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UNDERSTANDING COMMERCIAL REAL ESTATE: JUST HOW DIFFERENT FROM HOUSING IS IT?

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Understanding Commercial Real Estate: Just How Different from Housing Is It?
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ABSTRACT

Recent sharp declines in owner-occupied housing prices naturally raise the question of whether something similar will happen to income-producing properties. It already has based on the nearly 60% decline in the share prices of publicly-traded, commercial property firms from their peak in early 2007. The core model of spatial equilibrium in urban economics suggests this should not be a surprise, as it shows that both real estate sectors are driven by common fundamentals, which should make them perform similarly. On the other hand, stronger limits to arbitrage in housing suggest wider swings in prices unrelated to fundamentals are feasible in that property sector. The data find many more similarities than differences across the two real estate sectors. The simple correlation between appreciation rates on owner-occupied housing and commercial real estate is nearly 40%. Both sectors also exhibit similar time series patterns in their price appreciation, with there being persistence across individual years and mean reversion over longer periods.

Commercial real estate capital structure looks to be quite weak due to high leverage combined with strong mean reversion in prices. The aggregate loan-to-value ratio on income-producing properties is about 75%. Estimated mean reversion in price appreciation of at least 25% over relatively short horizons suggests that normal change from the recent peak will leave little or no equity on average to cushion against any future negative shocks.

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I. Introduction

The dramatic and unprecedented 18% decline in nominal house prices over the past year for 20 major markets tracked by the S&P/Case-Shiller Home Price Indices[1], with futures markets predicting similarly large drops in 2009, naturally raises the question of whether commercial, or income-producing, real estate will follow a similar path. Public commercial property firms already have traded down sharply according to the National Association of Real Estate Investment Trusts' (NAREIT) index for such firms, as reflected in the 20-30% implied decline in the values of their property holdings from their peak in February of 2007.[2] Privately-held commercial properties have only recently begun to reprice down according to the National Council of Real Estate of Investment Fiduciaries (NCREIF) index for that subset of the income-producing sector, but past research suggests that there is more to come, as the public market reliably leads the private market in commercial real estate over the cycle (Gyourko and Keim (1992); Gyourko (2005)).

The large size of the commercial property markets combined with their high financial leverage makes their study important, especially given current weakness in the financial sector. One prominent industry source estimates that the investable universe of investment grade properties was nearly $4.8 trillion early in 2008, with about $3.6 trillion encumbered by debt of some type.[3] Most income-producing properties are held privately, as equity REITs constitute

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[1] See the December 30, 2008, press release at http://www2.standardandpoors.com/spf/pdf/index/CSHomePrice_Release_123062.pdf.

[2] Firm returns fell by nearly 60%, but the 40%-50% leverage typical of this part of the industry implies that underlying property values declined by about half that amount. These figures apply only to equity REITs that own and operate income-producing properties.

[3] See the Urban Land Institute's *Emerging Trends in Real Estate 2009* publication, Exhibit 2-8, p. 21. The terms commercial and income-producing real estate are used interchangeably throughout this paper. To be income-producing, the property cannot be owner-occupied, but must be rented out to tenants. 'Institutional grade' is not a precisely defined term, but the publishers of this particular report intend it to cover high quality properties in major markets. Thus, this figure excludes various lower quality, often smaller properties, and those in smaller markets that are relatively illiquid by real estate industry standards. However, it does include debt and equity capital for

less than one-third of the overall equity investment in commercial real estate. The REIT sector also is less highly leveraged, typically having no more than a 1-to-1 debt-to-equity ratio (prior to the recent sharp drop in share prices). Thus, the aggregate loan-to-value (LTV) ratio of 75% (~$3.6/$4.8) for commercial real estate indicates that leverage is even greater for privately-held properties. This far exceeds the analogous 55% figure in the owner-occupied housing market[4], so that value drops of the magnitude already seen in the owner-occupied housing and equity REIT markets would wipe out most or all commercial real estate equity on average, leaving no cushion against any future adverse shocks.

This paper investigates just how similar or different we should expect outcomes in owner-occupied housing and income-producing real estate to be. The analysis begins by examining what urban economic theory and the bubbles literature in asset pricing have to say on the issue. The data are then explored to see how outcomes vary across the housing and commercial property sectors over time and by metropolitan areas. Various risk characteristics of income-producing properties also are documented and discussed.

The standard spatial equilibrium model in urban economics predicts similar longer-run movements in the different real estate sectors because each is driven by common fundamentals (Rosen (1979); Roback (1982)). However, the more stringent limits to arbitrage that exist in the housing market seem to permit the possibility of swings in prices that are disconnected from

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apartments because those units are rented out, and thus, are income-producing in the same sense that office or mall space is. Owner-occupied housing is not included, just as owner-occupied office buildings and manufacturing facilities are not. This is why this $4.8 trillion figure is much smaller than the amount of real estate on the balance sheets of non-farm, nonfinancial corporate and noncorporate businesses. According to the Federal Reserve Board's Flow of Funds Accounts for the third quarter of 2008, there was $8.9 trillion of real estate owned by nonfarm, noncorporate businesses, with another $7.0 trillion on the balance sheet of nonfarm, noncorporate entities. [See the December 11, 2008, release of the Flow of Funds Accounts of the United States at http://www.federalreserve.gov/releases/z1/Current/z1r-5.pdf.] Much of this property is owner-occupied.

[4] The ratio for homeowners was only 45% in 2002, so housing-related leverage recently has risen substantially in the household sector as mortgage debt expanded and home values then dropped. See the data in Table B.100 Balance Sheet of Households and Nonprofit Organizations from the December 11, 2008, Federal Flow of Funds statement, which is accessible at http://www.federalreserve.gov/releases/z1/Current/z1r-5.pdf.

fundamentals (Glaeser and Gyourko (forthcoming)). This could break the link from common demand fundamentals and allow market outcomes to diverge.

Examining the data finds many more similarities than differences in how these sectors behave over time. Using annual data since 1978, the simple correlation between the appreciation rates for income-producing property and housing is nearly 40%. During the recent boom period, the greater the rise in the ratio of house prices to their construction costs in a given metropolitan area, the larger was the rise in the analogous ratio for office buildings. The limits to arbitrage well may be less severe in commercial real estate, but the use of common production technologies and factors of production such as land and capital probably makes it difficult to prevent pricing in one property sector from influencing values in another within the same market area.

Both housing and commercial real estate have long, multi-year cycles, although the latter's is much more volatile. The time series properties of price changes in the commercial property sector also are quite similar to those previously reported for owner-occupied housing. There is persistence in price appreciation over short times periods, so that growth begets growth (and decline begets decline) from year-to-year in commercial properties, just as Case and Shiller (1989) documented for housing. However, there is substantial mean reversion over longer horizons that is similar to what Glaeser and Gyourko (2006) report for housing. Results reported below indicate that for every percentage point more that income-producing properties appreciated over the past three years, they will decline by 0.27 points over the next three years (always relative to national conditions and local market trend).

It also is noteworthy how risky commercial real estate appears to be as the general economy continues to decline. More than half of the rise in commercial property prices in the markets that boomed the most is due to an increase in the multiple investors placed on a given dollar of net rents, not rising cash flows themselves. That lenders, not just investors, became more enthusiastic about the commercial property sector is evidenced by the deterioration in underwriting standards evident at the height of the boom. Requirements for commercial owners to amortize their loans weakened considerably in recent years. And, the proliferation of 'pro forma loans' in which hoped for, prospective rent increases were credited as if they were certainties indicate that the belief that prices only could go up was not restricted to the subprime and Alt-A home loan markets.

Examination of office building transactions since 2003 for a sample of over 30 large metropolitan areas finds that prices have risen sharply relative to fundamental production costs in about one-third of them. This group includes many of the southern and sunbelt markets such as Las Vegas, Miami, Phoenix, and Tampa that experienced the greatest housing booms, and which are now busting. It also contains the most restrictive markets in terms of building regulation such as Boston, New York City, and San Francisco. While these places where prices have discretely diverged from production costs in a short period of time are natural candidates for repricing, no firm conclusions about irrational exuberance can be reached regarding America's major office markets. No tests for bubbles are performed, nor could they be with the limited data available (Flood and Hodrick (1990)). Urban economics suggests that some restrictive change in supply conditions or heightened productivity (or amenities) is needed to justify the larger gaps between prices and construction costs in these markets. Absent such changes, prices in these markets should be expected to fall.

Even without any irrational exuberance or the added risk of a serious general recession, the magnitude of mean reversion, the extraordinary nature of the recent boom, and the high financial leverage used in the commercial property sector would be cause for concern. The potential threat this combination could pose to the soundness of the banking system only reinforces the importance of increasing our understanding of the nature of the commercial property market cycles.

The plan of the paper is as follows. The next section discusses the underlying economic intuition about why commercial real estate and housing should or should not move together. Section III then begins the empirical analysis, starting with basic documentation of the data and the nature of commercial real estate cycles. This is followed in Section IV with an examination of predictability in commercial property markets, which documents the short-run persistence and medium-term mean reversion noted above. Section V then examines the role of local market versus common effects in explaining returns and price changes. Section VI then documents and analyzes a host of risk factors specific to the commercial property markets. There is a brief conclusion.

II. Should Housing and Commercial Real Estate Move Together?

The core model of spatial equilibrium in urban economics indicates that the fundamental sources of demand for both housing and commercial real estate are quite similar. In this compensating differential framework introduced by Sherwin Rosen and Jennifer Roback nearly three decades ago, land prices are the entry fee that households and firms must pay to access the productivity and amenities of a labor market area. Higher land values have to be paid to enter a metropolitan area with more productive firm clusters or nicer weather. Because land is substitutable on the margin between uses, the prices of both residential and commercial property will move together if local productivity or the amenity set changes. The essential insights of this model have been confirmed in numerous studies of price and wage differences across metropolitan areas.[5]

One counter to this equilibrium view is that features of the housing market in particular make it more likely for its prices to become disconnected from fundamentals. If so, the link between common urban fundamentals and performance across the two property sectors could be cut. The bubbles literature in asset pricing suggests markets are more prone to wide swings in prices not justified by fundamentals the higher are transactions costs and the harder it is to short sell (e.g., DeLong, et. al. (1990), Barberis, et. al. (2001); Hong, et. al. (2006, 2008)). Both are well-known features of real estate markets, and of owner-occupied housing in particular. The costs of directly exchanging a single-family home or any type of commercial property between two parties are very high compared to most other assets--at least 6%. However, fractional interests in pools of commercial properties can be cheaply transacted in the publicly-traded equity REIT market. And, trading in owner-occupied homes is done only infrequently by amateurs who must reside in their home if they are to sell it.[6] As for shorting, it was virtually impossible to do in single family housing until quite recently. Shorting commercial real estate is not easy either, but it can be done more readily via the public markets with equity REITs.[7]

Glaeser and Gyourko (forthcoming) argue that the limits to arbitrage are weak enough in housing so that even highly-skilled professional traders would have difficulty precisely pinning down the appropriate price for housing at any given point in time. Their argument, based on

[5] See Gyourko, Kahn and Tracy (1999) for a review and summary of the empirical work in this area.

[6] This abstracts from the issue of speculators who never intended to occupy the home, which could be quite relevant in today's market.

[7] It remains very difficult to short housing even after the advent of the S&P/Case-Shiller Home Price Index futures. Trading volume in those instruments is very light. One reason well may be that homeowners already are hedged (Sinai and Souleles (2005)), but that important debate is outside the scope of this paper. It is also noteworthy that shorting via the equity REIT market is more costly than normal because of the high dividend yield on those shares. Relatively high dividends are characteristic of REITs because of tax law that requires those firms to pay out most of their GAAP earnings in return for avoiding the corporate income tax.

analysis of the precision of the widely-used user cost of housing demand framework, rests on there being substantial uncertainty about the true values of a number of components of the user cost of owner-occupancy.[8] They maintain that modest changes in the values of maintenance costs, depreciation, and expected appreciation can alter user costs, and thereby predicted prices, by at least one-third.

In addition, the option to delay or accelerate purchase (or sale) of an asset to exploit temporary price deviations from fundamentals, which narrows rational pricing bounds in most markets (Shleifer and Vishny (1997)), are not fully operational in the owner-occupied housing market. Unlike a single stock, owner-occupied housing is such a large component of most households' wealth that risk neutrality cannot be presumed. Risk aversion and high price volatility in housing markets can combine to make it very risky to delay purchase decisions by renters especially, even if they believe prices will fall in the next year. Essentially, annual price volatility in many markets is high enough that even a modest degree of risk aversion will lead non-wealthy renters not to delay purchases.[9]

This not to imply that there are no limits to arbitrage in commercial real estate markets, but that they are less strong. The most obvious difference is that trading is done by professional investors who do not have to occupy buildings in order to buy and sell them. Rent on comparable buildings also has clearer meaning for investors in income-producing properties.

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[8] The user cost model is a financially-oriented one that relies on the implications either of there being no net benefit to owning versus renting on the margin or of there being no net benefit to being an investor/landlord versus an owner-occupier. Poterba (1984) is credited with introducing this framework into mainstream economics. At its simplest, this approach leads to the following equation which defines the price-to-rent ratio as a function of the various components of the user cost of occupying one's home for one period: $P(t)/R(t) = 1/[(1-\tau)(r+\rho) + \delta - \alpha]$, where $P(t)$ represents house price in period t, $R(t)$ reflects rent that same period, τ is the marginal income tax rate, ρ is the property tax rate, r is the relevant interest rate, δ reflects true maintenance and depreciation on the home, and α is the expected home price appreciation rate. The precision with which prices can be predicted obviously depends upon the accuracy with which one knows the values of R, τ, ρ, δ, and α, along with there being no unobserved factors that materially affect the user cost.

[9] See Glaeser and Gyourko (forthcoming) for more detail.

Because there is no deep rental market in single family detached housing, the comparable buildings used to measure rents tend to be apartments. The residential rental stock tends to be comprised of denser multifamily units that are more likely to be located in the central city of a metropolitan area. And, they are occupied by lower income households, so their demand can be quite different from that of owner-occupied housing. None of these distinctions really applies to the commercial sector, which makes valuation more straightforward.

It is no easier to accurately measure true economic depreciation or predict likely appreciation rates on commercial buildings than it is for owner-occupied housing, so not everything argues for tighter arbitrage bounds in this sector. In addition, there probably is more quality variation among office buildings or shopping centers than there is among single family homes, which would make it harder to evaluate the former. However, it seems reasonable to presume risk neutrality among the many large multi-billion dollar professional investment firms that now exist in the commercial real estate industry. In the absence of risk aversion, one would expect deviations from fundamentals to be corrected pretty quickly, as large investors who believe they can predict the direction of prices in the short-run, delay or accelerate purchase or sale decisions to take advantage of perceived price discrepancies.[10]

Whether stark differences in the limits to arbitrage trump the influence of common fundamentals at the heart of the Rosen-Roback model is an empirical question, so we next turn to the data to see whether the commercial property sector tends to perform in a fundamentally different way from the housing sector.

III. Commercial Real Estate Data: Cycles and Correlation with the Housing Market

[10] If one compares commercial real estate to other industries, the arbitrage bounds also seem relatively tight. For example, there is little rapid technological change of the type that can make it very hard to evaluate firms in information technology and other rapidly changing business sectors.

Research on income-producing property markets is challenging because of a relative paucity of high quality data. The federal government spends significant resources to monitor housing values and housing market conditions, producing widely used data sets such as the constant quality house price series reported by Office of Federal Housing Enterprise Oversight repeat sales price index.[11] However, it does not publish analogous series on the commercial property sector. Thus, we turn to private sector sources of data.

One is the public markets, where numerous listed companies trade daily. Most public companies that own and operate income-producing real estate are organized as trusts and are referred to as equity real estate investment trusts (REITs). The equity REIT market dates back to the early 1960s, but the entire market capitalization of the sector was under $7 billion until the early 1990s, so it is only over the last 15-20 years that this market is thought to be a reasonable proxy for what is happening in commercial property markets. This paper uses data on the prices and returns of an index of equity REITs compiled by NAREIT.[12]

The National Council of Real Estate Investment Fiduciaries (NCREIF) produces the other major income-producing real estate index.[13] The NCREIF series reflects the returns on and values of properties owned in the private markets, primarily by or for institutional investors. As of the third quarter of 2008, this index was comprised of 6,255 properties with an appraised value of $332 billion. One important difference between these series is that the NCREIF returns are computed on an unleveraged basis (i.e., it is as if the properties were acquired with cash). Equity REITs have had an average debt-to-equity ratio of about 1-to-1 over the long run, and

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[11] These data are available at the following URL: http://www.ofheo.gov/hpi_download.aspx.
[12] The data may be downloaded at the following URL: http://www.reit.com/IndustryDataPerformance/FTSENAREITUSRealEstateIndexHistoricalValu/tabid/78/Default.aspx.
[13] A third source is the S&P/GRA Commercial Real Estate Indices, which report values for sets of commercial properties by property sector and region. These indexes were recently discontinued, so we do not exploit them here, as no updating will be possible. However, they do contain data from 1993-2008 for those interested in other sources of income-producing property valuations.

leverage has magnified the variation in returns over this time period. Another important difference is that the NCREIF properties are determined by appraisals, which typically occur only once a year.

The top panel of Table 1 reports simple correlations in real annual appreciation rates across the three series beginning in 1978, which marks the first year of the NCREIF data.[14] House price appreciation is most strongly correlated with the growth in the NCREIF capital value series, but the correlation with appreciation in NAREIT share prices also is positive. That the two income-producing property series are slightly negatively correlated with one another is well known and is due to the fact that the NCREIF properties are appraised infrequently, while changes in market fundamentals are immediately reflected in the stock market valuations of equity REITs. That NCREIF prices are 'stale' suggests that the NAREIT series leads NCREIF, which has been confirmed in previous research (Gyourko and Keim (1992); Gyourko (2005)). That is, the two commercial property series are positively correlated, just not contemporaneously due to differences in the frequency with which prices are measured.[15]

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[14] Both commercial property series track capital values, not total returns, because the appropriate comparison with housing involves capital values, as the implicit rent on owner-occupied housing is unobserved. In addition, higher frequency data are available for each series, but annual averages are reported because the properties tracked in the NCREIF series typically are appraised only once per year. Other annually-based timing conventions are feasible (e.g., first quarter-to-first quarter changes rather than annual means), but nothing material is affected by this choice. Finally, the observations for 2008 are based on the average through the latest data release available for each series. For NCREIF and OFHEO, this is the third quarter of 2008; for NAREIT, it is November of 2008, as this series releases data monthly.

[15] Regressing real annual NCREIF appreciation on current and lagged annual REIT appreciation yield the following results:

$$\underset{}{NCREIF_t} = \underset{(0.0109)}{-0.0239} - \underset{(0.0707)}{0.0151}*NAREIT_t + \underset{(0.0719)}{0.0920}*NAREIT_{t-1} + \underset{(0.0763)}{0.1601}*NAREIT_{t-2},\ R^2=0.22,\ nobs=27.$$

See Gyourko and Keim (1992) and Gyourko (2005) for a more detailed analysis of the predictability of private-market, appraisal-based commercial property returns. The differences between these two series narrow further if differences in leverage are controlled for, as the NCREIF series becomes less smooth if it is 'levered' equally to the firms in the NAREIT index.

There is a lag in reported home prices, too, as agreed upon transactions prices typically are not formally recorded for some time due to delays in getting mortgages originated and final closing consummated. If this delay spills across calendar years, as one would expect for home purchases begun in the fourth quarter, then lagged NAREIT appreciation should be more positively correlated with current OFHEO prices. That is the case, as the correlation rises from 0.28 contemporaneously to 0.37 when last year's NAREIT price growth is correlated with this year's house price growth. While there are reasons to suspect that the commercial sector might lead housing across the cycle, this cannot be determined with any precision with such a limited amount of annual data.[16] Given that there is good reason to believe that measurement error accounts for at least some of the lead-lag relationship, we simply note that the data are quite consistent with appreciation on housing and income-producing properties being strongly and positively correlated contemporaneously.

To gain insight into the magnitudes involved, regressing the current year's appreciation in the OFHEO index on last year's appreciation in the NAREIT index finds an elasticity of 0.08, as shown in equation (1):

$$\text{(1) } OFHEO_t = \underset{(0.006)}{0.009} + \underset{(0.040)}{0.083}{*}NAREIT_{t-1},\ R^2=0.14,\ \text{nobs}=29, \text{ standard errors in parentheses.}$$

[16] Because people have to live somewhere, even if they lose their jobs, the demand for commercial space probably can change more promptly in response to economic shocks. If moving costs are high, or the shock is expected to be temporary, it could take a long time for households to adjust their demand for housing. Supply differences are another reason the sectors do not move together perfectly. The same demand shock will play out differently given varying initial supply conditions. Presently, the housing sector appears to be more overbuilt.

Nothing causal is implied obviously, but the relationship is economically, not just statistically, significant. A one standard deviation change in past equity REIT prices is associated with one-third of a standard deviation change in current house price appreciation.[17]

Additional evidence that the housing and commercial property sectors move together is available by comparing the ratio of prices to construction costs for office buildings and housing within metropolitan areas over time. If the Rosen-Roback model is correct, then booms in one property sector within a metropolitan area should show up in other sectors within the same market. The gap between sales prices and construction costs reflects both the developer's profit margin and the cost of land. While gross profit margins for homebuilders and commercial developers, which tend to be between 15%-20%[18], can vary over the cycle, land value is expected to be the most volatile factor because it is the residual claimant on project value. Hence, changes in the price-to-construction cost ratio are interpreted as primarily reflecting changes in implied land values.

Actual transactions prices on commercial properties are rare, but information on office buildings was obtained from Real Capital Analytics, a real estate research firm and data provider, for the period between 2003 and 2008. This time frame is a short one, but it does cover the most recent boom period in the commercial property market. In addition, this source disaggregates its

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[17] The standardized marginal effect is even greater, at about one, if the appreciation rate on the NCREIF property index is regressed on the OFHEO series (contemporaneously) :

$$\underset{}{OFHEO_t} = \underset{(0.010)}{-0.023} + \underset{(0.286)}{0.637}*NCREIF_t,\ R^2=0.15,\ nobs=30.$$

That is, these results imply that a one standard deviation change in appreciation on the NCREIF index is associated with about a one standard deviation change in housing appreciation as measured by OFHEO. Given the underlying standard errors, we cannot reject that the two standardized marginal effects are equal. We can reject that either is zero. Finally, past housing appreciation does not predict current equity REIT price growth:

$$NAREIT_t = \underset{(0.031)}{0.022} + \underset{(0.912)}{0.070}*OFHEO_{t-1},\ R^2=0.00,\ nobs=28,\ \text{standard errors in parentheses.}$$

[18] Gross margins of this magnitude yield the 9%-11% net returns that these firms earn over the cycle, depending upon their overheads.

data geographically into sales inside and outside the central business district (CBD) of the metropolitan area.

Transactions prices are compared to physical construction costs are from the R.S. Means Company and pertain to the specific office building depicted in Figure 1. This 80,000 square foot structure is typical of office product in many markets, especially in suburban office parks. The base cost for this physical structure in early 2008 was $11.44 million, or $143.05 per square foot. This number is then adjusted across markets based on the location factors reported in R.S. Means Company (2008). Costs over time are computed using annual data from previous years that also are reported in the firm's 2008 publication.[19]

For house prices, data from Glaeser, Gyourko and Saiz (2008) is used based on the value of a median quality home from the 2000 census in each metropolitan area. Construction costs again are from the R. S. Means Company (2008) for 2,000 square foot home of modest quality that just meets all local building code requirements.[20]

Housing and office data could be matched for the 32 metropolitan areas depicted in Figure 2's plot of the percentage changes from 2003 to 2008 in the ratio of prices-to-construction costs for CBD office buildings and owner-occupied homes.[21] The simple correlation between

[19] Unfortunately, the location factors do not differ across property types within the same metropolitan area. Hence, the cross-sectional variation in construction costs is the same for both property types, with measurement error showing up in land prices in the same way. This is not believed that this is a major influence, but it will lead the sectors to move together to some extent.

[20] The data provider provides costs for different quality houses. This reference unit is for the lowest quality single family home that meets all building code requirements. The results of the analysis are unaffected if a different quality home is chosen. See Glaeser, Gyourko and Saiz (2008) for more detail on physical construction costs for houses.

[21] Matching was done as best as possible, but is not perfect in all cases. For example, Real Capital Analytics restricts its CBD office price data to Manhattan, not the entire city of New York. In all cases, office sector data are matched with house price and cost data for the metropolitan area. There also are timing differences between when prices are measured relative to construction costs for housing versus offices. For reasons having to do with differences in the timing of the release of the Real Capital Analytics office price data, the R.S. Means Company construction cost data, and the house price data taken from Glaeser, Gyourko and Saiz (2008), a one-year lag of the housing sector data is compared with current office sector data. Essentially, this means Figure 2's plot is of the

the two series depicted in the graph is 0.47, with the underlying bivariate regression coefficient being 0.92 (standard error=0.31).[22] Thus, if implied land values in the housing sector rose a lot during the recent boom in a given metropolitan area, they also tended to rise a lot in that area's office sector. Note that this is the case whether the market is thought to have a very elastic supply side (e.g., Phoenix, Tampa) or an inelastic one (e.g., Manhattan, Los Angeles). This pattern certainly is consistent with the use of a common factor such as land fostering similar outcomes across property sectors within the same market, and is another force that appears to mitigate any potential impact of the more stringent limits to arbitrage that exist for owner-occupied housing.

While the housing and commercial property sectors clearly are closely related, there are some important differences. For example, the commercial market has been much more volatile on average, and it often experiences sharp drops in nominal prices during busts. The longer lead times in the production of income-producing properties may help explain this. Whatever the reason, the greater volatility is apparent in the summary statistics on real appreciation reported in the bottom panel of Table 1, as well as in Figure 3's plot of the two commercial real estate and one housing capital value series. In that figure, each series is indexed to 100 in 1978, with log real index values reported annually.

Even the appraisal-based NCREIF series has a coefficient of variation that is greater than that on housing (taking the absolute value of the mean), at 3.4 versus 2.8 for OFHEO. Not surprisingly, the publicly-traded equity REIT series is the most volatile, with a coefficient of

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percentage change in the office sector's price-to-construction cost ratio between 2003-2008 against that for housing between 2002-2007.

[22] Nothing causal is implied here, of course, only that the relationship is strong statistically. It is somewhat weaker if the ratio of price-to-construction costs for suburban office buildings is used. The simple correlation falls to 0.31, and the analogous regression coefficient (standard error) are 0.44(0.24).

variation of 5.5 (0.148/0.027). This volatility is great enough to generate nominal, not just real, price declines in commercial property prices during downturns.

The 1979-81 downturn in equity REITs is the only one in which nominal prices of firms did not fall appreciably. Even though real prices of publicly-traded owners of commercial properties declined by 20% during that time period, nominal values were flat because inflation was so high then. Real prices then boomed by 48% before peaking in 1986. From 1986-1990, there was a great collapse in commercial property markets, with real capital losses of -42%. Nominal losses over the same time period were about -30%.[23] The 1990-1997 period saw the recovery of all real value and then some, with the real index rising by nearly 81%. There was another bust between 1997-99, with real prices dropping by about 35%. Inflation was mild during this time period, so nominal price declines in the NAREIT price index were similarly large, at about -30%. A long and extraordinary boom then ensued, with public market prices growing by about 118% in real terms and by 164% in nominal terms between 1999 and 2006. The price component of the NAREIT series fell by nearly 20% in 2007, and is down about 45% in 2008 as this paper is being written. This decline takes the real price index for this series back to its level in 1978. The current downturn is the largest bust in publicly-traded real estate firm values in history.

As noted above, the NCREIF series is not as starkly different from the NAREIT series as Figure 3 suggests, if one were to adjust for appraisal-smoothing and leverage differences. Even

[23] For those not familiar with this sector of real estate, this extreme downturn can be attributed to a combination of supply and demand shocks. The supply shock was one of gross overbuilding. From 1981-1986, the tax code was very favorably disposed towards commercial construction, allowing accelerated depreciation and the easy use of losses on buildings to offset income from other sources, including wages and salaries. This effective subsidization of landlords had its expected effect—namely, a lot of building so that more people (especially those in high income tax brackets) could become landlords. These features were removed in the Tax Reform Act of 1986, but buildings are durable, and there was a rush to get them started before the reform took formal effect. This showed up in significantly rising vacancies (they doubled between 1986 and 1990), even before the recession of the early 1990s pushed them even higher due to declining demand.

without those adjustments, the first great collapse in commercial property values is readily apparent, as is the most recent boom. There was a 50% real (27% nominal) decline in this capital value index between 1986 and 1997. Between 1997 and 2003, the NCREIF capital index pretty much grew with the rate of inflation, and then experienced a major boom. In nominal terms, the index appreciated by 46% in nominal terms, and by 25% in real terms from 2003-2007. As yet, there is no downturn in this series, but if the past is any guide at all, the recent steep declines in the NAREIT series portend a lengthy and steep drop in this private market series. Over the full sample period, real capital values were about 50% lower in 2008 than in 1978 for NCREIF, although there still was nominal appreciation of over 50%.[24]

As many people have noted, there never was a nominal downturn in aggregate national house prices until 2008. However, Figure 3 documents that there have been real declines in the past. Real constant-quality house prices fell by 12% between 1979 and 1982, before rising by 13% before peaking in 1989. There was another modest downturn in real prices of just over 6% between 1989-1994. The biggest boom in the history of the U.S. housing market then ensued, with real constant quality prices increasing by 53% through 2006. Nominally, they more than doubled—by about 114%. The most recent data from OFHEO show modest, single-digit nominal declines on an aggregate basis for the first time in the history of this housing series.

In sum, these data provide no support for the hypothesis that weaker limits to arbitrage in the commercial property sector will lead to less volatility over the cycle. The recent extraordinary boom in owner-occupied housing was matched in magnitude by the equity REIT market, if not quite by the private investment market in commercial real estate. There are

[24] Total returns on commercial real estate have been much stronger over time, largely because of a consistently large net rental flow. The appendix plots total return and capital value indexes for the NAREIT and NCREIF series, along with net rental flows on the NCREIF properties. Those data show that appraised capital values tend to fall in real terms whenever rent growth decelerates, and especially when it turns negative.

differences, but they are consistent with there being different supply conditions and varying business cycle impacts across the cycles. The similar medium- to longer- run outcomes suggest that the common demand drivers predicted by the Rosen-Roback model of spatial equilibrium are dominant on average. If so, we should see other similarities associated with those fundamentals, and it is to that issue that we now turn.

IV. Return Predictability in Commercial Property Markets

That commercial real estate cycles are of fairly long duration, covering multiple years, raises questions about the predictability of returns. One of the most famous articles on housing price behavior by Case and Shiller (1989) showed that there is short-run persistence in price changes from one year to the next. Over longer horizons, Glaeser and Gyourko (2006) report substantial mean reversion for housing so that over five year horizons, 0.32 percentage points of every percentage point of any price appreciation above long run trend (controlling for business cycle effects) over the past five years will be given back over the next five year period. Those authors go on to show that shocks to local income, combined to a lesser extent with lagged building responses, can account for this pattern in house prices. If the standard urban model is right about the same fundamentals driving both sectors, then we should see similar patterns in the commercial sector.

To investigate this, we turn to NCREIF data for the 45 local markets listed in the Appendix.[25] Indexes analogous to those reported above for the nation are available on a

[25] Public market data cannot be used for this particular analysis. Equity REITs generally specialize in a specific property type, but very few firms limit their investment and ownership to a single market. While public filings by these firms identify any large investment, practically speaking, it is infeasible to isolate cash flows or valuations by metropolitan area.

consistent basis for each of these markets dating back to 1985.[26] Simple autocorrelation models are estimated over different horizons, as shown in equation (2), using data not only on the capital appreciation index, but on the net rental income index and the total return series:

$$(2)\ \%\Delta Index_{i,t+j} - \%\Delta Index_{i,t} = Year_t + Metro_i + \gamma(Index_{i,t-1} - Index_{i,t-1-j}) + \varepsilon_{i,j}.$$

Table 2 reports results for j equal to 1, 2, 3, and 4 year horizons. To avoid artificially inducing mean reversion in fixed effects regressions like these, any overlap in estimation period is avoided. Thus, for one year horizons, price appreciation between periods *t* and *t+1* (e.g., 2007-2008) is regressed on lagged price appreciation between periods *t-2* and *t-1* (e.g., 2005-2006).[27]

The top panel reports results for 1-year horizons.[28] The positive coefficient of 0.17 in column one indicates that a one percentage point higher appreciation rate last year, is associated with a 0.17 percent higher appreciation rate this year, controlling for national conditions and the local trend. This is less than the coefficients ranging from 0.2-0.5 reported for owner-occupied housing by Case and Shiller (1989), but both property sectors exhibit short-run persistence. That is, growth begets growth (and decline begets decline) across years in the housing and commercial property markets. Two sets of standard errors, one clustered by

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[26] To be included in this list, continuous data must exist since 1985. Note that we include components of the largest, consolidated metropolitan areas (noted as CBSA Divisions in the appendix table). Thus, the Oakland and San Francisco CBSAs are counted as separate markets in this analysis. This certainly is debatable. NCREIF's designations of individual markets are followed throughout, but readers should keep this issue in mind when thinking about the true degrees of freedom in the statistical analysis. In addition, pre-1985 data are available for a few markets, but we choose the 1985 start date for consistency. No results are altered by this choice. More important is the fact that the number of properties in each market tends to be small in the 1980s. For example, the mean number of properties across the 45 metropolitan areas is 18.7 in 1985, with 21 areas having less than ten properties. Metropolitan-area level property counts grow over time so that the smallest market has 11 properties in 2008, with the mean property count being 101 that year. Naturally, these are not constant quality series either.

[27] More sophisticated estimation techniques such as those introduced by Arellano and Bond (1991) are available of course, but the panel length is so small that doing anything beyond the simple OLS in equation (1) is not feasible (or useful) in a statistical or economic sense. Moreover, while one normally worries about mean reversion being induced if the ending and starting points of the estimation periods overlap, recall from the discussion above that the fact most properties are appraised only once per year means that capital value literally is unchanged between appraisals (presuming there are no renovations or improvements to the structure). This induces persistence that can go across years, so having any overlap in the return horizons leads to artificially high measured persistence in this particular series. See below for more on that.

[28] These are 11 such non-overlapping horizons since 1985 (e.g., 2007-2008 on 2005-2006, 2005-2006 on 2003-2004,…, 1987-1988 on 1985-1986). With 45 metropolitan areas, the number of observations is 495 (~45*11).

investment horizon length, the other by metropolitan area, are reported in parentheses. Even if one thinks that clustering by investment horizons is appropriate, the estimated persistence remains statistically significant at the usual confidence level.

Net rents on buildings are slightly more persistent across years, as indicated by the 0.23 coefficient reported in column two of the top panel of Table 2. The variation in real total returns essentially is driven by volatility in the capital value series in the NCREIF data, which leads the results for total returns and capital appreciation to be very similar in all specifications (e.g., compare columns one and three in Table 2). As is documented in the appendix, building rents do fluctuate, but they still are quite smooth compared to property values. This makes commercial real estate like stocks in the sense that total returns are driven more by changes in the multiple attached to rents (earnings) than by changes in the rents (earnings) themselves (Shiller, 1981).

The second panel of Table 2 indicates that the persistence in appreciation rates, income growth, and total returns weakens rapidly. Over two year horizons (e.g., 2006-2008 appreciation rates on 2003-2005 appreciation rates, etc.), the estimated γ coefficients remain positive, but their magnitudes are much smaller, and never are significantly different from zero.[29]

The findings reported in the third panel show substantial mean reversion in appreciation rates and total returns over three year horizons. The -0.27 coefficient in the first column of this panel implies that if the appreciation rate was one percentage point higher in (say) the 2005-2008 period, then it will be -0.27 points lower in the subsequent 2009-2111 period (always relative to national conditions and the local market trend). This effect is marginally statistically significant even if the errors are clustered by investment horizon. The point estimate on real income growth

[29] The influence of appraisal bias artificially inducing persistence is particularly evident here if one permits overlap in the estimation horizons (i.e., if one regresses 2006-2008 appreciation rates on 2004-2006 appreciation rates instead of on 2003-2005 rates). Rather than precipitating mean reversion as would normally be feared in this context, persistence remains quite high with an estimated γ=0.27 (which compares to an estimated value of 0.56 in the one-year horizon case with overlap in the estimation intervals).

also turns negative, although it never reaches statistical significance. As usual, real total returns show much the same pattern as real capital growth. Finally, the point estimates for 4-year horizons reported in the next panel indicate that mean reversion still exists over longer horizons. However, any semblance of statistical precision disappears by this point, especially if the errors are clustered by investment horizon.[30]

Even with the limitations of these data, it seems reasonable to conclude that commercial real estate appreciation, much like housing, persists from year-to-year and then mean reverts over medium to longer-term investment horizons. One can expect to give back at least one-quarter of any appreciation realized in excess of that warranted by national business cycle conditions and local trend during any 3 or 4 year period.

V. Common vs. Local Effects in Commercial Property Markets

To see changes of the magnitude documented Figure 3 and Table 2 for aggregate, national series also requires some common movement across local markets. To investigate just how strong those common effects are, we turn again to the NCREIF data on the local markets. In this case, fixed effects regressions of the real annual appreciation rate, the real growth rate in net rents, and of real total returns in each market on year and metropolitan area dummies are estimated to document how much of the variation can be explained by each set of variables. Table 3 reports the results.

[30] There are only three, non-overlapping four year horizons (2004-0008 returns on 1999-2003 returns, 1999-2003 returns on 1994-1998 returns, and 1994-1998 returns on 1989-1993 returns) in the estimation reported. Altering the years to start in 1985 does not change the results or their precision. Estimations were also done over longer horizons and they typically yielded even more mean reversion. For example, the mean reversion coefficients are at or in excess of -0.50 for 6, 7, or 8 year horizons. [For the six and seven year horizons, the coefficients are marginally significant when clustering by market. Clustering by year is not feasible for these horizons as there are only two such periods of this length. Only a single cross section with 45 observations can be estimated for any horizon longer than seven years.] The one exception to this pattern is for 5-year horizons. In that specification, no significant mean reversion is found (γ=0.02).

Common effects are large as indicated by the high R^2s reported in the top panel of the table. Nearly two-thirds of the variation in real annual appreciation rates and real total returns can be explained by year dummies, with over 80% of the variation in real annual income growth on these properties being common across markets. The middle panel of Table 3 shows that market dummies can only account for 3%-4% of the variation. The final panel reports explained variation when both time and market fixed effects are entered.[31]

This is quite different from what Glaeser and Gyourko (2006) report for the owner-occupied housing market. They found that year fixed effects could explain only 27% of the variation in real annual house price changes between 1980-2005 for 115 metropolitan areas. Thus, housing markets appear to be pretty local in nature, in the sense that appreciation is driven more by metropolitan-specific factors, while commercial real estate appears to be more of a national market, with nearly two-thirds of the variation in its asset values and total return being explained by a common effect. Why the commercial and owner-occupied markets differ so much in this regard is not well understood, and clearly merits future research attention, as it raises the possibility that macro variables will have more influence on commercial property than on owner-occupied housing values.

VI. Other Risk Factors and Characteristics of Commercial Property Markets

Leverage and Mean Reversion

The combination of high financial leverage and substantial medium-term mean reversion in prices has potentially important implications for the credit risk of commercial real estate. Information from the Urban Land Institute's *Emerging Trends in Real Estate* report indicates that the aggregate leverage ratio for institutional grade commercial real estate was 3-to-1 in

[31] Each regression has 1,035 observation—45 markets with 23 years of data.

2008, which implies a 75% loan-to-value ratio. Past publications indicate that this level of debt is typical for the sector.[32]

Unfortunately, data limitations leave us with little knowledge of the distribution of loan-to-value ratios in the commercial sector. Some parts of the industry such as equity REITs clearly have lower leverage on average, as 1-to-1 (or less) is more typical for those firms. Life insurance companies typically do not issue commercial loans with loan-to-value ratios in excess of 70%-75%. This means that there are at least some commercial property owners that are more highly leveraged, as equity REITs constituted just under one-third of the institutional grade equity catalogued by the Urban Land Institute in 2008, and life company loans were just under one-tenth of all institutional debt. Unfortunately, we cannot tell much more about the distribution than this, including whether there is a commercial landlord equivalent to the one-third of homeowners who have no debt.[33]

More research is urgently needed to document the distribution of loan-to-value ratios to pin down what fraction of commercial borrowers have or are likely to have negative equity in the event of a price decline of the magnitude already experienced in the public real estate markets or in the event that price growth mean reverts by its normal amount over the next 3-4 years. On average, the data suggest that normal reversion from the peak will wipe out much the equity in

[32] The Urban Land Institute publishes this report annually. Data were obtained going back to 1997. Aggregate LTVs ranged from a low of 73% in 2005 to a high of 83% in 2003. However, the 2005 publication represented a change in what the organization counted as institutional in quality. The amount of institutional grade equity investment in commercial real estate doubled between 2004 and 2005, and the aggregate LTV fell from 82% to 73%. It is doubtful that this represents a real change in leverage, rather than the outcome of a different measurement strategy. In any event, all the available data suggest a consistently high leverage ratio on the order of 3-to-1 has existed for the past decade.

[33] The *American Housing Survey* (*AHS*) provides detailed data on the distribution of loan-to-value ratios among homeowners. The most recent data from the 2007 *AHS* indicates that nearly one-third of all owners had no outstanding mortgage debt at the time of the survey (which was conducted from April through September of 2007; see Table 3-15 at www.census.gov/prod/2008pubs/h150-07.pdf for more detail). These tend to be older households that have lived in their homes a long time. Between 3 and 4 percent of all owner-occupiers had negative equity even then, while another 4.5% had less than ten percent equity. About 15% of all owners had loan-to-value ratios in excess of 80% as of 2007, with another 15% having LTVs between 60 and 80 percent. It is straightforward to compute new LTVs for the housing sector given assumptions on loan amortization and house price changes.

the institutional grade property sector. This is foreboding for lenders, not just borrowers, of course. The extent of mean reversion in this sector also suggests that both lenders and financial market regulators should rethink the wisdom of employing such high leverage, especially during booms. Downpayments of less than one quarter of property value look quite risky given the normal vagaries of this market.

Office Price Appreciation During the Boom: Rent Growth vs. Multiple Expansion

Data from Real Capital Analytics show that, between 2003 and 2008, office prices rose by nearly 60% nominally on average in the central business districts of the 32 markets for which there is transactions data in both 2003 and 2008. There is cross sectional variation, but the price appreciation was widespread, as indicated by the interquartile range of 34% to 81%. The same source indicates that price growth was substantial outside of CBDs, too. Average nominal price appreciation outside of central business districts was 48%, with the interquartile range running from 28% to 68%.[34]

Just as stock price increases can be due to earnings increases or expansion in earnings multiples, commercial property price changes can be decomposed into that part due to net rent (or cash flow) increases and that part due to multiple expansion. In real estate, investors typically refer to the cap (or capitalization) rate on properties, which is defined as the ratio of net rents to property value. For those more familiar with stock market terminology, the cap rate can be thought of as the inverse of the price-to-earnings ratio. Hence, a lower cap rate indicates that investors are willing to pay a greater multiple on a given dollar of net rents from a property.

[34] There are 33 markets with complete data for non-CBD areas. The difference in sample size is due to the fact that Real Capital Analytics does not report a non-CBD equivalent to its Manhattan data. And, it has no CBD equivalent to the non-CBD data it reports for Las Vegas and Palm Beach. Effectively, the company presumes there is no CBD for the latter two markets.

Cap rates on office buildings fell substantially in most markets, as reflected in Table 4's data on the distribution of office property cap rates at two points in time: 2003(2) and 2008(2). In 2003(2), cap rates typically were a little lower in CBDs, but the difference was not large on average, nor was this the case in all markets. Office buildings traded at a 9 cap (or an 11.1 price-to-net rent multiple) on average in the second quarter of 2003. Just over one-quarter of CBD areas had lower cap rates; for non-CBD areas, the analogous fraction was not much more than 10%. Cap rates fell in general between 2003-2008, with the average non-CBD cap rate falling to 7% and the average CBD cap rate dropping even further to 6%. Thus, net rent multiples expanded by one-quarter to one-third in most office markets between 2003 and 2008.

It is straightforward to decompose the overall change in price between 2003-2008 into that part due to rising net rents versus falling cap rates. The share attributable to rising net rents can be computed by discounting net rents in 2008(2) as a perpetuity using the cap rate from 2003(2), and then computing the implied price change as a share of the actual price change.[35] By definition, any remaining share is that due to falling cap rates.

Tables 5 and 6 report this decomposition for each market that experienced significant increases in office building prices relative to their construction costs. To be on this list, office prices had to rise by more than 20% more than construction costs between 2003-2008. This cut-off is admittedly arbitrary, but is intended to ensure a focus on markets where it is highly likely that land prices really jumped.

Table 5 lists the 14 (out of 32) CBD areas that meet this requirement. Among this group, nominal growth in office prices was 106%. Prices rose relative to construction costs by 52%.

[35] This is a standard use of cap rate data in the real estate industry. Recall that the cap rate (c) is defined as the ratio of net rents (NR) to asset price (P) or c=NR/P. Using data on c and P from Real Capital Analytics, implied net rents can be computed. That number for 2008(2), which reflects any increase since 2003(2), is then discounted as a perpetuity using the cap rate from 2003(2).

On average, the share of price growth due to net rent growth was 41%, versus 59% due to cap rate compression. This average does mask some important variation, as net cash flows grew enough in the Cleveland, Houston, and Phoenix CBDs to account for more than half of the very high price appreciation that occurred in those markets. Still, multiple expansion is more important than rent increases on average in explaining price appreciation in these high growth central business districts.[36]

Table 6 lists the 11 (out of 33) non-CBD areas where office building prices rose by at least 20% more than construction costs. Not only is this a somewhat shorter list, but the price growth is less on average, and the decomposition of that appreciation is split evenly between rent increases and cap rate declines. Nominal office price growth averaged 83% among this group, with prices rising relative to construction costs by 41% on average. And, as just noted, rent growth accounts for 50% of the observed price appreciation. Among the other 22 market areas, prices rose by as much as construction costs on average, with nominal prices increasing by 35% for this group. Cap rate compression explains the bulk of appreciation, accounting for 72% of it.[37]

Among the 25 high growth market areas listed in Tables 5 and 6, the simple average share of price appreciation that can be accounted for by cap rate decreases is 55%. Among the larger group that includes those areas which experienced some positive price growth between

[36] This leaves 18 CBD areas in which prices did not rise by at least 20% more than construction costs during the recent boom. Those markets are Baltimore, Charlotte, Chicago, Columbus (OH), Dallas, Denver, Detroit, Indianapolis, Jacksonville, Kansas City, Milwaukee, Minneapolis, Nashville, Philadelphia, San Antonio, San Jose, and Washington, DC. Among these 18 CBD areas, nominal price growth averaged 24%, the ratio of price to construction costs fell by 6%, the share of price growth that could be attributed to rent growth was 25%, with 75% due to falls in cap rates. Thus, even in markets where office prices did not rise appreciably relative to construction costs, more than half of the appreciation is due to cap rate moves, not rent increases.

[37] The 22 non-CBD market areas in which prices did not escalate sharply relative to construction costs include Austin, Boston, Chicago, Cleveland, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Miami, Milwaukee, Minneapolis, Nashville, Orlando, Philadelphia, Phoenix, Portland (OR), St. Louis, San Jose, Seattle, and Tampa.

2003 and 2008, the cap rate compression share is 65%.[38] In sum, the bulk of the price appreciation experienced in the typical, as well as the hottest, office markets is due to multiple expansion, not higher net rents.

Explaining the large role that rent multiple expansion played in the recent commercial property boom is another issue in need of serious research.[39] Unfortunately, nothing definitive can be said about whether there has been any widespread mispricing in the office sector without much better data. That about two-thirds of the markets do not show prices escalating significantly more than construction costs indicates there is no glaring evidence that prices are 'too high' in these places. This is not the case for the places listed in Tables 5 and 6, which contain some of the biggest markets in the country, as well as many markets in Arizona, California, Florida, and Nevada where housing boomed the most, and is now busting the most. This raises a suspicion that mispricing of a common factor such as land occurred across property types in these areas.

Large price increases beyond those warranted by production costs outside of CBDs, where supply probably is more elastic, are the most obvious signals of potential mispricing. Minimum profitable production costs (MPPC) can be defined as the sum of physical construction costs, land and land assembly costs, and the developer's normal profit. As long as demand is

[38] This simple average excludes a couple of markets such as Philadelphia in which nominal price appreciation was very close to zero. In these very low, positive growth markets, the decomposition computation methodology can lead to misleadingly large share estimates. The median cap rate share actually is higher, at 72%.

[39] One possible factor discussed below is rising physical construction costs that raised the minimum profitable production cost. A given dollar of rent on an existing building could be worth more if competitive buildings only can be produced at new higher costs. Of course, if construction costs themselves mean revert, this effect could be reversed. Another potential explanation for the fall in cap rates is the rise of diversified bidders. It is thought to take at least $1 billion to amass a truly diversified portfolio of commercial properties. By the turn of the century, there were no more than a handful of multi-billion dollar firms in the real estate industry. The number grew rapidly, so that there were 85 equity REITs with market capitalizations in excess of $2 billion by the end of 2006, as well as an indeterminate number of very large, privately held portfolios. Financial economics tells us that the ability to diversify lowers required risk premia. Given a large enough equity risk premium and big enough drop in beta from being able to better diversify could account for at least some of the multiple expansion observed in real estate in recent years. That there is some overlap in the rise of large firms with the fall in cap rates suggests this factor should be investigated more fully, but that is left for future work.

sufficient to pay those costs, new supply should keep market prices close to MPPC in the places listed in Table 6, yet implied land values have jumped.[40] Rising land values still could be justified if supply became more inelastic in these areas, perhaps because of the adoption of more stringent building controls. Unfortunately, there are no consistent data on the flow supply office space within a metropolitan area so we still cannot conclude that irrational exuberance of the type Shiller (2005) claimed for housing developed in other property sectors.

It is even more problematic to interpret the often much larger price increases experienced within the CBDs listed in Table 5. One of the oldest literatures in urban economics suggests that there will be scarcity value to land in the urban core that well could be growing over time (Alonso (1964); Mills (1967)). That the implied compound annual price increases tend to be in excess of 10% suggest that it probably will be difficult to account for them by normal demand growth, even assuming a fixed supply.

The Rosen-Roback model of spatial equilibrium provides some insight into this matter, even for these markets. One of its key underlying assumptions is that there is a reference market always available to workers and firms which provides a baseline level of utility for workers and of profits for firms. Further, residential and commercial buildings always can be supplied at their respective MPPCs in the reference market. Equal profits (or utility) across markets is consistent with both higher wages and land prices in (say) Manhattan than in the reference market if workers or local amenities are more productive. Urban economists long have viewed the consistently high land values in CBDs such as Boston, New York and San Francisco as at least partially as reflecting persistently higher productivity of the local workforce. This certainly

[40] This presumes that the builder's gross profit margin is not increasing discretely, of course. See Glaeser, Gyourko, and Saiz (2008) for an application to the housing sector.

is plausible given large agglomerations of highly skilled finance and tech workers in these markets.

Whether a greater productivity differential developed between (say) Manhattan and the reference market over the last five years that would justify the greater implied gap in land prices is another question entirely. Until quite recently, it plausibly could have been argued that Manhattan had become more productive in recent years because of its innovation of new financial products. Now, fewer people would agree, as it is beginning to look more like increasing leverage on many of the same low margin business lines drove the increased profitability of the financial sector. If so, this market's recently much higher relative land values should be viewed with suspicion, as spatial equilibrium requires a permanently higher productivity differential (or an increase in relative amenity values) to maintain the greater land price differential with respect to the reference market.

Underwriting Quality Deterioration

There are signs that lenders, not just owners, became more optimistic during the boom. This is evident in the deterioration in underwriting quality in recent years. For example, data from a variety of Moody's research reports show that, on transactions that firm rated between 2003 and 2007, the fraction of conduit loans with either partial or full interest-only periods skyrocketed from less than 10% to nearly 90%.[41] Thus, lenders to commercial property owners, not just those to home owners, appear to have falsely concluded that asset values always rise, so that building equity the old-fashioned way via amortization was no longer needed.

[41] Conduit loans are at the heart of the CMBS market. Typically, these are smaller loans that are pooled together before securitization, and then sold off in many different tranches in the bond market.

Not only did loan terms ease, but more aggressive cash flow assumptions that credited prospective rental increases in lieu of in-place income became more widespread. These so-called 'pro forma' loans total more than $40 billion according to one recent report.[42] The 'pro forma' moniker arises because the loan amount and terms were based on prospective rents, not actual in-place rents. One CMBS market data provider (Trepp) estimates that these loans constituted at least 10% of all commercial mortgages securitized in 2007.

In addition, subordination levels, which represent the value that must be lost before a given bond tranche is impaired due to defaults, declined substantially over time. Gyourko (2008) shows that some investment grade tranches from 2006 have subordination levels that are below the peak delinquency rates that were reached in the last major real estate downturn in the early 1990s.

Construction Costs

Another interesting feature of the property markets is how construction costs have changed over time. Figure 4 plots real construction costs in 2008(1) dollars since 1982. Real costs declined for a decade from the early 1980s through the early 1990s. They then remained flat for another ten year period, before rising sharply beginning in 2004-5. Since 2004, real construction costs have increased about 20%, offsetting the previous declines, and leaving them at their highest point in the last quarter century.[43]

The real cost of producing most durable goods (on a constant quality) basis has fallen over time, as manufacturing techniques have become more productive. With the recent rise in

[42] See the Bloomberg News story by Sarah Mulholland on November 20, 2008.
[43] In nominal terms, construction costs have risen by 32% since 2003 for this reference building. This 5.7% nominal average annual compound growth rate far exceeds the 3.4% per annum figure that holds over the 1982-2008 period for which we have consistent data.

costs, real estate is an exception. Whether real construction costs will mean revert is unknown. There are arguments on both sides that merit careful research because the answer has important implications for future prices.[44]

As argued above, property prices should be pinned down by minimum profitable production costs (MPPC) in elastically-supplied markets. In such places without stringent restrictions on new property development, land is not very expensive and typically amounts to no more than 20% of total property value. Normal (gross) profits for developers are 15%-20%. This implies the cost of putting up the physical structure (which include some soft costs associated with engineering and design) generally amount to 65%-75% of overall property value in a market with modest development restrictions. Thus, every ten percentage point decline in construction costs lowers minimum profitable production costs by about 7%. If the recent 30% nominal increase in building costs turns out to be temporary, and costs mean revert to their levels from the turn of the century, builders could earn normal profits on homes that are priced 15-20 percent below today's levels in elastically supplied market areas. While that is a boon for those wanting to purchase buildings, it is not for current owners (and possibly for those who financed them).

VII. *Conclusion*

Standard urban spatial equilibrium theory suggests that residential and commercial property markets are driven by common fundamentals. Supply conditions can and do differ across real estate sectors, and business cycle effects can and do have differential effects over

[44] One argument is that on-going economic growth by large population economies such as India and China will stress the supply-demand balance for various natural resources, including some of the materials used in building construction. A counter is that production capacity for some of those materials will be increased, reducing the pressure from growing demand.

time across these sectors, but common demand drivers should move these markets in the same direction over the longer term. Potentially countering this is the possibility that owner-occupied housing markets in particular are more susceptible to sharp swings in prices unrelated to fundamentals. This can break the link to common fundamentals, and there is increasing agreement that there has been a bubble in some housing markets, at least.

Looking at the data finds much more commonality than differences across the housing and commercial property sectors. Cycles in both sectors are long and their appreciation rates are positively correlated contemporaneously. Both sectors also enjoyed recent booms that are extraordinary by the standards of the admittedly limited times series available for study. Commercial real estate values and returns exhibit short-run persistence and medium-term mean reversion that are quite similar to what has been reported for owner-occupied housing. There is evidence consistent with the use of common factors such as land, capital, and production technologies helping lead to similar results across real estate sectors within the same market area.

In the office markets that have experienced the largest increases relative to fundamental production costs, most of the price increase is due to falling cap rates (i.e., rising net rent multiples), not rent increases themselves. Thus, investors appear to have developed more optimism about commercial real estate in recent years. And, that optimism was shared by lenders, as evidenced by the multiple ways in which underwriting standards were relaxed during the boom.

This does not necessarily mean that irrational exuberance infected the commercial property markets in a widespread fashion. However, some of the results raise such suspicions that warrant more research. For example, one-third of our sample of metropolitan areas experienced sharp increases in office building prices relative to construction costs outside their central business districts over the past five years. Office building prices in traditionally high cost and tightly regulated central business districts in the Boston, New York, and San Francisco metropolitan areas also have escalated sharply in recent years, including with respect to other, more typical markets in the country. This change can be justified if local amenities or productivity have increased relative to those other markets, but the unfolding financial crisis casts doubt on the productivity part of that explanation.

Regardless of one's view on irrational exuberance in the commercial real estate sector, the fact that commercial real estate prices tend to mean revert over the medium term and that the sector has recently enjoyed a major boom raises the possibility that income-producing property markets, not just owner-occupied housing, are at risk of a substantial fall. Equity REITs already are far off their peak valuations reached in February of 2007, and many private real estate investment firms could not have survived the large percentage share price declines were they as highly leveraged as private commercial real estate investors. Capital structure among private investors looks to be weak, as the high average leverage on privately-held buildings indicates that there is a relatively small equity cushion to absorb any losses. Many of these institutional owners are long-term holders, and are not subject to mark-to-market rules. However, even they will be at risk if there are near term debt rollovers. Ultimately, a weakly capitalized commercial real estate sector that mean reverts much like housing and is further subject to the negative economic shock of a possibly severe recession looks likely to pose another problem for the health of the banking sector and the financial system more generally.

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Table 1: Summary Statistics on Real Annual Appreciation Rates, 1978-2008			
Correlation in Real Annual Appreciation Rates Across the Property Sectors			
	OFHEO	NAREIT	NCREIF
OFHEO	1.00		
NAREIT	0.28	1.00	
NCREIF	0.43	-0.12	1.00
Means and Standard Deviations in Real Annual Appreciation Rates			
	OFHEO	NAREIT	NCREIF
Mean	0.012	0.027	-0.016
Standard Deviation	0.032	0.148	0.054

Table 2: Time Series Properties NCREIF Real Appreciation, Income, and Total Return Indexes			
	1-year investment horizon $\%\Delta(Index_{i,t+1} - Index_{i,t}) = Year_t + Metro_i + \gamma\%(\Delta Index_{i,t-1} - Index_{i,t-2}) + \varepsilon_{i,j}$.		
	Appreciation	Income	Total
γ	0.17 (0.08)[1] (0.04)[2]	0.23 (0.10)[1] (0.05)[2]	0.18 (0.17)[1] (0.04)[2]
R^2	0.70	0.93	0.70
nobs	495	495	495
	2-year investment horizon $\%\Delta(Index_{i,t+2} - Index_{i,t}) = Year_t + Metro_i + \gamma\%\Delta(Index_{i,t-1} - Index_{i,t-3}) + \varepsilon_{i,j}$.		
	Appreciation	Income	Total
γ	0.04 (0.08)[1] (0.09)[2]	0.08 (0.13)[1] (0.06)[2]	0.03 (0.08)[1] (0.09)[2]
R^2	0.74	0.93	0.73
nobs	315	315	315
	3-year investment horizon $\%\Delta(Index_{i,t+3} - Index_{i,t}) = Year_t + Metro_i + \gamma\%\Delta(Index_{i,t-1} - Index_{i,t-4}) + \varepsilon_{i,j}$.		
	Appreciation	Income	Total
γ	-0.27 (0.13)[1] (0.08)[2]	-0.07 (0.12)[1] (0.05)[2]	-0.25 (0.12)[1] (0.08)[2]
R^2	0.78	0.94	0.78
nobs	225	225	225
	4-year investment horizon $\%\Delta(Index_{i,t+4} - Index_{i,t}) = Year_t + Metro_i + \gamma\%(\Delta Index_{i,t-1} - Index_{i,t-5}) + \varepsilon_{i,j}$.		
	Appreciation	Income	Total
γ	-0.24 (0.26)[1] (0.13)[2]	-0.06 (0.18)[1] (0.12)[2]	-0.31 (0.24)[1] (0.11)[2]
R^2	0.79	0.97	0.69
nobs	135	135	135

Notes:
[1]Standard errors clustered by investment horizon.
[2]Standard errors clustered by market.

Table 3: National vs. Local Market Effects NCREIF Real Appreciation, Income, and Total Return Indexes			
	Common Effects Specifications: $\%\Delta Index_{i,t} = \alpha + \beta * Year_t + \varepsilon_{i,t}$,		
	Appreciation	Income	Total
R^2	0.62	0.86	0.62
nobs	1,035	1,035	1,035
	Market-Specific Effects Specifications: $\%\Delta Index_{i,t} = \alpha + \beta * Market_i + \varepsilon_{i,t}$,		
	Appreciation	Income	Total
R^2	0.04	0.04	0.03
nobs	1,035	1,035	1,035
	Common Plus Market-Specific Effects Specifications: $\%\Delta Index_{i,t} = \alpha + \beta * Year_t + \gamma * Market_i + \varepsilon_{i,t}$,		
	Appreciation	Income	Total
R^2	0.66	0.89	0.66
nobs	1,035	1,035	1,035

Table 4: Office Building Cap Rates, CBD and Non-CBD Areas, 2003(2) and 2008(2)				
	Non-CBD Areas		CBDs	
	2003(2)	2008(2)	2003(2)	2008(2)
Mean	0.09	0.07	0.09	0.06
Std. Dev.	0.01	0.01	0.01	0.01
25^{th} Percentile Value	0.09	0.07	0.08	0.06
50^{th} Percentile Value	0.09	0.07	0.09	0.06
75^{th} Percentile Value	0.09	0.07	0.09	0.07

Source: Real Capital Analytics.

Table 5: Office Price Growth Decomposition, 2003(2)-2008(2) *14 CBD Areas Where Prices Grew by 20%+ More than Construction Costs*			
Market Area	Nominal Price Growth, 2003-3008	Share Due to Rent Growth	Share Due to Cap Rate Compression
Atlanta	82%	34%	67%
Boston	77%	13%	87%
Cleveland	83%	78%	22%
Houston	105%	53%	47%
Los Angeles	146%	46%	54%
Miami	133%	53%	47%
Manhattan	147%	31%	69%
Orlando	80%	12%	88%
Phoenix	193%	56%	44%
Portland (OR)	58%	45%	55%
St. Louis	76%	45%	55%
San Francisco	78%	21%	79%
Seattle	70%	26%	74%
Tampa	153%	68%	32%

Source: Author's calculations using Real Capital Analytics' office price data and R.S. Means Company (2008) construction cost data.

Table 6: Office Price Growth Decomposition, 2003(2)-2008(2) *11 Non-CBD Areas Where Prices Grew by 20%+ More than Construction Costs*			
Market Area	Nominal Price Growth, 2003-3008	Share Due to Rent Growth	Share Due to Cap Rate Compression
Atlanta	97%	68%	32%
Baltimore	78%	47%	53%
Charlotte	162%	66%	34%
Columbus (OH)	28%	121%	-21%
Jacksonville (FL)	52%	14%	86%
Las Vegas	68%	32%	68%
Los Angeles	79%	28%	72%
San Antonio	70%	9%	91%
San Diego	99%	52%	48%
San Francisco	111%	53%	47%
Palm Beach	71%	56%	44%

Source: Author's calculations using Real Capital Analytics' office price data and R.S. Means Company (2008) construction cost data.

Figure 1: Real Construction Costs, 80,000ft^2 Office Building, R.S. Means Company Data

COMMERCIAL/INDUSTRIAL/ INSTITUTIONAL | **M.470** | **Office, 5-10 Story**

Costs per square foot of floor area

Exterior Wall	S.F. Area	20000	40000	60000	80000	100000	150000	200000	250000	300000
	L.F. Perimeter	260	360	400	420	460	520	600	640	700
Precast Concrete Panel	Steel Frame	193.70	166.10	151.60	143.05	138.95	132.15	129.30	126.65	125.30
	R/Conc. Frame	193.10	165.25	150.70	142.10	137.90	131.10	128.20	125.60	124.20
Face Brick with Concrete Block Back-up	Steel Frame	184.25	159.40	146.65	139.10	135.50	129.55	127.00	124.70	123.50
	R/Conc. Frame	183.10	158.30	145.55	138.05	134.40	128.45	125.85	123.65	122.40
Limestone Panel Concrete Block Back-up	Steel Frame	231.60	192.30	171.00	158.30	152.25	142.20	137.95	134.10	132.05
	R/Conc. Frame	230.55	191.15	169.85	157.20	151.15	141.10	136.80	132.95	130.90
Perimeter Adj., Add or Deduct	Per 100 L.F.	26.35	13.20	8.80	6.55	5.25	3.50	2.60	2.15	1.75
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	5.45	3.80	2.80	2.25	1.95	1.45	1.20	1.10	1.00

For Basement, add $33.50 per square foot of basement area

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $68.65 to $201.80 per S.F.

Common additives

Description	Unit	$ Cost
Clock System		
20 room	Each	15,400
50 room	Each	37,400
Closed Circuit Surveillance, One station		
Camera and monitor	Each	1750
For additional camera stations, add	Each	940
Directory Boards, Plastic, glass covered		
30" x 20"	Each	580
36" x 48"	Each	1450
Aluminum, 24" x 18"	Each	570
36" x 24"	Each	635
48" x 32"	Each	925
48" x 60"	Each	1950
Elevators, Electric passenger, 5 stops		
2000# capacity	Each	127,300
3500# capacity	Each	134,300
5000# capacity	Each	139,800
Additional stop, add	Each	7875
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	278
Nickel cadmium	Each	800

Description	Unit	$ Cost
Intercom System, 25 station capacity		
Master station	Each	2500
Intercom outlets	Each	160
Handset	Each	440
Smoke Detectors		
Ceiling type	Each	174
Duct type	Each	445
Sound System		
Amplifier, 250 watts	Each	2225
Speaker, ceiling or wall	Each	181
Trumpet	Each	345
TV Antenna, Master system, 12 oulet	Outlet	299
30 outlet	Outlet	192
100 outlet	Outlet	179

178

Important: See the Reference Section for Location Factors

Figure 2: Price-to-Construction Cost Changes

Office and Housing Sectors

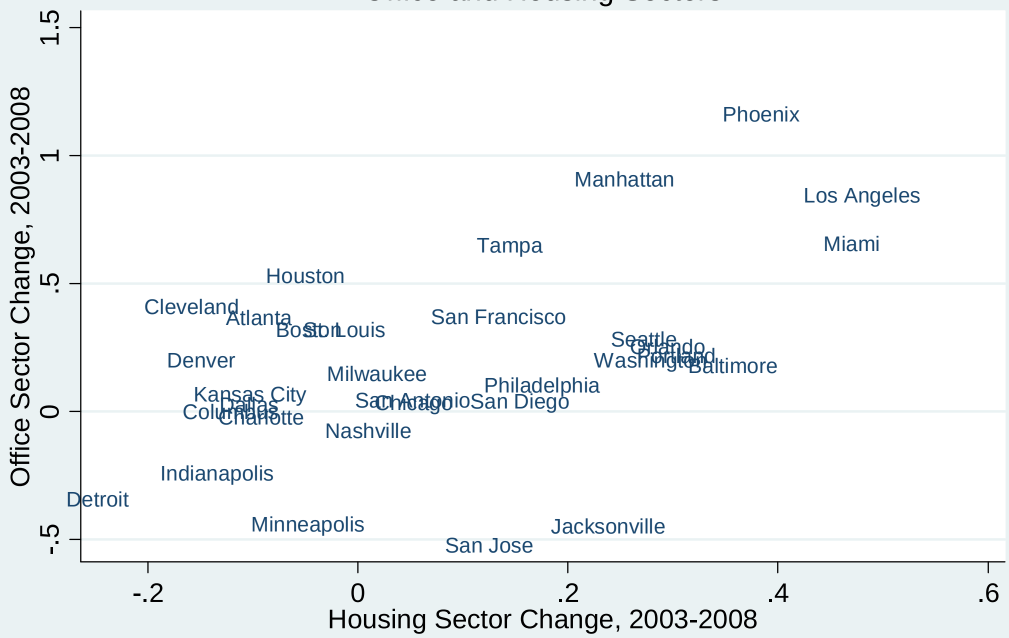


Figure 3: Commercial Real Estate and Housing: Asset Values from 1978-2008

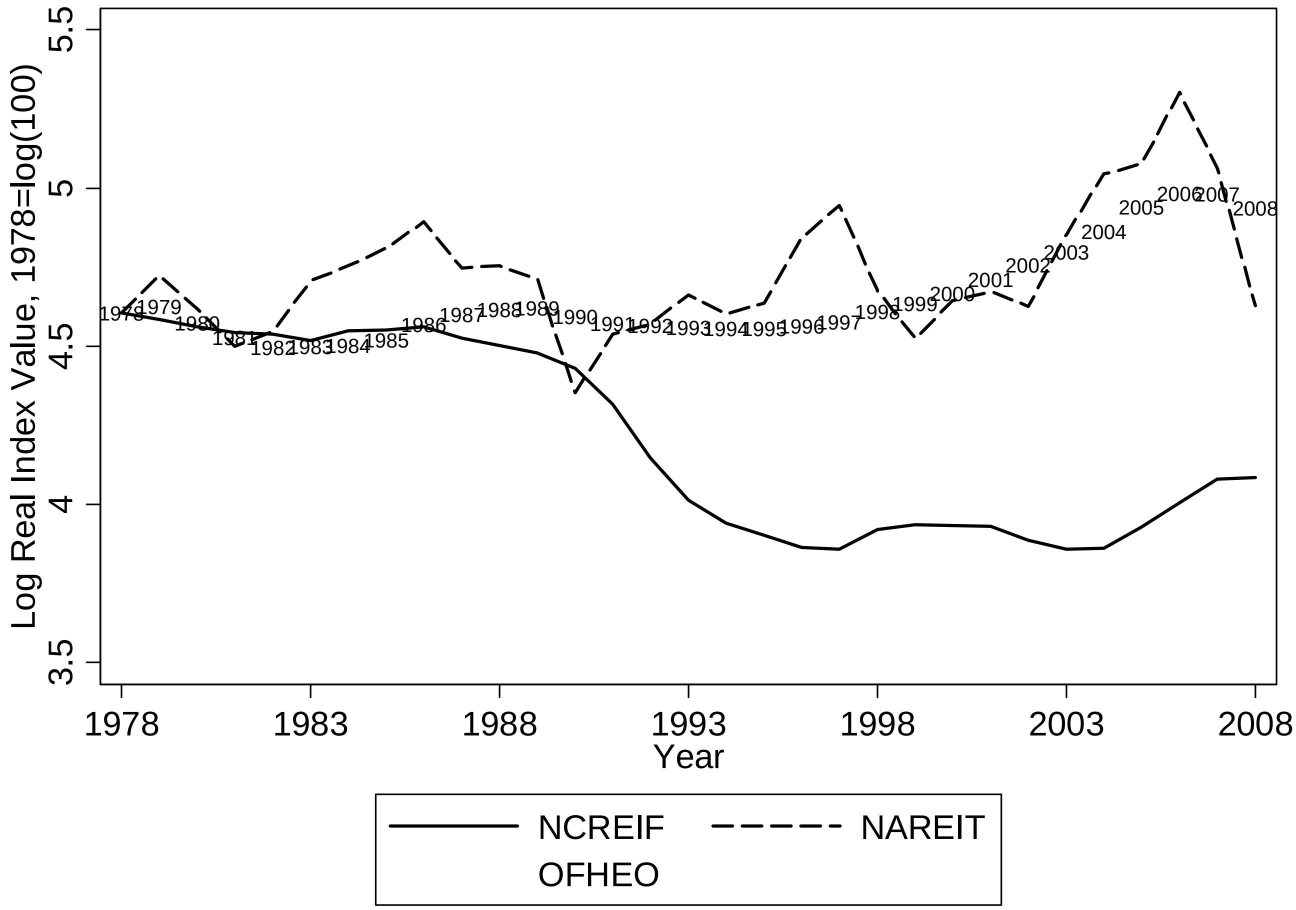
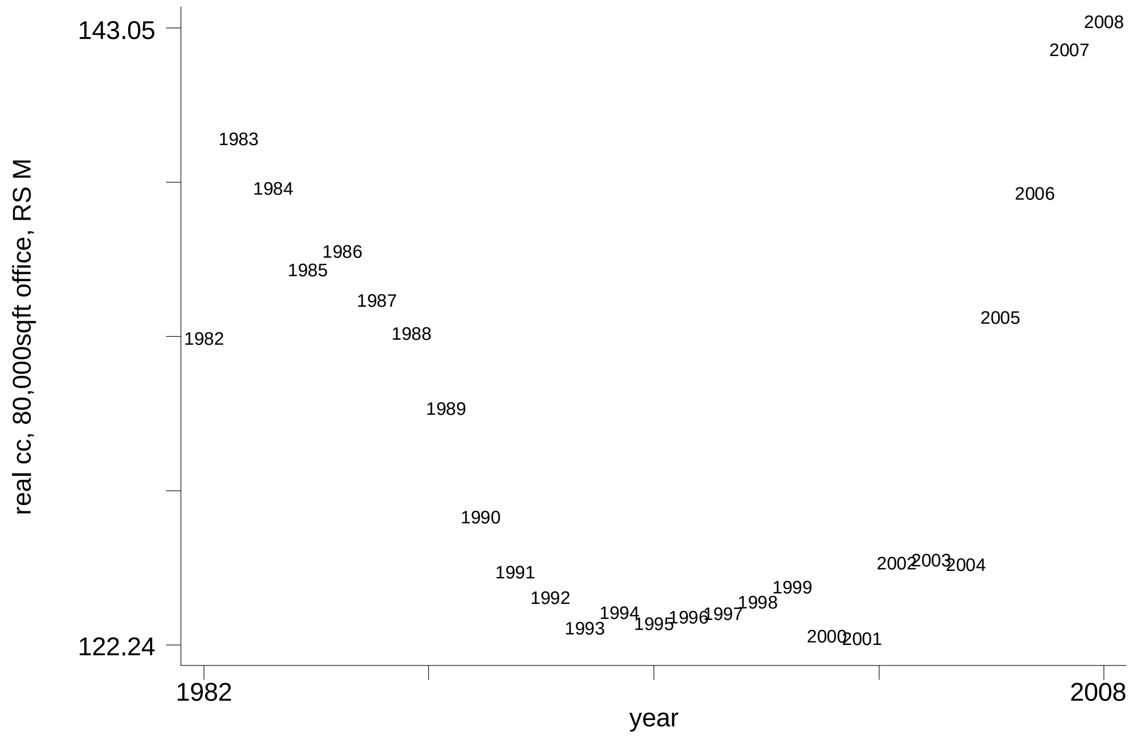


Figure 4: Real Construction Costs Per Square Foot, National Average, 80,000ft^2 Office, 1982-2008 ($2008)



Source: R.S. Means Company (2008).

Appendix

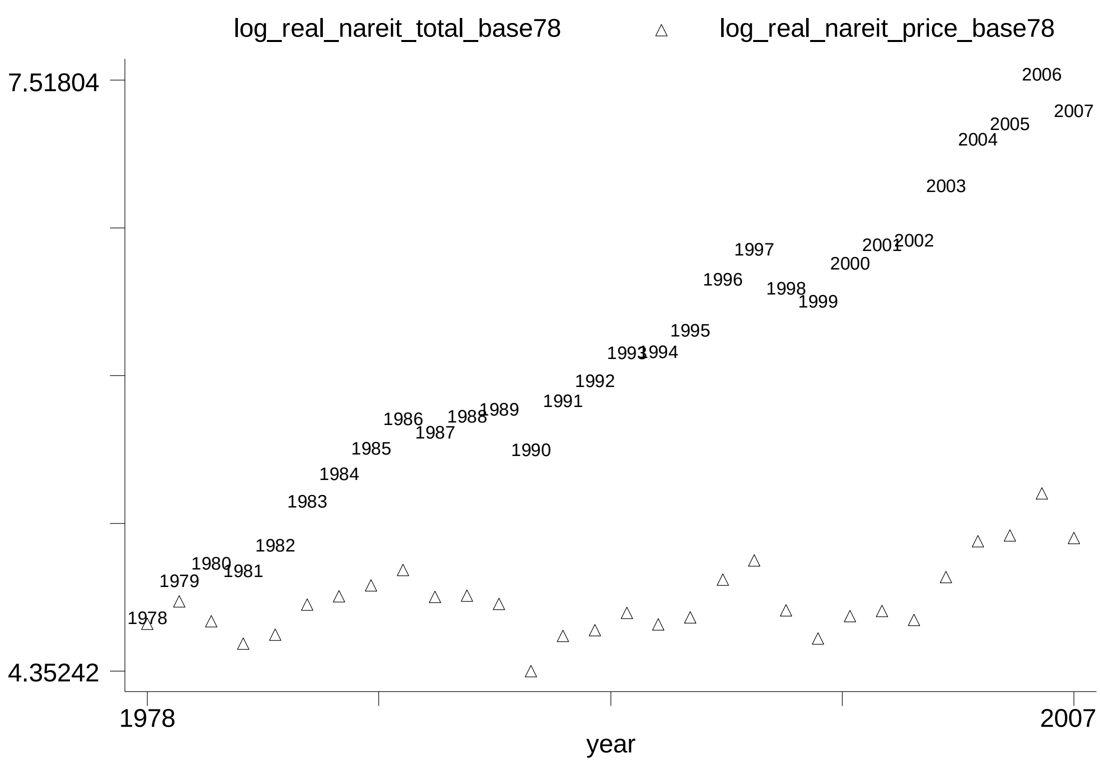
Appendix Table 1: Metropolitan Areas in NCREIF Data

1. Atlanta
2. Austin
3. Baltimore
4. Bethesda (CBSA Division)
5. Boston (CBSA Division)
6. Cambridge (CBSA Division)
7. Camden (CBSA Division)
8. Charlotte
9. Cincinnati
10. Columbus (OH)
11. Dallas (CBSA Division)
12. Denver
13. Detroit (CBSA Division)
14. Ft. Lauderdale (CBSA Division)
15. Ft. Worth (CBSA Division)
16. Hartford
17. Houston
18. Indianapolis
19. Jacksonville (FL)
20. Kansas City
21. Los Angeles (CBSA Division)
22. Memphis
23. Miami (CBSA Division)
24. Milwaukee
25. Minneapolis
26. Nashville
27. New York
28. Oakland (CBSA Division)
29. Orlando
30. Philadelphia (CBSA Division)
31. Phoenix
32. Portland
33. Sacramento
34. St. Louis
35. Salt Lake City
36. San Antonio
37. San Diego
38. San Francisco (CBSA Division)
39. San Jose
40. Santa Ana (CBSA Division)
41. Seattle (CBSA Division)
42. Tampa
43. Virginia Beach
44. Washington, DC (CBSA Division)
45. West Palm Beach (CBSA Division)

Appendix: Real Total Returns on Commercial Real Estate

Figure A.1 plots the cumulative compound real return (in log scale) on a dollar invested in 1978 in the equity REIT index reported by NAREIT, as well as the real capital gain component of that return. Recall that this total return reflects the impact of leverage, with the debt-to-equity ratio being around one over time for a widely diversified set of equity REITs. Net rents on buildings clearly must be consistently positive to generate the increasingly large gap between the total return and capital gain series.[45] Over the thirty years from 1978-2007, real total returns were 271%, which implies a compound annual real return of about 4.5%. As noted

Figure A.1. Real Returns on Publicly-Traded Real Estate—Equity REITs

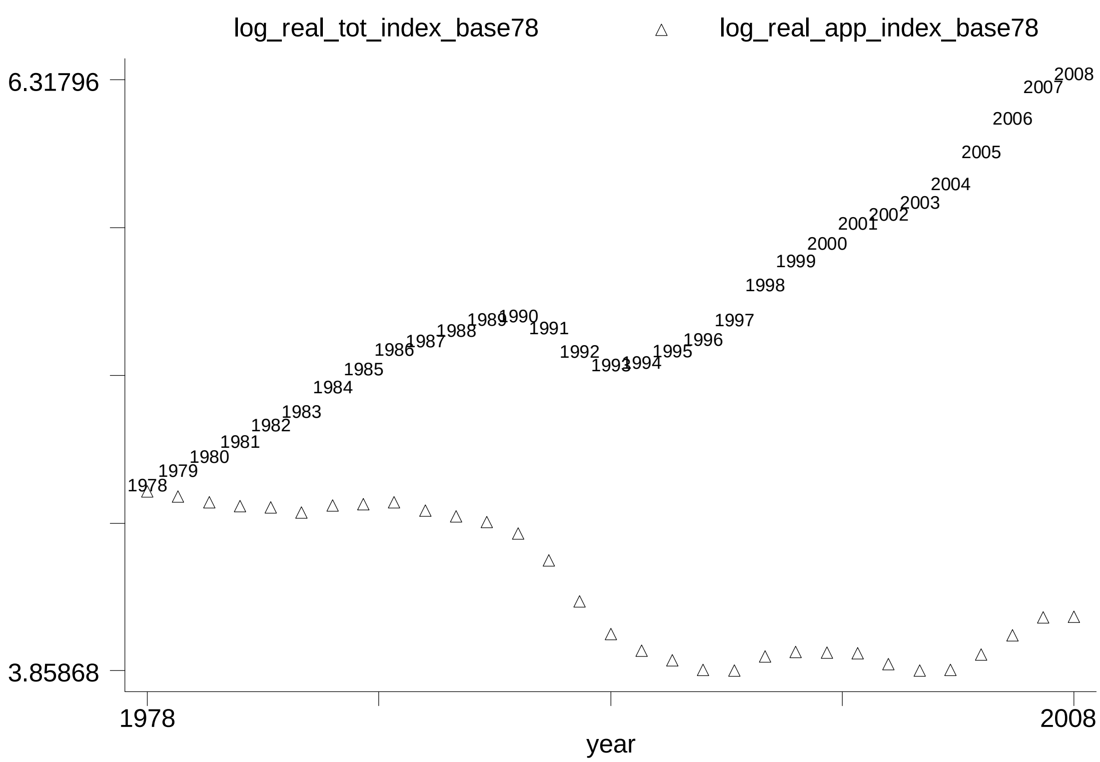


[45] Equity REIT dividends are high on average, with the mean nominal dividend yield being 5.4% in the seven years since the turn of the century, when that yield was at historic lows for this sector.

Above, real firm prices grew by much less—only 40% since 1978, or about 1.1% per annum on a compound basis over the past three decades.

Figure 2.A plots the analogous total return and capital gain series for the NCREIF properties. As with the publicly-traded REIT series, strong real total returns over time are due to continued income growth, not capital gains (on the properties themselves for this series, not the firms that own them).

Figure A.2: Real Returns on Privately-Held Real Estate—NCREIF

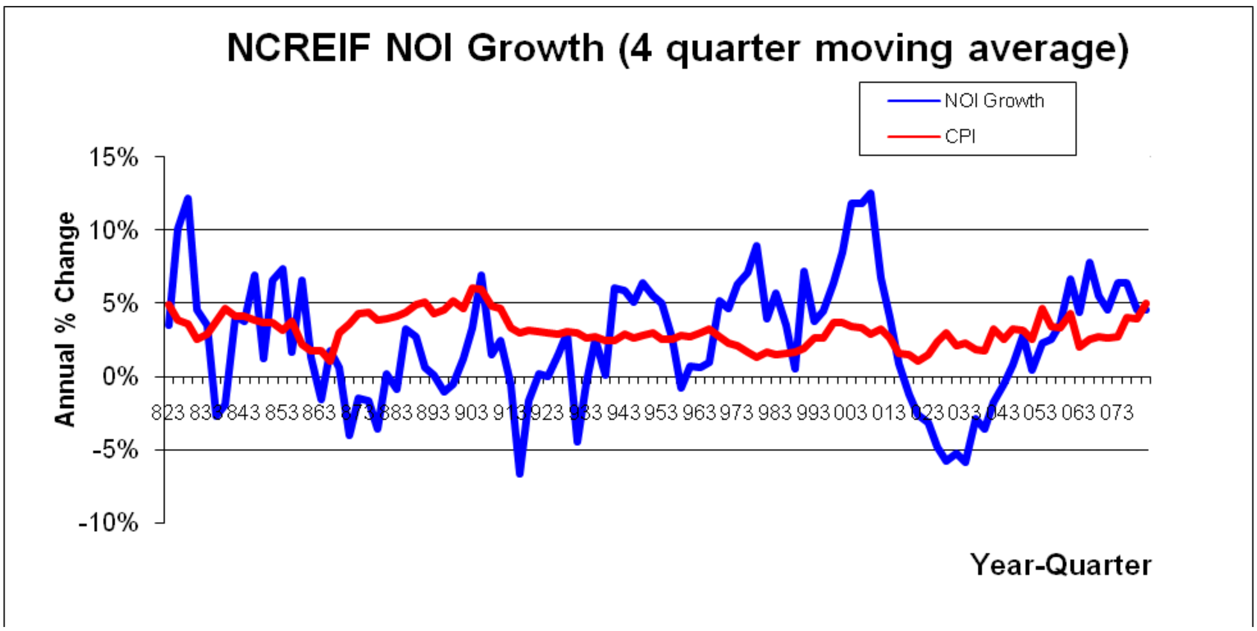


While net operating incomes always are positive on these unleveraged properties, these is volatility in the growth rate of the rental flow.[46] Figure A.3 documents this in its plot of the four

[46] Net operating income, or the net rental flow, is measured before portfolio-level management fees in the NCREIF data. This means that the level of the rental flow passed through to the investor is lower, with anecdotal evidence

quarter moving average of the growth rate in nominal net operating income provided by NCREIF for the properties tracked in its index. Strong positive growth in net rents occurred in much of the early and mid-1980s, as well as throughout the mid- to late-1990s. In contrast, net rents fell significantly in the late 1980s, the early 1990s, and after the 9/11 attacks. Thus, there are cycles in the growth rate of rents, too. And, appraised capital values tend to fall in real terms whenever rent growth decelerates, and especially when it turns negative.

Figure A.3: Net Rental Growth on NCREIF Properties



Source: National Council of Real Estate Investment Fiduciaries, 2008(2)

from investors indicating that income-returns are 100-150 basis points below those reported by NCREIF. Of course, if this is consistent over time, the rate of change is unaffected.