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LEASE TERMS, OPTION PRICING AND THE FINANCIAL CHARACTERISTICS OF PROPERTY

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ABSTRACT

Traditional and standard discounted cash flow valuation techniques are unable to deal with a variety of options contained in lease contracts. In the United Kingdom the most important embedded option is the upward-only rent review. This becomes more valuable to the landlord in an era of low demand and low inflation, as nominal market rents are more likely to fall. Lease contracts are freely negotiated between landlord and tenant, and alternative forms of rent review clause would fundamentally change the investment characteristics of property. Many other less common options also exist in lease contracts and these create further valuation difficulties. It is essential that property valuation techniques be developed that explicitly value the options in lease contracts.

KEYWORDS

Property Valuation; Lease Terms; Upward-Only Rent Reviews; Options

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1. Introduction

1.1 The characteristics of property as an investment depend on the terms of a typical lease contract which vary from country to country. Many contract terms, such as renewal or break clauses, provide options for the lessor or lessee. They can also create cash flows with embedded options of different forms. Such options have been ignored in traditional and discounted cash flow (DCF) analyses of property.

1.2 There are various other differences in lease terms, including different lengths of lease and methods of indexation to prices. In many respects, this wide variety of terms and conditions that can exist in property leases also exists in the bond market, particularly the Eurobond market; but while valuation techniques in the bond market have kept pace with the development of more complicated investment characteristics, valuation or appraisal techniques in the property market seem unsophisticated by

comparison. Individual contributions have been made by property academics to price certain options in lease contracts, but practice has not generally progressed beyond the use of DCF techniques.

1.3 An options approach has been applied to various aspects of the valuation of mortgages (see, for example, Brennan & Schwartz, 1983; Childs *et al*., 1996; Dunn & McConnell, 1981a and 1981b; Kau, Keenan & Kim, 1993; Kau *et al.*, 1987, 1990, 1992 and 1993; Leung & Sirmans, 1990; Ling, 1993; Titman & Torous, 1989). It has also been applied to the valuation of land (Brown & Achour, 1984; Clarke & Reed, 1988; Lentz & Tse, 1995; Titman, 1985; and Turnbull & Sirmans, 1990). Other applications have been to pricing in the condominium market (Shilling *et al*., 1985) and to mineral asset prices (Davis, 1996).

1.4 Johnson & Wofford (1987), Shilling *et al*. (1987) and Grenadier (1995a) have considered wider applications of option theory to property market analysis. Grenadier, for example, considers the option that a property owner has to let a property or to hold it vacant until the rental market improves. The value of this option increases as letting adjustment costs increase and as future volatility increases. He also considers the development market, and shows that the probability of overbuilding increases with the length of the construction period, the adjustment costs and uncertainty about future demand.

1.5 More recently, attention has turned to the valuation of lease options (see, for example, Grenadier, 1995b; Crosby *et al*., 1997; Ambrose *et al*., 1999; Booth & Walsh, 2001a; 2001b), but as yet this has had little impact on practice. Nonetheless, an approach to valuation which values the option explicitly offers an important new approach to property valuation practice and provides an opportunity for significant inputs from other professions and disciplines, such as actuaries and financial economists. Eventually this could be absorbed into the standard methods of surveyors. Indeed, for reasons made clear in ¶1.6, it is arguable that further advances in financial theory could be used in the valuation of embedded options. Valuation practice could be regarded as being at least two steps behind theory.

1.6 The particular contributions of this paper are: to highlight a general approach to the valuation of options in lease clauses; to discuss the origins and risk characteristics of the upward-only rent review clause, which is the most important embedded option in the United Kingdom property market; and to discuss alternative lease contracts that have evolved in different countries. In most of the work referred to in ¶1.5 one of two approaches is adopted. Both approaches have disadvantages. Either a number of unrealistic assumptions are made that allow the valuation of the options to proceed in a risk-neutral framework, or such assumptions are relaxed, but subjective elements are used in the valuation process. While this paper concentrates on these two approaches, further developments in the valuation of options embedded in property lease structures are possible. In particular, state price

deflators could be used. These have recently been introduced in the actuarial literature, for example in Jarvis *et al.* (2001) and Hairs *et al.* (2002).

1.7 Section 2 discusses the financial nature of the upward-only rent review clause and its value to institutional investors. In Section 3 the debate regarding upward-only rent reviews and possible alternative institutional arrangements is considered. Section 4 outlines other forms of embedded option and Section 5 is the conclusion.

2. The Option Nature of Upward-Only Rent Reviews

2.1 Both traditional open market valuation and DCF investment appraisal methods ignore the option nature of an upward-only rent review clause. The option arises because the clause provides a fixed nominal floor, below which rents cannot fall for the term of the lease, except when there is a void (the equivalent of default in the corporate bond market). To value a property with upward-only rent reviews, we have to look at all possible future outcomes and take the expected present value. It is incorrect to take the present value of the expected future rent (see Example 2.1).

2.2 Upward-only rent reviews are analogous to options that are encountered by actuaries in life insurance and pensions work. For example, life insurance companies offered guaranteed annuities (and the opposite financial option of guaranteed commutation terms) for many years. It can be argued that actuaries did not use sufficiently rigorous techniques to value these options. They assumed that if current interest rates are above interest rates implied by the guaranteed annuity rate, the present value of the liability of the option is equal to the present value of the expected payout (rather than, correctly, the expected present value of the payout). An example in the pensions area is limited price indexation annuities, which offer pensioners a given percentage increase in their pension or, if lower, a percentage increase in line with the retail price index. It is notable that the two above examples of options arising in actuarial work are, like the upward-only rent review, long term and relatively unmarketable, as well as being difficult to hedge. These analogies are therefore important.

2.3 The option nature of the upward-only rent review system is of little significance in times of relatively high inflation and growth in demand, as the fixed nominal floor is of limited importance. For this reason investors have largely ignored it. However, it is more likely that the fixed nominal floor will be invoked in current financial conditions.

2.4 Taking account of the fixed nominal floor may be done implicitly, for example by using a lower discount rate. (Existence of the fixed nominal floor increases value, as does lowering the discount rate.) However, unless the option value is considered explicitly, the market may react incorrectly to

a change in financial conditions. Such a change has arisen as inflationary expectations have lowered and as rent review periods have shortened since the 1960s. The former means that increases in nominal rents due to inflation are small and may not offset any negative real rental growth between rent reviews. The latter means that a year or two of significant negative nominal rental growth is less likely to be offset by other years of positive nominal rental growth in the period between rent reviews. (This is particularly relevant if rents are cyclical; an hypothesis for which there is considerable evidence — see, for example, Hendershott, 1995.) Also, if the option characteristics are ignored, appraisals will not fully take into account other factors such as different risk characteristics and expectations of rental growth of individual properties.

2.5 There are two approaches to valuing the upward-only rent review option explicitly. One is to use traditional option-pricing techniques, which we return to in ¶2.13. The other is to use an adjusted DCF approach that takes account of the option value.

2.6 Consider the value of the option to receive the higher of the current passing rent and the market rent at the next review. With five-yearly reviews, a lease contract contains a series of such options during its life. We wish to find an expression for the present value of the rental income in the five-year period following the next rent review date. That is, we wish to evaluate:

$$V\left[\mathrm{Max}\left(R \cdot \ddot{a}^{(4)}_{\overline{5}|i}, S(t) \cdot \ddot{a}^{(4)}_{\overline{5}|i}\right)\right]$$

where:

$V[\cdot]$	denotes the present value;
R	is the current annual rent (paid quarterly in advance);
$S(t)$	is the market rent at time t; and
i	is the appropriate rate of interest for valuing cash flows of the risk profile relevant to the current rental stream (see below).

2.7 The objective of this paper is not to derive techniques for determining i, which is a standard problem in any commercial DCF appraisal. Nevertheless, that is potentially an important area of research, and we make the following observations. The rental income at level R should be received as long as the tenant remains solvent; corporate bonds issued by the tenant could therefore be a starting point for estimating i. In theory, rental income from a tenant should be more secure than interest and capital payments from corporate bonds. However, property investments are generally far less liquid than corporate bonds.

2.8 The annuity function represents the value of an annuity of one per annum payable quarterly in advance for five years after the review at time t. It can be taken outside the functions V and Max. To simplify the discussion

therefore, the annuity function will be ignored and we will concentrate on the expression:

$$V[\text{Max}(R, S(t))].$$

DCF methods normally take the value of the income stream as the value of the higher of the current rent and the rent that would be achieved if rents were to grow at the expected rate. Thus, $V[\text{Max}(R, S(t))]$ is assumed to be equal to $V[\text{Max}(R, \text{E}[S(t)])]$ where $\text{E}[\cdot]$ is the expected rental value.

2.9 DCF property appraisal methods differ only in how the current rent R is treated compared to future increases in rent. In one DCF method the rental stream at the current level of rent is valued as if it were known with certainty, and the expected extra amount from any review valued separately. Booth & Walsh (1998) describe this as the 'risk-free plus extra' method. The passing rent is in a sense 'risk free', although it is still subject to the risk of tenant default. The 'extra' rent arises from any increase in rents at the next review, over and above the passing rent. With this method the present value of one year's rent is:

$$\frac{1}{(1+i)^t} \cdot R + \frac{1}{(1+j)^t} \cdot \text{Max}(\text{E}[S(t)] - R, 0).$$

This method is similar to the 'convertible bond' approach of Adams & Booth (1996) for over-rented property (i.e. properties let at rents in excess of their open market rental value). The above formula, however, has general application to properties regardless of whether or not they are over-rented. The interest rate j is the appropriate rate for valuing that part of the income stream that is subject to the uncertainty of future rental growth rates, and will normally be taken as greater than i. A simplified example will help to illustrate the deficiency of this method in not recognising the option value.

Example 2.1

2.10 The current level of rents on an over-rented property is 10 (the units are irrelevant). The level of market rents can take any of the values 5, 6, 7,...,14, each with probability 0.1 (i.e. a uniform distribution). DCF methods which ignore the option would calculate $\text{E}[S(t)] = 9.5$. Compare this with $R = 10$, and discount whichever is larger (in this case R). If the level of $S(t)$ were 9.5 with certainty (i.e. a point distribution), exactly the same present value would be discounted. A corrected DCF approach would not discount the higher of the two expected values, but would discount the expected amount of the actual income stream. In the case of the uniform distribution of rents, the expected value of the income stream is $0.1 * (11 + 12 + 13 + 14) + 0.6 * 10 = 11$ (if $S(t) < 10$, the rent will be 10; the probability of this is 0.6, so there is a probability weight of 0.6 at a rental

level of 10). In the case of the point distribution of market rents the expected income stream is 10. Thus, the contemporary DCF approach (which does not allow for the correction above) does not take account of the probability distribution of future rental outcomes in a way that allows properly for the non-linear pay-offs implied by the upward-only rent review option. Another illustration of the weakness of the above formula is when $E[S(t)]$ is less than R. Assume $R = 10$ and $S(t) \sim N(x, 1)$. If $x = 9.99$, Pr (income receivable > 10) $= 0.5$; if $x = 5$, Pr (income receivable > 10) $= 0$. However, an income stream of 10 would be valued in both cases.

2.11 Mathematically, the problem with most published valuation approaches arises from taking the maximum of two expected pay-offs, rather than the expected value of all possible pay-offs. This is the fundamental weakness of the 'DCF present value of the expected amount' approach. Correcting for this by using a distribution for $S(t)$ leads to the following formula for the present value of future income:

$$P.V = \frac{1}{(1+i)^t} \cdot R + \frac{1}{(1+j)^t} \cdot E[\text{Max}(S(t) - R, 0)]. \tag{2.1}$$

The expectation is now outside the square bracket.

2.12 We can obtain precise valuation formulae with certain simplified distributions for $S(t)$. These were derived originally in Booth & Walsh (1998). For example, if we choose a lognormal distribution for $S(t)$ with:

$$E[S(t)] = S(0) \cdot e^{\mu \cdot t}$$

where the force of growth μ could be negative, and

$$\text{Var}[\log(S(t))] = \sigma^2 \cdot t$$

we obtain:

$$E[\text{Max}(S(t) - R, 0)] = E[S(t)] \cdot N(a_1) - R \cdot N(a_2) \tag{2.2}$$

with:

$$a_1 = \frac{\log(E[S(t)]/R) + (\sigma^2/2) \cdot t}{\sigma \cdot \sqrt{t}}$$

and

$$a_2 = \frac{\log(E[S(t)]/R) - (\sigma^2/2) \cdot t}{\sigma \cdot \sqrt{t}}$$

where $N(\cdot)$ is the cumulative normal distribution.

2.13 When E[$S(t)$] is large in relation to R, N(a_1) and N(a_2) are both just below 1. When E[$S(t)$] is relatively small, N(a_1) and N(a_2) are both just above 0.

2.14 Equations (2.1) and (2.2) give the following formula for the present value of the future income.

$$P.V. = \frac{1}{(1+i)^t} \cdot R + \frac{1}{(1+j)^t} \cdot \{\mathrm{E}[S(t)] \cdot \mathrm{N}(a_1) - R \cdot \mathrm{N}(a_2)\}.$$

The present value changes smoothly with changes in the expected value and the variance of future rents. The method allows completely for the option characteristics of the property freehold. Similar formulae can be derived for other distributions and then evaluated using numerical methods. The method is compatible with the approach to option pricing of Pemberton (1997), and is applied in Booth & Walsh (2001a) and Booth & Walsh (2001b). An appropriate risk discount rate j has to be chosen. This approach can be regarded as an 'adjusted DCF' approach. It correctly takes into account the full probability distribution of rents.

2.15 Traditional option-pricing methods were first applied to property, using a binomial pricing model, by Ward & French (1995), and were developed by Ward *et al.* (1998) and other authors in the U.K. and United States real estate finance literature. Ward & French provide a critique of their own model, which suggests that it is hard to apply the model in practice. First, the option is a compound option with a number of different exercise dates, and the exercise price is dependent on whether the rent was increased at a previous review. Additionally, the implicit assumption is made that the rent takes only one of two values at review: the expected market rent or the passing rent. A true binomial model requires a series of possible changes in rental value at discrete time intervals within the review period, ultimately leading to a distribution of possible rents at review. A further criticism of the Ward & French approach in Booth & Walsh (2001a) is that it treats the underlying quantity from which the option is priced (the value of a rental stream with upward and downward reviews) as if it is a tradable quantity in small units. This is not the case. Indeed, it probably does not have an observable market price. Nevertheless, Ward & French do find intuitive results from their option-pricing model. In particular, as the volatility of rents increases, the value of the option increases.

2.16 The critical determinant of the value of the option is the volatility of *nominal* rather than *real* rents. Booth & Walsh (2001a) value the upward-only rent review option when there is one review due in four years' time and nine years left on the lease. A lognormal random walk is assumed for the evolution of rents. At a risk discount rate of 8% and a standard deviation of rental growth of 20%, the value of the option is 3.6% of the value of the

property on a 'present value of the expected amount' basis if expected nominal rental growth is 5%. The value of the option becomes 7.2% of the value of the property if expected nominal rental growth is 0%. Thus, as expected nominal rental growth falls, the value of the upward-only rent review option rises. To explain this, recall that, on review in an upward-only lease, rent either increases to the market rate (if it is above the passing rent) or an option to hold rent constant is exercised (if the market rent is below the passing rent). In our example, as expected nominal rental growth falls, the distribution of expected market rental levels moves to the left. This increases the range within which the market rent would be below the passing rent and so increases the probability that the option to hold rent constant is exercised. Thus, the value of the option increases. This means that the upward-only rent review option has greater financial value in a low inflationary or deflationary environment, assuming that real rental growth is independent of the rate of inflation.

2.17 Simulation can be used to value the rental income over a succession of rent reviews, using stochastic investment models for both rental growth and rental yield changes (Ambrose *et al.*, 1999; Booth & Walsh, 2001b). In this way a probability distribution for the amount and value of future pay-offs can be determined. This will be a compound distribution, with the probability distribution of rents at the second and subsequent review determined by the outcome of the first rent review.

2.18 It should be noted that the form of lease, as such, does not necessarily affect the value of a property. Different lease terms will have different equilibrium levels of rent. Nevertheless, in order to value properly a particular property, let with particular lease terms, the value of any options should be taken into account explicitly. This paper concentrates on the valuation of the different lease terms. Another approach would be to determine the different equilibrium rental levels under different lease structures that would give rise to the same value for a particular property.

2.19 So, the option nature of upward-only rent reviews has been recognised by property academics. Its valuation is an interesting problem that actuaries, the property professions and financial economists should address. It is likely to be the subject of ongoing work to develop further analytical techniques in property analysis.

3. Upward-Only Rent Reviews and Alternatives

3.1 Burton (1992) finds that the upward-only rent review clause dates back to the 1960s, and was cemented by a House of Lords judgment of 1978 (United Scientific Holdings Ltd v Burnley Borough Council). In this case it was ruled that the upward-only rent review clause was fair to both tenant and landlord. It was fair to the landlord because it enabled the landlord to

obtain a fair rent instead of a rent far below that which reflects the value of the property, and both inflationary and real increases in rents. It was fair to the tenant because, without it, under inflationary conditions, it would not be possible for a tenant to obtain a long lease. Burton, however, contends that the existence of the clause is an example of 'contractual failure', because contract terms have not changed to meet changed economic conditions, namely the reduction in inflation. (The reduction in inflation has had a similar effect in increasing the value of the embedded options in with-profits policies represented by guaranteed reversionary bonus amounts.)

3.2 The Department of the Environment first consulted on the upward-only rent review issue in 1993. Their consultation echoed some of the concerns raised by Burton. In a response to the consultation paper, Booth (1993) argues that the upward-only rent review clause exists, like any contractual relationship, because the benefit to the landlord has a lower cost to the tenant than an alternative relationship of similar value to the landlord. The benefit to the landlord can come in the form of greater stability and certainty of future rent (and, hence, lower risk) and possible reductions in the cost of development finance (because of the cash flow certainty). The cost to the tenant of alternative contractual terms could be a higher equilibrium level of rents. In addition, the tenant may be less concerned by future downside variability of rent than by the affordability of the initial level of rent. However, Booth pointed out that, as market conditions change, the relative costs and benefits of the option embedded in upward-only rent reviews will also change. Alternative contract clauses might then evolve. Indeed, there was evidence to suggest that this was happening. The Department of the Environment concluded along the above lines when it responded to the consultation in 1994.

3.3 Crosby *et al.* (1993) look at the possible fall in the value of existing investments if upward-only rent review clauses were banned. The estimated fall in value of the IPD database was 4.3% across all properties. This is remarkably close to the value of the upward-only rent review option calculated by Booth & Walsh (2001a). The estimated fall is calculated from the rise in yields (capitalisation rates) that survey evidence suggested would result from a ban on the upward-only rent review clause. This rise in yields would arise because of a higher risk premium and reduced expected cash flow after reviews.

3.4 The above does not take into account the likely increase in rents resulting from less onerous lease terms. This arises partly because upwards and downwards reviews would produce a lower expected cash flow for a given initial rent level. Initial rents might also increase because cash flows are less secure; the investor will wish to be compensated for this higher risk by an increase in expected cash flow. It is also possible that alternative mechanisms would evolve that redistribute the cost and risk between landlord and tenant. These alternative contract terms could involve either

Table 1. Alternative contractual arrangements to upward-only rent reviews

Alternative clause	Where commonly used	Comments on valuation
Upward or downward reviews	Nowhere, but similar effect to shorter leases	Valuation would be simpler as there is no 'option' to value
Rents linked to turnover	Common in the U.S. retail property market	Essentially provides equity interest; may be even more dependent on the tenant than are upward-only rent reviews; risk premium in valuation should be quite different from currently (see note below)
Indexation to price index; longer time between reviews	Portugal, Italy, Germany, France (in Italy, this is subject to maximum of 75% of increase in index)	Interesting valuation issues; property should be treated as a real asset for valuation purposes; inflation sensitivity close to zero; real rental growth sensitivity depends on term of lease; there is likely to be 'basis risk' depending on the precise index to which rents are linked
Indexation to construction index	France (although, if market rents move significantly, application can be made to increase rent)	Nature of asset and possible structure of rent increases very complex; less obvious economic rationale (see ¶3.6)

lower or higher costs for the tenant, and can be valued using the approach in this paper.

3.5 Table 1 shows four alternative contract terms that could be used instead of upward-only rent reviews. Each would change the links between the property market, the economy and other capital markets. Thus, they would fundamentally change the investment characteristics of property. Turnover links also have option characteristics. In the U.S. retail property market, it is common for there to be a basic floor to the rent and, as turnover increases beyond a certain level, turnover-linked rents are then received. This is similar in character to the higher of floor or market rent option in the U.K. lease structure.

3.6 Upward or downward rent reviews and rents linked to turnover both link rents to the returns on property as a factor of production. The property investor is, therefore, more directly exposed to the risks linked to the general economy, and property has stronger equity characteristics. When rents are linked to a price index, the risk characteristics of the property are similar to those of an index-linked bond, except that there is a risk of tenant default during the term of the lease (and re-letting at a lower rent). When the lease is complete, the value of the investment will depend on the level of

market rents in the property market. The value of the investment will, therefore, still depend on rental growth rates, although a known real income will be provided over the term of the lease. Rents linked to construction indices have similar characteristics to those linked to price indices, but there is what could be described as a 'basis risk' between the construction price index and the retail price index. Rents linked to a construction index are linked to the replacement cost of buildings rather than to the value of the land component of property. They are not very appropriate as a means of obtaining a commercial bargain between landlord and tenant, unless there is a chance of rebuilding. Nevertheless, although the economic rationale for using construction indices is less obvious, there are parallels with the depreciated replacement cost (DRC) method of valuation, typically used for specialist buildings for which there is, effectively, no market. All of these alternative lease clauses have different risk characteristics and should lead to different yields prevailing in the market; but none contains the embedded option that exists in the upward-only rent review clause.

3.7 The use of index linking with a longer time between reviews (or with no review until the end of the lease) would move the market to a position similar to that which existed before the 1960s, but with rents fixed in real terms rather than in nominal terms. Reviews could be incorporated within a contract, in case market rents grew at a different rate from the rate of growth of the index. Despite low current inflation, institutions, which dominate the property investment market, do not wish to leave themselves exposed to a possible increase in future inflation. Index linking would provide landlord and tenant with certainty of real income or cost, and protection from falling or rising real rents in the market over the term for which rents were fixed. It would provide an alternative to index-linked bonds for investors, but without a government guarantee. Presumably the risk premium required by institutions from such a contract would be less than that from upward and downward reviews. It is also worth noting that, in the case of price index-linked rents on the continent, there is no reduction on deflation. This, in itself, is an option which may be of considerable value in an environment where the average price level is stable over a long period. It is not unlike the option to which pension funds commit themselves when retirement pensions are index linked, but where nominal pensions do not decrease if the price index declines.

3.8 The Department of the Environment began a further consultation on upward-only rent review clauses in September 2000. The result of the consultation was for a new lease code to be produced. Specifically, the code recommends: "The basis of rent review should generally be to open market rent. Wherever possible, landlords should offer alternatives which are priced on a risk-adjusted basis, including alternatives to upward-only rent reviews; these might include up/down reviews to open market rent with a minimum of the initial rent, or another basis such as annual indexation." (Commercial

Lease Group, 2002, recommendation 6). The thrust of the revised code is a desire to ensure that businesses (in particular small businesses) are fully informed of the alternative contractual clauses that exist. Legislation may follow if the code is not implemented. However, the 25-year upward-only lease is no longer the norm as regards institutional lets. The average term of a U.K. institutional lease has been falling progressively. In 1991 the rent-weighted average stood at 25 years for retail property and 20 years for both offices and industrials; by 2001 it had fallen to 16 years and 15 years respectively (BPF/IPD, 2002). In addition, break clauses (see Section 4) are very common in the U.K. So it is not clear what objective the code will achieve. Nevertheless, it is notable that reference to differential pricing of leases with and without options is made explicitly in the code. Concerns have also been raised that the cost of finance for developments will be raised if there is no upward-only clause; in itself, this may cause base rents to rise. See, for example, Royal Institution of Chartered Surveyors (2000) for a discussion of these issues.

4. Other Forms of Options within Lease Contracts

4.1 The upward-only rent review clause is only one of a variety of options that can exist in property leases. The U.S. retail market provides numerous examples of multiple options in leases (see Hendershott, 1999, for a review). These options include: turnover rents, whereby the landlord receives a share of the turnover above a set level; renewal clauses; break clauses for the landlord if tenant sales do not reach a specified level; break clauses for the tenant if an anchor store closes; an increase in the leased space (a tenant's call option); a decrease of the lease space (a tenant's put option); a ceiling on tenant contributions to operating costs; and sub-letting. Such options exist when there is benefit to both landlord and tenant. Hendershott suggests three sources of net benefit: an expected reduction in transaction costs, such as taxes and professional fees; improved incentives; and superior risk sharing.

4.2 Gemmill *et al.* (1998) examine the problem of the valuation of 'break clauses', whereby a tenant can break a lease at specific points. In a sense, a break clause is the mirror image of an upward-only rent review. If a break clause exists and market rents fall below current rents, the tenant can leave so that the building has to be re-let at the lower market rent. A better understanding of the nature of the break clause, in option terms, can be gained from the following reasoning.

4.3 Consider the basic rental agreement as an agreement for the tenant to pay a fixed sum at a given time and assume, for simplicity, that the risk-free rate of interest is zero. From the landlord's viewpoint, the break clause is like holding the cash asset and being short of an equity put. This is because,

if the market rent (which we will consider to be the equity income) is less than the initial fixed rent, the landlord will have to re-let the property to receive the market rent and give up the fixed rent. An upward-only rent review clause and a break clause is therefore equivalent to the right to a fixed sum plus a long equity call (on the market rent) and a short equity put (on the market rent). The put/call parity relationship in option pricing makes use of the fact that holding an equity plus a long put position plus an obligation to pay a fixed cash sum is equivalent to a long equity call. Re-arranging this, we have:

$$\text{equity} = \text{long equity call} + \text{fixed cash sum} - \text{short equity put.}$$

Thus, a lease with an upward-only rent review clause and a break clause (right to receive a fixed sum plus a long call and a short put on the equity income) must be equivalent to a lease to receive the equity income (market rent). In other words, it is equivalent to an either-way lease. This assumes, of course, that the break and the upward-only rent review can be exercised at the same time.

4.4 A similar relationship exists for the tenant. The tenant can be regarded as having an obligation to pay a fixed cash sum from a fixed lease (i.e. negative cash or a loan). The upward-only rent review clause then requires the tenant to pay the market rent if that is higher than the fixed rent. This is equivalent to being short of an equity call. The tenant will have to pay or to deliver the market rent in return for not having to pay a fixed rent.

4.5 The break clause is then equivalent to holding a long equity put position. The tenant will be able to pay the market rent in exchange for not paying the fixed rent if the fixed rent is higher. This is equivalent to selling an equity at a fixed price higher than the market price. Again, re-arranging the put/call parity relationship, we obtain:

$$-\text{equity} = \text{short equity call} + \text{obligation to pay fixed cash sum} + \text{long equity put.}$$

Thus the tenant, who has the equivalent of an obligation to pay a fixed cash sum plus a long equity put and a short equity call, has the equivalent of holding the negative of the equity (equivalent to an obligation to pay market rent). So the tenant also has the equivalent of an either-way lease. This result is intuitively reasonable. On the one hand, the tenant with a break clause should never pay more than the market rent because he could exercise the break and leave. On the other hand, the landlord should never have to accept less than market rent because the upward-only rent review clause can be activated to raise the rent to the market level.

4.6 This analytical approach is useful for the purposes of valuation and

understanding the conditions under which break clauses, combined with upward-only rent reviews, may lead to any overall option value. Prima facie, a property let with a break clause combined with an upward-only rent review might as well be let on an either-way lease. Indeed, Gemmill *et al.* (1998) argue that a lease with upward-only rent reviews and break clauses exercisable at the same time would have the same value as an upward or downward lease, after rental drift is taken into account.

4.7 However, the lease can still have a value different from that suggested by an upward or downward lease. The break clauses and the rent review options may be exercisable at different times. Also, with a break clause there is the additional cost of a possible void together with the associated costs of managing the empty property and bargaining with potential tenants. There is a credit risk aspect to this. If the tenant goes bankrupt there will be a void, and it may be necessary to re-let the property at a market rent below the passing rent. In such circumstances, however, the tenant is likely to exercise the break clause at the next opportunity anyway, so the credit risk does not add substantially to the total risk.

5. Conclusion

5.1 The central proposition of this paper has been that leases contain options with which traditional and standard DCF valuation techniques cannot cope. The most important in the U.K. is the upward-only rent review clause, which was established in an economic environment of higher and more variable inflation than currently prevails.

5.2 The application of techniques from finance was illustrated by treating the upward-only rent review as an embedded option. Approaches to valuing this specific option have been developed. Alternative forms of rent review clause were identified, and their consequences for the characteristics of property as an investment discussed. The form of these review clauses affects the cash flow characteristics of property. Some produce an investment with strong links to the real economy through the occupier markets and so with strong equity features. Others link property income to the money economy through inflation and result in an index-linked investment.

5.3 Other types of option created by leases were briefly discussed, and it was suggested that these are likely to become more common in the future. There is a much wider variety of lease terms than was the case at the beginning of the 1990s. In particular, there is greater use of break clauses, which, like upward-only rent review clauses, are not easy to value. The changed economic environment for upward-only rent review clauses and the possibility of other options being introduced into leases, make property valuations more difficult. The case for developing techniques from mainstream finance is compelling.

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