A REAL OPTION APPROACH TO PRICING EMBEDDED OPTIONS IN RETAIL LEASES

TIEN FOO SING
National University of Singapore

ABSTRACT

Percentage lease agreements (PLAs) contain lease clauses with payments of a flat base rent plus a variable rent, which is pegged to sales turnover. This paper applies a multi-period binomial tree option-pricing model to value default options in PLAs. In the absence of penalties on lease pre-termination, tenants have an implicit call option, if exercised, giving them a right to "break" a lease and move to alternative premises at a lower prevailing market rent. Using a hypothetical PLA lease defined by key input parameters, the value of the tenants' default option is estimated at 1.08% for a 3-year PLA lease. When sales turnover and relocation costs are simulated using selected random probability processes, the expected option premiums increase by 0.18% to 1.26%. The levels of base rent and the overage rate are positively related with option premiums. The option premiums, however, decline when relocation costs and sale breakpoint increase.

Keywords: *percentage lease agreements (PLAs), option pricing model, default risks*

INTRODUCTION

Percentage lease agreements (PLAs) contain lease clauses with payments of a flat base rent plus a variable rent, which is pegged to the sales turnover. The variable rent component is also known as an overage rent or a turnover rent. PLAs come in different forms like pure base rent or turnover-related income, base rent plus turnover-related income (overage), stepped base rent plus turnover-related income (McAlister 1996). In the USA, the most common form of PLA is the base rent plus overage, which is a percentage of the gross sales above a threshold level, which is known as "breakpoint" (Benjamin, Boyle, and Sirmans 1990; Miceli and Sirmans 1995; Wheaton 2000; Colwell and Munneke 1998). Overage is a universal and common feature in retail leases in multi-tenanted shopping centers. Under the PLAs, interests between the landlord and tenant are effectively aligned such that efforts to improve the shopping centers' performance will not solely lie with the tenants. PLAs offer sufficient incentives to curb opportunistic behaviors of landlords or center operators to ensure that they keep the existing tenants' interest in mind when optimizing the centers' space allocation decision (Wheaton 2000).

PLAs have been adopted by retail mall developers to reduce leasing risks for retail space during recessions in the 1930s in the US and the 1970s in the UK (McAlister 1996). In addition to meeting risk-sharing and risk-shifting objectives of retail developers (Miceli and Sirmans 1995), PLAs are also an effective mechanism used to facilitate tenant mix and rent discrimination strategies (Colwell and Munneke 1998). However, a high breakpoint to actual sale ratio recorded in many US shopping centers implies that the overage rents, if collected late into the lease term, will constitute only a small fraction of the total rent (Chun, Eppli and Shilling 2001 and 2003; Eppli, Hendershott, Mejia and Shilling 2001). The breakpoint and overage term, if written well beyond the exercisable threshold, meant tenants are unlikely to have to pay overage rents as the percentage rent option was simply out-of the-money.[1] Miceli and Sirmans (1995) suggest that a provision for the landlord to cancel the leases of stores that fail to achieve the target sale level will be necessary in the PLAs to ensure that the tenants will exert optimal efforts.

[1] The breakpoint overage rent (R) consists of a base rent plus a call option on the sale turnover of the tenant with the strike price fixed at a breakpoint or threshold sale (S^*). The overage rent function for tenant i under PLAs can then be written technically as $R_i = a_i + Max[0, b_i(S_i - S_i^*)]$, where a_i is the base rent, b_i is the fraction of sale of tenant I made as a overage rent, and S_i is the gross sales.

PLA is a relatively new leasing concept for multi-tenanted shopping centers in Singapore. In two surveys conducted in mid 1990s, only 40% of landlords and not more than 37% of retailers in sample malls responded positively on the use of PLAs for leases of retail mall space (Knight Frank Cheong Hock Chye and Baillieu 1995[2]; Addae-Dapaah and Yeo 1999). Tenants of shopping centers expressed reservation against the arrangement of pegging their rents to their turnovers.[3] Difficulties in monitoring and collecting the sale information are one of the main considerations of landlords against implementing the PLAs.

Another impediment to the prevailing use of PLAs in shopping center leases is related to the lack of understanding by the landlords and tenants on how PLAs can be accurately and competitively valued. The current valuation technique has some limitations when valuing variable rent components, which are dependent on the performance of the lessees (McAlister 1996 and 2001). Understanding the dynamic relationships between the base rent, overage rate and sale breakpoint and the implications on the tenants' default risks is important, if PLAs are to be used effectively to achieve risk-sharing objectives (Benjamin, Boyle and Sirmans 1990). PLA clauses should be optimally written to reduce asymmetric information between the landlords and tenants, such that the risks of premature termination of PLA leases are minimized. This study applies the option pricing methodology to evaluate "default risks" of tenants, and quantify option premiums in retail PLA leases having different levels of overages and base rents.

The objectives of study are twofold:

- to use a discrete time binomial tree option pricing model to value PLA leases with different clauses; and
- to analyze default risks in PLA leases in different scenarios (changing interest rate volatility, relocation costs and retail trade volatility).

The paper is organized into six sections. The first section defines the objectives of the study. Relevant literature on PLA retail leases is reviewed in the next section, followed by the development of a discrete time option pricing model and discussion of tenants' default risks in PLA leases. The following section applies the option-pricing model to value hypothetical PLA leases, with the next section numerically simulating tenants' default risks by changing key parameters and the final section concluding the findings.

LITERATURE REVIEW

This literature review is divided into two parts. The first part covers theoretical and empirical studies on the structure and application of the PLAs. The second part will deal more explicitly on the application of real options technique to evaluating various embedded options in real estate leases. Grenadier (1996) develops a unified real options model to evaluate default risks based on the assumption that the timing of default is stochastic, and Sing and Tang (2004) also examine the default risk options in office leases using a multi-period binomial tree model. There is still, however, no study that examines the issue of tenant's default risk in a percentage lease framework. Hendershott and Ward (2000) model the overage rents as a call option contingent on the sale turnover of the tenants, but the model did not deal with the issue of tenant's default risk. This study is thus designed to evaluate possible default risks in a PLA framework, when the base rent and overage rent are not optimally determined.

[2] The survey findings of Knight Frank were reported in "Tough Times Ahead for Retail Market, Says Survey by Property Consultant," *Business Times Singapore*, 10 March 1995.

[3] The sentiment of shopping centers' tenants on PLAs was expressed in a local newspaper's article: "Tenant Less Keen On Pegging Rents to Turnover – Survey," *Straits Times*, 13 March 1995.

Percentage Lease Agreements (PLAs)

Unless a landlord is a perfect discriminating monopolist, who is able to allocate space in shopping centers based purely on inter-store externality, maximization of a shopping center's profit will still invariably need a rent discriminating structure to ensure that optimal efforts are made by the tenants (Brueckner 1993). In Brueckner's (1993) model, landlords will reward stores whose efforts generate large inter-store externalities and high gross sale turnover with favorable rental terms. This type of discriminating rent contract, however, lacks realism and will not work in an imperfect world with high transaction costs. Therefore, in practice, developers will not only allocate space that maximizes externalities of a shopping center, they will also enter into lease agreements with individual tenants which tie their rents to some threshold level of sales. These PLAs change the basic principal-agent relationship between landlords and tenants in shopping centers. The relationships between the landlords and tenants under the PLAs (Miceli and Sirmans 1995) and the roles of the PLA as a mechanism for risk sharing, rent discrimination and tenant mix (Colwell and Munneke 1998; Wheaton 2000; Eppli, Hendershott, Mejia and Shilling 2001) will be reviewed in this section. Empirical evidence on the trade-off of the overages and base rents in the PLAs will also be examined (Benjamin, Boyle, and Sirmans 1990; Chun, Eppli and Shilling 2001 and 2003).

From the landlord's viewpoint, PLAs provide many advantages over the fixed rent system. Under the fixed rent system, the effort level of the landlord has no influence on the rent collected, and there is a disincentive for the landlords to maximize the shopping center performance. The landlord will react opportunistically by adopting a rent-maximizing space allocation strategy, which may not be in the best interests of the tenant (Wheaton 2000). By expanding Brueckner's (1993) model in a two-period framework with sunk cost and contracting uncertainty, it was shown that tenants would opt for PLAs as a mechanism to incentivize landlords to ensure that they will align their interests with those of the tenants in their space allocation strategy. The use of PLAs will also generate superior returns to the landlords by increasing flexibilities in establishing the tenants' rent structure via a rent discrimination strategy (Colwell and Munneke 1998; Wheaton 2000). They will enable landlords to diversify their risk through having a portfolio of leases that are not positively correlated (Colwell and Munneke 1998). PLAs also serve as a hedge against inflation and at the same time eliminate the need for frequent rent reviews. Miceli and Sirmans (1995) also found that PLAs would only function effectively if there were a cancellation provision, which allows the landlord to terminate the leases of under-performing stores.

Risk sharing is another mechanism that motivates the adoption of the PLAs in shopping centers. Landlords will take a more pro-active role in improving the tenants' sale turnovers as they have a vested interest in the tenants' businesses under the PLA (Miceli and Sirmans 1995; Colwell and Munneke 1998). For risk-averse tenants, flexible rent structure that is linked to the sale turnovers of tenants shifts part of the business risk to the landlord especially in the time of slow growth. The risk reduction benefit associated with PLAs contributes to the growth of PLAs (Miceli and Sirmans 1995; Colwell and Munneke 1998).

The success in the implementation of PLAs in shopping centers is dependent on the mutual trust between the parties in sharing sale information. As long as there is information asymmetry where the parties' effort levels in the PLAs are unobserved, we would expect difficulty in fully exploiting the benefits of the PLAs without agreeing on an optimal threshold of the base and overage rents. Evidence in the US shopping centers indicated that landlords tend to charge a high base rent, because of the costs in attempting to mitigate the tenants' tendency to shirk their effort levels. A high breakpoint to sale ratio in exchange for a high base rent has also been common in many PLAs, which attenuates the tenants' incentive to distribute their business risks. Chun, Eppli and Shilling (2001 and 2003) showed in their retail lease data obtained from large regional shopping center developers in the US that most of the PLAs were written "out-of-the-money" because of the high

breakpoint ratio of more than one. They showed that retail sales for some tenants must grow as much as 16% per annum before the option on the turnover rent will ever be exercised. In the first empirical study of the PLAs in the US, Benjamin, Boyle and Sirmans (1990) found a significant negative relationship between the percentage rent rate and the base rent. They also showed that the base rent was positively and significantly related to the threshold sale level.

Another study using simulation analyses by Chun, Eppli and Shilling (2001) found that the link between average rents and sale turnovers was not as strong as proposed in the theoretical percentage rent model. They found that average rent adjustment in the sample regional shopping centers were slow in responding to the change in the income generating capacity of the tenants. Their simulation results indicated that shopping center rents would increase in the short run as retail sales decrease and they would also decrease as the retail sales increase. Eppli, Hendershott, Mejia and Shilling (2001) also found that the percentage rent components varied among different tenant types and also between tenants in new and renewed leases. They showed that franchise tenants pay a higher overage rent and a lower base rent than local tenants in shopping centers. The renewed retail leases were also written farther out-of-the-money than new retail leases. Chun, Eppli and Shilling (2003) showed that the choice of the percentage rent leases is driven by the debt-asset ratio of retail firms. They found empirical evidence to support that retailers with higher debt-asset ratios are more likely to opt for percentage lease in lieu of the fixed payments, which is treated as a liability in their balance sheet.

Real Options in Real Estate Leases

There are leasing risks in a multi-tenanted building as long as the rental cash flows and the timing to default is stochastic. From the standpoint of a landlord, the lease default includes late payments, failure to maintain the asset, or failure to fulfill the covenants of other financial assets. Grenadier (1996) models the leasing risks using a unified equilibrium real option model that comprises two rental streams, one from a default-free lease and another from a default-risky lease. He then derives the default risky lease rate by numerically solving for the equilibrium point between the two types of leases at the point of default at time $t<T$. In another paper on leasing risks, Sing and Tang (2004) examine the default option as a right of the lessee to terminate the existing lease for the rental savings obtained by relocating to an alternative office space at a lower rent in a down market. The numerical results showed that the exercise of the default option is directly dependent on the relocation costs inclusive of the forfeited security deposit. In Grenadier's (1996) model, he assumes the remaining lease term after the occurrence of the default event, T-t, is leased to a default-free lessee at the prevailing market rent. This assumption that the landlord could re-let the premises at a market rent for a shorter T-t lease term is unrealistic. Sing and Tang (2004) extended the framework by assuming that the defaulting lessee will have to relocate their operation to an alternative space by signing a lease for a term equivalent to the original lease, but at the prevailing market rent. The total lease term for the lessee who defaults at time t is equivalent to T+t, where T is the lease term for the new and also the original leases.

In Sing and Tang's (2004) model, they found that default risk is positively related to the initial contracted rents, relocation cost, rental volatility and rental growth rate. The default probability is higher for tenants who place less emphasis on fitting-out quality. The lease default decision, which is triggered by the relocation costs, is consistent with the "hysteresis" or "sticky vacancy" phenomenon explained by Grenadier (1995b) in another paper. "Hysteresis" explains the scenario where a landlord is reluctant to change the vacancy level of his building by filling vacancy in a downward market or terminating leases that pay below market rent in an upward market. In an uncertain market, the option premium to retain the status quo is high enough to offset the possible payoffs that may be realized in making a vacancy adjustment, either by filling a vacancy and/or incurring a vacancy.

Leasing flexibility and various embedded options in real estate leases has been well developed theoretically by Grenadier (1995a). The proposed unified option pricing framework can be used to price a wide variety of leasing contracts, including forward leases, leases with options to renew or cancel, lease insurance contracts, adjustable-rate leases and leases with payments contingent on asset usage. However, the models did not specifically deal with the PLAs. Hendershott and Ward (2000) apply the binomial tree option model to price the overage rents as a call option on the tenant's sale turnover. They found that the option like feature of the overage rent will add value to retail leases when the sale volatility is high. They also examine other option like features like expense stop, extension and cancellation options. The optimal space allocation and inter-store externalities in retail leases (Brueckner 1993) were turned into valuable tenant mix options in the Grenadier (1995c) model. An "upwards only" rent revision option, which is the common feature in UK commercial leases, was another most widely examined real estate option feature (Ward 1982; Ward and French 1996; Ward, Hendershott and French 1998; Ambrose, Hendershott and Klosek 2002). However, there were thus far no other studies that explicitly evaluate the issue of tenant's default options in the PLAs. This is the gap which this study is intended to fill. This study in particular will examine the PLAs risk in Singapore's market context, where fixed rate retail leases are still dominating. Therefore, the default risk would entail the action of retail tenants to give up their PLAs for fixed payment leases at prevailing market rates.

TENANT'S DEFAULT OPTION IN A PERCENTAGE RENT VALUATION FRAMEWORK

Percentage Rent Valuation

PLAs can be structured in different forms (McAlister 1996) with different trade-offs between the base rent and overage rent. The base plus breakpoint-overage contract is the most common form of retail lease adopted in the US and other countries. This contract, which will be referred to hereafter in short as percentage rent, will be the framework for the analysis of tenant's default options in this study. Basically, the percentage rent consists of two rental components. The first component is the fixed base rent payable every month regardless of the sale performance of the tenant, a_i.[4] The second component is linked to the gross sales of the tenant, which is estimated as a percentage, b_i, of the gross sales over a breakpoint S_i^*. In some cases, a natural breakpoint is determined as a ratio of the base rent over the percentage of overage, i.e. [$S_i^* = a_i/b_i$]. For an individual retail tenant *i* in a shopping center, the percentage rent (R_i) can be written as:

$$R_i = a_i + Max[0, b_i(\overline{S}_i - S_i^*)] \qquad \text{Equation 1}$$

where $\overline{S}_i$ is the monthly gross sale turnover, which is probabilistic in nature.[5] In this study, we use Monte-Carlo simulation to generate the normal probabilistic distribution of S_i, which follows a correlated random walk trend defined by the past sale probabilistic figure, $\overline{S}_{i,t-1}$ and volatility, $\sigma_{S,t}$:

$$\overline{S}_{i,t} = E_{Normal}(\overline{S}_{i,t-1}, \sigma_{S,t}) \qquad \text{Equation 2}$$

[4] In this study, we assume that the base rent is due and payable at the end of each month to ease technical complication. However, this assumption can be easily relaxed such that the base and overage rents can be collected at different time periods.

[5] Unlike the Hendershott and Ward (2000) model, where the sale turnover is modeled as a stochastic state model that determines the payoff of the call option, the stochastic driver in our model that affects the default option of tenants is the exogenous market rent variable. The assumption reflects the uncertain nature of tenant's sale turnovers, which appear as an endogenous variable in the gross rent function.

where $[\sigma_{t=1} \le \sigma_{t=2} \le \sigma_{t=3} \le \ldots \le \sigma_T]$ which implies that the uncertainty of sale turnover projection increases in time.

If we discount the two rental streams at two different risk adjusted discount rates of r_1 and r_2, where $[r_1 \le r_2]$ to account for a higher uncertainty associated with the overage rent, the discounted value for a T-year retail lease of tenant *i at time t=0,* $\Phi(S_i)_{t=0}$, can be written as:

$$\Phi(S_i)_{t=0} = a_i.PVAF_{r_1,T-t,12} + \left\{Max[0, b_i(\overline{S}_i - S_i^*)\right\}.PVAF_{r_2,T-t,12} \qquad \text{Equation 3}$$

where, PVAF is the present value annuity factor. For a T-year lease with m number of rental payments per year and the annual discounting interest rate of r, the PVAF factor is represented by the following formula:

$$PVAF_{r,T,m} = \frac{1-\left(1+r/m\right)^{-mT}}{r/m} \qquad \text{Equation 4}$$

For a shopping center with *N* number of retail tenants, the gross rental revenue (ϑ) at time *t=0* can be collectively represented as:

$$\vartheta_{t=0} = \sum_{i=1}^{N} \Phi(R_i) \qquad \text{Equation 5}$$

Model tenant's default as an American Call option

Risk sharing by pegging rent to tenant's sale performance is a primary feature of PLAs. This flexibility creates uncertainty with respect to the cost of service flows from the retail space. Hendershott and Ward (2000) treat the variable rent component as a call option, which increases the upside value of the retail leases for the landlord when the sale turnover of the tenant is volatile. They also show in the model how the percentage rent should be adequately estimated, such that tenants are indifferent between the PLAs with option-like feature and the fixed rent contract. They do not, however, examine the risk of default if the values of the two leases are not optimally determined.

When tenants face choices between a fixed rent scheme and a percentage rent scheme, there exists a risk at some point in time that the tenant would find the variable rent increases their cost of leasing to an extent that makes the PLA sub-optimal vis-à-vis a fixed rent lease. The tenants will have a right to prematurely terminate the PLAs, if the rental saving they obtain by opting for a fixed rent scheme exceeds the costs incurred in exercising the default option and relocating to a comparable shopping center. The relocation costs for retail tenants include not only the fixed costs in fitting-up the new store and also reinstating the existing store, they also include loss of goodwill created in the existing store, search cost and also commission fee. There are no simple rules to estimate the relocation costs. The costs will also vary with respect to different retailer types. For the purpose of modeling the default option, the relocation costs are assumed in this study to be a one-time lump sum fixed expense at the time the default option is exercised. We will simulate the relocation costs as a normal random walk process using the Monte Carlo technique.

In the absence of lease pre-termination penalties[6], the right of a tenant to "break" a lease is an implicit call option in PLAs which, when exercised, allows the tenant to default on the existing lease and move to alternative premises, particularly if the continuing rent is higher than the market rent for similar premises (Rowland 2000). The default option contains a time and an exercise value. The option's time value arises because the tenant can exercise the option anytime within the lease term, or he can choose to postpone the default decision as long as the payoff for holding on to the default option till the next period is higher. This is a feature of an American option. The exercise value or the payoff for exercising the default option comes in the form of rental saving obtained when the market rent falls below the percentage plus base rents. If the rental savings exceed the costs incurred in relocating, the tenant will be better off by defaulting and giving up the PLA for a lower fixed market rent option.

Based on the multiplicative discrete-time binomial tree option model developed by Cox, Ross and Rubinstein (1979), an American type default option model can be developed in a PLA framework. In the proposed model, the market rent (R_m) is the sole stochastic driver of the default option premium. It is assumed to follow a binomial tree path, which will take either an upward movement, $R_{m,t-1}.u$, or a downward movement, $R_{m,t-1}.d$, at time, t. The rental generating process is repeated iteratively forward from time [$t = 0$] to the end of the lease term, [$t = T$]. The upward and downward paths of the binomial tree for a small time interval, $\Delta t = T/n$, where n is the number of equal time intervals within the least term, T, are multiplicative processes defined as a function of rental volatility, σ, which are given below:

$$u = e^{\sigma\sqrt{\Delta t}} \qquad ,and \quad d = e^{-\sigma\sqrt{\Delta t}} \qquad \text{Equation 6a, 6b}$$

The base rent in Equation 1 once agreed between the landlord and tenant at the point of signing the PLA will be fixed without revision for the entire lease term.[7] The default option is thus solely dependent on the fluctuation of the prevailing market rent, which in turn changes the rental savings as represented by the first three terms of the following boundary condition, f:

$$f(R_m)_t = a_i.PVAF_{r_1,T-t,12} + \left\{Max[0, b_i(\overline{S}_i - S_i^*)\right\}.PVAF_{r_2,T-t,12} - R_m.PVAF_{r_1,T-t,12} - \Psi_i \qquad \text{Equation 7}$$

where Ψi denotes the lump sum relocation or transaction costs, which is defined as the exercise price of the default option.

The payoffs of exercising the default option are determined starting from the nodes at the end of the binomial tree. The option payoffs are then determined iteratively in a backward direction till the original node of the binomial tree. At each of the binomial tree nodes, the decision to exercise the default option is a function of the option payoff at time t and the weighted payoffs of the payoffs in one period ahead:

$$f(R_m)_t = Max\left\{f_t,\ e^{-r_f\Delta t}.\left[pf(R_m)^u_{t+1} + (1-p)f(R_m)^d_{t+1}\right]\right\} \qquad \text{Equation 8}$$

---

6 Some retail leases contain liquidated penalty clauses that penalize tenants for breaking their leases prematurely. There are cases where less stringent provisions are incorporated, which allow tenants to break the leases prematurely conditional upon tenants completing a substantial portion of their lease obligations, say two years into their three-year leases.

7 The exact percentage used to compute the base rent given the prevailing market rent is subject to the negotiation between the parties. The anecdotal evidence in McAlister (1996) indicates that the figure that is most commonly found in the PLAs in the UK is 80%.

where r_f is the risk-free interest rate and p is the risk-neutral probability, which is written as:

$$p = \frac{e^{r_f \Delta t} - d}{u - d} \qquad \text{Equation 9}$$

ESTIMATION OF DEFAULT OPTION PREMIUM

Base Case Scenario

For numerical estimations of the default option premium, we will first define a base case scenario (Table 1) for a hypothetical 3-year PLA lease for a prime ground floor retail space in a shopping center along Orchard Road, the main shopping belt in Singapore. The prevailing monthly gross market rent for a comparable retail space is estimated at S$200.00 per square metre (psm) and we assume that there is no rent-free period granted and no security deposit paid by the tenant. Let us assume that the tenant taking up a retail space of 1,000 square metres (sqm) generates a monthly gross turnover of S$800,000 with a standard deviation of S$50,000. The standard deviation of the sale turnover is assumed at 10% every year due to increasing market uncertainty late into the lease term. The parties negotiated for a base rent of 90% of the prevailing market rent, an overage rate of 10% and a breakpoint turnover of S$300,000.

The time interval for the multiplicative binomial tree process of the prevailing market rent is set at 3 months, i.e. [$\Delta t = 0.25$]. The 3-month Singapore Government Treasury bill (T-bill) rate, which coincides with the binomial tree interval, is used to represent the risk free rate. The average 3-month Singapore Government T-bill rate for the sample period 1Q1990 to 2Q2003 is estimated at 1.64%. The retail yield can be represented by the yield of the retail real estate investment trust, CapitaMall Trusts,[8] which is projected approximately at 7%. The standard deviation of the Urban Redevelopment Authority (URA) of Singapore rental index for retail space in the central area is used to represent the volatility of the prevailing market rent and the annualised figure is estimated at 8.75% for the same sample period from 1Q1990 to 2Q2003.

Relocation cost is the "strike price" that will trigger the tenant's default option. It is assumed to be a one-off lump-sum capital payment, which is incurred at the point of default by the tenant. The costs include the tangible items like mover expenses, fitting-out and reinstatement costs, as well as the intangible items like loss of goodwill associated with the existing store location and disruption of business. The costs may vary by the type and the size of stores and an exact estimation of the costs is difficult. For the purpose of our analysis, we assume that the relocation costs will vary around an expected figure of S$80,000 and a standard deviation of S$50,000 in a normal distribution process.

Default Option Premium

Based on the assumptions defined for the hypothetical base case scenario of a PLA lease for a 1,000 sqm retail space in a prime shopping center in Singapore in Table 1, the option premiums were estimated in two parts. In the first part, we assume the sale turnover and the relocation cost to be constant throughout the entire T-year lease period and these two variables are then allowed to take some random probabilistic distribution in the second part of the analysis using the Monte Carlo simulation technique in @Risk program with all the pre-defined probabilistic parameters.

If the prevailing market rent (R_m) variable is assumed to be the sole stochastic driver of the default option model, we find that the value of the tenant's call option to relocate to alternative premises at a fixed rental scheme at prevailing market rent, i.e. the American type of default option premium,

[8] CapitaMall Trust (CMT) is the first real estate investment trust listed on the Singapore Stock Exchange. The CMT portfolio consists of three prime shopping centers in Singapore and the performance of the trust is thus a good proxy for the retail market performance.

may be estimated at S$82,487. As a percentage of the value of the 3-year PLA lease of S$7,624,872, the option premium is computed at 1.08%. The result implies that the tenant will only be convinced to default the existing PLA lease and move to an alternative retail space under the fixed rental scheme, if the rental savings after deducting the estimated relocation cost of S$100,000 will not be less than S$82,487, or 1.08% of the existing 3-year leasehold value.

Variables	Symbol	Base case values
Gross Floor Area (sm)	Q	1000
Lease Term (Year)	T	3
Prevailing Market Rent ($psm/mth)	R_m	S$200
Market Rental Volatility (%)	σ	8.75%
Monthly Base Rent ($Psm/mth)	a_i	S$180
Projected Monthly Gross Annual Sales ($/mth)	S_i	S$800,000
Standard Deviation of Gross Sales Volatility ($/mth)	σ_S	S$50,000
Overage Rate (%)	b_i	10%
Monthly Sale breakpoint ($/mth)	S_i^*	S$300,000
Risk free rate (% p.a.)	r_f	1.64%
Retail Rental Yield (%)	r_1	7.0%
Discounting Rate for Retail Sales (%)	r_2	8.0%
Relocation costs ($)	Ψi	S$100,000
Standard Deviation of relocation costs	σ_Ψ	S$50,000

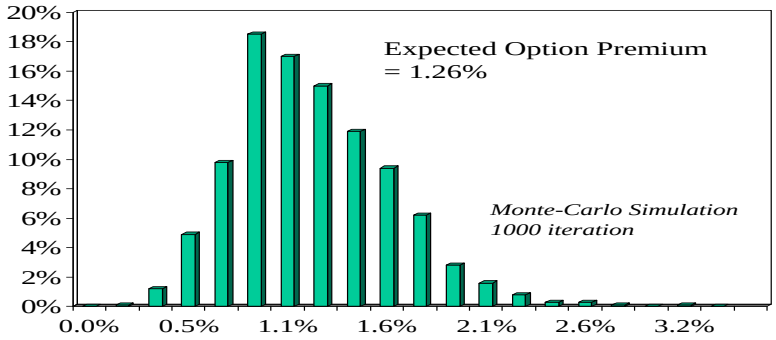
Base Case Scenario Assumptions
Source: Author
Table 1

Variable	Default Option Premium	
Term	S$	%
Minimum	$25,320	0.34%
Maximum	$243,368	3.20%
Mean	$96,282	1.26%
Std Deviation	$31,401	0.41%
Variance	$986,039,900	0.00%
Skewness	0.6961736	0.6951942
Kurtosis	3.797614	3.821549
Mode	$78,245	1.02%
10% Percentile	$59,488	0.78%
25% Percentile	$74,311	0.98%
50% Percentile	$92,502	1.21%
75% Percentile	$115,078	1.51%
95% Percentile	$151,022	1.97%

Summary of the Monte-Carlo Simulation Analysis on the Option Premium
Source: Author
Table 2

In the second part of the analysis, random probabilistic distributions are added to account for the uncertain nature in the projection of the gross sale turnovers and the relocation costs variables. The

simulation results as summarized in Table 2 show that the expected tenant's default option premium increases to S$96,282, which is equivalent to 16.7% increase over the previous result, when the gross sale turnover and relocation cost variables are random and probabilistic in nature. In the percentage term, the expected option premium increases by 0.18% to 1.26%. The positive skewness of 0.69 and the kurtosis of close to 3 suggest that the distribution of the option premium is close to normal and the probability distribution of the percentage option premium is shown in Figure 1.



Probability Distribution of the Default Option Premium (%)
Source: Author
Figure 1

SENSITIVITY ANALYSIS OF DEFAULT OPTION PREMIUM

Sensitivity Analysis

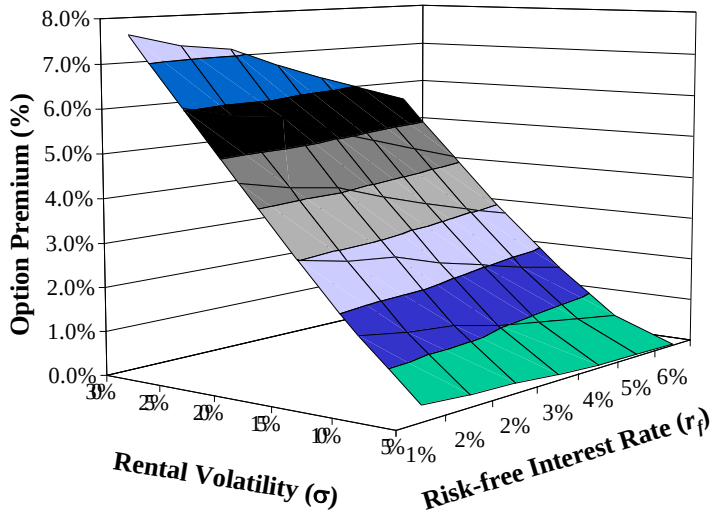
In this section, we will put the default option model under various sensitivity analyses to examine the effects of changes in various key input variables in the PLA framework on the default option premiums. By varying the parameters of selected input variables within a reasonable range: risk free rate, r_f, (1% - 6%); fraction of base rent, [$\alpha_i = a_i/R_m$], (40% - 100%); overage rate, b_i, (5% - 50%); sale breakpoint, S_i^*, (S$100,000 - S$800,000); relocation cost/strike price, Ψi, (S$50,000 - S$400,000); retail rental yield, r_1, (5% - 11%); and rental volatility, σ, (5% -30%), the sensitivity of the option premium is analysed and the effects are summarized in Table 3.

Key Input Variables:	Range of Variation	Effect on Default Option Premium
Rental Volatility, σ	5% - 30%	+
Risk-free Interest Rate, r_f	1% - 6%	-
Percentage of Base rent, [$\alpha_i = a_i/R_m$]	40% - 100%	+
Overage Rate, b_i	5% - 50%	+
Sale Breakpoint, S_i^*	S$100,000 – S$800,000	-
Relocation Costs, Ψi	S$50,000 – S$400,000	-
Rental Yield, r_1	5% - 11%	-

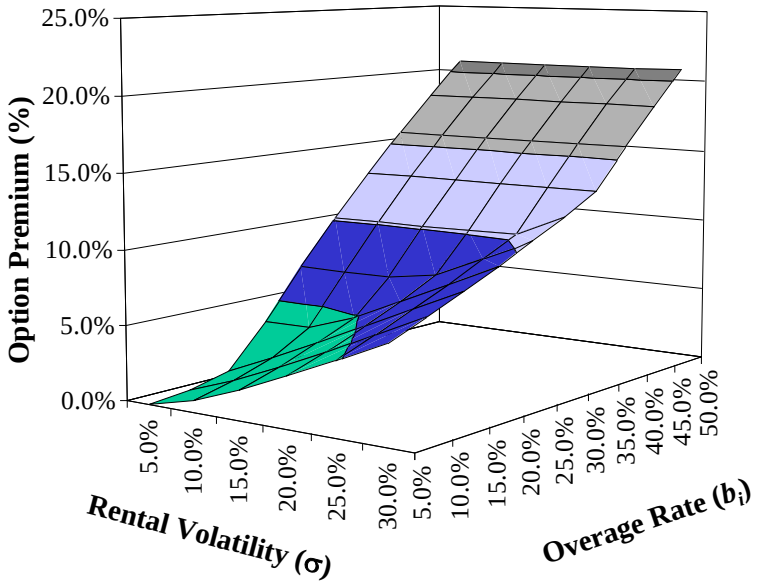
Sensitivity of Default Option Premiums to Key Input Variables
Source: Author
Table 3

The input variables collectively represent two types of effects: market factors and lease specific factors. The observed positive relationship between the option premium and rental volatility is

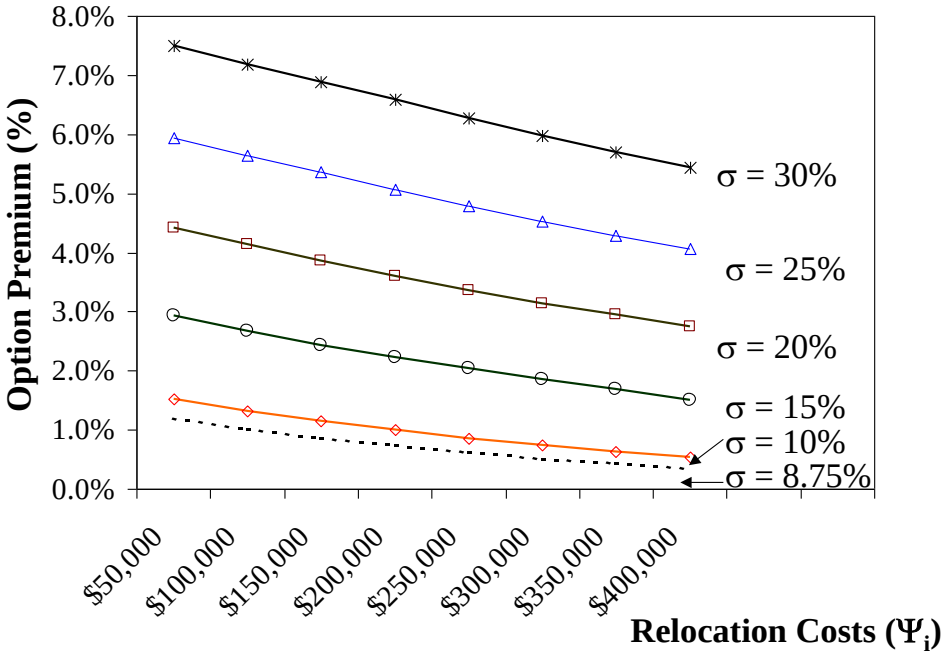
consistent with the standard real options theory (Figure 2). Risk free interest rate (Figure 2) and the rental yield are two other market factor that have influence, but in a negative direction, on the option premiums. As for the lease specific factors, the percentage used to set the base rent and the overage rate (Figure 3) have positive effects on option premium, whereas the option premiums decline when the relocation costs (Figure 4) and the sale breakpoint increase.



Sensitivity of Market Factors - Rental Volatility (σ) and Risk-free Interest Rate (r_f)
Source: Author
Figure 2



Effects of Overage Rate on Option Premiums
Source: Author
Figure 3



Relationship between Relocation Costs and Option Premiums
Source: Author
Figure 4

Theoretical and Practical Implications of the Findings

The comparative statistics indicate the significance of market and lease-specific factors in influencing the tenant's option to default. In a weak and volatile market, tenants' default is translated into vacancy in the retail space. The vacant retail space, if is not filled up at a favorable prevailing market rent, will adversely affect the rental revenue of the landlord. Therefore, the option to default or prematurely terminate a PLA lease by tenant will increase the leasing risks of shopping center landlords / developers. As a risk sharing mechanism, it is therefore important from the landlord's perspective to be able to structure PLA terms that will minimize the leasing risk, and at the same time, increase the incentive for tenants to expand efforts to not only increase the sale turnover, but also generate positive inter-store externalities to the center.

Market factors like rental volatility, rental yield and risk-free interest rate have not been examined in the PLAs literature reviewed earlier, but they are critical factors in influencing the leasing risk of a shopping centre. We expect the default risk to increase when the future market rent is highly volatile. Increases in the rental yield and the risk-free interest rate, which indirectly reduce the time value of the PLA leases, on the other hand, will reduce the option to default of tenants. In other words, the incentive to prematurely terminate the existing lease for alternative lease under a fixed rent scheme is less attractive in a high interest rate environment.

Base rent, overage rate and sale breakpoint are important lease-specific factors that will determine the success of the PLAs. Benjamin, Boyle and Sirmans (1990) found in their empirical study that base rents were positively linked to the sales breakpoint, but they are negatively related to overage/percentage rent rates. The findings are not inconsistent with our results, which show that a high percentage rent rate will increase the default options, whereas sale breakpoint, if set at a high level, will reduce the option premiums. In other words, if the landlord sets a high percentage rate,

and if the base rent is not adequately adjusted, the disincentive for the tenant to stay on the PLA lease term increases. On the other hand, if a high breakpoint is set, the likelihood of the tenant having to pay overage rent reduces, so the default option premium will also reduce correspondingly. Therefore, it is important to optimally determine the three parameters in the PLAs: overage rate, breakpoint and percentage of base rent, such that efficient risk sharing objectives can be achieved via the PLAs. The link between sales performance and PLA retail rent was found to be weak in Chun, Eppili, and Shilling (2001). They show that the adjustment to centre rent in reaction to changes in store sale performance was "smoothed" out over time and not as responsive in the short term.

Relocation costs are another factor that have also been found to be negatively significant to the default option premiums and the results are consistent with the findings in Sing and Tang (2002) and Grenadier (1995 a, b and c). For an established retailer that has already attracted strong association with a shopping centre, the cost of giving up the store's goodwill for other premises will be too high to be offset by possible rental savings from moving out to another retail premise.

CONCLUSION

PLAs have been widely regarded as an important mechanism to achieve risk sharing, tenant mix and also rent discriminating objectives in shopping center management. Earlier studies of PLAs focused on a string of diverse issues ranging from the agency-principal relationship, asymmetric information, incentive and effort levels of the parties in the lease, to empirical tests of the relationships of various PLA lease-specific factors like base rent, breakpoint and overage rent. Most of the studies point to the superiority of the PLAs over fixed rent schemes in generating and enhancing values of shopping centers. Real options literature examining various embedded lease options has also been extensive, but few have attempted to evaluate default risks in leases using the real options framework. Grenadier (1996) models the default timing as an exogenous stochastic variable in his leasing risk model, showing how the default risk should be reflected in the equilibrium lease rate to compensate the landlord for the leasing risks. Sing and Tang (2004) then extended the model to examine the default options from the perspective of a tenant, and this default option model was further extended to a retail PLA framework in this study.

In the proposed option to default model in a PLA framework, we assume that tenants are in a pro-active position to exploit the opportunity to capitalize on possible rental savings in a down market by prematurely terminating the existing lease. In the absence of lease pre-termination penalties, the tenants are deemed to possess an implicit call option which, if exercised, gives them a right to "break" a lease and move to alternative premises at a lower fixed prevailing market rent. This American type of call option exercisable anytime within the lease term is modeled as a function of the prevailing market rent as the sole stochastic variable. The strike price that triggers the tenant's default option is defined by the relocation costs, which include both tangible and intangible costs.

Based on a hypothetical retail PLA lease with various base case parameter assumptions, the value of the tenant's default option was estimated at 1.08% for a 3-year term. When uncertainties in both sale turnovers and relocation costs are simulated using selected random probability processes, the expected option premium increases by 0.18% to 1.26%. The sensitivities of the option premium with respect to the changes of two sets of input variables: market and lease specific factors, were also analyzed. The observed positive relationship between the option premium and rental volatility is consistent with the standard real options theory. Risk free interest rate and the rental yield are two other market factor that have influence, but in a negative direction, on the option premiums. As for the lease specific factors, the percentage used to set the base rent and the overage rate have positive effects on option premium, whereas the option premium declines when the relocation costs and the sale breakpoint increase.

The above results imply that both market and lease specific factors in the PLA are critical and should be fairly negotiated and provided in the PLAs. The default option premium should also be reflected in the equilibrium default-free lease rate, such that the leasing risks can be minimized for the center's developer/landlord. At the same time, the PLAs terms should also ensure that a fair incentive structure is in place to encourage tenants to expand optimal efforts in generating positive return and inter-store externalities to the shopping center.

REFERENCES

Addae-Dapaah, K and Yeo, C 1999, 'Percentage lease agreement as a shopping center management tool: a panacea for Singapore's retail industry woes?', *Property Management*, 17(1), pp. 24-36

Ambrose, BW, Hendershott, PH and Kosek, MM 2002, 'Pricing upward-only adjusting leases', *Journal of Real Estate Finance and Economics*, 25(1), pp. 33-49

Benjamin, JD, Boyle, GW and Sirmans, CF 1990, 'Retail leasing: the determinants of shopping center rents', *AREUEA Journal*, 18(3), pp. 302-312

Brueckner, JK 1993, 'Inter-store externalities and space allocation in shopping centers', *Journal of Real Estate Finance and Economics*, 7(1), pp. 5-16

Chun, GH, Eppli, MJ and Shilling, JD 2001, 'A simulation analysis of the relationship between retail sales and shopping center rents', *Journal of Real Estate Research*, 21(3), pp. 163-186

Chun, GH, Eppli, MJ and Shilling, JD 2003, 'The effect of firm characteristics on the use of percentage retail leases', *Journal of Real Estate Finance and Economics*, 27(1), pp. 25-37

Colwell, PF and Munneke, HJ 1998, 'Percentage leases and the advantage of regional malls', *Journal of Real Estate Research*, 15(3), pp. 239-252

Cox, J, Ross, S and Rubinstein, M 1979, 'Option pricing: a simplified approach', *Journal of Financial Economics*, 7 (Oct 1979), pp. 229-264

Eppli, MJ, Hendershott, PH, Mejia, LC and Shilling, JD 2001, *Base and overage rent clauses in retail leases: motivation and use*, working paper

Grenadier, SR 1995a, 'Valuing lease contracts: a real-options approach', *Journal of Financial Economics*, 38, pp. 297-331

Grenadier, SR 1995b, 'The persistence of real estate cycles', *Journal of Real Estate Financial and Economics*, 10, pp. 95-119

Grenadier, SR 1995c, 'Flexibility and tenant mix in real estate projects', *Journal of Urban Economics*, 36, pp. 357-378

Grenadier, SR 1996, 'Leasing and credit risk', *Journal of Urban Economics*, 42, pp. 333-364

Miceli, TJ and Sirmans, CF 1995, 'Contracting with spatial externalities and agency problems –the case of retail leases', *Regional Science and Urban Economics*, 25, pp. 355-372

McAlister, P 1996, 'Turnover rents: comparative valuation issues', *Journal of Property Valuation and Investment*, 14(2), pp. 6-23

McAlister, P 2001, 'Pricing short leases and break clauses using simulation methodology', *Journal of Property Investment and Finance*, 19(4), pp. 361-374

Rowland, P 2000, 'Pricing lease clauses: the prospective of an art becoming science', *Journal of Property Investment and Finance*, 18(2), pp. 177-195

Sing, TF and Tang, WL 2004, 'Valuing leasing risks in commercial property with a discrete-time binomial tree option model', *Journal of Property Investment and Finance,* 22(2), pp. 173-191

Ward, CWR 1982, 'Arbitrage and investment in commercial property', *Journal of Business Finance and Accounting*, 9(1), pp. 93-108

Ward, CW. and French, N 1996, 'The valuation of upward-only rent reviews: an option pricing model', *Journal of Property Valuation and Investment*, 15(2), pp. 171-182

Ward, CWR and Hendershott, PH 2000, 'Incorporating option-like features in the valuation of shopping centers*', Real Estate Finance*, pp.31-36

Ward, CWR, Hendershott, PH and French, N 1998, 'Pricing upwards-only rent review clause', *Journal of Property Valuation and Investment*, 16(5), pp. 447-454

Wheaton, WC 2000, 'Percentage rent in retail leasing: the alignment of landlord-tenant interest', *Real Estate Economics*, 28(2), pp. 185-204

ACKNOWLEDGMENTS

This paper was prepared for the RICS Foundation Global Symposium, Adelaide, Australia, January 2012. The author wishes to than Goh, W.K for his kind research assistance in the paper. The author remains responsible for the errors, if any, in the paper

Email contact: *rststf@nus.edu.sg*