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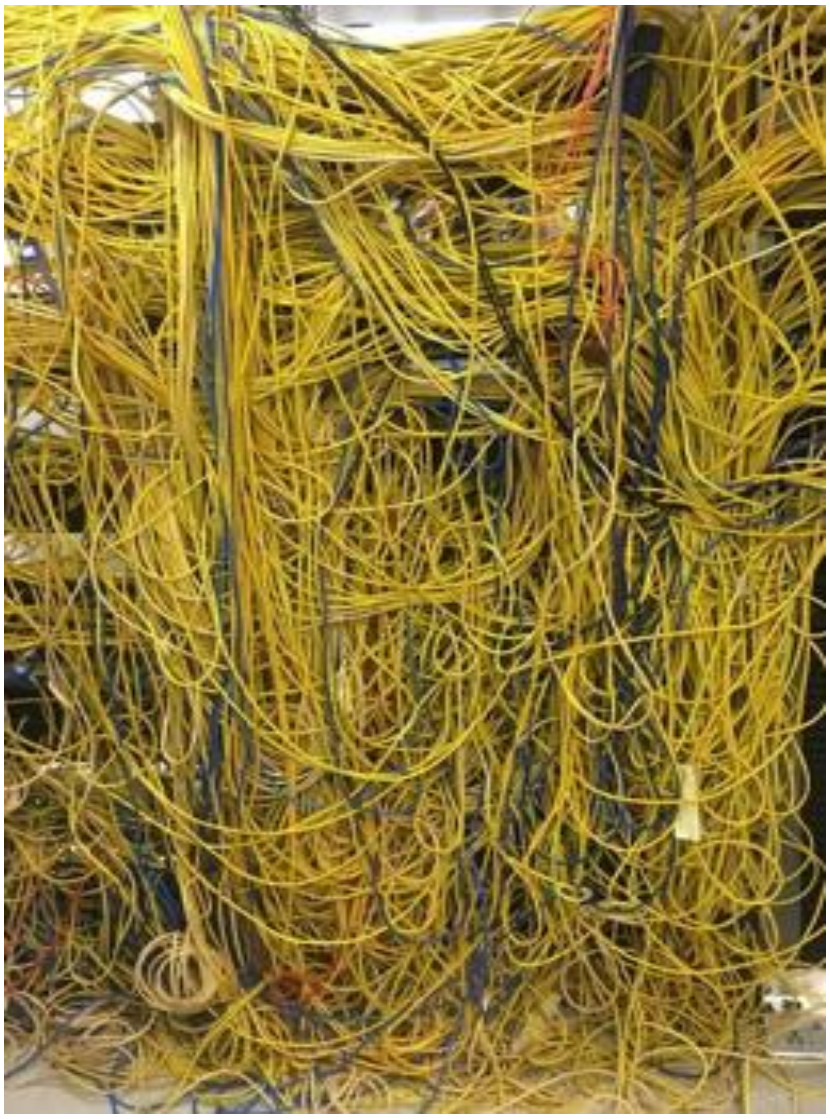

Unravelling risk and valuing embedded options

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February 22, 2023

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Introduction

Zisler Capital Associates serves pension funds, endowments, insurance companies, money managers, REITs, and other private equity managers. We have advised over 150 institutional investors, closed over $6 billion of transactions, as pension consultant advised over 25 pension funds (including CALPERS, CALSTRS, IBM, AT&T and GM), and written over 100 papers. Our firm has raised capital on behalf of managers, some well-established and others new to the world of pension capital.

Few research firms combine sophisticated analytics with many years of transactions experience. Our research focuses on ways to make the right deals happen.

Our firm is also different because it engages in basic research regarding risk, structuring, and pricing. Ongoing developments in other capital market sectors inspire our work. We are pioneers in the application of modern portfolio theory, attribution analysis, stochastic optimization (or multi-phased, multi-use projects), derivatives, and fixed income to real estate, public and private, debt and equity. In our search for practical, wealth-enhancing solutions to client problems, we search for the deeper structure that others often ignore.

This short overview illustrates the kinds of assignments we accept and showcases our unique approach to portfolios, deals, financial instruments, leases, and markets.

We like to think of ourselves as trusted advisors.[1]

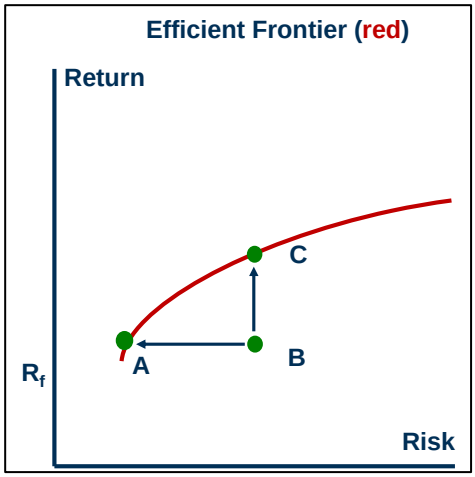
[1] Randy's resume includes a professorship at Princeton, executive director of real estate research at Goldman Sachs and Nomura Securities, head of investment banking at Jones Lang LaSalle, and partner at Pension Consulting Alliance.

Zisler Capital Associates publishes cutting edge research which it posts on its website, www.zislercapital.com. Pension funds receive the research free while managers and others pay a nominal fee.

Portfolio: Building a Korean Portfolio with Senior US Mortgage Debt

We derived efficient portfolios including senior mortgages using modern portfolio theory. An important component is the efficient frontier, which is a set of efficient risk-return points. For example, investors can increase the return of Portfolio C only by incurring greater risk. Portfolio B lies below the efficient frontier. Hence, the investor can reduce risk without sacrificing return by moving from Asset B to Portfolio A on the frontier.

Exhibit 1. Efficient frontier



Similarly, the investor can increase return without incurring additional risk by moving from Asset B to Portfolio C. These shifts increase portfolio efficiency. Lack of rebalancing exposes the investor to needless risk and leaves value on the table. Each move usually entails a change in the asset allocation. The benefits of diversification are strongest when the correlation between assets is low.

We use proprietary methods to adjust private returns for serial correlation or to create for non-traditional assets synthetic returns and risk analytics using Monte Carlo simulation.

Exhibit 2. Efficient surplus frontiers for different funding statuses (and liabilities)

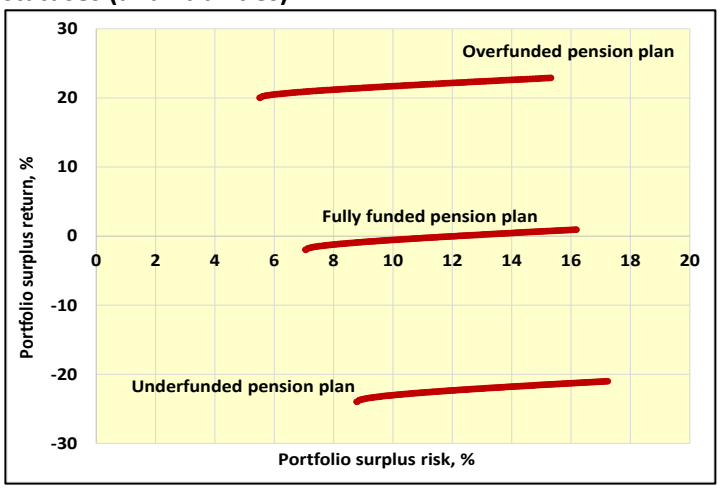
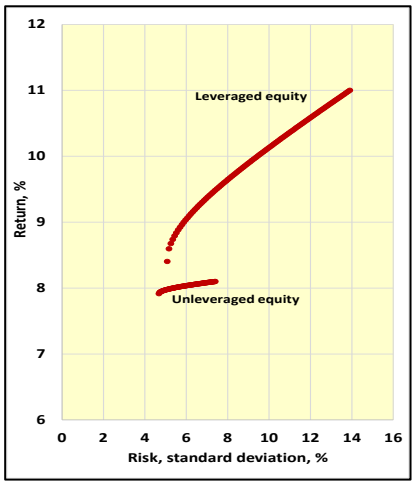


Exhibit 3. Leveraged and unleveraged efficient frontier.



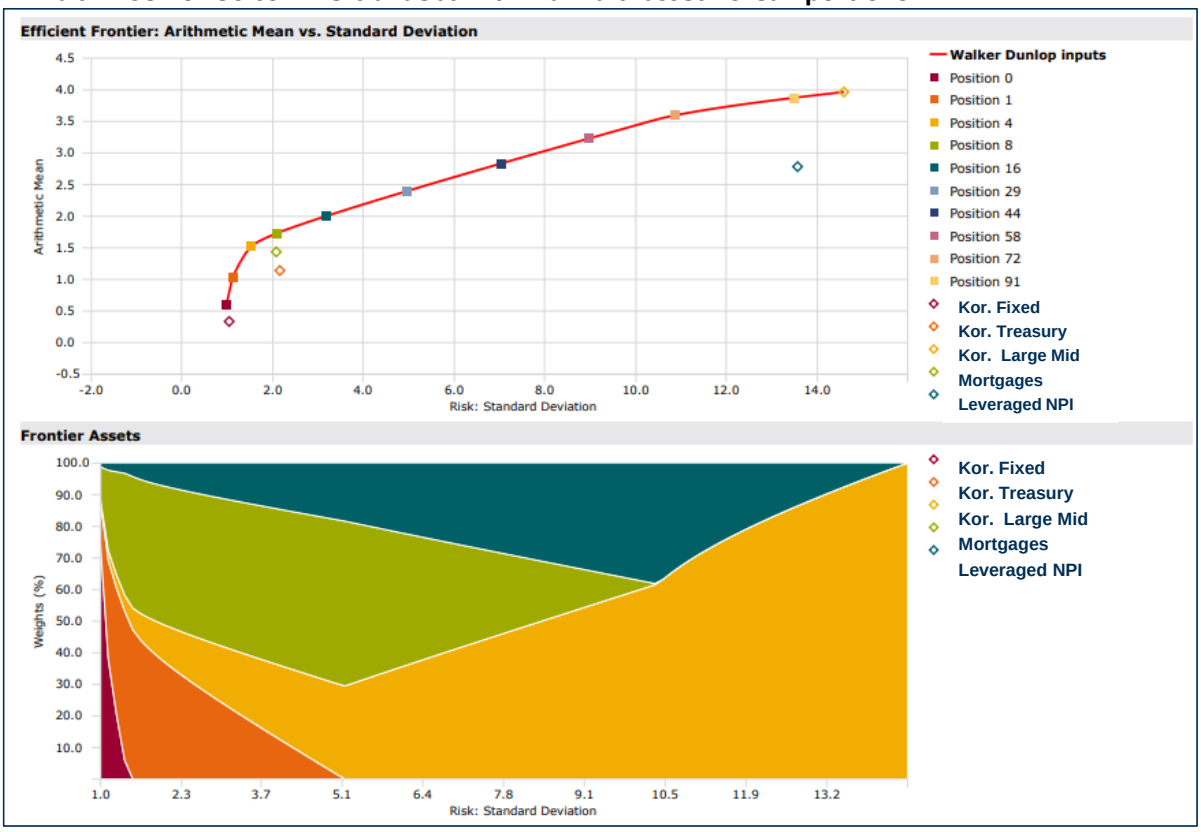
Source: Zisler Capital Associates, LLC

Exhibit 2 shows that the efficient surplus return is sensitive to the funding status. Leverage makes a significant difference with regard to risk and return, as shown in Exhibit 3. The next example shows the efficient frontier for a multi-asset Korean portfolio that includes US senior commercial mortgage debt.

Portfolio (Continued)

While the allocation to senior debt is this example is practically speaking too large, the results do indicate the strong diversifying power of commercial mortgage debt within a Korean multiclass portfolio. [2] Exhibit 4 shows the efficient frontier and asset allocation.

Exhibit 4. Senior US commercial debt within a multi-asset Korean portfolio

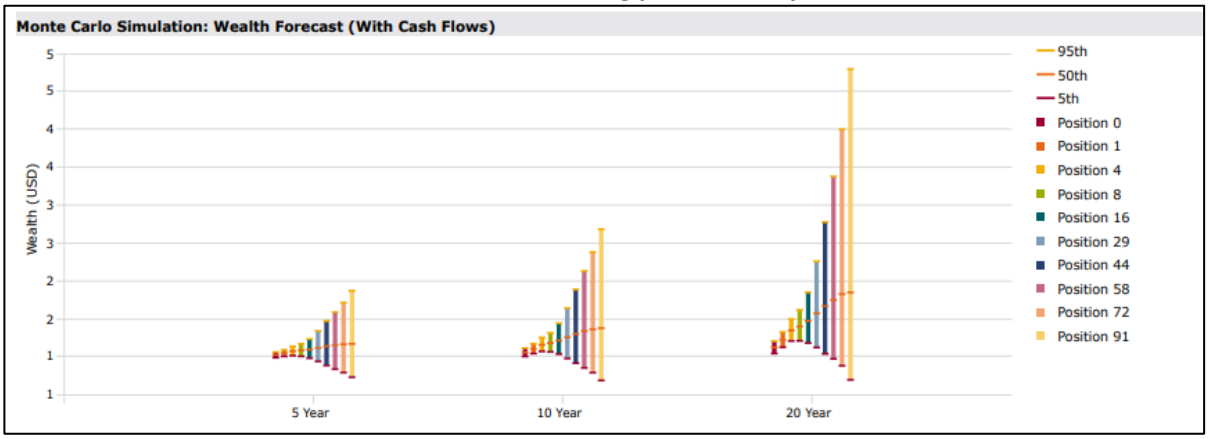


Source: Zisler Capital Associates, LLC

We simulate the impact of alternative asset allocations on wealth. Additionally, we investigate the stability of the asset allocations with regard to alternative volatility, correlation, return, and liability assumptions.

[2] In the analysis we corrected for serial correlation (or smoothing) in the commercial mortgage return data using a technique published by Randall Zisler and Stephen A. Ross in the ***Journal of Real Estate Finance***.)

Exhibit 5. Simulation of wealth for different holding periods and positions on the efficient frontier.



Source: Zisler Capital Associates, LLC

Financial Instrument: Designing a Convertible Bond for an Asian REIT

Clients ask us to design and back test new instruments, such as convertible bonds, mortgages, leases, preferred equity and other mezzanine debt products. We use advanced econometrics and Monte Carlo to value the embedded options.

The following are exhibits from an assignment involving the design of a convertible bond to be issued by a Chinese public REIT. The client was a London private equity firm. We simulated the Chinese REIT market (including discounts to NAV) and the Shanghai property market. Exhibits 6 through 10 are exhibits from our research.

Exhibit 6. Hang Seng return and NAV discount.

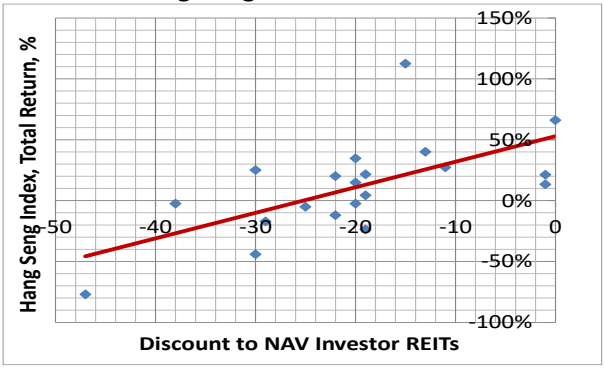


Exhibit 7. Singapore discount/premium to NAV

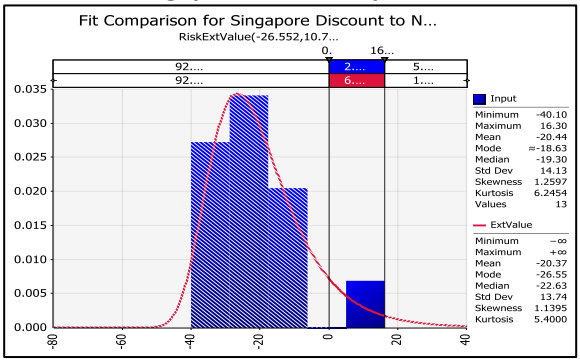


Exhibit 8. Unleveraged property IRR after 3.5 yrs

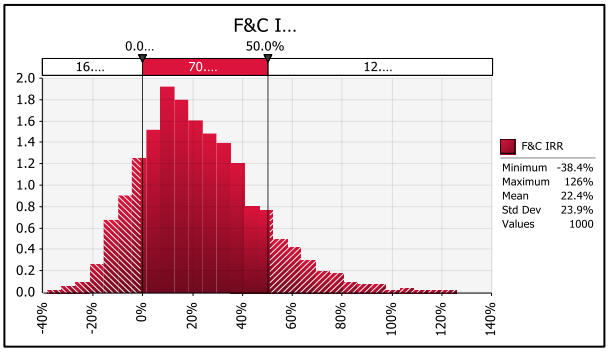


Exhibit 9. Probability of entity default is low.

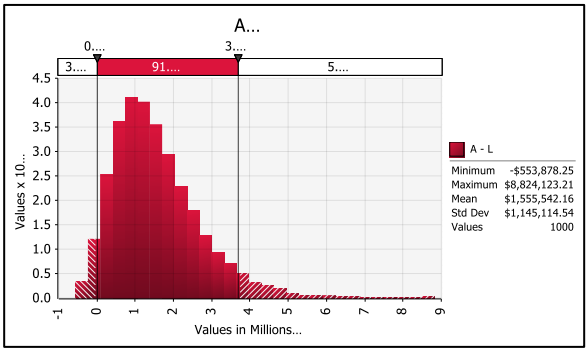


Exhibit 9. Property IRR with a 35% LTV.

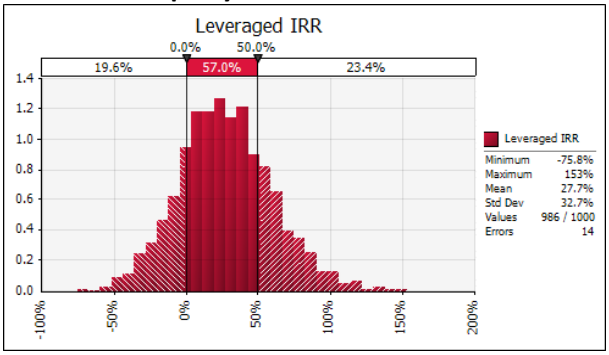
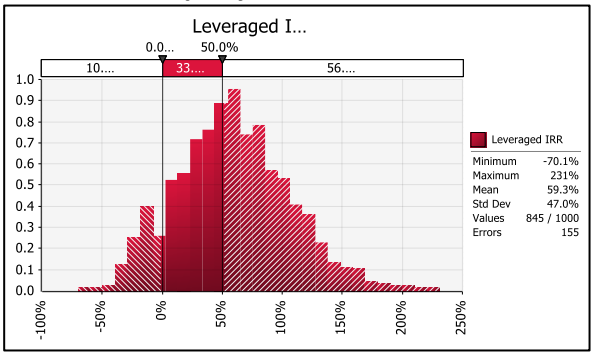


Exhibit 10. Property IRR with a 75% LTV.



Source: Zisler Capital Associates, LLC

Designing a Convertible Bond for an Asian REIT (Continued)

Exhibit 11. Simulated stock price return

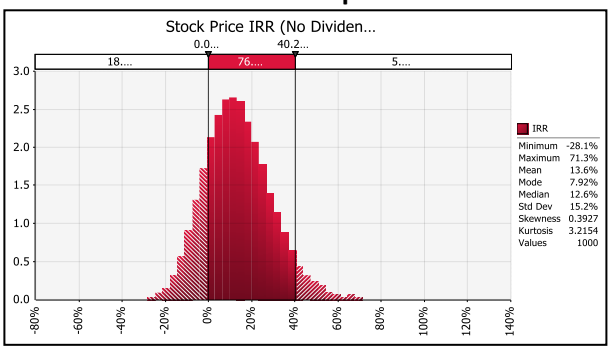
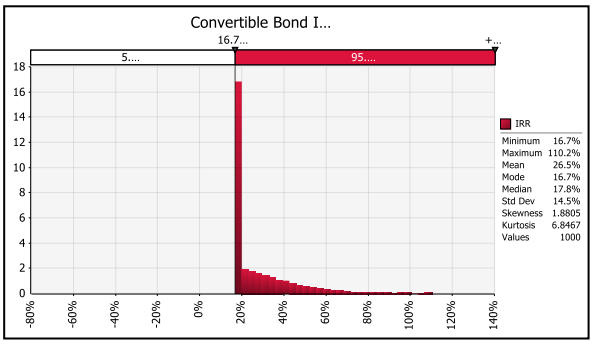


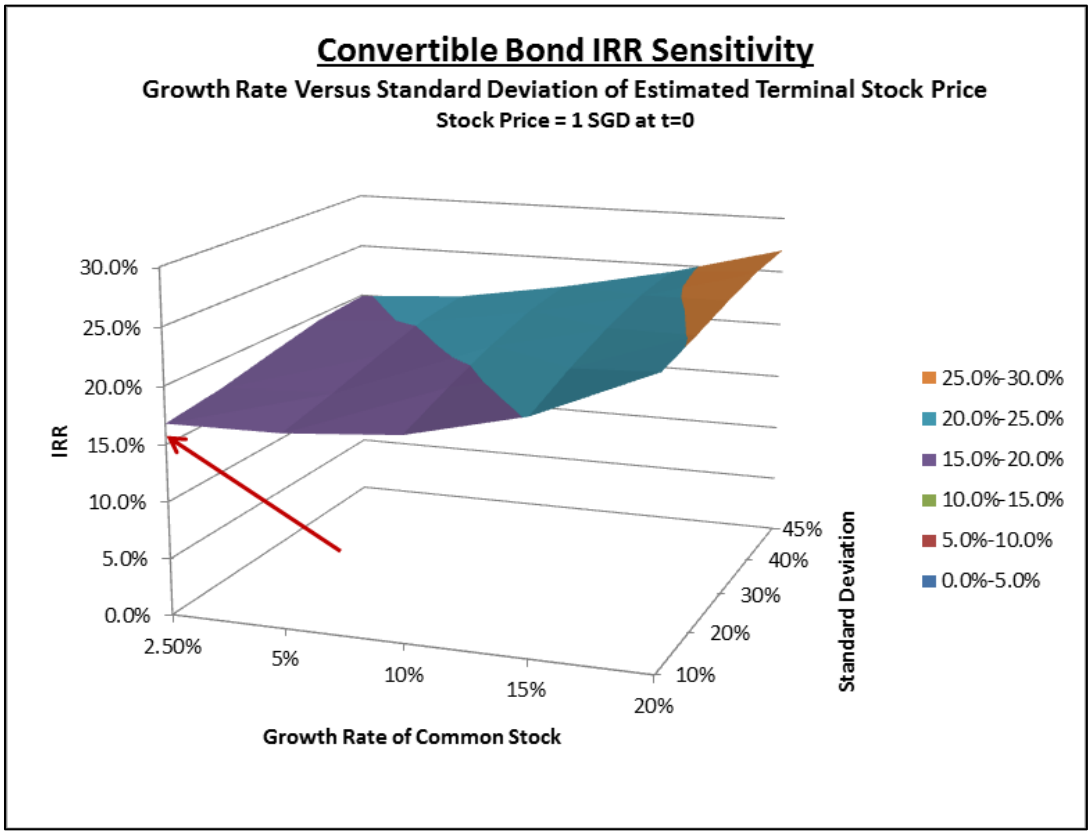
Exhibit 12. Convertible bond return distribution.



Source: Zisler Capital Associates, LLC

Our results underscored the importance of evaluating the embedded optionality using Monte Carlo techniques. We show that, given our stock return and volatility assumptions, the convertible bond expected return is worth more than its yield to maturity. There is sufficient conversion opportunity or optionality to generate an expected return in excess of the yield to maturity.

Exhibit 13. IRR exceeds 16.75% for a broad range of return and volatility assumptions



Source: Zisler Capital Associates, LLC

Lease: Using Real Options to Unlock Hidden Value

Our UK client asked us to evaluate a number of alternative lease structures. We include some exhibits from the analysis, which included the use of Monte Carlo simulation.

Most real estate portfolio managers do not focus on volatility. This is surprising since many real estate contracts contain complex options, the value of which vary depending on the volatility of the underlying market or reference indexes.

Examples include the right, but not the obligation, to release, to terminate a use, to redevelop property, and the right to increase a tenant's rent. A penalty function is a contract is an option.

Leases are replete with options and are, therefore, susceptible to real options valuation tools. The value of these values responds to random variables, such as interest rate and other shocks.

Most real estate investment analysis is deterministic. The usual sensitivity analysis amounts to no more than perturbing one variable while holding others constant. Deterministic methods fail to properly price embedded options. As a result of this industry-wide malpractice, investors leave value on the table and incur needless risk, sometimes substantial risk. This industry pathology affects all levels of real estate: the lease, debt, the deal, and the portfolio. With regard to leases, ignoring the volatility of market rents and their impact on embedded options causes tenants and owners to make the wrong choices.

Exhibit 14. Evolution of leasing market volatility with no time trend.

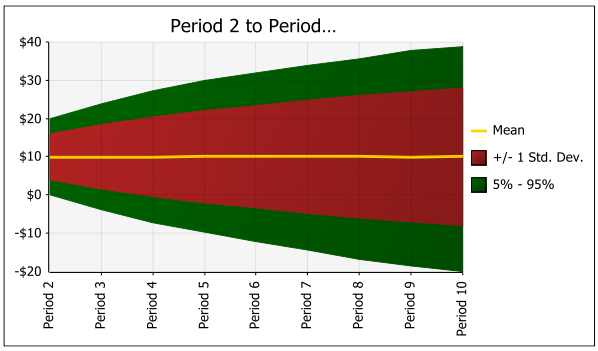


Exhibit 15. Net present value of UK upward-only adjusting lease as a function of volatility

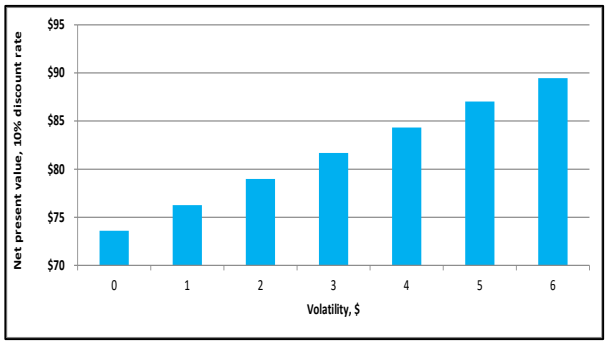


Exhibit 16. The increase in the flat lease initial rent to equate the NPV's of the flat rental lease and the upward-only adjusting lease.

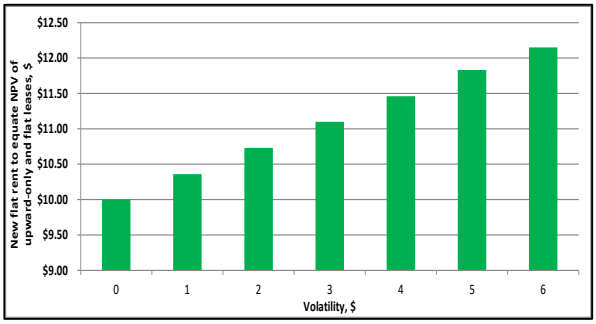
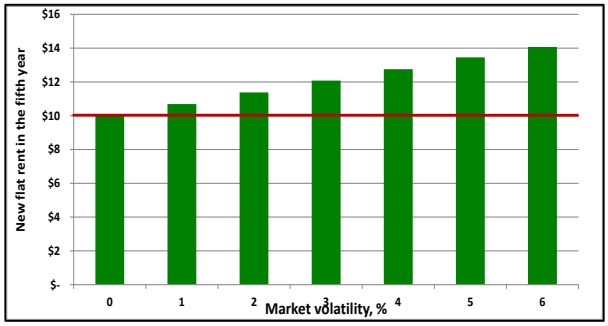


Exhibit 17. Adjusted 5-th year rent of upward-only adjusting lease.



Source: Zisler Capital Associates, LLC

We consider a flat coupon lease with term to maturity that is identical to the term of an upward-only adjusting lease. In order for the values (NPVs) of the two leases to be identical, the flat coupon must rise with increasing market volatility. The volatility increases the value of the escalation option, even if there is no trend growth assumed in rental payments. We simulate two leases: A ten-year flat and a ten-year adjusting lease. Volatilities range from no volatility to £6 per year for an adjusting lease whose initial rate is $10. We assume no trend growth.

Even without trend growth, the standard deviation of market rent increases over time because the mean market rent adjusts stochastically (or randomly). As a result, the probability of rents exceeding the base rent increases. (See Exhibit 14.)

As rental volatility decreases, the market rent probability distribution is narrower and more focused—there is less uncertainty—and the escalation option is less valuable. Exhibit 15 shows the net present value of the escalation option as market volatility increases. Note that we assume that the expected rental increase is zero! Moreover, we ignore the correlation between the tenant's and the market's performances. (See Exhibit 15.)

Another way to look at the option is to ask, what is the flat rent required to equate the NPV of the flat lease with the NPV of the lease with the upward-only adjusting lease. Exhibit 16 shows that the rent of a 5-year flat lease must increase as expected market volatility increases.

The fifth year, upward-only, adjustment, is higher with increasing market volatility, as shown in Exhibit 17.

Corporate Finance

Budgeting as if we live in a world of certainty is dangerous to your wealth. Many organizations fail to account explicitly for risk, often eschewing more quantitative approaches, such as Monte Carlo analysis. We show how Monte Carlo analysis can help assess the probability of attaining, but not exceeding, the base case budget. We seek sufficient reserves such that we will breach the budget no more than 5% of the time. When submitting a budget proposal, an executive wants to know the probability that the project will actually be delivered within this budget and how much contingency or working capital should be included to ensure that this budget level will be achieved with a minimum level of confidence? This approach is especially relevant in light of recent inflation volatility.

Exhibits 18 and 19 show the distribution of total costs for two levels of volatility, 105% and 125% of the base cost. The low volatility distribution is narrower and more compact than the higher volatility distribution. With increasing volatility, the overall spread increases with most of the increase occurring in the right tail of the distribution.

Exhibit 20 shows that the probability of meeting the budget target declines exponentially and the required contingency increases linearly as volatility increases, as shown in Exhibit 21. In this example, we have not addressed any possible correlation among the budget categories. We do so next.

Exhibit 18. Cost distribution for volatility 105% of base case

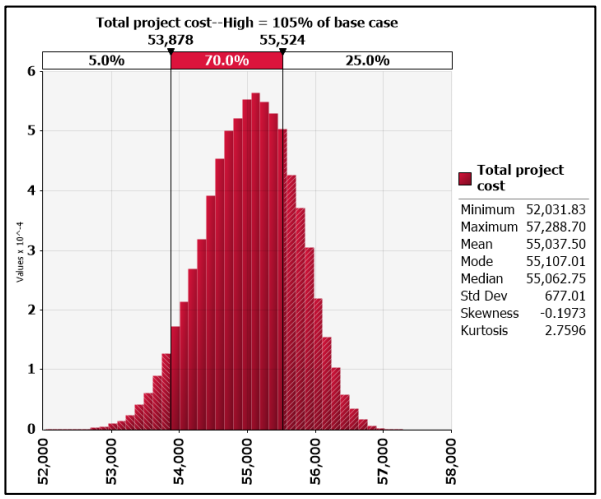


Exhibit 19. Cost distribution for volatility 125% of base case

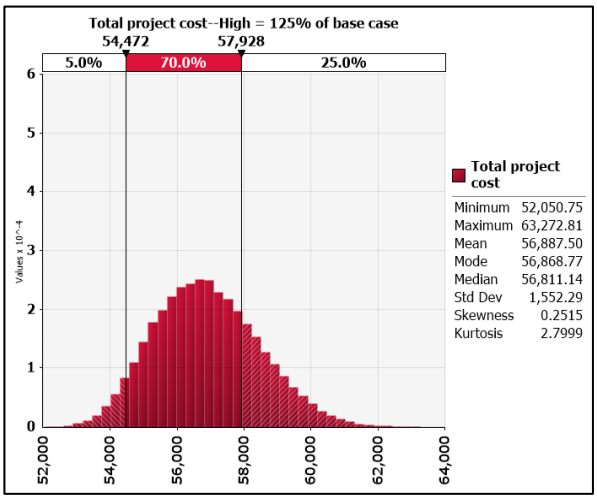


Exhibit 20. The likelihood of meeting budget declines with additional volatility.

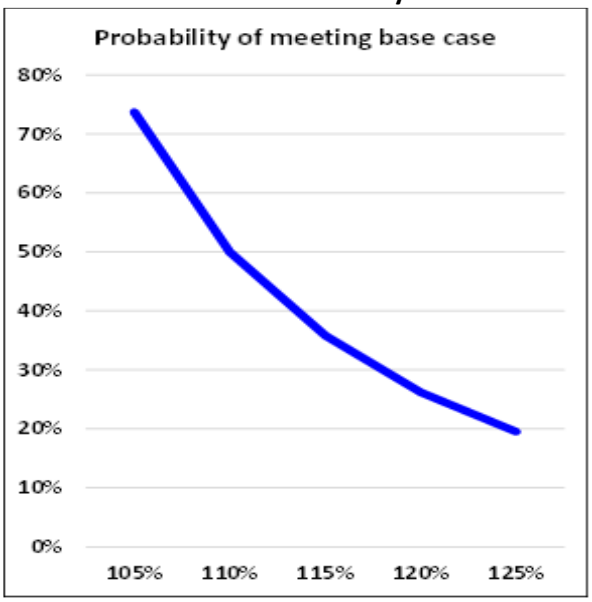
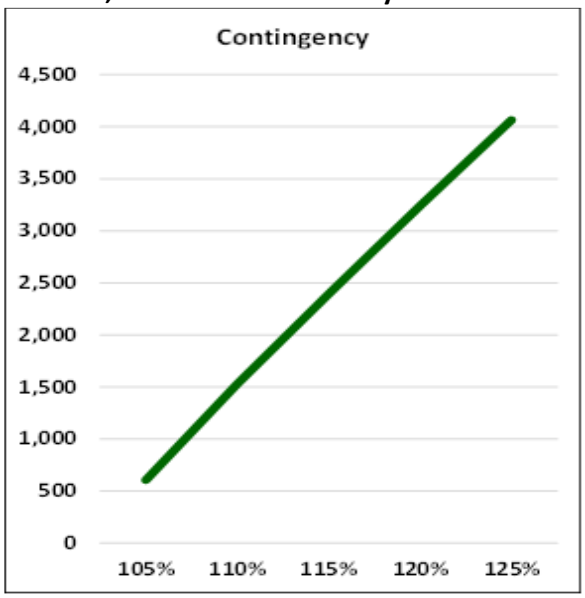


Exhibit 21. The continency, or working capital reserves, increase with volatility.



Source: Zisler Capital Associates, LLC

What happens if the cost categories are correlated, either positively or negatively? How does the correlation affect the optimal level of reserves and the probability of breaching the budget? (The correlation is bounded by +1 and -1,) We consider a simplified two-line item budget consisting of land and building. The total base cost is deterministically estimated to be $55,500.

Exhibits 22 and 23 show the probability of meeting the base case and the required contingency as a function of the upside uncertainty of costs and the correlation. Note the switching of probabilities as a function of budget correlations and volatility. The probability of meeting the base case budget is highest

for positively correlated cost categories when volatility is high. If the correlation is negative, then the likelihood of meeting the budget is highest at low volatilities.

Exhibit 22. The likelihood of meeting the budget falls with increased volatility. At higher levels of volatility, positive correlation increases the likelihood; at negative correlations, it reduces the probability.

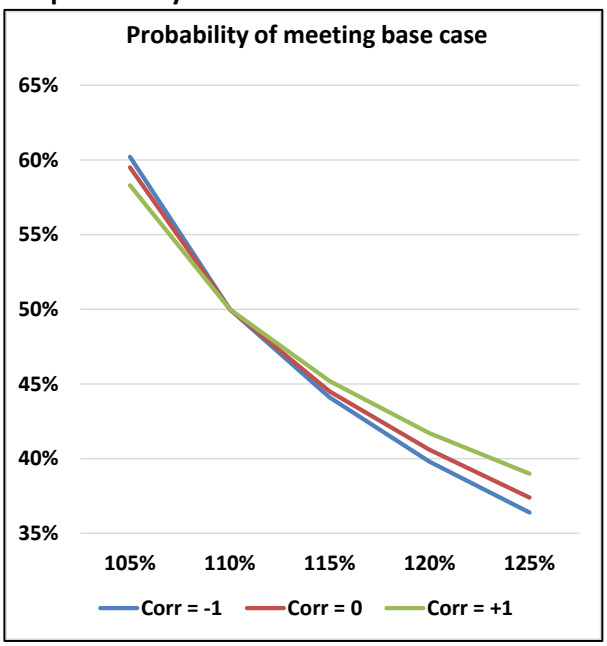
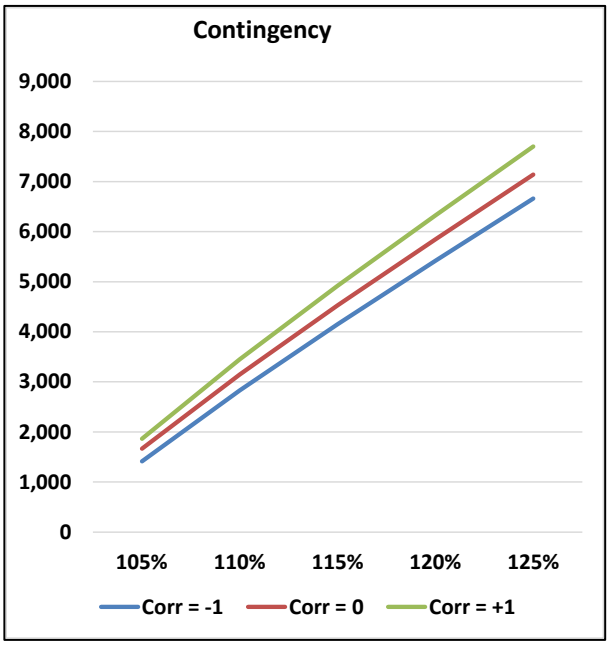


Exhibit 23. The contingency, or working capital reserves, increase with volatility. The reserves are lowest if the correlation is negative and highest when the correlation is positive.

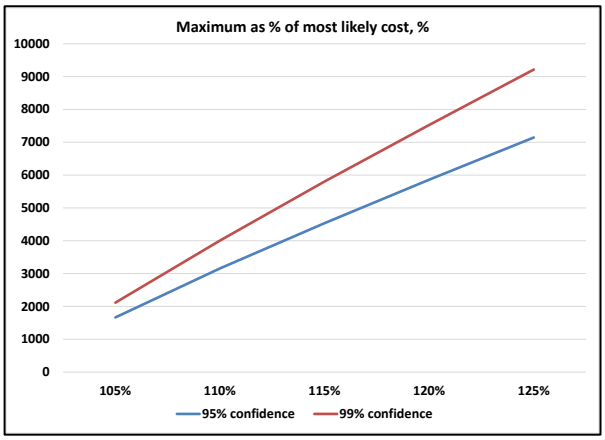


Source: Zisler Capital Associates, LLC

The price of confidence. Managers want to be confident that they will not breach the budget, but confidence comes at a price. Our analysis mostly assumes a confidence level of 95%, which means that there is a breach only once in 20 tries. What happens if we increase the confidence level to 99%? A confidence level of 99% means that breaching the budget would likely occur no more than once in 100 tries.

The reserve gap between the 95% and 99% confidence levels increases with volatility. (See Exhibit 24.) Assuming volatility is 125% (maximum as percent of likely cost), the gap is 29% of the reserves required for 95% confidence. Indeed, a good night's sleep is not cheap.

Exhibit 24. Contingency reserves at the 99% confidence level exceed 95% confidence reserves and rise at a faster rate.



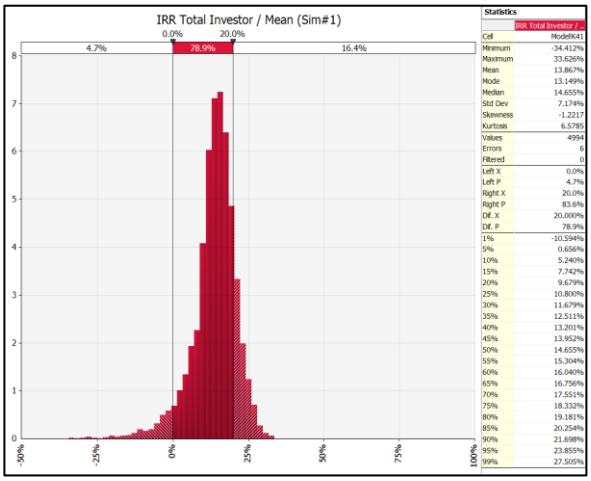
Source: Zisler Capital Associates, LLC

Dissecting Deal Risk

Exhibits 25 through 28 are the culmination of an analysis of a value-add apartment development. The investment includes leverage, LP and GP positions, a waterfall and other nonlinearities. The stochastic, or uncertain variables were the exit cap rate and the rate of rental growth. Deterministic analyses, especially those of complex transactions with phasing and multiple uses, do not assess risk properly.

Monte Carlo analysis includes add-ins to standard EXCEL discounted cash flow analysis. An explicit and rigorous incorporation of risk elevates risk analysis from a metaphorical, impressionistic discussion to one of hard analysis that provides important answers to questions such as the following: What is the likelihood of loss? Is the LP fairly compensated for taking risk?

Exhibit 25. In this transaction the likelihood of a loss to the LP is about 5% and an IRR in excess of 20% is 16.4%



Source: Zisler Capital Associates, LLC

Exhibit 26. The GP position is replete with optionality, which explains why the probability of a return in excess of 20% is 72.2%.

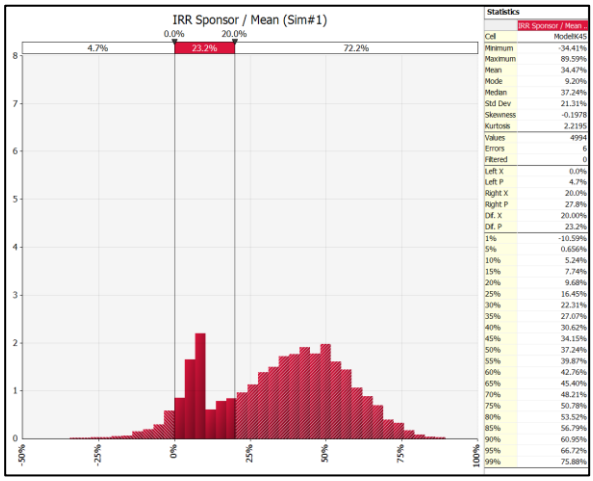
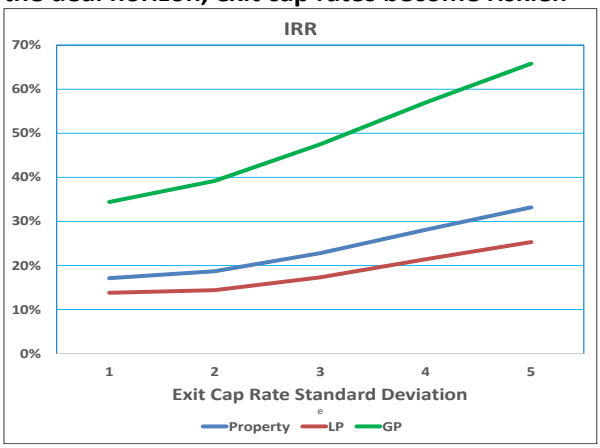
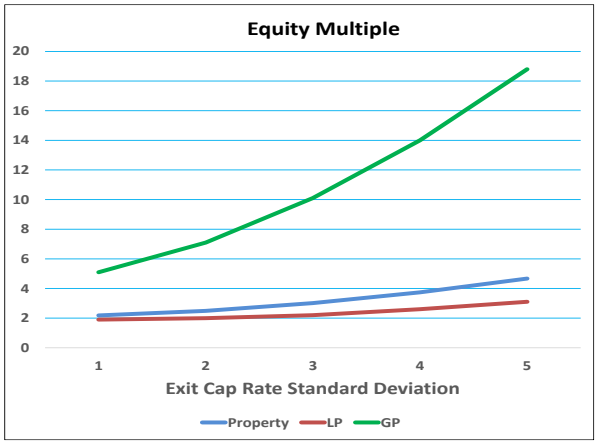


Exhibit 27. GP's IRR rises faster than the LP's IRR with rising exit cap rate volatility. The longer is the deal horizon, exit cap rates become riskier.



Source: Zisler Capital Associates, LLC

Exhibit 28. The GP's equity multiple rises even faster than the GP's IRR as exit cap rate volatility rises.



Market Risk

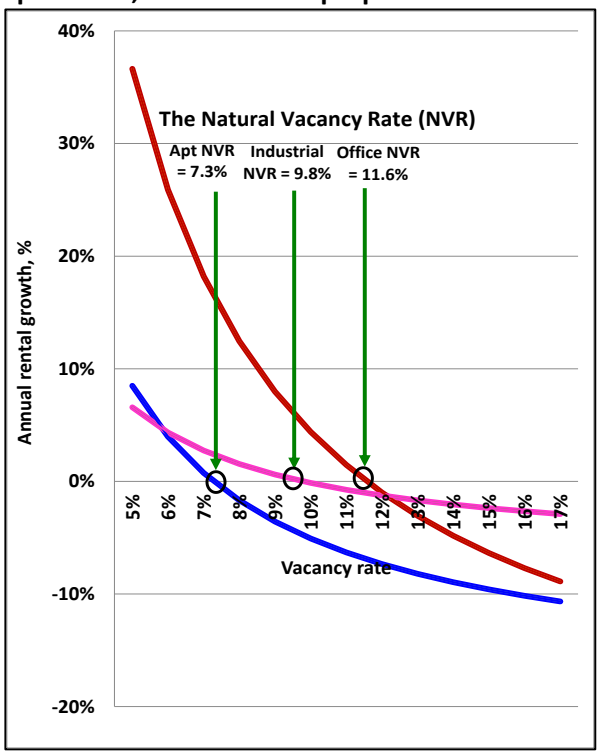
Market analysts too often do not deal explicitly with market risk and treat all MSAs as if they were alike. We have developed extensive risk metrics to characterize MSA risk. These metrics better inform risk analysis at the deal and portfolio levels.

An important question is what is an equilibrium vacancy rate or the natural vacancy rate (NVR). If vacancy rates are higher then equilibrium, then rental rates should fall, attracting new tenants and restoring equilibrium. If vacancy rates are lower than equilibrium, then rents should rise. We estimate econometrically the natural vacancy rate, which we define as the rate at which rental growth is zero.

We observe that the NVR is generally higher in faster growing MSAs wherein the transactions demand for vacant space is higher. Tenants and owners engage in a complex search and matching process, which an optimal amount of vacant space supports.

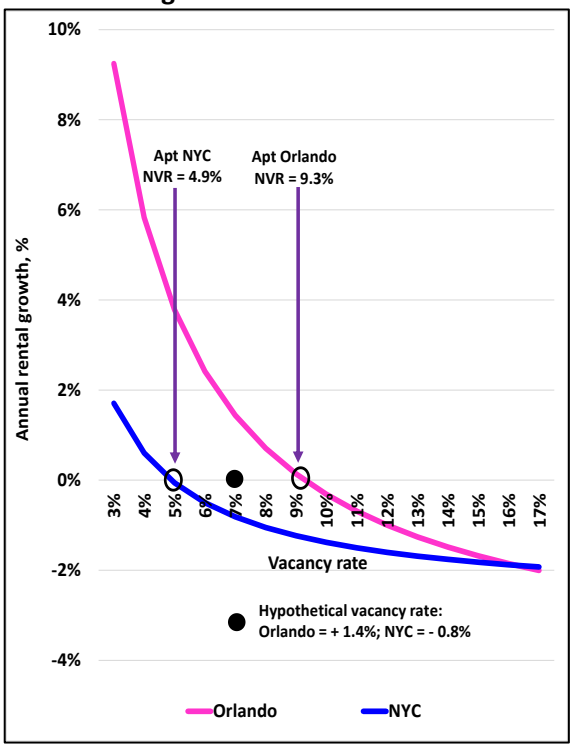
For example, investors should note that when vacancy rates are 7% rents fall in NYC but rise in Orlando.

Exhibit 29. US natural vacancy rate for office, apartment, and industrial properties.



Source: Zisler Capital Associates, LLC

Exhibit 30. The NVR varies by MSAs due to differences in growth and other factors.



Risk analytics are useful in challenging the received wisdom. For example, many investors prefer faster growing MSAs but ignore risk. If risk rises rapidly with growth, then the risk adjusted return may be lower in higher growth MSAs.

Additionally, the more inelastic is the supply of office space, the greater is rental growth volatility. This is especially true if, at the same, time, demand for space is inelastic.

Exhibit 31. High growth MSAs with more elastic supply curves, e.g., Phoenix. Demand shocks work mostly through the vacancy rate.

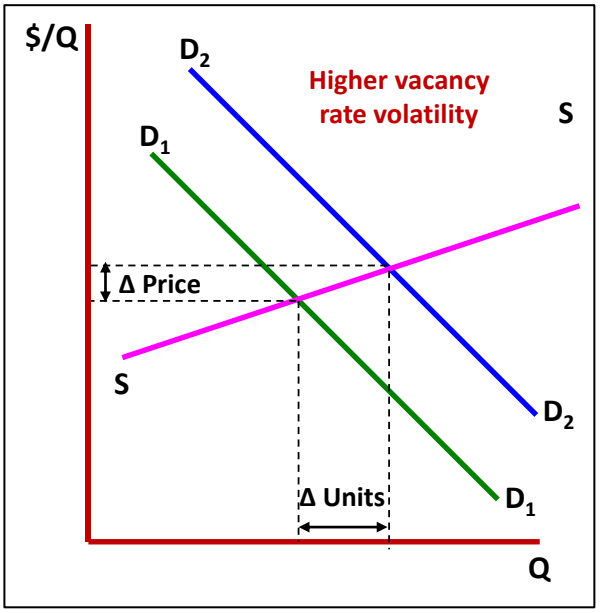
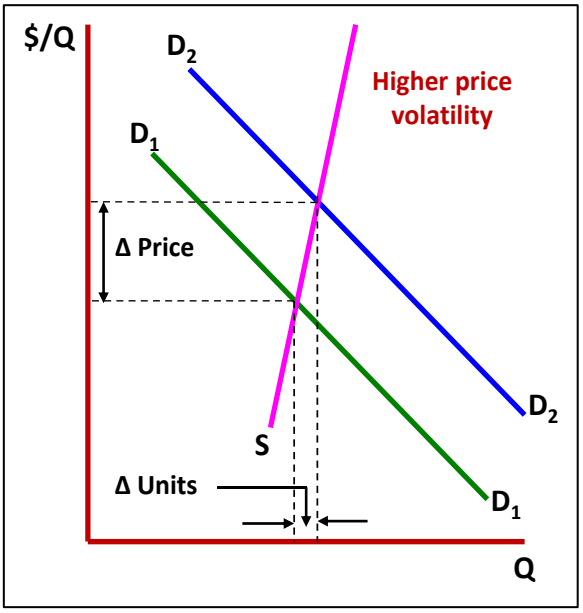


Exhibit 32. Low growth MSAs with inelastic supply curves, e.g., NYC and SFO: Demand shocks work mostly through price adjustments.



The following two exhibits illustrate the empirical cross-MSA relationship between growth and volatility and rental volatility and supply elasticity.

Exhibit 33. Rental volatility rises with growth, which raises questions about risk-adjustment.

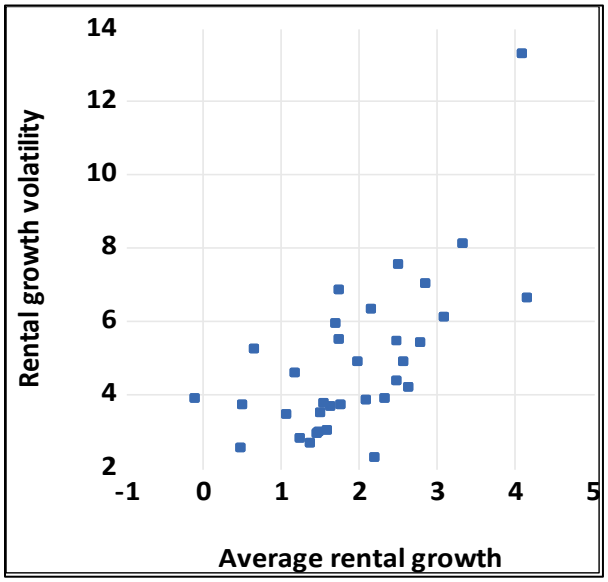


Exhibit 34. Rental volatility rises as supply elasticity falls.