Evaluating Risk in Real Estate

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The rapid recovery of US real estate markets and the concomitant emergence of new development have stimulated concern over whether U.S. real estate markets will once again overbuild as they did in the late 1980s. The 1989-92 crash actually resulted from the confluence of two events; almost six years of continuous and excessive real estate development mixed together with a macroeconomic recession. The last time an economic contraction of demand occurred precisely at the point when real estate markets were saturated was in 1975. On the other hand, in the recession of 1980-82 real estate markets were still largely under-served, and escaped the economic downturn relatively unscathed. This review of the historic gyrations in the market reminds us that real estate risk involves both sides of the market interacting together. The greatest down side risk comes from a negative economic shock at the apex of a building boom, while up side risk occurs when positive economic events coincide with the absence of new supply.

Against this background, the following paper reviews some traditional definitions and measures of real estate investment risk, and then proposes a different and more forward-looking methodology for evaluating real estate markets and property specific risk.

Defining Real Estate Risk: Future Uncertainty

Most economists agree that risk is best conceptualized as greater uncertainty over likely future outcomes [Bodie, Kane, Markus, 1993]. Technically, this is expressed as an increase in the (mean preserving) spread of the probability distribution of future outcomes, whether the outcome is that of a space market (e.g., rent levels) or an asset market (e.g. return). If the event tends to have a stationary time series, then this spread is represented by the variance in the future expected value of the outcome. In more complicated non-stationary stochastic processes (e.g. Brownian Motion) there is also a variance, in this case representing the spread in the movement of the outcome. Whatever debate there is among economists or finance theorists concerns, not so much the definition of risk, but rather its measurement.

Measuring Real Estate Risk: Historic or Forecast Return Variability

The most often used measures of investment risk have been developed in traded securities markets, where analysts frequently look at the historic variability of outcomes (in this case, investment return). This historic variability can be decomposed into two components: predictable and non-predictable. The former tends to appear when the series has auto regressive or other distinct patterns which give the analyst a good idea of at least short-term future behavior. A series that is quite predictable in one sense has less risk – because the future can be forecast with some degree of confidence. A series that is largely unpredictable has almost complete uncertainty about its future – and in this sense great risk. Now, traded securities markets are widely held to be efficient, and as such have little predictable component. If returns are largely a random walk, then future returns cannot be predicted. Historic variability is both all the analyst can use, as well as an appropriate measure of likely future investment risk.

The question is whether real estate risk should be measured as it has been done in the public markets. The problem with extending such measurements to real estate is that this category of assets is still largely privately owned, where it is widely believed that there is less than efficient asset pricing. With inefficient pricing, positive (uncertain) shocks will always set off a rise and fall in asset prices that easily can be predicted. Numerous writers have documented the unusually strong predictable component in real estate markets [Shiller]. When there are predicable components to real estate returns, these returns can and should be forecast forward – rather than simply using historic variability. Some investment consultants in fact are using historical return data to predict real estate returns into the future, using the variability in these returns as a measure of real estate risk. This is dangerous.

Returning to the discussion on the sources of historic variability, the same decomposition applies to the future. A forecast of future real estate investment returns is itself likely to be possibly quite uncertain. The total future risk of real estate assets has two components: the variability of the forecast return and the uncertainty surrounding that forecast. The variability of the future forecast by definition is based only on the predictable component (the forecast "model"). As such, it ignores the random factors that generated much of the historic variability. Lest there be any doubt about this, look at an econometric forecast for any variable – it is always smoother than its historic data series. Forecasts are quite useful, but they understate the true likely future variability of the data being forecast.

In some sense, a real estate forecast that has asset income and price varying over time because of predictable factors (the "model") actually has less risk than its predictable variability. With modern financial techniques, it is often possible to insure hedge or plan for the predicted variability. A much greater source of true return risk is the uncertainty that the forecast will not be correct.

Measuring Real Estate Risk: Forecast Return Uncertainty

Any forecast of future real estate performance by definition incorporates only what is predictable and not what is unknown or random. If the forces influencing the historic movements of an investment are well understood, then forecast models should fit well and the predictable component is large relative to what is unknown. In this case there is confidence in the forecast of investment performance – and hence lower risk (uncertainty). Econometrically, the forecast is said to have tight confidence intervals. Alternatively, if the forecast model has a low fit and wide confidence intervals, this generates considerably more uncertainty about the true likely outcome*. It is the uncertainty of the forecast that generates most of the true future risk rather than whether the forecast has a smooth or varying pattern of returns.*

In real estate forecasting there is an additional complication because such forecasts are almost always "contingent". In "contingent" forecasting, the underlying model incorporates local market demand and supply dynamics, and makes assumptions about a range of influential but "exogenous" macroeconomic variables (economic growth, interest rates). Most real estate forecasters (Torto Wheaton Research, FW Dodge, Property Portfolio Research, Rosen Consulting) base their forecasts on some VAR or vector autoregressive system [1](either with or without structural restrictions). These in turn, however, are always conditional on a forecast of national and regional economic variables (provided by vendors such as RFA, DRI or WEFA).

These contingent real estate forecasts have two sources of uncertainty: uncertainty in what is assumed or forecast about the macroeconomic variables, and the uncertainty or fit of the forecast model – conditional on these variables. Both sources of uncertainty can be important and can interact with each other in complicated ways. Modern time series analysis has largely given up trying to derive equations for the confidence intervals of a multi-variable VAR type model – even when it is unconditional. Most often, numerical bootstrapping simulations are used to develop such confidence intervals [Hamilton]. Similarly, if model error is ignored, simulation approaches can be used to produce forecast confidence intervals for the real estate market – if the confidence intervals are known for the macroeconomic inputs. It is far too complicated, however, to either derive or simulate the joint likelihood of both the macroeconomic inputs and the VAR model error.

The forecasting models we have developed (which predict rents, construction and property income) tend to fit statistically quite well – given a regional and macroeconomic outlook. Looking retrospectively over our

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[1] Vector autoregressive models relate a system of variables to their own lagged values, but not to current values.

forecasts, much of the forecast error has been due to unforeseen macroeconomic changes and unpredictable regional economic or demographic factors. For example, in the mid 1980s we predicted a national real estate "crunch" at the end of the decade, but not with the severity that actually occurred. The reason is that our forecasts (at that time) did not incorporate a macroeconomic recession. Similarly, while recoveries in many rocky mountain markets were forecast for the late 1980s and early 1990s, the regional employment outlooks we used did not foresee the emerging economic strength of Denver and Salt Lake. Thus, much of the uncertainty or risk in our real estate forecasts is due not to real estate model error, but to unforeseen events or "shocks" likely to happen to the local economy together with how each property market reacts to these shocks.

We have devised a system for ascertaining the risk of real estate investing in each market and property type that incorporates these two concerns. It is important to recognize that this system does not encompass all of the risk that real estate is exposed to, but it does cover the main risk – that market fundamentals will deviate from that which is anticipated. It operates in these three steps:

1). First, we begin by developing confidence intervals for the regional economic variables that underlie the forecasts – that is the likelihood of unknown local economic events happening. We do this by estimating an ARIMA forecast for the employment data that drives each local office market. Our statistical software package contains a feature that generates statistical confidence intervals (plus and minus 1 and 2 standard deviations) around the forecast trend in each variable.

2). Since the ARIMA trend cannot consider a range of future macroeconomic factors that will influence each area's economy (e.g., the baby boom, changing industrial structure), we take these confidence bands and apply them to a vendor's regional forecast that does (RFA).

3). Finally, we use our models to forecast the real estate market under each economic confidence band, and apply the scenario probabilities to the corresponding real estate forecast. This generates confidence intervals for rent, construction, etc.

This approach gives results that make considerable sense. Local economies that have strong and relatively smooth historic growth trends (e.g., Atlanta, Phoenix) tend to have generally tight economic confidence bands. Areas with slower long term growth and greater cyclic oscillations (e.g., Cleveland, Boston) have wider economic confidence bands. When the economic forecasts are fed into the real estate model, each area's supply elasticity and current stage in the building boom considerably influence the width or tightness of the rent and construction confidence bands that emerge. This can best be described by examining the following cases.

Los Angeles: High Economic, Low Supply Risk

The economy of Los Angeles has a number of risks associated with its future growth. First, its traditional economic base (entertainment, aerospace) has always reacted strongly to macro-economic events. Second, its economic structure is changing rapidly. Applying our ARIMA generated confidence bands to a forecast for the Los Angeles economy generated by RFA, we find the results in Figure 1. These show the base forecast together with the one and two standard deviation confidence intervals in that forecast. The –2 standard deviation scenario, for example, suggests that there is only a 2.5% probability that ten years from now, Los Angeles would have the same (or fewer) number of office workers as today. At the other extreme, there is also a 2.5% probability that by 2008, office employment would have grown by more than 60% (from 880 to 1,340 workers). In between are office employment outcomes which are far more likely.

Each of these economic outlooks is fed into our office forecasting model for the Los Angeles market. The model forecasts rents and construction simultaneously as each interacts with and influences the other. The outcomes are shown Figures 2 and 3. The –2 standard deviation economic scenario leads to a cessation of construction (from its current rather low level) and to flat rents over the next five years (in current dollars). After 2004, rents begin to rise with inflation. A scenario this poor happens with only a 2.5% probability. In the +2 standard deviation case, construction rises to 8 million square feet annually in 2004, while rents experience a 60% increase between 1998 and 2008. Again, an outcome at least this optimistic occurs with only a 2.5% probability. In between are rent and construction projections that are again far more likely.

In some sense, the office market income risk in these figures looks quite low. The spread in year 2008 maximum/minimum rent levels is 41% of today's value and even in the worst case, gross income would be flat. All other outcomes have income rising significantly. The reasons for this are two-fold. First, the LA office market is just beginning a new development cycle. This is because rents have only recovered back to the levels of the late 1980s in current dollars. They are still below their historic highs in real dollars, and it is the latter which is a much better benchmark for the cost of replacement. A negative shock at this point does little damage to the market. Positive shocks will generate a few years of strong rental growth before new supply catches up. Secondly, office supply in LA historically is somewhat "rent inelastic". It takes significant increases and some time to generate a development "boom" in reaction to rental growth. It has been argued that this makes real estate markets in general more stable [Wheaton] and therefore less likely to overbuild.

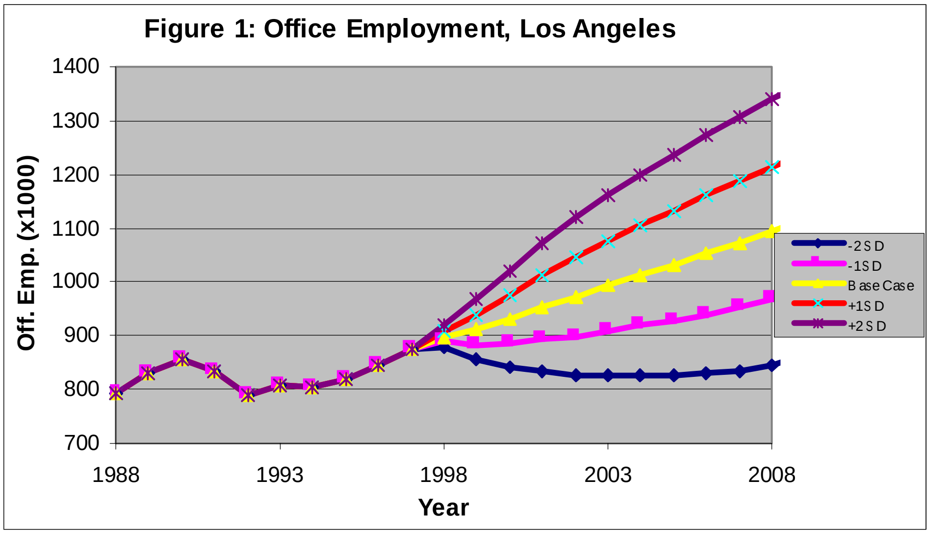


Figure 1: Office Employment, Los Angeles
Off. Emp. (x1000)
1400
1300
1200
1100
1000
900
800
700
1988
1993
1998
2003
2008
Year
-2SD
-1SD
Base Case
+1SD
+2SD

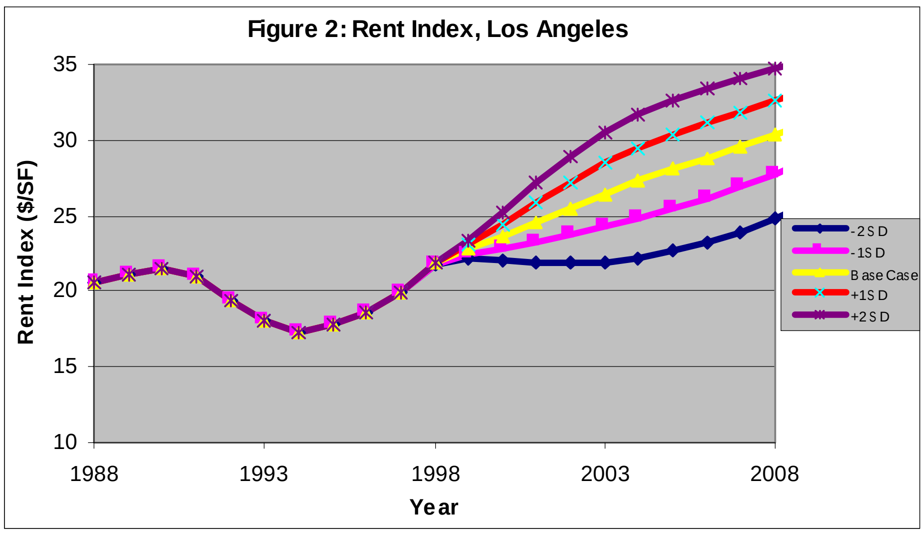


Figure 2: Rent Index, Los Angeles
Rent Index ($/SF)
35
30
25
20
15
10
1988
1993
1998
2003
2008
Year
-2SD
-1SD
Base Case
+1SD
+2SD

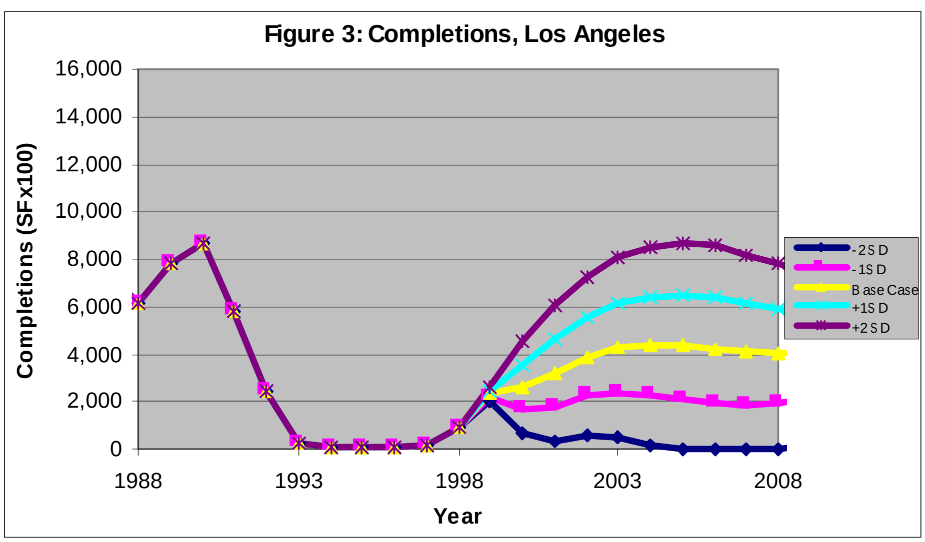


Figure 3: Completions, Los Angeles
Completions (SFx100)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1988
1993
1998
2003
2008
Year
-2SD
-1SD
Base Case
+1SD
+2SD

Washington D.C.: Low Economic, High Supply Risk

Applying the same ARIMA methodology to the Washington DC economy, together with the RFA forecast for that region, yields the office employment confidence intervals shown in Figure 4. Washington has less economic risk than Los Angeles. The range of 2008 employment levels between the +2 and -2 standard deviation scenarios is 44% of current office employment, as opposed to 57% for Los Angeles. The economic forecast is less risky because the Federal presence in Washington historically has smoothed its economy and because growing high technology employment seems to be filling the void left by shrinking defense related sectors.

In Washington, however, the next office construction cycle is already well underway. Completions this year were 4.5 million, and 10 million is under construction for 1999. Beyond that, committed planned projects loom even bigger. Turning to the rent forecasts in Figure 5, the reason for this building boom becomes apparent. Washington rents are already 30% ahead of their late 1980s levels. Even adjusting for inflation, real rents in the Washington market have set a new precedent. Historically, the building cycle in Washington has been quite volatile and exhibits a great deal of momentum once underway. The market has a high "rental elasticity" of construction, and is prone to overbuilding, with a boom well under way.

The rental outlook for Washington shows considerable risk. In the –2 standard deviation scenario, rents in 2008 fall back to 1992 levels, while in the +2 standard deviation outlook, they are only 20% higher than currently. While outcomes above or below these bands are unlikely (2.5% probability), the forecasts in between show little rental growth and considerable oscillation over the next decade. The range in year 2008 rent levels is 61% of today's value as opposed to only 40% for Los Angeles. The culprit is again the already occurring building boom. The alternative economic scenarios only determine the extent and magnitude of new development – too much momentum is already underway to avoid overbuilding. [2]

[2] While the confidence intervals of the economic forecast are symmetric around their expected values, the property market reactions need not be. The ability to generate almost any level of new construction tends to limit rental values on the upside, while the durability of built assets makes rent more volatile on the downside.

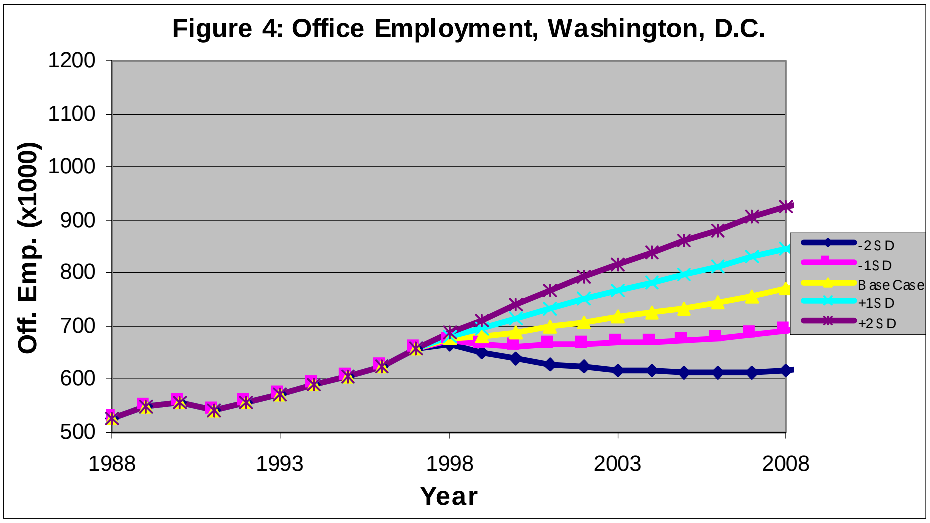


Figure 4: Office Employment, Washington, D.C.
Off. Emp. (x1000)
1200
1100
1000
900
800
700
600
500
1988
1993
1998
2003
2008
Year
-2 SD
-1 SD
Base Case
+1 SD
+2 SD

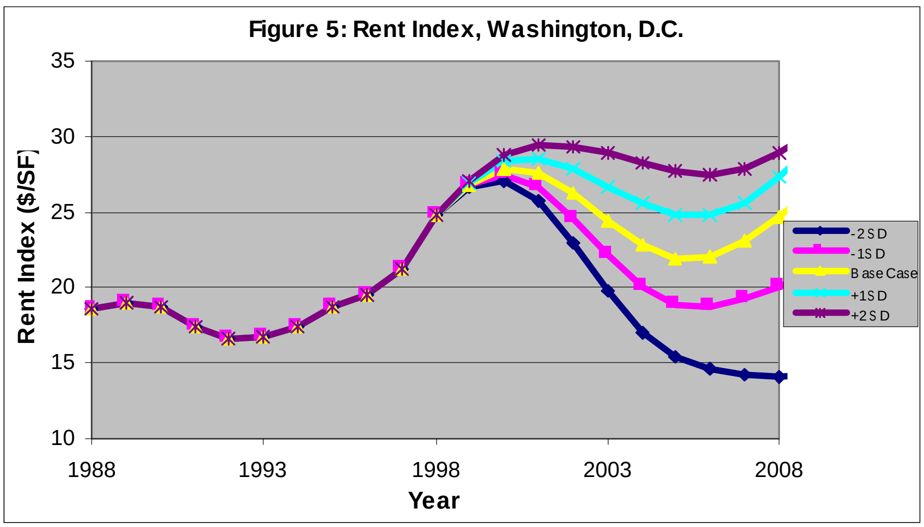


Figure 5: Rent Index, Washington, D.C.
Rent Index ($/SF)
35
30
25
20
15
10
1988
1993
1998
2003
2008
Year
-2 SD
-1 SD
Base Case
+1 SD
+2 SD

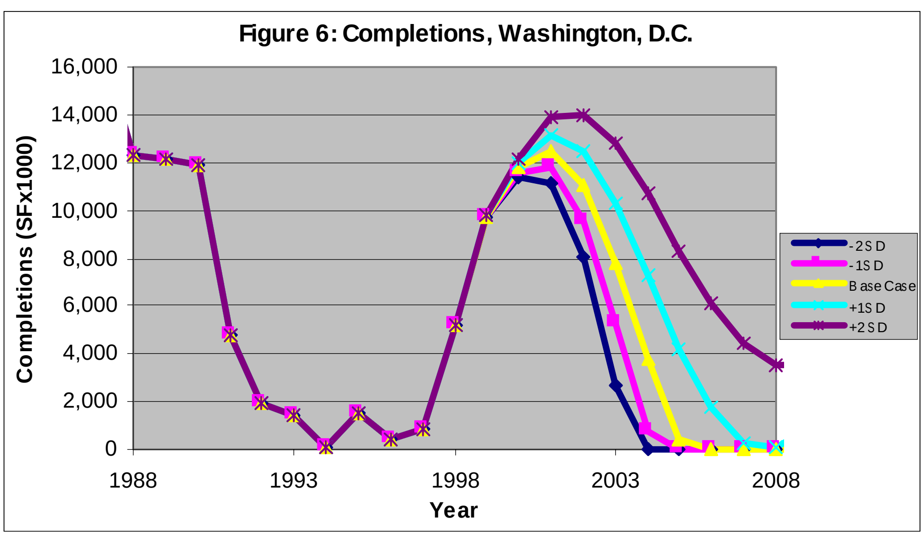


Figure 6: Completions, Washington, D.C.
Completions (SFx1000)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1988
1993
1998
2003
2008
Year
-2 SD
-1 SD
Base Case
+1 SD
+2 SD

Translating Market Risk into Property Income Risk

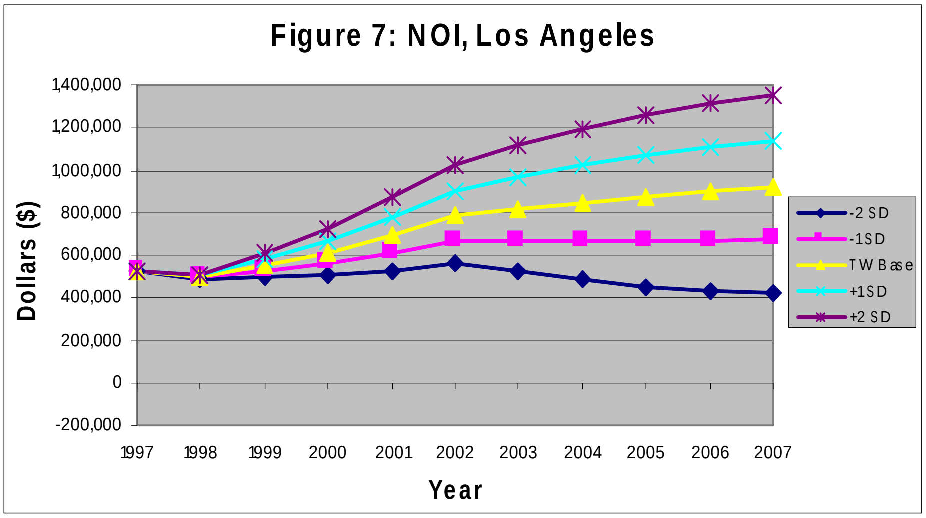
The confidence bands for the Washington and Los Angeles office markets are academically interesting, but to be truly useful for investment decision making, they must be translated into the likely scenarios for a particular property's income. In many instances, the longer term and staggered leasing of a property can provide some insurance against temporary market rent fluctuations. At the same time, the magnitude and growth of operating expenses creates a leverage effect on gross income – increasing the volatility of NOI or net cash income. To compare each area's market risk for a "representative" property we must convert each market rent forecast into one for net property income. We have devised a software that does this in several steps – with user supplied inputs.

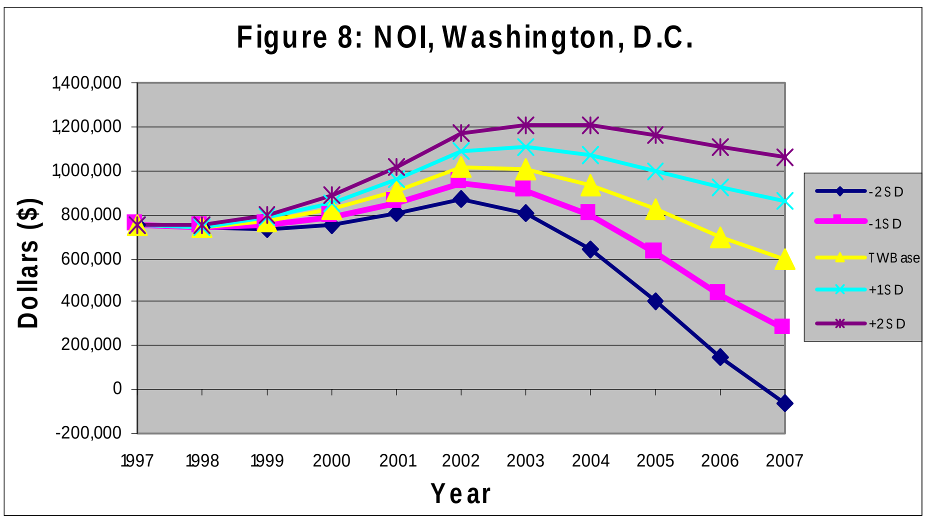
1). Office rents are assumed to rollover every five years and move with the forecast "market" rent. Thus, gross income is a five year blend of the rent series depicted. An allowance is made for lease non-renewals, and the downtime during re-leasing is based on the market wide vacancy rate at that period.

2). Prototypical operating costs have been obtained from several sources, and are assumed to rise with CPI inflation. Additional prototypical allowances are made for tenant improvements after lease non-renewals, and capital expenses. Using these, prototypical building gross income is converted to net operating income after capital expenses (here called NOI).

In Figures 7 and 8, this approach is applied to a prototypical 100,000 square foot office building in each market. In the case of Los Angeles, there is only a small risk that building net income will fall below $400,000 from its initial level of roughly $500,000. This risk is greatest in the year 2008, but is still only about 2.5%. In Los Angeles the expected income stream of a property seems exposed to very little downside risk. The implications for lending in this market are quite important. For example, a typical 70-80% debt service coverage ratio would be quite secure and virtually risk free. Washington, however, presents another story. The initial property income of $750,000 stands a 50% probability of falling below $600,000 in the year 2008 and has a 15% probability of dropping to below $200,000 in that year. Thus, a loan with the same 70-80% debt service coverage ratio in Washington has almost a 50% probability of being delinquent in the year 2008. In fact, for virtually any size loan, there is at least a 2.5% probability of falling delinquent in 2008 for properties in the Washington DC market.

This type of analysis can be duplicated across property types and geographic markets – and then used to comparatively evaluate lending risk. We are in the process of undertaking such an exercise, and initial indications suggest that there are far greater differences in lending risk across markets than current differences in mortgage spreads would suggest.





Summarizing Property Income Risk: IRR Risk

The two examined MSAs show substantial difference in their degrees of market risk, and resulting income risk, all as measured by the spread in these respective forecasts. The issue remains as to how these forecast spreads can be captured into a single measure of total return that could be used to rank or compare investments. An obvious candidate should calculate the IRR that is implied by the income streams such as those shown in Figures 7 and 8.

To calculate the IRR for a "prototypical" property of course requires an initial property value. We have gathered several sources of current building transaction data and used these to derive a cap rate for assets in each market.

In LA this value is 8.15%, while in Washington it is 8.90%. This cap rate is applied to the base year NOI numbers to calculate an estimated "transaction price" for the prototypical building asset. The income forecast is then run for a long term period (55 years) effectively assuming a perpetual hold. Then, calculate the IRR that equates this property value with the "perpetual" net income forecast.

If this process is repeated for each economic scenario, then the probability distribution of IRRs can be obtained. In Los Angeles, this approach yields the five IRR estimates shown in the first column of Table 1 below. Assuming a normal distribution of the scenarios, we can calculate the expected value and standard deviation of these income returns in Los Angeles (and then Washington).[3] In the table, Washington not only has a lower expected IRR, but also higher variance as well. Since individual real estate assets, or even specific geographic portfolios of these assets are not traded in any current public market, there is little reason to expect that they will follow CAPM rules.

Earlier, we observed that the Washington D.C. economy is less risky than that of Los Angeles. Despite this lower economic risk, the real estate investment risk in Washington D.C., as judged by the standard deviation in IRR, is somewhat greater than in Los Angeles. The reason, of course, is the greater volatility of supply and that a building boom is well underway in Washington. As an experiment, we have generated a series of forecasts for Washington that use the economic confidence bands of the Los Angeles economy (around the base RFA Washington forecast). The results are shown in the final column of Table 1. With this equivalent (and greater) amount of economic risk, the standard deviation in Washington's IRR rises to 1.78. Thus, the greater supply problems in Washington are responsible for about 40 basis points of relative extra risk – in comparison to Los Angeles.

Table 1: IRR with 55 year hold

Scenario	Los Angeles	Washington, D.C.	Washington, D.C. (LA)
-2 SD	11.01	7.34	6.36
-1 SD	12.49	10.12	9.76
TW Base	13.99	11.89	11.89
+1 SD	15.36	12.98	13.12
+2 SD	16.76	13.76	14.07
Mean IRR	13.94	11.49	11.38
Var IRR	1.92	2.23	3.17
StDev IRR	1.39	1.49	1.78

[3] Assuming the IRR distribution is normal, the five observations available can quite closely approximate the distribution's mean and standard deviation.

In examining Table 1, we are struck by two overall observations regarding our approach. First, our expected IRR values are roughly comparable with historic NCREIF data and seem quite in line with the current investment targets of many asset managers. Second, the risk measures produced by our analysis are far lower than the historic risk in total return that emerges from the NREIF data.

Conclusions: Sources of Investment Risk

We have outlined an approach for assessing the income risk in properties. The approach is based on the premise that the most important source of this risk is the market's fundamentals – rent and vacancy – and that this risk derives from uncertainty about demand (the market's economy) and supply (stage of building cycle). Using modern time series analysis, it is possible to quantify this kind of risk. We suggest that the confidence intervals around a future forecast of each market's economy can be fed into a real estate model to generate confidence intervals for prototypical property rents and income. With confidence bands around property income, we can calculate an expected (perpetual hold) IRR – and the standard deviation of that return.

If this approach yields risk measures that seem low by historic performance standards, it is because it accounts for only one source of investment risk: income risk. In examining the NCREIF series, for example, much of the historic variability in returns has come from capital gains and losses. While these appraisal based valuations have been often criticized, it is certainly true that the approach described here does not consider "pricing" risk, and with anything less than a perpetual hold, this type of risk can be important.

While the income risk measures here would make it difficult to compare real estate risk with that of other (more traded) assets, it would seem possible to make comparisons within the real estate sector, across markets and types of property. In fact, using the type of expected IRRs and standard deviations shown in Table 1, we have begun to undertake a more formal portfolio analysis exercise. With a set of mean and standard deviation IRRs across 54 markets and four property types, we have found that an "efficient real estate frontier" involves a relatively small number of area-property types, and that several different portfolios can come quite close to the efficient one in terms of risk adjusted return.

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