Stand-Alone Centers Occupied by Big-Box Retailers

Likely poor choices for institutional investors.

James D. Shilling, Tammie X. Simmons-Mosley, and Stephen F. Thode

We argue that equity investments in stand-alone centers occupied by big-box retailers like Costco, Target, or Wal-Mart do poorly as a hedge against changes in variables that generally matter to institutional investors. The reason, we submit, is structural. Retail leases to big-box retailers typically include a clause that allows the tenant to cease operating on the leased premises. This so-called go-dark option is a positive sum-game.

The tenant, for example, can move to a new store location that is more accessible to customers, or open a bigger location between two smaller ones whenever cash flows warrant. The option gives the landlord or investor little chance of an upside return particularly when it might dislike poor performance. All the landlord or investor receives (assuming it has some degree of market power) is a slight rent premium in any year the tenant operates on the leased premises, and a low or negative return when the tenant opts to cease operating.[1]

Most of our discussion focuses on conditions under which big-box retailers are likely to exercise the option to cease operating on a leased premise. We compare these to states of the world in which institutional investors would like their investments to perform well.[2]

Ordinarily, one would like to analyze historical returns on big-box retail outlets to get at such questions. The difficulty with this approach is that go-dark events are typically rare events, so it is hard to estimate the true average return, including the rare event.

In our first set of results, we show that equity invest-

James D. Shilling
is a professor of business at the University of Wisconsin-Madison.
jshilling@bus.wisc.edu

Tammie X. Simmons-Mosley
is an assistant professor of finance at California State University, East Bay in Hayward, CA.
tammie.mosley@csueastbay.edu

Stephen F. Thode
is an associate professor of finance at Lehigh University in Lehigh, PA.
goodmancenter@lehigh.edu

ments in stand-alone centers occupied by big-box retailers offer high returns only about 40% to 60% of the very times high returns are most needed by institutional investors—periods of great inflation and rapid increases in pension liabilities. The probabilities vary by size and by strength of the retailer.

Second, we find that uncertainty about future sales affects these probabilities in a significant way. As uncertainty increases, the option to cease operating becomes more valuable, while there is a greater chance that the landlord or investor will suffer a loss at the very time high returns are most needed.

The advice that limited investment in big-box outlets is optimal for most institutional investors holds only if institutional investors invest more in line with Merton's [1971] intertemporal model than with Markowitz's [1952] mean-variance model. Both models assume institutional investors want portfolios with higher mean return and lower return variance, and that they are willing to accept more volatile portfolios only if they earn a higher average return.

The main difference is that in Merton's intertemporal model institutional investors are concerned not only with expected returns and risks today, but also with the way expected returns may vary over time. These considerations give rise to intertemporal hedging demands for financial assets. Consequently, such investors should be willing to trade a slight rent premium to make sure that their investment portfolio does well when high returns are most needed.[3]

We first discuss the *raison d'être* for go-dark options, and then explore conditions under which big-box retailers will exercise a go-dark option. A key result here is that the decision to exercise is analogous to the decision to exercise an American call option. The tenant should generally exercise the option only when the incremental cash flows (net of all relocation costs) are sufficiently positive.

The go-dark decisions have serious implications for the landlord or investor. We ask whether the times or states of the world when a tenant might exercise a go-dark option coincide with the times or states of the world an institutional investor might be especially concerned about poor performance.

DRIVEN BY FLEXIBILITY

Big-box retailers face a different pricing problem from traditional retailers. Traditional retailers such as Marshall Field's, Saks, and Macy's tend to have high overhead costs, but also can command high profit margins because of their strong retail brand. Such stores generally receive a rent concession to locate in regional shopping centers, because they generate far more customer traffic for the inline stores than the inline stores do for them. It is natural, then, for the inline stores to want to pay a premium to locate at the shopping center.[4]

This premium can be sustained only if the customer interchange at the center continues, and the customer interchange can similarly persist only if the stores at the center agree to operate for the stated duration of the lease. This effect helps to explain why most shopping center owners insist that traditional retailers agree to a continuous operation clause in their leases.

The whole process is quite different for big-box retailers—because big-box retailers generally lack market power. Instead they use economies of scale to generate greater profits. Some specialize in single categories of consumer products such as office supplies, toys, hardware, consumer electronics, or books, and by specializing they achieve cost savings through bulk purchases. Others offer the convenience of a traditional department store. Their value proposition is mostly low prices.[5]

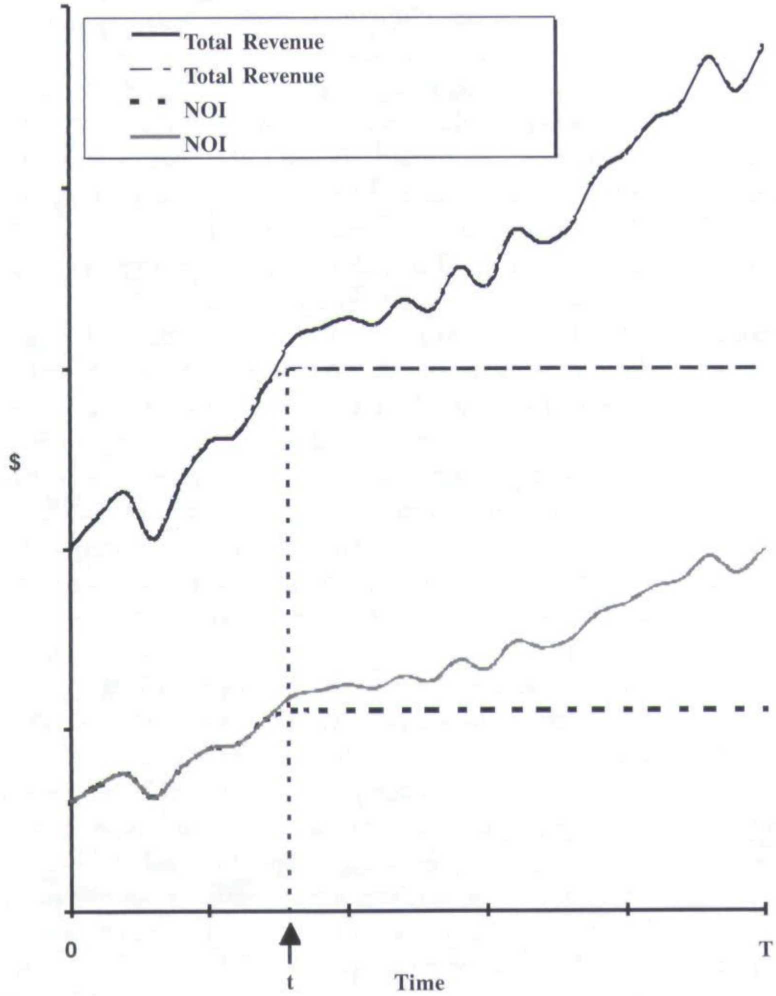
Another difference is the continuous operation clause. Traditional retailers may be content with operating at a particular location. Most big-box retailers are generally not. Most start out by operating a small store in a community just in order to keep out other big-box retailers. Then, as the market grows, the retailer may decide to cease operating on the leased premises, take advantage of economies of scale to generate greater sales, and open a bigger location between two formerly smaller ones.[6]

A good example is Wal-Mart, the Bentonville, Arkansas, based company. Wal-Mart is the world's largest retailer. Wal-Mart is also the largest tenant of dark space in the world. Going dark for Wal-Mart is a strategic decision; it will choose to move when it can improve its productivity and increase profits. Wal-Mart moreover will often refuse to re-let the building (or will typically sit on the land) just to keep other big-box retailers from entering the market.[7]

EXERCISING THE GO-DARK OPTION

A tenant may exercise a go-dark option under a variety of conditions: 1) to expand into a larger store to take advantage of scale economies; 2) to move to a new and more attractive (more profitable) location that will allow the retailer to draw on a larger population area; or 3) to achieve higher productivity by operating at a larger scale (to make bulk purchases) or providing a narrower variety of goods.

Exhibit 1
Total Revenue and NOI Through Time



The model we use to value the go-dark option is similar to the option pricing model of McDonald [1999] and Jagannathan and Meier [2002]. The underlying intuition is that the decision about ceasing to operate on the leased premises and opening another store is an investment timing problem, analogous to when to exercise an American call option. The model is derived in the appendix.

The model assumes that:

1. Big-box retailers are able to draw customers to wherever they locate.
2. All tenants pay a fixed or base rent.
3. A tenant that is doing well is unable to expand at the current premises and hence must move to a new location in order to generate greater profits.
4. Tenants that move must pay moving costs and a rent premium. All tenants must continue to pay rent on the old store. The moving costs and rent premium are sunk costs and completely irreversible.

The model consists of T dates, so if the tenant chooses not to cease operating on the leased premises today, it may still choose to do so later.[8]

Uncertainty in the model is captured in a very simple way; it relates to the tenant's profitability. This is the only uncertainty in the model. Per square foot rents are known as are the moving costs. The model further assumes that the expected growth rate in cash flows (i.e., profits) and the standard deviation of the cash flow process are exogenous.[9]

The model can be expressed either in terms of the present value of the lease or the internal rate of return on investment. If we base our decisions on hurdle rates, the model would say to postpone the decision to cease operating on the leased premises until the internal rate of return exceeds a fair discount rate by enough to compensate for the option to wait for another period.

The model considers a stand-alone center occupied by a single big-box retailer; a power center with a few inline stores and a major big-box retailer would behave similarly, with one exception. The closing of the big-box store can have a significant repercussion on the inline tenants in the center, perhaps forcing bankruptcy, but we cannot be sure of that. (This is why we limit our focus to stand-alone centers occupied by a single big-box retailer.)

Finally, the model is agnostic about the determination of tenant higher profits. Higher profits could arise from providing merchandise that is new and different, from offering a more pleasant shopping environment, from moving to a more convenient location, from achieving optimal scale (a larger store) and an efficient operation, or from offering a better mix of merchandise and services to customers.

To analyze the model, we apply it to three major big-box retailers, Costco, Target, and Wal-Mart. The model is then simulated to assess the option value associated with any arbitrary cash flow level (i.e., profitability), any

EXHIBIT 2

Company Parameters and Results for R = $1

Company	Expected Return ρ	Opportunity Cost δ	Volatility σ	Threshold π_{GD}	Value Function $V(\pi_{GD})$	Relocation Ratio $\frac{R}{\pi_{GD}}$	Value Ratio $\frac{V(\pi_{GD})}{\pi_{GD}}$
Costco	9.17%	4.80%	28.23%	$3.13	$2.13	31.94%	68.06%
Target	27.38%	4.88%	28.16%	$6.56	$5.56	15.24%	84.76%
Wal-Mart	17.94%	4.85%	27.51%	$4.69	$3.69	21.32%	78.68%

arbitrary cash flow growth rate, and any arbitrary standard deviation of the cash flow process.

High Profitability

Suppose that initially the tenant's net operating income at the leased premises is quite high and increasing over time. Eventually, the tenant reaches a capacity constraint at the leased premises, and finds itself a high-cost producer, unable to expand (without moving to a new location) to realize economies of scale and generate higher profits. When this happens, the tenant's net operating income at the leased premises hits a ceiling.

The tenant can achieve lower per square foot costs and higher efficiency by ceasing to operate on the leased premises and expanding into a larger store. This makes for higher net operating income; see Exhibit 1.

But the theory tells us that the tenant will not immediately exercise this option until the net operating income exceeds the net operating income at the current store by an amount to compensate for the costs of moving, including possibly poorer sales at the new location. As a result, while the tenant may be tempted, at t', to consider exercising the go-dark option, actual exercise of the option may not be optimal until time t^*, when net operating income has risen sufficiently to cover the costs of relocation.[10]

These points are illustrated in Exhibit 2, which gives indicative figures for Costco, Target, and Wal-Mart of when to cease operating on the leased premises and open another store. The parameter values are based on monthly data over 1987-2004 taken from Yahoo Finance. The volatility is the standard deviation of company stock returns over that period.[11] The risk-free rate of return is initially set at 5%. Later we allow the risk-free rate of return to vary depending on the nominal discount rate and the inflation rate. For simplicity, moving costs are arbitrarily set at $1. The main conclusions of the model are robust to moving costs.

The trigger values in Exhibit 2 range from a low of $3.13 to a high of $6.56 (computed as a percentage of moving costs). We interpret these numbers as follows. Optimality requires the tenant to cease operating on the leased premises and move to a new store location when actual net operating income (relative to moving costs) rises above these trigger values. Values of NOI (relative to moving costs) that are lower than these trigger values indicate the tenant should continue to operate on the leased premises. Using Wal-Mart as an example, the optimal time to exercise the go-dark option is when the expected net operating income is approximately 4.69 times the expected relocation costs.

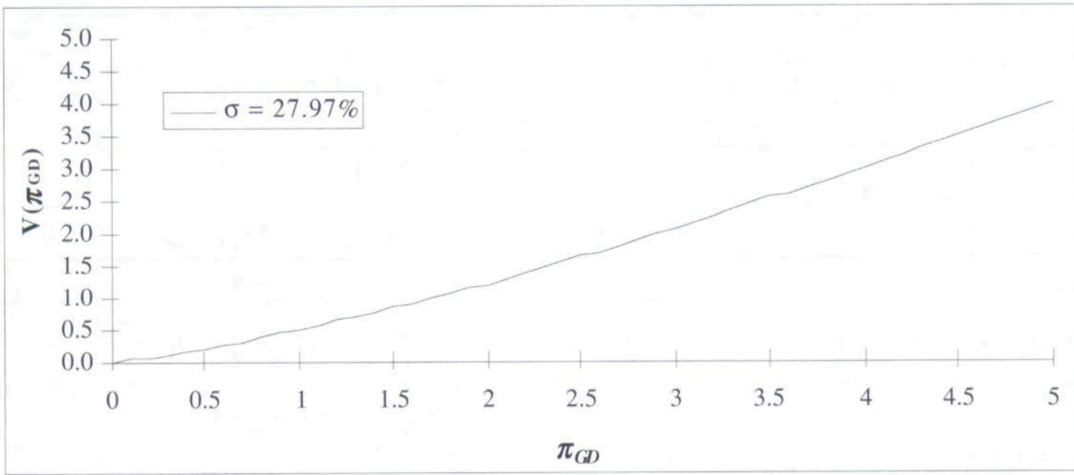
Now let's consider some comparative statics. Exhibit 3 shows the effects of an increase in profitability on the value of the go-dark option. It is clear from the exhibit that the value of the go-dark option is an increasing function of tenant profitability. The more profitable the tenant is, the more likely, holding all else constant, that the tenant will face a capacity constraint on the leased premises and the more likely it will need to move to a new location to realize economies of scale and generate greater profits. Hence, as tenant profitability increases, the value of the go-dark option increases.

And, as we saw in Exhibit 2, which computes trigger values, the value of the option and the optimal trigger value change in the same direction. Hence, as the go-dark option becomes more valuable, the optimal trigger value increases as well.

High Uncertainty

What happens if we add uncertainty to the model? Presumably, as uncertainty increases, the possibility of poor sales at the new location increases, which reduces the

EXHIBIT 3
Value as Function of Going Dark



relative attractiveness of relocating at the current time while increasing the benefit of delaying the option exercise to a later date. Hence, as uncertainty increases, the value of the option to go-dark should increase.[12]

Exhibit 4 depicts the value of the go-dark option as an increasing function of tenant profitability and illustrates the effect of varying the volatility of the cash flow process. Each point on the plot can be thought of as a different tenant, arranged from the least successful to the most successful (in terms of current net operating income).

Holding moving costs constant, as the cash flow process becomes more volatile, the value of the go-dark option increases. This can be seen by comparing the value of the option when volatility is 10% with the value of the option when volatility is 20%. This result is consistent with the basic intuition that increased uncertainty increases the value of open alternatives.

High Growth

A little less obvious is the effect of varying the cash flow growth rate on the value of the go-dark option. An increase in growth signals future high growth. Thus, a shift in cash flow growth today makes it more likely that the tenant will face capacity constraints on the leased premises at a later date. This in turn immediately increases the value of the go-dark option.

This story makes sense, especially when economies and diseconomies of scale can be equally significant. Exhibit 5 shows that the higher the cash flow growth rate, the more chance the option has of ending up in the money later. Hence, the value of the go-dark option increases with an increase in the cash flow growth rate.

EFFECT ON INVESTMENT RETURNS

Our results have significant implications for institutional investors thinking about investing (or evaluating current investments) in stand-alone centers occupied by big-box retailers. The go-dark option exposes the landlord or investor to little chance of an upside return just when it might especially dislike poor performance: namely, when inflation is high (and hence cash flow growth rate is high), and uncertainty is high.

We illustrate this result using a fixed-increment Monte Carlo simulation. Time in this simulation advances year by year. One of two events occurs in each period: Either the tenant continues operating on the leased premises, or the tenant ceases operating, depending on whether the optimal trigger value hits the simulated cash flow. We then let the probability of going dark equal the ratio of the number of actual hits to the number of possible occurrences.[13]

If the optimal trigger value hits the simulated cash flow 20 times out of 100 over the term of the lease, the cumulative probability of going dark is 20%. (Note that these calculations work with the stochastic process in Equation (A-2) in the appendix. The calculations lack a term like $-\rho V(\pi)$ because no discounting is required in the probability calculations.)

Exhibit 6 presents the simulated probabilities of

EXHIBIT 4
Value as Function of Going Dark under Different Volatilities of V

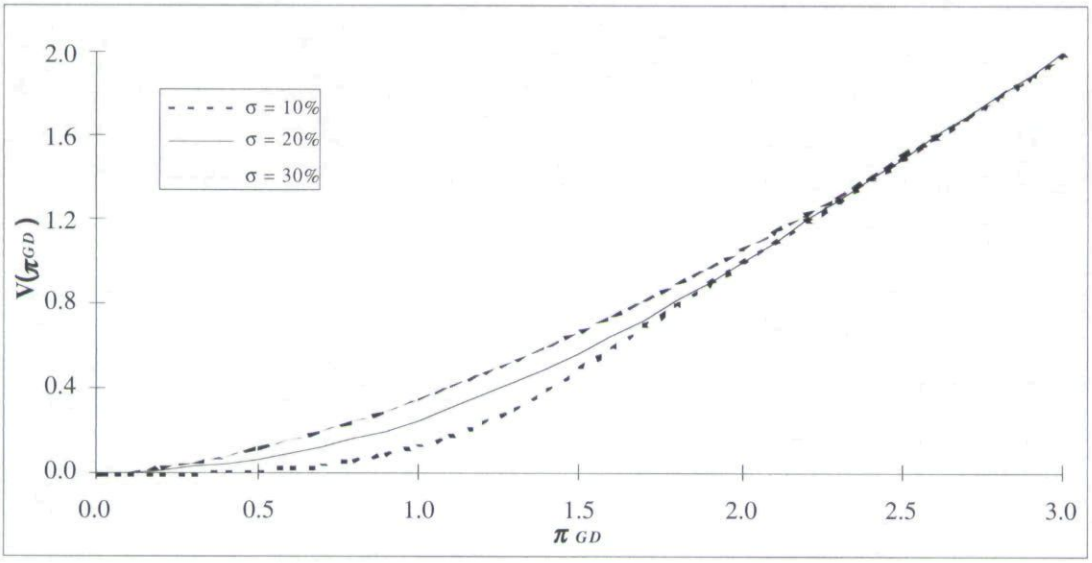
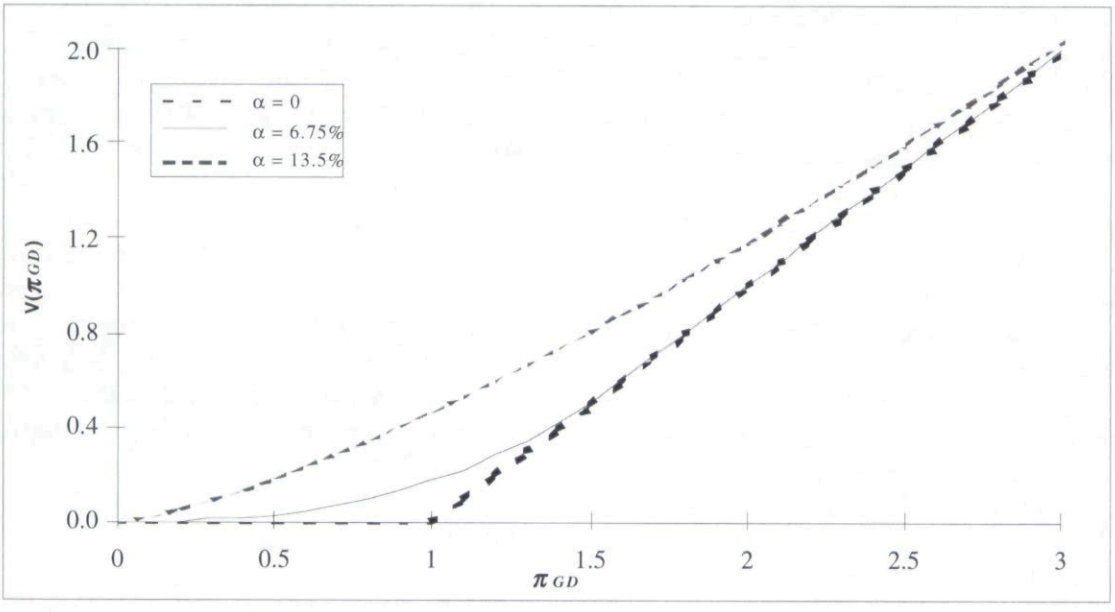


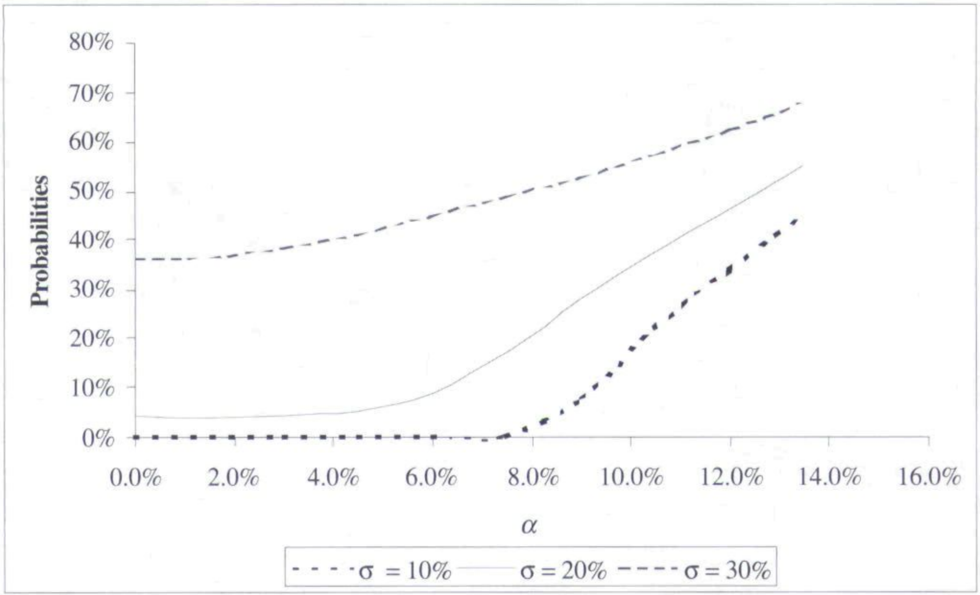
EXHIBIT 5
Value as Function of Going Dark under Different Cash Flow Growth Rates



going dark using our fixed-time simulation and 1,000 Monte Carlo state variable paths. To highlight how volatility influences the results, we first estimate the cumulative probability of going dark for a given standard deviation. The results are plotted in Exhibit 6 as a function of the cash flow growth rate. We then repeat the calculations for different standard deviations.

Exhibit 6 shows that the go-dark probabilities increase monotonically with an increase in the cash flow growth rate. In the base case scenario (the probability distribution shown in the middle of Exhibit 6), these probabilities generally range from 5% to 40%. Obviously, as these probabilities increase, the landlord or investor is left with little chance of an upside return.

EXHIBIT 6
Probability of Going Dark as Function of Cash Flow Growth Rate



Hence, it would make sense to avoid investments in stand-alone centers occupied by big-box retailers if investors particularly dislike poor performance on their investment portfolios at times of high inflation.

We can also analyze the go-dark probabilities when the cash flow growth rate is highly uncertain. Exhibit 6 shows that, as well as being higher, the go-dark probability distribution also spreads out at higher volatilities. Here the probabilities of going dark generally vary from 40% to 70%. This means that stand-alone centers occupied by big-box retailers are apt to do poorly in a highly inflationary and volatile economy.

At a standard deviation of 20% and a cash flow growth rate of 6% to 12%, there is about a 65% to 95% chance of a high return. At a standard deviation of 30% and a cash flow growth rate of 6% to 12%, however, the chance of a high return is down to 40% to 60%. This brings out rather clearly the risks associated with investing in big-box outlets.

Thus, if maintaining a portfolio that performs well in a highly inflationary and volatile economy is important to an institutional investor, the investor should optimally commit little of its real estate investments to big-box outlets when tenants have a go-dark option.

CONCLUDING REMARKS

Our research on the performance of stand-alone centers occupied by big-box retailers measures investment performance using simulation analysis; theoretical returns rather than actual returns on big-box centers are examined. According to these returns, big-box centers are poor investments for institutional investors in a highly inflationary and volatile economy. When a go-dark clause allows a tenant to cease operating on the leased premises and open a larger store elsewhere, the investor has little chance of an upside return under high inflation and volatile states of the world. These are the very times most institutional investors most dislike poor investment performance.

APPENDIX

The model assumes a lessee's decision to go dark is based entirely on financial considerations. We define net operating income as:

$$NOI = r \times sf - OC \tag{A-1}$$

where NOI, which is known with certainty, is the anchor tenant's normal (net operating income) profit, after the anchor tenant deducts operating costs (OC) from revenue, r is rent per square foot, and sf is square feet.[14]

Next, we let π denote all future streams of NOI. We assume that the dynamics of π are described by the stochastic process:

$$d\pi/\pi = \alpha\, dt + \sigma\, dz \tag{A-2}$$

where α is the expected rate of growth in π, σ is the standard deviation of π, and dz is an increment of a Gauss-Wiener process. Following Cornell, Longstaff, and Schwartz [1996], we decompose α into two components: ρ and δ, in the sense that ρ is the expected return on the property (tenant's discount rate), and δ reflects a property capitalization rate.[15]

Given this, we can rewrite Equation (A-2) as:

$$\frac{d\pi}{\pi} = \left(\rho - \delta\right)dt + \sigma dz \tag{A-2$'$}$$

Discounting future NOI streams, π, by ρ yields a present value of $V(\pi)$:

$$V\left(\pi\right) = \mathrm{E}\int_0^T e^{-\rho t}\pi_t dt \tag{A-3}$$

where V represents the present values of the anchor tenant's stochastic net operating income, and E is the expectation of

$$\int_0^T e^{-\rho t}\pi_t dt$$

under the measure related to the Brownian motion.

We solve a differential equation to represent the terminal payoff for Equation (A-3). Next, we impose constraints that allow us to determine the optimal time for a big-box retailer to exercise the go-dark option.

At each time t, the tenant can either choose to cease operating on leased premises and move to a new location, or wait. If the tenant decides to cease operating and move to a new location, the moving costs are R. These costs include the incremental rent and leasehold improvements on the new space, direct moving expenses, and so forth.

Next, we assume that the tenant follows the optimal rule to cease operating on the leased premises when $\pi_{GD} \geq \pi$. The value of π_{GD} is referred to as optimal threshold value. Once $\pi = \pi_{GD}$, tenant profits (net of moving costs) are higher elsewhere. When $\pi < \pi_{GD}$, profits are higher on leased premises, so the tenant will continue to operate on the leased premises, and keep the option to go dark.

Given these assumptions, the value function that maximizes π_{GD} takes on an expectation, because π_{GD} is a random process. To solve for π_{GD}, we follow Dixit and Pindyck [1994] by assuming risk-neutrality and using the Bellman equation:[16]

$$\rho\, V\, dt = \mathrm{E}\,(d\, V)$$

This equation implies that over the time interval dt the total expected rate of return earned by the tenant, $\rho V dt$, is equal to the expected rate of appreciation or depreciation in profits.

Next, we substitute Equation (A-2$'$) into Îto's lemma, $dV = V'(\pi)\, d\pi + \frac{1}{2} V''(\pi)\, (d\pi)^2$, which results in the differential equation:

$$0 = \frac{1}{2}\sigma^2\pi^2 V''\left(\pi\right) + \left(\rho - \delta\right)\pi V'\left(\pi\right) - \rho V\left(\pi\right) \tag{A-4}$$

This differential equation is a quadratic equation of the form:

$$0 = \frac{1}{2}\sigma^2\beta(\beta - 1) + (\rho - \delta)\beta - \rho$$

which has a positive root:

$$\beta_1 = \frac{1}{2} - (\rho - \delta)/\sigma^2 + \sqrt{[(\rho - \delta)/\sigma^2 - \frac{1}{2}]^2 + 2\rho/\sigma^2} > 1$$

and a negative root:

$$\beta_2 = \frac{1}{2} - (\rho - \delta)/\sigma^2 - \sqrt{[(\rho - \delta)/\sigma^2 - \frac{1}{2}]^2 + 2\rho/\sigma^2} < 0$$

Equation (A-4) explains how π will adjust so that the anchor tenant will earn a risk-adjusted rate of return, but does not take into consideration boundary conditions. The boundary conditions are:

$$V(0) = 0 \tag{A-5}$$

$$V(\pi_{GD}) = \pi - R \tag{A-6}$$

$$V'(\pi_{GD}) = 1 \tag{A-7}$$

Equation (A-5) implies that if π goes to 0, the anchor tenant's option to go dark will be of no value. Thus, the owner would want to go dark before $\pi = 0$. The value-matching and smooth-pasting conditions are (A-6) and (A-7), respectively, where the critical value of π_{GD} is the optimal profit, and R is the anchor tenant's direct relocation cost.

To solve the differential equation, we try a general solution in the form of

$$V(\pi) = A_1\pi^{\beta_1} + A_2\pi^{\beta_2}$$

where A_1 and A_2 are the go-dark option coefficient constants to be determined. The two terms on the right-hand side of this equation represent the anchor tenant's profit from exercising the option to go dark at a particular time. As π goes to 0, the option to relocate becomes worthless because it goes far out of the money. As the go-dark option becomes far out of the money, boundary condition (A-5) implies that A_2 goes away because it corresponds to the negative root of β_2, which leaves the solution for the differential equation as $V(\pi) = A_1\pi^{\beta_1}$. This solution is simply the future value of the anchor tenant's go-dark option.

We use the optimality conditions of (A-6) and (A-7) to solve π_{GD}. Substituting the general solution for $V(\pi)$ allows us to rewrite the value-matching boundary condition as:

$$\frac{\beta_1}{\beta_1 - 1}R = \pi_{\text{GD}} \tag{A-8}$$

Equation (A-8) implies that the tenant will cease operating on the leased premises only when the value of the option reaches the trigger π_{GD}, which is some multiple of R.

ENDNOTES

The authors thank an anonymous referee and Georgette C. Poindexter, as well as participants at Wharton's Spring 2002 Real Estate Seminar Series and the 2001 International Real Estate Society (IRES) meeting for helpful comments and suggestions.

[1]We say negative return because the property may fetch a price well below the property's value in use after the tenant stops operating.

[2]These states of world are determined by worker benefits. If worker benefits are indexed to the cost of living both before and after retirement, an unanticipated increase in inflation will raise the present value of a plan's benefit obligations and reduce the plan's liability funding ratio. Most institutional investors will thus dislike poor performance of their investment portfolios in periods of high inflation and high uncertainty.

[3]Merton's [1971] model assumes institutional investors want to hold a portfolio that is hedged against unanticipated changes in inflation and that has a return positively correlated with the return on their pension liabilities. Other investors who do not face these constraints may find investing in big-box outlets attractive, especially if such investments carry a slight rent premium in all the years the tenant operates on the leased premises.

[4]See Brueckner [1993]. Benjamin, Boyle, and Sirmans [1990] also emphasize this point.

[5]Big-box retailers like Kohl and Target are good examples of "category killers." Both have taken men's and women's apparel—a specialty of many department stores—and made it their specialty. Target, based in Minneapolis, is especially interesting, because it is the owner of Marshall Field's.

[6]The go-dark option can also be used to take advantage of tax incentives. A big-box retailer establishing a new store in a local community typically receives some kind of financial inducement from the local government. Examples include infrastructure improvements, labor training grants, and reduced tax rates in the early years of operation. These inducements are often be very attractive, and the lure of an investment incentive elsewhere may easily prompt the closing of one store and the opening of another.

[7]Sometimes a big-box retailer like Wal-Mart may re-let the building to non-competing retailers like Jo-Ann Fabrics and Hobby Lobby. Several national retailers look for closed big-box sites to locate stores, with the aim of saving on rent.

[8]Despite the T dates, leases are rolled over continually, which makes the retail space active indefinitely. The infinite time horizon implies only that there need not be a definite date the tenant needs to cease operating on the leased premises.

[9]The model while not fully realistic captures the most important determinants of the go-dark decision.

[10]In this case, the tenant's decision to go dark can be modeled as a kind of capital budgeting problem. That is, the incremental NOI achieved as a result of exercising the option must be as high as the current net operating income plus all moving expenses, including poorer sales at the new location.

[11]We use company stock returns as a proxy for net operating income. The standard deviation of company stock returns accounts for total rather than market risk.

[12]The option to go dark is not always valuable. If there is no uncertainty about net operating income, the option can generally be shown to be worthless for certain values of the cash flow growth rate.

[13]In option pricing theory, this is *a binary call* (value equals zero if net operating income is below the optimal trigger and value equals one if NOI is above the optimal trigger).

[14]Since profits are normal, operating expenses are based on profits that keep the owner in business, not excess profits.

[15]δ may also be thought of as the opportunity cost of keeping the option alive.

[16]Risk-neutrality assumes that the anchor tenant's opportunity cost, δ, is equal to the riskless interest rate.

REFERENCES

Benjamin, John D., Glenn W. Boyle, and C.F. Sirmans. "Retail Leasing: The Determinants of Shopping Center Rents." *American Real Estate and Urban Economics Association Journal,* 18 (1990), pp. 302-312.

Brueckner, Jan. "Inter-Store Externalities and Space Allocation in Shopping Centers." *Journal of Real Estate Finance and Economics,* 7 (1993), pp. 5-16.

Cornell, Bradford, Francis A. Longstaff, and Eduardo S. Schwartz. "Throwing Good Money After Bad? Cash Infusion and Distressed Real Estate." *Real Estate Economics*, 24 (1996), pp. 23-41.

Dixit, Avinash K., and Robert S. Pindyck. *Investment Under Uncertainty*. Princeton: Princeton University Press, 1994.

Jagannathan, Ravi, and Iwan Meier. "Do We Need CAPM for Capital Budgeting?" NBER Working Paper 8719, 2002.

McDonald, Robert L. "Real Options and Rules of Thumb in Capital Budgeting." In M.J. Brennan and L. Trigeorgis, eds., *Project Flexibility, Agency, and Competition*. London: Oxford University Press, 1999, pp. 13-33.

Markowitz, Harry M. "Portfolio Selection." *Journal of Finance,* 7 (1952), pp. 77-99.

Merton, Robert C. "An Intertemporal Capital Asset Pricing Model." *Econometrica,* 41 (1971), pp. 867-881.

To order reprints of this article, please contact Ajani Malik at amalik@iijournals.com or 212-224-3205.