices in real estate markets have been buffeted in the past two years by a number of shifts in the important variables that determine values and yields. Proper prices for buildings have become more difficult to determine as past yields become poorer predictors of expected returns. To find proper discount rates for valuing properties, we need to examine in more detail the relationships among leverage, infla-tion, and other variables in order to gain an understanding of how such shifts are likely to influence the future.

From 1978 through 1981, returns to investments in office buildings were spectacular. Yields- unleveraged and without tax benefits--averaged over 21 percent a year, mainly because rent levels rose over 3 years by almost 100 percent. The 1981 amend-

ments to the tax code further increased benefits to high-income taxpayers. As a consequence, syndicators were able to forecast after-tax returns of 30 percent or more based on heavy leverage. They could do this even though they used seemingly conservative assumptions as to rental increases and assumed high mortgage interest rates of 15 percent or more.

A sharply higher level of funds flowing into commercial real estate resulted in overbuilding in many markets and caused office vacancy rates to rise from below 5 percent into the 20-25 percent range by 1986. At the same time, the overall rate of inflation, along with that in construction, slowed dramatically. As a further blow, the Tax Reform Act of 1986 slashed tax benefits for limited partnerships. In contrast, a significant favorable factor has been a sharp decline in market interest rates, including those for mortgages. These various developments raise questions as to whether property prices have fully adjusted to this new climate.

To answer these questions, analysts need a basic understanding of the factors at work and their influence on yields. We examine these issues by use of a simple model of real estate returns. Emphasizing the role of leverage, inflation, nominal versus real interest rates, and taxes, we test in turn the impact of each one on yields.

Discounted Cash Flows in a Non-Inflationary Economy

We consider first the returns to real estate in a non-inflationary economy--one in which prices are stable. Any investment has a value equal to its discounted future cash flows.

This means that the value or selling price depends both on future cash flows and on the discount rate, which is determined by the required investment return or yield for the specific type of property.

$$\text{Value} = \text{Purchase Price (PP}_o) = \sum_{t=1}^{n} \frac{CF_t}{(1+y)^t} + \frac{CF_n}{(1+y)^n} \qquad \text{eq. 1}$$

Cash Flow For real estate, cash flows from both operations (CF_t) and sales (CF_n) are important. The cash flow (CF_t) from operations in a non-leveraged (no loans) situation equals its net operating income (NOI). This consists of potential rent minus vacancies, concessions, and collection losses, and minus operating expenses.

In leveraged situations, equity falls below the purchase price by the amount of the loan. The cash flow from operations (CF_t) equals NOI minus debt service, while that from termination (CF_n) equals the net sales price less the amount needed to repay the outstanding loan. In either case, depending on the tax status of the owner, some of the cash flow may be absorbed by taxes. Prior to the tax reform act, the ability of owners to reduce taxes owed on other income meant that after-tax cash flows could exceed the pre-tax cash flows.

The Yield and Discount Rate In a non-inflationary, non-leveraged, non-taxed situation, the yield (y) on an investment will equal the risk-free real interest rate (r) plus a risk premium (a) to cover the risks from investing in a specific type of real estate. The amount of risk premium depends on the expected variance of returns less any reduction in portfolio risk resulting from a less than perfect correlation of real estate

returns with other parts of the portfolio.

In projecting the expected real interest rate, two uncertainties are paramount:

1. What should the normal risk-free real rate (r) be over a holding period horizon? No one is sure what past period to use in projecting future rates. For the last 24 years, the interest rates on one-year Treasury notes less the rate of change in the Consumer Price Index averaged about 1.75 percent. On the other hand, this average conceals the fact that such real interest rates were negative in the 1970s, whereas they averagedover 6percent for the period 1981-86. I estimate that the risk-free rate now is between 3.5 and 4.0 percent.

2. How much risk premium (a) is required for investors to put their money in commercial real property rather than in risk-free governments? Again, the data are rough because the estimated yields during this period are quite inexact and because the estimates of the risk-free rate contain errors. Nevertheless, I estimate the annual office building risk premium for the period 1979-86 to range around 4.5 percent.

When we add this risk premium totherisk-free rate, 8 percent (y= r + a = 8%) appears to be a logical estimate of the expected non-inflationary (real), non-leveraged, non-taxed annual yield from investments in office buildings. This 8-percent real yield can be thought of as either a 4-percent risk-free rate (r) plus a 4-percent risk premium (a), or the 8 percent may reflect a 3.5-percent risk-free rate plus a 4.5-percent risk premium. (In the period for which data are available, the discount rate for retail stores averaged considerably less than that for office

buildings, while other types, such as hotels and industrial space, required substantially higher yields and discount rates.)

The Effect of Leverage on Yields and Discount Rates To many individuals, a major attribute of real estate investments is the ability to fund a substantial part of an investment with other people's money (one form of leverage). In contrast, property owned by pension funds, insurance companies, and other institutional investors often does not use borrowed funds.

If the debt service is fixed, leverage becomes one of the main causes for cash flows to differ from projections. The mechanism through which leverage affects yields, both in cases where inflation is correctly anticipated and in those where it is not, is important in projecting yields.

Three basic types of leverage exist:

1. Financial leverage (the main type considered in this paper) arises when borrowing fixes the debt service. This causes any movements in net operating income to have a magnified impact on the equity's yield. The smaller the equity, the greater the impact.

2. Operating leverage occurs as a result of differences between the movements of income and expenses. Since successful projects have expenses lower than income, an equal percentage growth of both will increase the NOI and the cash flow to the equity.

3. Tax leverage arises primarily because depreciation deductions reduce taxable income, and such savings are concentrated on the equity. To the extent that the deductions are higher

than actual depreciation, the return to equity is shielded from current taxes.

When future cash flows and yields are projected, the effect of leverage automatically enters into the estimated yields and the price of a property. Equation 2 in the Appendix shows that financial leverage alters yields (and perhaps the price) of a property by increasing the rate of return to the equity through both the operating period cash flow and, if the sales price differs from the purchase price, through the amount received upon sale. The amount by which leverage alters yields depends on the difference between the rate of interest and amortization (the debt service constant) and the overall return on the capital assets (ROR), on the amount of appreciation or depreciation, and on the leverage ratio.

Figure 1 illustrates the fact shown in the discussion of Equation 2 that if the return on assets exceeds the debt constant, the greater the leverage, the higher are operating period returns. Leverage and the return on equity rise as the leverage percentage increases. On the other hand, as the last two columns show, a negative gap between the return on capital and debt service means that leverage reduces yields, again with a multiplied effect that depends on the leverage ratio.

Figure 1. The Effect of Leverage on the Return on Equity from Operating Income
($1,000,000 Purchase Price; $100,000 Annual NOI)[a]

Leverage Ratio	Equity (000)	Return on Capital Assets (ROR)	Positive Leverage (ROR > K)		Negative Leverage (ROR < K)	
			Debt Service Constant (K)	Return on Equity	Debt Service Constant (K)	Return on Equity
0%	$1,000	10%	9%	10.0%	11%	10.0%
25	750	10	9	10.3	11	9.7
50	500	10	9	11.0	11	9.0
80	200	10	9	14.0	11	6.0
90	100	10	9	19.0	11	1.0

[a] An interest-only mortgage is assumed for this example, so the debt service constant K is equal to the mortgage interest rate m (see Equation 2 in the Appendix).

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The first five columns of Figure 2 illustrate the impacts from appreciation and depreciation. Again, the larger the leverage ratio,the greater is the degree of multiplication.The final column shows the combined effects resulting from leverage through changes in both the operating cash flows and that upon sale.

Figure 2. The Effect of Leverage on the Return from Appreciation and the Internal Rate of Return ($1,000,000 Purchase Price; $1,100,000 Sales Price, Five-Year Holding Period)

| Leverage Ratio | Equity | | Percentage Appreciation | | Internal Rate of Return From Operations and Appreciation |
	Down Payment (000)	Cash on Sale (000)	Total	Compounded Per Year	
0%	$1,000	$1,100	10.0%	1.9%	11.6%
25	750	850	13.3	2.5	12.4
50	500	600	20.0	3.7	14.0
80	200	300	50.0	8.4	20.6
90	100	200	100.0	14.9	30.0

<u>Increased Risk</u> Since any changes in cash flows are multiplied by the use of leverage, any errors in projections are multiplied. The variance of actual around expected returns increases. To the extent that investors are risk-averse, this greater variance raises the required risk premium in yields as leverage increases. On the other hand, to the extent that real estate investments attract individuals who are willing to gamble on a large killing, the availability of leverage will not entail a larger risk premium. Furthermore, even conservative investors find leverage worthwhile to the degree that returns from real estate lack correlation with the remainder of their portfolios. If properties are bought to protect against unanticipated inflation, leverage--as we shall see--may increase the degree of

protection.

An unanswered question is how the market sorts out buyers who want to use leverage from those who do not and, similarly, which properties go to those whose incomes are taxed in competition for purchases by tax-free or partially-taxed entities. In an efficient market, competition should sort out the players so that those who can earn the highest returns obtain the properties. Yet, when we examine yields in the market, we find entities with widely divergent degrees of leverage and of tax liabilities buying similar properties.

Several hypotheses can explain the facts. Because information is poor and because analytical ability exerts a major influence, the market is probably not too efficient. Furthermore, firms and entities may have divergent risk-aversions and thus will differ in the risk premiums they require. They also differ in the yields they are willing to accept. Some sorting does occur, however, by size, type, and location of properties, with different types of investors tending to concentrate in specific spheres.

Inflation and Real Estate Returns

A major attraction of real estate investments is that, unlike bonds and common stocks, their nominal yields rise with both anticipated and unanticipated inflation. If the inflation is fully anticipated, real pre-tax yields will remain as projected no matter what the level of inflation. Price-corrected returns are not affected by inflation because buyers, sellers, and lenders correct for the actual inflation. More important, if

inflation is greater than expected, real returns will increase, thus offering a protection against what are unpleasant surprises for most portfolios. Contrariwise, if inflation falls below that anticipated at the time of purchase, real returns will fall.

<u>Correct Anticipation of Inflation</u> Equation 3 in the Appendix shows that the effect of inflation on a non-leveraged, non-taxed investment should result in an equivalent increase in nominal yields, but should not affect real returns. Again with a caveat concerning poor data, this relationship between inflation and nominal and real rates seems to have held. When the inflation rate was 5 percent, the nominal yield on office buildings rose to 13 percent, while an inflation rate of 10 percent brought about nominal returns of 18 percent. In each case, the actual real (inflation-corrected) returns remained at 8 percent.

Equation 4 in the Appendix shows that the basic relationships in a leveraged situation are also not affected by correctly anticipated inflation. Nominal yields alter with the degree of inflation, while real yields remain as projected, provided that the mortgage and equity yields were expected to be equal. To the extent, however, that mortgage and equity yields differ, an increase in the degree of multiplication occurs for real yields.

Figure 3 illustrates how this works. It and the figures that follow compare the rates of return on a typical office building under a variety of assumptions as to inflation and mortgage rates. Rents and expenses are assumed to move with inflation. The figures employ a tax rate of 33 percent under the Tax Reform Act of 1986. The holding period is 10 years except when a

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higher yield can be obtained in less time.

Figure 3. Effect of Leverage and Anticipated Inflation on Yields of a Typical Office Building

Leverage Ratio	0% Anticipated Inflation 6% Mortgage		5% Anticipated Inflation 10% Mortgage		10% Anticipated Inflation 14% Mortgage	
	Yields Untaxed	Yields Taxed	Yields Untaxed	Yields Taxed	Yields Untaxed	Yields Taxed
0%	8.0%	5.5%	13.0%	9.4%	18.0%	13.5%
25	8.7	6.0	13.8	10.2	18.9	14.6
50	9.9	7.0	15.3	11.6	20.5	16.4
80	15.5	11.5	20.2[a]	16.5	25.8[a]	21.0
90	24.3	19.2	26.1[a]	21.1	34.1[a]	26.1

[a] Highest yield reached in less than 10 years.

The first row of Figure 3 shows that with correctly anticipated inflation, the nominal return depends on the rate of inflation. Subtracting the inflation rate, we note that the pre-tax real rate of return remains at 8 percent, irrespective of the inflation rate. However, the after-tax real yield falls. The effect of inflation is to increase the tax burden, causing a decline in the after-tax real return.

If the mortgage and equity were expected to be equal, the same results would hold even under a leveraged situation. However, in this case the return on assets exceeds the mortgage rate. Thus, in columns 2 and 3, the return on assets is 8 percent, and the mortgage interest rate is 6 percent. As a result, each increase in leverage raises both the before- and after-tax yields. The multiplication works slowly as the average rises to 50 percent, but increases rapidly thereafter as the amount of equity decreases sharply.

The remaining columns illustrate situations under more rapid

rates of inflation. Again, both nominal and real yields rise with leverage. Yet the percentage impact of leverage diminishes rather than increases. This seems somewhat surprising, since in Figure 3 (which reflects actual market experience) the mortgage rate does not rise as fast as anticipated inflation. With a larger gap between the return on assets and the mortgage rate, we might expect leverage to have a greater impact. It does not for three reasons: Expected nominal rates are higher, which means that the same absolute gap between return on assets and the mortgage constant is a smaller share of the total return. At higher nominal rates, the future sale is more heavily discounted, resulting in a reduced impact. The negative effect of taxes is greater in real terms at higher rates of inflation.

Moreover, another problem, called "the mortgage tilt problem" arises. Since, with inflation, income rises steadily while the mortgage interest rate is fixed, interest payments typically will be higher than NOI in the earlier periods, while exceeding it in later periods. Furthermore, the equity upon sale will exceed the initial equity. Both of these cause the actual yield, which is constant over the holding period to first fall below and then to exceed typical mortgage payments.

To correct mortgage tilt, credit-enhancement or graduated-payment loans are necessary. Either reserves can be used to meet the early deficit of NOI below interest payments, or some or all of interest payments can be delayed (negative amortization), allowing the payments to be funded by an increase in the out-standing principal. In addition, of course, the lender's receipts can be made to vary directly with the rate of inflation

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by the use of contingent interest or contingent principal payments.

Errors in Projecting Inflation Equations 5 and 6 in the Appendix show why real estate acts as a hedge against unexpected inflation. Both nominal and real returns increase if prices rise faster than anticipated. In contrast, both fall in periods when the rate of inflation drops below that expected. Moreover, while returns in both leveraged and non-leveraged situations are not affected by correctly anticipated inflation, leverage serves to multiply the returns when actual earnings differ from projected ones. The greater the degree of leverage, the higher are the yields that result from unanticipated inflation.

At the time of purchase, prices are based on projected net operating incomes and a projected inflation rate. If actual revenues differ from projections, actual income will also differ, as will actual real yields (y_a).

Real estate is a protection against inflation to the degree that, in equilibrium, rents depend on the level of replacement costs. If demand is expanding, new construction is necessary. Vacancies stop effective rents from rising and may cause them to fall. Rents below the level required to make new construction profitable halt new building. In a growing economy, vacancies will eventually disappear. Rents and selling prices will rise to replacement costs. (The discussion of Table 4 shows that returns depend on the level of vacancies and their duration.) Developers will not build unless they expect a profit. While they need not pay attention to the market and vacancies, if lenders allow

developers to mortgage out--that is, to make a profit from the development process irrespective of operating and sales prices-- developers need not pay attention to the market vacancies. However, at some point lenders will refuse additional loans if vacancies, new rent levels, and property prices bring about defaults.

Unanticipated Inflation

Leverage and unanticipated inflation, acting together, were a major cause of the high returns to real property in the late 1970s and of the high (incorrectly projected) expected returns of the early 1980s.

Figure 4 illustrates the major influence of unanticipated inflation. The center columns, headed 5% actual inflation, repeat information from Figure 3. They project the rate of return expected when the property is bought. If inflation stays at 5 percent, as projected, they are also the actual returns. The table reflects the actual situations in 1978 and 1986. A basic discount rate and expected yield of 13 percent, together with mortgage rates of 10 percent, mirror an expected real rate of return on office building investments of 8 percent and an annual inflation rate of 5 percent. With such market rates, an investor who could obtain 90-percent, fixed-rate financing would project a nominal return of 26 percent before taxes and 21 per- cent after taxes.

Figure 4. Effect of Unanticipated Inflation on Yields (Expected Inflation 5%; Mortgage Rate 10%)

Leverage Ratio	0% Actual Inflation		5% Actual Inflation		10% Actual Inflation	
	Yields Untaxed	Yields Taxed	Yields Untaxed	Yields Taxed	Yields Untaxed	Yields Taxed
0%	8.1%	5.5%	13.0%	9.4%	18.1%	13.6%
25	7.4	5.1	13.8	10.2	19.9	15.3
50	6.1	4.3	15.3	11.6	23.2[a]	18.2
80	(0.3)	(0.2)	20.2[a]	16.5	35.5[a]	27.9[a]
90	(36.7)[a]	(17.5)	26.1[a]	21.1	49.1[a]	39.8[a]

[a] Highest yield reached in less than 10 years.

But what if inflation is not correctly projected? The final two columns show how returns would be increased if inflation were actually 10 percent. As we have seen, the unleveraged rate of return remains approximately constant in real terms, with nominal yields rising at the rate of inflation.

With unanticipated inflation, moreover, leverage becomes far more valuable. As Equation 6 shows, the effects of having large fixed costs from the debt service multiply rapidly. This is illustrated in the final two columns of Figure 4. At 90-percent leverage, the real rate of return rises from 8.1 to 39.1 percent, or by 380 percent. The type of change pictured reflects the actual events between 1978 and 1980-81. The rate of inflation rose from an expected 5 percent to an actual 10 percent. The basic discount rate rose to 18 percent. Investors who had fixed-rate mortgages saw the value of their properties shoot upward. The greater the leverage, the better off they were.

However, unanticipated changes in the rate of inflation are not always positive. Columns 2 and 3 of Figure 4 reflect an unexpected drop in the rate of inflation. Again, the real returns on unleveraged properties do not change. Nominal

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returns, income, and values fall by the decline in the inflation rate. But see what happens to those borrowers stuck with leverage and fixed-rate mortgages based on a higher expected inflation rate. They now experience large losses.

Furthermore, unanticipated changes in inflation greatly increase the variances of returns. Leverage improves the amount of protection against inflation, but it can also lead to large losses if the rate of inflation declines faster than expected.

Inflation and Replacement Costs

While we speak of real estate as a protection against general inflation, this holds true only to the extent that inflation and building replacement costs move in tandem. How close is this relationship? Figure 5 plots the year-to-year percentage changes in an index of general inflation and in the cost of constructing nonresidential structures. (Both are based on the GNP implicit price indexes, with a base of 1982 equal to 100.) We note from this figure that over the past 25 years the price index for nonresidential structures has increased at a somewhat faster pace than have prices in general. The annual average rate of construction inflation over the period was 5.8 percent, compared to 5.3 percent for prices as a whole.

Figure 5. Inflation in the General Price Level and for Nonresidential Structures, 1960-85 (1982 = 100)
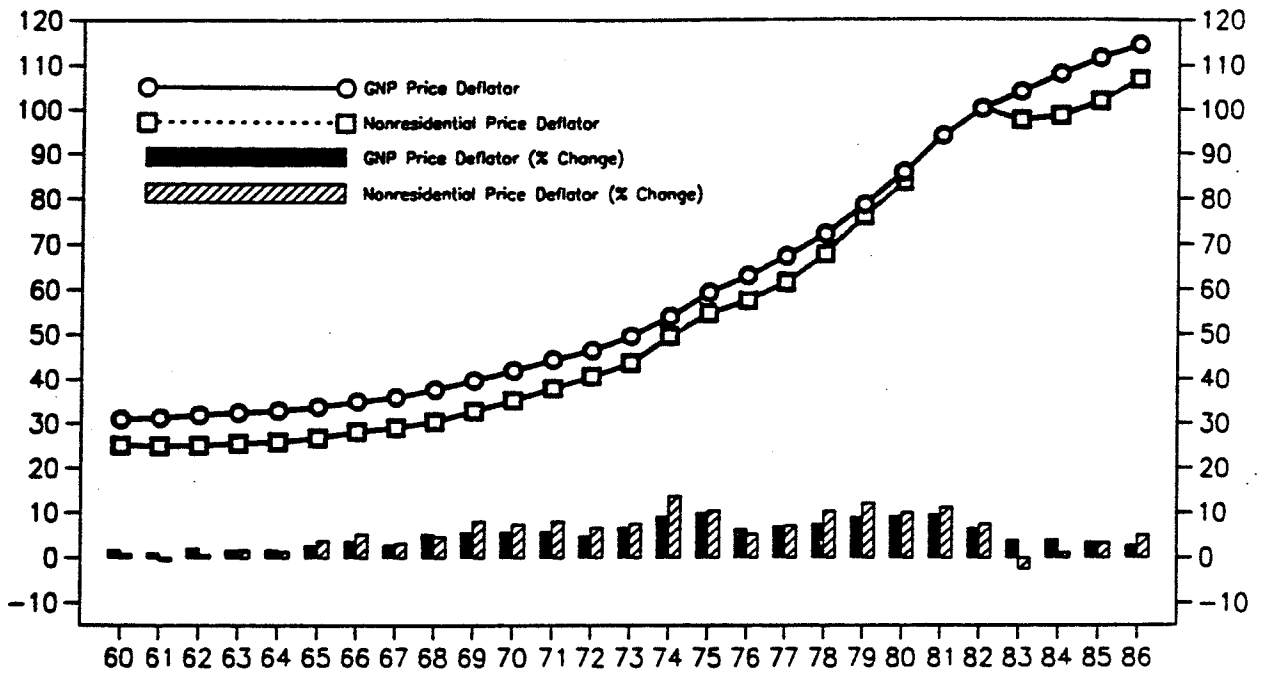
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

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[5] See Equation 6 in the Appendix.

Examining the year-to-year movements, we see that most of this difference occurred between 1969 and 1975. Excluding this period, the average change in the general and nonresidential price levels differed by less than a third of a percent, which is well within the margin of error of the data. However, variations are not random. Building costs seem to experience a run of excesses or shortfalls, since demand adjusts only over periods of 3 to 5 years.

This close resemblance of general inflation to inflation in building is not surprising. Differences arise either because of much heavier weights of some factors subject to extra inflation-

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ary pressures (such as oil and interest rates) or because productivity grows at a very different pace. While the possibility that building prices vary from the average both because of these factors and because land is limited has been debated for over 50 years, the best conclusion seems to be the Scotch verdict of "not proven." Figure 5 shows a close relationship since 1960.

When predicting price changes for a 10-year horizon, as is common in most real estate projections, no strong reasons exist for not using the more readily available market projections of general inflation as an estimate of what will happen to real estate prices. Of course, such uses must be tested carefully and adjustments made if recent trends in real estate demand and prices have varied greatly from those of the overall economy.

Taxes

The tax system has been of great significance to individual investors in real estate. Prior to the Tax Reform Act of 1986, high depreciation deductions, the ability to take tax advantage of non-recourse loans, the capital gains exclusion, and the right to reduce taxable income from other sources by paper losses meant that the after-tax rate of return on heavily leveraged properties was somewhat higher than the before-tax yields. The ability to postpone taxes to a later period and then be taxed at the lower capital gains rate meant that taxes had a positive--not negative-- impact on yields. Even so, pension funds, foreigners, and other tax-exempt entities were able to compete in the market with the tax-assisted individuals. Much of the apparent tax advantages actually reflected high levels of leverage accompanied by high

risks.

As Figures 3 and 4 bring out, the Tax Reform Act removed most of these advantages. The tables show that in the specific cases examined in this paper, when the marginal rate is assumed to be 33 percent, the effective tax rate causes yields to decline by from 20 to 30 percent compared to those under the previous act. This means that investments in real estate retain some tax advantages, but they are considerably reduced compared with the previous tax advantaged situation.

Vacancies and Rent Concessions

With high vacancies and rent concessions lowering current revenues, a great deal of concern has been expressed over the impact on yields of such losses in revenues. Two different problems are involved. The first is cash flow. Highly leveraged properties are unlikely to be able to meet debt payments if net operating income falls as much as 20 or 30 percent below projections. Few properties in recent years have met the 1.25 debt coverage ratio that was once considered normal. The possibility of such shortfalls requires adequate reserves or other forms of credit enhancement.

A second issue is the one addressed in the tables. If owners have enough other resources to meet a cash flow deficit and if losses from vacancies and concessions are moderately large, what will be the effect of the interim losses on final returns after the market has returned to equilibrium?

Comparing Figure 6 with Figure 3 gives one measure of these impacts. The data in the tables use the same building, tax,

correctly anticipated inflation, and leverage assumptions, but assume that 20 percent of revenues are lost during each of the first 5 years. At that point, the market returns to equilibrium. Rents and the final selling price depend on the replacement cost of the property. Costs go up according to the rate of general inflation.

	0% Inflation		5% Inflation		10% Inflation	
Leverage Ratio	Yields Untaxed	Yields Taxed	Yields Untaxed	Yields Taxed	Yields Untaxed	Yields Taxed
0%	7.0%	4.8%	11.9%	8.6%	16.8%	12.7%
25	7.3	5.1	12.4	9.2	17.5	13.5
50	7.8	5.6	13.3	10.2	18.5	14.8
80	10.2	7.7	16.2	12.8	22.7	18.1
90	13.4	10.6	20.4	16.1	28.1	22.1

Figure 6. Effect of 20% Vacancy and Concessions for the First 5 Years on Yields

The results are not surprising. A comparison of Figures 3 and 6 shows that, in the unleveraged situation, yields drop by only 100 to 130 basis points. As leverage increases, however, the fall in yields becomes somewhat larger. The largest decline in yields is an absolute drop of 10.9, or 45 percent in the zero-inflation, 90-percent mortgage case. The greater the expected inflation, the smaller is the decline. Thus, at 10-percent inflation with a 90-percent mortgage, yields stay at 28.1 percent (down from 34.1 percent). The smaller the amount of leverage, the less is the percentage decline. The tables simply illustrate the fact that if we believe that in a dynamic economy rents must return to an equilibrium based on replacement costs, then yields will be dominated by the rate at which replacement costs change.

The actual yield for any financing arrangement depends on the risk-free real interest rate, the risk premium, the rate of

change in replacement costs, and the leverage multiplier.   Only
if inflation is low and leverage high do interim vacancies and
concessions have much impact on yields.

The Model

The analysis and tables in this report are based on a standard deterministic cash flow model of an office building similar to that typically employed by real estate industry analysts.

Equation 1: No inflation, leverage, or taxes

$$\text{Value} = \text{Purchase Price } (PP_o) = \sum_{t=1}^{n} \frac{CF_t}{(1+y)^t} + \frac{CF_n}{(1+y)^n} \quad \text{eq. 1}$$

Where: CF_t (operating period cash flow) equals the cash flow in each period based on:

Gross potential rent (space times rent level)

(minus) vacancies

(minus) concessions and collection losses

equals effective gross income

(minus) expenses less escalations

equals net operating income (NOI)

CF_n (Cash flow on sale) equals the;

Sales price (SP_n)

(minus) selling costs

equals net sales price

where the sales price is the end-of-period NOI capitalized at some capitalization rate close to the initial one.

and y the yield or internal rate of return equals the risk-free real interest rate (r) plus a risk premium (a) based on the risk of the individual investment in a market portfolio.

In equilibrium, the selling price will equal the value--which depends on the projected cash flow from operations and sale discounted by the yield required by investors in investments of similar risks.

Equation 2: Leverage: no inflation or taxes

In a leveraged purchase, the equity (E) will be less than the selling price by the amount (M) of any mortgage. The cash flow from operations (NOI - mM) will fall short of the unleveraged cash flow by the amount of the mortgage times the mortgage interest rate (m). (Assume an interest-only loan with a balloon.) The cash flow from the sale will fall short of the selling price by the need to repay the mortgage. The yield on the equity in a leveraged sale (y_L) will exceed that of one without leverage (y), depending on the amount by which the expected yield exceeds the mortgage interest rate (or $y_L > y$ if $m < y$) and on the amount of leverage. If $m > y$, negative leverage will result.

$$E = PP_o - M = \sum_{t=1}^{n} \frac{CF_t - mM}{(1+y_L)^t} + \frac{CF_n - M}{(1+y_L)^n}$$

Comparing Equations 1 and 2 for one period, we find that:

$$y = \frac{CF_t + CF_n - PP_o}{E} \quad .$$

When $E = PP_o = CF_n$,

$$\text{then } y = \frac{CF_t}{E} \quad . \qquad\qquad\qquad\qquad \text{eq. 2}$$

Furthermore, $y_L = \dfrac{CF_t + CF_n - M - E_L}{E_L} - \dfrac{mM}{E_L}$.

When $E_L = PP_o - M$ and $CF_n = PP_o$

$$\text{then } y_L = \frac{CF_t - mM}{E_L} \quad \text{and } y_L - y = \frac{M}{E_L} (y - m).$$

Figure 1 shows an example of positive and negative leverage. The leveraged yield will exceed the non-leveraged, depending on

the degree to which the yield on assets exceeds the mortgage interest rate and on the amount of leverage. Since the leveraged yield will be subject to more variance (increasing or decreasing at a multiplied rate with each change in net operating income, some or all of the difference in yields will reflect the necessary changes in the risk premium.

If the expected yield is not correctly penalized for the amount of risk, it will be smaller than the discount rate that should be expected by the market. Capitalizing the projected cash flows by a smaller required yield will result in a higher estimated value and selling price. In the market of the period 1982-1985, syndicators seem to have offered higher prices for leveraged office buildings than other market participants. These higher prices either could have reflected a failure to include a sufficient risk premium, particularly as leverage increased, or they could have partially reflected actual tax advantages of this form of ownership. In any case, it appears to have been a significant cause of overbuilding and inflated prices in many markets.

Equation 3: Correctly anticipated inflation: no leverage or taxes

In a correctly anticipated inflation, net operating income, the final sales price, and the required yield will all be increased by the projected rate of inflation ($\dot{p}e$) under the assumption that operating cash flow increases at the rate of inflation.

$$PP_0 = \sum_{t=1}^{n} \frac{CF_t(1+\dot{p}^e)^t}{(1+y)^t(1+\dot{p}^e)^t} + \frac{CF_n(1+\dot{p}^e)^n}{(1+y)^n(1+\dot{p}^e)^n} \qquad \text{eq. 3}$$

The nominal yield will be $y + \dot{p}e$, or the real yield (y) plus the expected rate of inflation ($\dot{p}e$) (neglecting the small cross-product term). Since all of the $(1 + \dot{p}e)$ cancel out, the initial selling price and the expected real yield (y) are identical to Equation 1.

Equation 4: Leverage: correctly anticipated inflation: no taxes

In a correctly anticipated inflation, the effect of leverage is to raise the nominal yield by the amount of inflation. This will occur on the assumption that the lender also correctly anticipates inflation and, therefore, that the lender's nominal return ($m + \dot{p}t$) includes an inflation premium sufficient to insure that inflation does not reduce the lender's real rate of return.

The equation for the real rate of yield is:

$$E_L = \sum_{t=1}^{n} \frac{CF_t(1+\dot{p}^e)^t - iM}{(1+y_L)^t(1+\dot{p}^e)^t} + \frac{CF_n(1+\dot{p}^e)^n - M}{(1+y_L)^n(1+\dot{p}^e)^n} \qquad \text{eq. 4}$$

when the amount of the mortgage is M and the nominal interest rate is $i = m + \dot{p}e$. If the real interest rate on the mortgage is equal to the real yield on equity and the nominal mortgage interest rate fully reflects the rate of inflation, real yields

are not affected by correctly anticipated inflation. However, if mortgage rates are lower than leveraged yields, inflation will increase real yields to some extent.

Equation 5: Errors in the projection of inflation: no leverage or taxes

No one expects that market projections of inflation over the next ten years will be exactly correct. The actual rate of inflation will differ from the anticipated rate by some error, either positive or negative.

Actual inflation = $\dot{p} = \dot{p}e \pm b$ and

$$PP_o = \sum_{t=1}^{n} \frac{CF_t(1+\dot{p})^t}{(1+y)^t (1+\dot{p})^t} + \frac{CF_n (1+\dot{p})^n}{(1+y)^n (1+\dot{p})^n} \quad \text{eq. 5}$$

The actual real yield will differ from that projected because, at the time of investment, the price and the expected yield are set on the basis of the anticipated inflation. If the rate of inflation is higher than anticipated, $(1 + \dot{p})$ will exceed $(1 + \dot{p}e)$, and the cash flows in the numerators of Equation 5 will be higher than projected. As a result the actual yield (y_a) will also rise, since the selling price has already been paid for the property. In contrast, if inflation is less than expected, the actual yield will fall below expected yields.

Equation 6: Errors in the projection of inflation, with leverage; no taxes

With a fixed-rate mortgage, all plus or minus errors in the projection of inflation accrue to the equity owner. The larger the amount of leverage, the larger is the resulting variation from projections. Combining Equations 3 and 4, we have:

$$E_L = \sum_{t=1}^{n} \frac{CF_t(1+\dot{p})^t - iM}{(1+y_L)^t (1+\dot{p})^t} + \frac{CF_n(1+\dot{p})^n - M}{(1+y_L)^n (1+\dot{p})^n} \qquad \text{eq. 6}$$

Again with an error of b, as in Equation 3, since the mortgage payments are constant and the cash flow increases by the full amount of inflation, the change in the yield (YaL) varies either directly or negatively with the amount of leverage, but by a multiplier that depends on the amount of leverage.

Equation 7: Adding in taxes

Under the Tax Reform Act of 1986, the after-tax yield on real estate held for rental purposes will be lower than the pre-tax yield. This contrasts with the pre-reform era under which after-tax income could be higher than before-tax income because tax losses could reduce other taxable income.

Since depreciation deductions for tax purposes are still probably larger than actual depreciation, real estate retains some tax advantage. With an optimum level of leverage, no current taxes need be paid on income, but a capital gains tax must be paid on the difference between the net selling price and the adjusted basis. In effect, taxes are delayed until the time of sale. The effective tax rate is the discounted present value of the future tax payment. This present value will be less than if taxes were paid currently. Assume that the depreciation allowance (d) is just sufficient to offset all taxes; that any losses can be carried forward and used to offset future income or

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a gain in sales, and that the tax rate is t. Then, the selling price or value of a property will be:

$$PP_0 = \sum_{t=1}^{n} \frac{CF_t}{(1+y)^t} + \frac{CF_n - (CF_n - PP_0 + nd)T}{(1+y)^n}$$

This will be larger than that shown below

$$PP_0 = \sum_{t=1}^{n} \frac{CF_t}{(1+y)^t} + \frac{CF_n - (CF_n - PP_0)T}{(1+y)^n} \qquad \text{eq. 7}$$

Equation 8: The effect of vacancies and concessions

Any increase in vacancies and concessions (V) during the operating period will reduce the cash flow from operations. A critical assumption, as discussed in the body of this paper, is the degree to which these vacancies will influence the sales price. If one believes that the market will return to equilibrium before the time of sale, the vacancies will not affect the final selling price. If this is true, the impact of V on the yield depends on how much of the yield comes from operations and how much from any change in the selling price above the initial price.

$$PP_0 = \sum_{t=1}^{n} \frac{(CF-V)_t}{(1+y)^t} + \frac{CF_n}{(1+y)^n} \qquad \text{eq. 8}$$