Long Term Ground Leases, the Redevelopment Option and Contract Incentives

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Abstract

Since the option to redevelop a property is valuable, ground leased property should trade at a discount relative to fee simple property because of the impairment of the value of that option resulting from the foreshortened horizon of the leaseholder. This discount would be over and above the discount that results from the leaseholder's non-existent residual claim to the property. We evaluate alternative contractual arrangements that may be more incentive compatible between the owner of the leased fee and the leasehold. We find that a lease extension clause causes the lessee to defer development and develop at much higher density. Sharing of the value of the residual claim between the owner of the leased fee and the leasehold also increases the intensity of redevelopment but results in earlier redevelopment. Also, we find that a more realistic escalation clause causes redevelopment to occur sooner but at similar density.

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Introduction

Ground leases are long term contracts where there is significant uncertainty as to the future outcomes that may influence the value of the contract to the parties involved. While it is important to simplify the contract as much as possible, there is a tradeoff between drafting a contract that predetermines the benefits and costs to parties to the contract under all economic outcomes and the costs of negotiating and drafting such an instrument. Typically, the landowner (ground lessor) leases land to a developer (ground lessee) for a long period of time (usually more than thirty years). The ground lessee develops the land in an agreed upon fashion and the lessor and lessee share the resultant cash flows. At the end of the lease, the improvements revert to the landowner (ground lessor). Because of the long term nature of the lease, it is important to the landowner that the contract contain incentives that cause the ground tenant to maximize the net present value of the underlying asset at the outset and throughout the life of the lease.

It is well known that the property rights associated with ground leases yield the owner of those rights less value than fee simple ownership. First, the lessee has no rights to the property at the termination of the lease. That is, the terminal value to the lessee is zero. Second, during the life of the lease, the redevelopment option is less valuable to the lessee because any capital expenditure has zero terminal value. See Capozza and Sick (1991). Specifically, these authors find that faced with the prospect of redevelopment, the lessee will redevelop sooner and at lower density than would the fee owner. Such behavior is non-optimal from the point of view of the lessor as the present value of the ground lease revenues will be lower than they would have been had the lessee built at the same time and to the same scale as would have the landlord. Another way of thinking of this is that the lessee will not develop the property to the highest and best use because the improvements have no value at the termination of the lease. Also, any improvements undertaken during the life of the lease must be amortized over a shorter time period than the original lease assuming there is no extension of the lease coincident with the redevelopment.

Capozza and Sick focus on value of the leasehold relative to the value of the fee simple and, in particular, the role of the redevelopment option and its impact on that value. They do not focus on the nature of the contractual arrangement between lessor and lessee. In fact, the lease contract assumed in their analysis is not common in practice. Capozza and Sick assume that the rent paid by the ground tenant continually 'marks to market.' That is, the periodic payment on the lease changes each period according to the underlying value of the land. In practice, we know that it is impractical to adjust the rental payment annually based on an index value that reflects the underlying value of the land. In fact, most leases mark to market every five or ten years, at a minimum, because the cost of determining the market lease rate is excessive.[1]

Usually when a ground lease is initially negotiated, it is in the interests of both the landlord and the ground tenant for the property to be developed to the highest and best use. That is, the use that yields the highest land residual or the most profitable use. The landlord has the leverage to have the site developed at highest and best use because the landlord can withhold from agreeing to a contract with any party that will not commit to the development the landlord believes is the highest and best use. However, once the site has been developed, time has passed and market conditions have changed, depending on the terms of the contract, redevelopment may not be optimal for the ground tenant even if there is a higher and better use for the site. Sometimes redevelopment may be optimal but not at the scale that would be optimal for the fee owner. The motivations of the ground tenant will be driven by the terms of the ground lease. Most ground leases are silent about the issue of redevelopment even though during the thirty or more year term of a typical contract, the likelihood that a higher and better use will arise is very real. One of the objectives of this paper is to explore alternative contractual arrangements which may lead to behavior on the part of the lessee that is more consistent with what the fee owner would do in the same economic circumstances.

The paper is organized as follows. Section 1 includes a very brief literature review. In section 2, the typical structure of North American commercial ground leases is described along with a discussion of how such a lease might handle the prospect of redevelopment by the ground tenant. Section 3 will develop a model which determines the value of the development option to the ground lessee in the case of a single development opportunity assuming ground lease terms similar to those employed by Capozza and Sick (1991. Section 4 will extend this model to examine the impact on the option value of alternative contractual structures with specific emphasis on escalation mechanisms for the base rent, opportunities for lease extension and determination of value at lease termination.

Literature

Williams (1991) uses the option pricing approach and analytic and numerical techniques to determine the optimal timing and density of development and timing of abandonment of a property. Cash flows and construction costs are stochastic and the cost of developing density is Cobb-Douglas. Capozza and Sick (1991) examine the value of long term ground leases relative to fee ownership. They find, using option pricing theory, that the discount in the value of a ground lease relative to the fee is not just the result of the termination value of the lease to the ground tenant, but also the result of the reduced redevelopment opportunity afforded the lessor as a consequence of the foreseeable termination of the lease. Thus, as noted earlier, even with a mark-to-market ground lease, a ground lessee will redevelop sooner and at a lesser intensity than a fee owner would in the same economic circumstances. The redevelopment is at lower density because the ground tenant does not benefit from the revenues after the termination of the lease and occurs sooner so the ground tenant can benefit from the enhanced revenues for a longer period of time. Capozza and Sick consider the possibility of one redevelopment opportunity for either the fee owner or the ground lessee. Construction is Cobb-Douglas and rents are stochastic. The fee simple values are determined analytically and the lease values are solved for using numerical methods.

In these early papers, the redevelopment option can be exercised only once. Others that have explored once only exercise of the development option include Titman (1985), Clarke and Reed (1988), Capozza and Schwann (1990), Williams (1993) and Capozza and Li (1994).

Unlike financial options, the development option can be 're-exercised.' Amin and Capozza (1993) explore sequential development under certainty. Williams (1997) analyzes the redevelopment option under uncertainty when sequential redevelopment opportunities are permitted. He finds that relative to the standard solution, redevelopment is more frequent, at less intensity and results in higher market values of the property. Independently, Childs, Riddiough and Triantis (1996) (hereafter Childs et al.) explore repeated redevelopment with mixed uses and find that the mix of two possible uses makes a property more valuable and that the incremental value is greater if the growth paths of the cash flows from each use are less correlated. In both papers, the cash flows are stochastic and construction costs are Cobb-Douglas; Williams' solutions are primarily analytic and those of Childs et al. are numerical.

Numerous papers have examined the terms of other types of leases usually with the goal of providing some theoretical rationale for contractual features that have evolved in the marketplace. Examples of this research include Grenadier (1995). More recently, Grenadier (1998) has explored the impact on the value of the redevelopment option of the ‘time-to-build’ issue. The delay imposed by the construction period at the time of redevelopment imposes considerable additional risk on the developer. Grenadier models the negative impact this delay has on the value of the redevelopment option.

It is clear from the literature that the prospect of redevelopment along with the loss of the residual value at the termination of the lease causes the value of ground leased land to be less than the value of the fee simple. The existing literature, however, has not focused on the contractual arrangements between landlord and tenant. Capozza and Sick (1991), for example, assume that it is only the above factors that cause the differences and not the potential complexity of the lease contract. Grenadier (1995) models the pricing of lease contracts of various terms and structures including variable rate leases, leases with renewal options and leases with contingent payments. Thus we know how to price various types of lease contracts and we know actual ground lease contracts are much more complicated than those modeled by Capozza and Sick. It therefore seems worthwhile to explore the actual structure of ground lease contracts to explore the impact of more realistic contract terms on the value of the ground lease relative to the fee simple interest. Assuming symmetric information, a landowner would, in a perfect world, like to negotiate a ground lease that yielded to him a rental stream consistent with the value of the underlying asset (the land) in highest and best use. This would be the first best outcome. Exploring alternative contractual arrangements may allow us to come closer to the second best alternative.

Ground leases

Most ground leases in North America have the following structure. Land is leased by the owner to a tenant usually for a period of at least 50 years. That 50 year term is usually comprised of an initial ten or twenty year term with options for two or three ten year renewals. The lease, including options to renew, may be as long as 99 years. Longer leases (over 99 years) are viewed as sales from a tax perspective in the US and are seldom used.[2]

The length of the lease allows sufficient time for return of capital invested and amortization of debt in the case that leasehold improvements are financed with debt. Lenders are reluctant to finance improvements on ground-leased property unless the term of the lease including extension options does not exceed the amortization period associated with the debt.

The landowner will typically agree upon (and may even dictate) the nature of development before finalizing the lease. In fact, in many cases, the landowner will seek proposals from competing developers. While the landowner is usually in the end a 'silent' partner, at the time the development program is determined, the landowner will be heavily involved as it is at this time that the parameters that determine the revenue stream from the lease are determined. Usually the ground lease will assess penalties if the development does not occur as planned or when planned. Often, there will be a date at which the lease can be terminated if the ground tenant/developer has not performed.

Landowners may negotiate a participating ground lease. Participating ground leases allow the landlord to maintain a contingent interest in the property and benefit from the performance of the project once it is completed and operating. The key attribute of the participation is that the ground rent fluctuates with the revenues generated by the property or the sales of occupants of the property. This is another way for the lessor to ensure that the rental stream 'matches' the performance of the property. If the base rent adjusts only every ten years, a participation clause allows rents to increase periodically provided the gross income from the property or sales of tenants in the property are increasing.

In North America, this type of lease has been commonly used by public agencies including ports, airports and local governments, specifically, redevelopment agencies. Such contracts provide revenues, albeit risky, not affected by changes in the law or tax base. The participation feature may provide inflation protection. Also, the lease permits a degree of long-term control during operations. This may allow a public agency to recoup subsidies, including the write-down of land, over time without unduly burdening the project during the development and start up periods when cash flow may be critical to the project. Thus ground leases may be an effective tool in public/private partnerships.

Similar leases are employed by private landowners that want long term revenue from land but lack the interest or expertise to develop and manage the improvements to the land.[3] These and other owners may use the ground lease to defer paying a capital gains tax on land with a low historic basis. Non-developer owners may choose to ground lease developable land rather than sell as that approach allows them to generate an ongoing income stream without personal responsibility for development while deferring the tax on any capital gain far into the future. A tax-free exchange would accomplish the tax deferral goal, but would leave development of the new site in the hands for the taxpayer. So for investors in developable parcels, tax deferral alone seems to provide a rationale for the existence of long-term ground leases.[4] On the other side of the transaction, ground leases provide an alternative to finance the land component of a development transaction so for some developers a ground lease may present, at some price, a preferable mechanism for financing a development.

Typical economic terms of a participating ground lease include:

A. Major forms of rent

1. HOLDING RENT, typically a fixed dollar amount paid until commencement (or completion) of construction. The holding rent may escalate if target dates are not met with respect to the completion of the project. Also, the landlord may have the right to terminate;

2. MINIMUM RENT (sometimes BASE RENT), typically a fixed dollar amount (during the life of the lease) which is adjustable at specified intervals (usually every five or ten years) using an agreed upon approach or formula;

3. PERCENTAGE RENT (of Gross Income), an amount determined as a percentage of the rents received from and/or gross sales by the occupying tenants payable annually in the amount, if any, by which percentage rent exceeds the minimum rent; and

4. BONUS RENT (Percentage of Net Income) generally defined as a percentage of the net income of the ground tenant.

The holding rent is designed to facilitate development and reduce out-of-pocket costs of the ground lessee during the pre-development, development and construction periods. The base rent is the least risky ongoing revenue source for the ground lessor. This component of the rental stream should yield the equivalent of a relatively low risk return for the term of the lease. The actual payment should be computed on a notional amount equivalent to the land value in highest and best use (presumably the existing use) at the time the lease begins. The base rent may adjust periodically (usually every five or ten years). The adjustment should be triggered by a change in the value of the land. Such changes in value are normally determined by an appraisal although some creative draftsmen have tried to finesse the need for valuation to trigger changes in the base rent.[5]

Landlords cannot unreasonably withhold transfer an assignment of the ground lease by the developer to successors. However, the contract may permit the landlord to renegotiate the terms of the lease. At a minimum, the landlord will require that the transferee have an acceptable credit rating.

The rental stream that Capozza and Sick contemplate is a ‘mark-to-market rental stream. That is, the rents that the lessor would earn if the lease payment adjusted instantaneously to evolving property values due to economic growth or changes in use. In practice, such instantaneous adjustment does not occur. For lease revenues to track property values, it would be necessary for the lease to readjust periodically to some ratio of the unobservable market value of the property. Since the market value is unobservable, an appraisal would be required to determine the expected market value and, in turn, the new face rate of the lease. In practice, periodic appraisals to determine lease rates are costly and are employed only at longer intervals. Thus rents ‘mark-to-market’ every five or ten years rather than instantaneously as existing models have assumed. Other indexing mechanisms or participation clauses may serve to index the lease revenue to the inflation rate or property performance. However, there is no reason to expect changes in such revenue streams to be proportionate to changes in ‘highest and best use’ land values.

If the highest and best use changes, many leases are silent about what should happen. It may be presumed that the lease will be re-negotiated but without a clause addressing this issue in a lease, there is no mechanism to bring about re-negotiation let alone optimal redevelopment. The ground lease represents an unusual allocation of property rights. Hart (1995, Chapter 2) develops a simple property rights model which allows him to conclude that a party is more likely to own an asset if he or she has an important investment decision with respect to the productivity of the asset. The redevelopment decision is such a decision. As well, he argues, highly complementary assets should be under common ownership. Land and buildings are complementary assets. Hart’s focus is on determining the boundaries of the firm. It would seem that the ground lease has to provide contractually for activities that in a perfect world would be undertaken by the same entity. Thus a purpose of this paper is to explore possible contractual arrangements which may cause the lessee to be proactive regarding redevelopment in a way which is in the interests of the lessor as well as his own thus coming closer to a first best outcome.

In this paper, we examine the impact of ‘step-up’ rents on the value of the ground lease and on the timing and intensity of redevelopment. Step-up rent structures are typical in ground leases. Usually, every ten years the base rent marks-to-market as a result of an appraisal of the highest and best use of the land. Also, we consider the impact of compensation by the lessor to the lessee for the residual value of the improvements at the termination of the lease. We consider alternatives where the amount of compensation is equivalent to the depreciated value of the improvements or the original cost. Also, we consider the possibility of a percentage lease. With such a lease the ground lessee would make a lease payment equivalent to a percentage of the gross revenue of the property. Such a lease would be a simple example of a participating ground lease.[6] Finally, we examine the impact of an option for the lessee to extend the lease at the time of redevelopment by the number of years that have already elapsed. For these alternatives we explore the impact on both timing and intensity of redevelopment. All of these alternatives are either typical arrangements in existing ground leases or easily implemented arrangements which may change the lessee's motivation to undertake redevelopment which may be optimal for the lessor.

We also undertake some sensitivity analysis to examine the impact of changes in various parameters on the value of the ground lease as well as on the timing and intensity of redevelopment. Specifically, we explore the impact of variation in the rental growth rates, changes in the correlation between the building and the land rent growth rates, changes in development efficiency and changes in the interest rate. The role of these parameters will become clear as our model is described in the following section.

Overview of our approach

Future development of a land creates an option that has value to the individual who has the right to use the land. The risk neutral pricing method for options offers an alternative that employs significant computational time but avoids intractable analytic approaches to certain option pricing problems. Using Monte Carlo techniques, the current value of the development option, can be estimated by simulating many sample paths of development, finding the maximum value in each sample path and then averaging the present discounted value of the maxima over all the sample paths to yield an expected value over all sample paths. That expected value is an estimate of the value of the development option. Boyle (1977) was the first to employ numerical or Monte Carlo techniques in valuing financial options and, subsequently, numerous others have employed these approaches particularly for partial differential equations that are difficult to solve analytically. See, for example, Capozza and Sick (1991) and Childs et al. (1996).

In a real estate development environment, the value of a property is a function of the expected path of rents, the development technology, the expected interest or discount rate and the expected cost of construction. The optimal development decision involves choosing the optimal time and intensity of development. In our paper, we build upon the approach employed by Capozza and Sick (1991) with some exceptions. First, our model includes a value or rent for both the land and the improvements (building). This permits the lessee to be compensated for the residual value of the building while the residual value of the land reverts to the lessor. Thus, the rental stream generated by a property is comprised of building rent and land rent. Both building rent and land rent are stochastic but land rent adjusts to its theoretical market value at the time of redevelopment.[7] We employ Monte Carlo techniques to estimate the values of the fee simple and the lease contracts and determine the optimal timing and intensity of redevelopment for both landlord and ground tenant. Starting rents, interest rates, lease terms, construction costs, conversion technology (efficiency) and building and land growth rates and volatilities are fixed parameters. We do not consider multiple or sequential redevelopment alternatives at this point.

The model for each lease contract is created to simulate the redevelopment decisions faced by a ground tenant. The ground tenant leases the land from the landlord and then leases the building to the space users. When the current land use is no longer at its highest and best use, the ground tenant needs to decide if and when it is optimal to redevelop (convert) the land to its best use. Even though the property may not be at highest and best use, the lease contract may not provide the same incentives for the ground tenant to redevelop the property as in the case of the fee owner.

The model

The market land rent (R_L) and market building rent (B) each follow lognormal distributions (Wiener processes). The 'growth rate' for land rent is positive and that for building rent is also positive. Thus

$$dR_L = g_1 dt + \sigma_1 dz \tag{1}$$

and

$$dB = g_2 dt + \sigma_2 dz \tag{2}$$

where dz is a standard Wiener process. We expect that there will be a strong relationship between g_1 and g_2. In fact, we would expect that in a competitive environment, the two drifts would move in tandem. However, this would be the case with respect to new properties. In our simulations, we include depreciation so that after accounting for depreciation, g_1 may not equal g_2 or the effective growth rate after depreciation may be $g_2 -$ _.

The ground tenant pays contractual ground rent to the landlord, which may or may not be equal to the market land rent depending on the lease structure. The rest of the rent flows are the income to the ground tenant. We assume for the purposes of this paper that building rents 'mark to market.' That is, lease contracts between the ground lessee (the owner of the ground leasehold) and his or her tenants (occupants of the building) mark-to-market.[8]

Assuming the ground rent specified by the lease is R_S, then the rent flow or income to the ground tenant is equal to:

$$R(t) = R_L(t) + B(t) - R_S(t). \tag{3}$$

It is assumed that after redevelopment (conversion), where new construction is homogenous,[9] both land rent and building rent increase by the same multiple. If the redevelopment occurs at time τ, the rent flow after the redevelopment becomes:

$$R'_L(\tau) = q(k)\, R_L(\tau) \tag{4}$$

$$B'(\tau) = q(k)\, B(\tau) \tag{5}$$

The rent multiple is determined by a Cobb-Douglas type production function such as:

$$q(k) = K^{\gamma} \tag{6}$$

where γ is the capital elasticity of substitution, K is the amount of capital per unit of land and $q(k)$ is the resulting rentable space per unit of land.[10] The cost of applying a unit of capital is c so:

$$\{[K^{\gamma} \times B(\tau)] / (i-g_1)\} + \{[K^{\gamma} \cdot R_L(\tau)] / (i-g_2)\} - K \cdot c \tag{7}$$

is the value of conversion at any period _. Note that the land rent (land residual rent) increases with the ability of the property to generate income that results from increases in the FAR.

In both models of certainty and uncertainty, the ground tenant tries to maximize the net present value of the project at time 0 given the opportunity to redevelop at some point _ in the future, where $0<\_<T$. The NPV consists of four elements: rent flow before and after the redevelopment, the cost of redevelopment (c per unit of space), and the compensation value or the residual value (m), if any, when the lease expires.

Assuming the property is redeveloped at time τ to a density q, then the present value at time 0 is

$NPV(R,\tau,K;T) = PV(R,\tau) + q(k)PV(R', T - \tau) - PV(kc) + PV(m)$ (8)

where *T* is the term of the lease. Here, the formula to calculate the present value *(PV)* is the standard discrete one.

$$PV(R) = \sum_{t=1}^{N} \frac{R_t}{(1+r)^t} \quad (9)$$

Therefore in a single certainty scenario, the optimal timing and the optimal scale (density) of the redevelopment is the solution to the following problem

$$\max_{\tau,k} NPV(R,\tau,k;T) \quad (11)$$

This problem can be solved through numeric optimization techniques.

To find the optimal solution under uncertainty, we employ Monte Carlo methods to simulate different scenarios as described above in the initial paragraph of this section. The sampling method used for the uncertain variables in the models is the Latin-hypercube method, which is a stratified sampling method. Latin Hypercube sampling will accurately recreate the probability distributions specified by distribution functions in less iterations than Monte Carlo sampling. See Judd (1998, p.314). In the former, sampling is stratified while in the latter, sampling is random across the full range of possibilities in the specified distribution.

Within each scenario, an optimal solution of the redevelopment timing and density is found by using numerical optimization methods as above in the certainty case. However, multiple iterations permit the final optimal solution to be the one that maximizes the expected mean of $NPV(R, \tau, k; T)$.

The following table summarizes the exogenous variables, derived parameters and endogenous variables in the model. The exogenous parameters include:

1. Interest rate, cost of capital;
2. Starting land rent, its growth rate and “sigma”;
3. Starting building rent, its growth rate and “sigma”;
4. The building depreciation rate;
5. Production efficiency; and
6. Correlation coefficient between the land rent and the building rent.

The derived parameters include:

1. Land value;
2. Real building rent growth rate;
3. Building value;
4. Rent multiple; and
5. Capitalization rate.

The results of the analysis include:

1. Conversion year (redevelopment timing); and
2. Conversion scale (redevelopment intensity).

We can also further describe each outcome with the following information:

1. Rent multiple;
2. Period zero value of the asset assuming no redevelopment;
3. Period value of the asset (when redeveloped);
4. Period zero value of asset assuming redevelopment occurs at the optimal time and with the optimal intensity; and
5. Period zero value of the leased fee when optimal redevelopment has occurred.

To implement the model, we apply the depreciation rate only to the building rent. Thus, the real growth rate used in the Wiener Process for the building is the market growth rate less the depreciation rate. To determine asset value, a capitalization rate is derived from the land rent growth rate and the interest rate.

Thus the capitalization rate[11] is constant throughout the lease term. The building value and the land value are both calculated by dividing the current rent by the capitalization rate. The same method is employed to determine the residual value of the building at the termination of the lease.

The landowner's position must also be considered as the contractual arrangements are changed. In order for the landowner to consider negotiating an alternative contact, the landlord must be better off that he or she would be with the original contract as well. In other words, there must be a joint optimization process. In this analysis we simply compute the value of the leased fee and demonstrate that under some of the alternative contracts, the landlord or the owner of the leased fee is better off than in the case of the baseline contract.

The analysis and results

In the paper, we explore contractual alternatives to the mark-to-market lease structure assumed by Capozza and Sick. The first objective is to show that lease contracts that are more realistic lead to timing and intensity of development decisions that are somewhat different form those depicted by Capozza and Sick. The second and more important objective is to explore alternate contract designs that may provide incentives to the lessee to undertake upgrades at a time and intensity that would be a second best outcome for the lessor. Presumably, the first best or optimal outcome for the landowner would be redevelopment at a time and intensity identical to that which the fee owner would undertake if the fee were not subject to a ground lease. Specific aspects of ground lease contracts that will be explored include mechanisms for escalation of the base rent, alternative residual claims for the lessee at the termination of the lease and provisions for extension of the lease in the case of redevelopment.[12] The model described in the prior section is employed to determine values of the redevelopment scale and year for each of the contractual alternatives below. As well, the sensitivity of the model to changes in the parameters is tested.

The following are specific alternatives we consider:

1A. Mark-to-market rents

This baseline case is analogous to the ground lease analyzed by Capozza and Sick (1991). Ground lease payments adjust instantaneously to the impact of growth or a change in use (redevelopment). See Figure 1 and Table 1.

1B. Mark-to-market rents (with a residual claim)

This lease is as above (1A) but the lessee is eligible to receive compensation from the lessor for the residual value of the building at the termination of the lease.

- **i) Depreciation** - The building is assumed to depreciate at some annual percentage rate. Since the building also grows in value, the actual growth in value is the net of the value growth rate and the depreciation rate. See Figure 2 and Table 1.

- **ii) No depreciation** - The original cost of the building would be paid by the lessor to the lessee. See Figure 3 and Table 1.

2A. Step-up rents

In this structure, leases are assumed to mark-to-market every five years. If redevelopment occurs, the base rent adjusts and a new five year clock begins as of the date of redevelopment for determining the time of the next step-up. See Figure 1 and Table 1.

2B. Step-up rents (with a residual claim)

- **i) Depreciation** (as above in 1Bi except with step-up rents). See Figure 2 and Table 1.

- **ii) No depreciation** (as above in 1Bii except with step-up rents). See Figure 3 and Table 1.

3. Percentage rents

In this structure, the contractual ground rent is proportionate to the value of the building. Since the building leases are assumed to be mark-to-market, this means that the ground lease payments will be exactly proportional to the gross rental income from the building. Since the capitalization rate is assumed to be constant, this means the ground lease payments are proportional to the value of the building. See Figure 5 and Table 2.

4. Lease extension (step-up rents, no residual claim)

In this case the lessee may redevelop at any point in the first fifty years (the initial lease term) but may extend the lease by the number of years expired in the initial lease. E.g., if lessee chooses to redevelop in year 40, the lease is extended 40 years becoming a 90 year lease. See Figure 4 and Table 1.

We also examine the sensitivity of our model to changes in some of the parameters including the correlation between land and building growth rates (Figure 6 and Table 3), the growth rate (Figure 7 and Table 4), the interest rate (Figure 8 and Table 5) and production efficiency (Figure 9 and Table 6).

In Table 1, Column 17, we report the value of the leased fee in the case that redevelopment occurs under the alternative contract. What is reported is the present value of the cash flows to the landlord during the life of the lease plus the present value of the reversion. Our goal, in this paper, is to show that there are contractual alternatives that cause the ground lessee to behave in a fashion that is in the interests of the owner of the leased fee as well as the ground lessee. Thus we compute the value of leased fee under various scenarios and compare that value to the value in the baseline case.[13]

The baseline case

The baseline case assumes a land rent of $16.00 and an equivalent building rent. The growth rate for values and rents of land and buildings is assumed to be 1%. Buildings are depreciable so we assume that the 1% building growth rate is the net result of a 2% market growth rate and a 1% depreciation rate. Depreciation is assumed to influence rents as well so rents grow at the rate of 1% rather than 2%. The variance of the land growth rate is 0.30 and the variance of the building growth rate is 0.20. The interest rate is assumed to be 5% and the cost of capital $100.00. With an interest rate of 5% and a growth rate of 1%, the appropriate capitalization rate is 4% resulting in an initial value of $800.00 for each square foot of leasable space. Since the production efficiency _ is 0.50 and Equation (6) indicates that an additional square foot of leasable space can be generated with 1 unit of capital. However, two square feet of additional space would require four units of capital. In other words, a marginal expenditure of $100.00 would be required to create an additional square foot of leasable space on a square foot of land. A marginal expenditure of $400.00 would be required to create two additional square feet of leasable space.

To provide perspective for the analysis of the ground lease contracts we compare ground lease contractual outcomes with fee simple outcomes using similar market assumptions. That is, if the building rent growth rate is assumed to be 2% with a depreciation rate of 1%, we determine the optimal redevelopment timing and intensity for both the ground lessee and the fee owner (the lessor) under the same circumstances. Table 1, Cases 9 though 12 (the last four rows) report the results and parameters for four fee simple scenarios. To illustrate, Case 9 involves a fee owner with a 50 year horizon who may redevelop only one time during the 50 year period. Depreciation of the building is assumed. Redevelopment occurs in year 46 at a scale of 51.12 with a resulting rent multiple of 7.15. Scale refers to the units of capital expended. The redeveloped property has a new floor area ratio (FAR) of 7.15 equivalent to the rent multiple. Thus, the new rent generated is 7.15 times the old rent. The scale and rent multiple appear in the second column of Table 1. The third column reports that the initial value of the land is $400.00 and the present value of the eventual redevelopment is $1149.36. Thus the redevelopment option is worth $749.36. The present value of the project in year 46, at the time of redevelopment is $4581.71. Now we can proceed to evaluating the outcomes for various possible ground lease contracts. Our parameterization of the model results in dramatic difference between the intensity of redevelopment that would be undertaken by the fee owner and that which would be undertaken by the ground lessee in the baseline case. A discussion of the latter follows.

Figure 1 plots the values of a leasehold interest with mark-to-market rents and step-up rents as well as the value of the unencumbered fee simple interest in the land. In each of the three scenarios, depreciation of the improvements is assumed. Table 1 illustrates all of the input assumptions and key parameter values as well as the outcomes associated with each case. The outcomes describe the timing and intensity of redevelopment. Specifically, Column 2 in Table reports for each case, the intensity of redevelopment and the rent multiple. Remember that $q(k) = K^{\gamma}$ from Equation (9). That is, the rent multiple is equal to the capital applied per unit of land raised to the power γ, where γ is the capital elasticity of substitution or the production efficiency. We assume that $\gamma = 0.50$ in most of our runs. Column 4 in Table 1 reports the timing of redevelopment. Column 3 of Table 1 reports respectively, for each case: (1) period zero value of the asset assuming no redevelopment; (2) period _ value of the asset (when redeveloped); and (3) period zero value of asset assuming redevelopment occurs at the optimal time and with the optimal intensity. Column 17 reports the period zero value of the leased fee when optimal redevelopment has occurred. The remainder of the table reports input parameters or attributes of the contract.

Going back to Figure 1, we see, as was demonstrated by Capozza and Sick, that with mark-to market rents (Case 1), the lessee redevelops at less intensity than would the fee owner. Note that we report the results for the fee owner in four scenarios: with depreciation (Cases 9 and 11) and without depreciation (Case 10). Redevelopment by the lessee in the mark-to-market case occurs in year 29, before redevelopment in any of the fee owner scenarios. As well, the value of the leasehold declines to zero at the date of the termination of the lease. The scale of development by the fee owner is much greater than in the case of the lessee. The ground lessee would only apply 2.93 units of capital per square foot of land resulting in a rent multiple of 1.71 compared to the fee owner's 51.12 units of capital and 7.15 rent multiple with depreciation (Case 9, Table 1). Without depreciation, the owner would develop at a scale of 79.13 units of capital with a rent multiple of 8.90 (Case 10). The rationale, as suggested by Capozza and Sick, is that since the ground lessee has no residual claim it makes sense to redevelop at a lower intensity than would the fee owner. The finding that the lessee redevelops sooner than the fee owner is also consistent and reflects the lessee's desire to earn the enhanced income over as long a period as possible.

With step-up rents (Case 2), redevelopment is at a greater scale (5.26 units of capital with a rent multiple of 2.29) and occurs sooner, in year 17. Remember that with step-up rents, the ground lessee is actually subsidized for the term of the lease prior to the step-up date as market rents grow and the terms of the contract keep the contract rent flat and below market. Since the assumed land rent growth rate is 1%,[14] the lessee benefits from the savings on the base rent prior to the step-up year. This rent saving makes redevelopment justifiable sooner but still at a low scale relative to what is optimal for the fee owner.

Figure 2 plots the values of a leasehold interest with mark-to-market rents (Case 3) and step-up rents (Case 4) where the ground lessee has a residual claim equal to the depreciated value of the improvements. Presumably, the lessor in a ground lease transaction wishes to maintain a residual claim at least to the land. Since one of the challenges facing the ground lessee is the recovery of capital investment when the passage of time foreshortens the recovery period, giving the ground lessee a residual claim to the value of the improvements should reduce if not eliminate this problem. At the same time, the lessor retains the residual interest in the land. In the analysis we assume depreciation is 1% per year. This is equivalent to depreciating the building straight-line over 100 years. Note that the rents decline as well to reflect the depreciated value of the building. At lease termination, the lessee receives a payment from the lessor equal to the depreciated value of the redeveloped building. In the case of mark-to-market rents, the lessee redevelops sooner (in year 14) and at less intensity (5.65 units of capital) than would the fee owner. With step-up rents, redevelopment also occurs sooner in year 14 but at much higher density (12.65 units of capital). It is clear from this result that giving the ground lessee a residual claim has a significant effect on the lessee’s behavior. In particular, redevelopment occurs at higher intensity more in line with that which would be undertaken by the lessor. As well, redevelopment occurs sooner.

Figure 3 plots the values of a leasehold interest with mark-to-market rents (Case 5) and step-up rents (Case 6) where the lessee has a residual claim equal to the undepreciated value of the improvements. Remember, here the lessor is being paid the appreciated value of the redeveloped building with no adjustment for depreciation. Here, the lessee defers redevelopment and then redevelops at high intensity relative to the lessee in Cases 1 through 4. Still, the intensity of redevelopment is sooner and at lower intensity than is the case for the fee owner (Cases 9 through 11). Here, in the case of mark-to-market rents (Case 5), the lessee redevelops in year 22. With step-up rents (Case 6), redevelopment occurs sooner in year 17. Again, the lessee benefits from the rent savings in the years prior to the step-up year and that justifies earlier redevelopment.

Figure 4 shows the impact of providing the ground lessee the option to extend the lease at the time redevelopment occurs. We assume that the extension permitted is equal to the period of time that has already passed in the existing fifty year lease. For example, if the ground lessee wished to redevelop in year ten, the lease could be extended a further ten years so that the original lease would then have a life of 60 years. As we previously noted, the fee owner would redevelop in year 46 using 51.12 units of capital to generate a rent multiple of 7.15 in the case of a fifty year horizon with depreciation. Remember that the fee owner owns the residual rights to the property forever. On the other hand, we have parameterized our model so that the ground lessee is normally subject to a fifty year limitation on his right of use. We found in Case 1, that the ground lessee would only apply 2.93 units of capital in year 29. With the ability to extend the lease as described above, the ground lessee chooses to apply 9.42 units of capital in year 37 to generate a rent multiple of 3.07 in the case where depreciation occurs. Remember that if there is depreciation, the growth rate of the building rent is reduced by the depreciation rate. Without depreciation (Case 8), the ground lessee chooses to apply 27.5 units of capital in year 38 to generate a rent multiple of 5.25.

Note that in column 17 we report the value of the leased fee in the case of redevelopment at the intensity and time determined by the simulation of the ground lessee's alternative contract. In the baseline case (Case1), the value of the leased fee, assuming redevelopment occurs in year 29 at an intensity (scale) of 2.93, is \$500.58. In all other cases (Cases 2 though 8), the value of the leased fee exceeds the baseline value of \$500.58. Thus, it appears that in all of the alternative contractual arrangements, the owner of the leased fee is better off than in the baseline case.

Figure 5 and Table 2 illustrate the impact on the value of the leasehold interest where the lease payments are determined as a percentage of the asset's gross income (assuming net leases). Since a constant capitalization rate is assumed, computing the ground lease payment as a percentage of income would yield the same cash flow as computing a constant percentage of value. In practice, values are unobservable so the percentage rent strategy finesses the valuation problem discussed earlier provided that cap rates remain relatively constant and that building leases adjust fairly frequently. The way our model is parameterized in period zero, the aggregate rent is generated 50/50 by the building and the land. Therefore, if the percentage rent is 50%, in period zero that rent will exactly reflect the rent attributable to the land. This scenario is Case 13 in Table 2. The results of other scenarios are shown. However, in those scenarios, the ground lessor is taxing the ground lessee by imposing a rent in excess of that justified by the underlying land value.

We also undertook a number of sensitivity analyses to show the impact of changes in the assumed parameters on the timing and intensity of development that would be optimal for the ground lessee. Specifically, we explored the impact of changes in the assumed correlation between the building rent and the land rent, changes in the assumed growth rate, changes in the assumed interest rate or discount rate, and, finally, changes in technological efficiency of development.

The results of these sensitivity analyses are consistent with our intuition and with prior studies. Figure 6 and Table 3 illustrate the result of exploring the impact of changing the correlation between the growth rate of the land rent and the building rent. At zero correlation, the scale of development is highest and the proposed development occurs in the 20^{th} year. This is consistent with the results of the Childs et al. (1996) study discussed earlier in which the authors explore the mix of two possible uses and find that the less correlated are their growth paths, the more valuable will be the property. Presumably, this reflects development at higher density than would be the case in either individual use.

Figure 7 and Table 4 illustrate the impact of changes in the growth rate. We examined growth rates ranging from 1% to 5% and made the assumption that the land rent and the building rent would grow at the same rate. We also assumed, for simplicity that the two growth rates in rents would be perfectly correlated. The scale of development increases with the growth rate from 5.79 at one % growth to 22.01 at 5% growth. Initially, as the growth rate rises, the time of redevelopment moves closer to the present. For example, from a 2% growth rate to a 3% growth rate, the timing of redevelopment declines form year 15 to year three. However, as the growth rate increase to 4 and 5%, the timing of redevelopment moves further into the future. At higher growth rates, the tradeoff between costs and revenues causes development to be deferred, while at lower growth rates, the reverse is true. Note that since we presume there is a relationship between the growth rate, the interest rate and the capitalization rate and since we hold the cap rate constant, higher growth rates mean lower cap rates and higher residual values. The higher the growth rate, the greater the role capital appreciation plays in the return since the going in cap rate remains fixed at 4%.

Figure 8 and Table 5 illustrate the impact of changes in the interest rate or discount rate. As the interest rate increase from 4% to 6%, the scale of development decreases from 4.89 to 1.30 and the timing of development increases from year 2 to year 49. At the higher discount rate, the ratio of benefit to cost is lower since all benefits accrue after the cost of development is incurred. As the ratio falls, development will be deferred further and further into the future.

Figure 9 and Table 6 illustrate the impact of changes in production efficiency. Production efficiency essentially measures the ability of each dollar of new capital to generate FAR and rent. The higher is γ, the more FAR each dollar of capital investment generates and the more dollars of income are generated. Not surprisingly, as the value of γ increases from 0.40 to 0.75, the scale of development increases from 1.38 to 54.85 and the timing of the redevelopment falls from year 41 to year 1. At the highest production efficiency of 0.75, the property is immediately rehabilitated at a scale that exceeds what the fee owner would build at a production efficiency of 0.50. Unfortunately, the ground lease contract cannot assure the ground lessor that the ground lessee has a monopoly on more efficient construction technology.

Conclusions

The results of this research are promising in that they suggest that the terms of the lease contract have a great deal to do with the value of the leasehold interest and the timing and intensity of redevelopment that would be contemplated by the ground lessee. The ground lessee's decision about the timing and intensity of redevelopment has significant implications for the ground lessor both in terms of the nature of the asset for which the ground lessor has a residual claim and the value of the leased fee. Our research provides valuable and practical insight into alternative contractual structures.

The key alternatives we consider are the option to extend the lease and the sharing of the residual claim at the termination of the lease. In the US most leases are silent about the issue of redevelopment. In the former case, we propose a contract that is automatically extended by the number of years elapsed if redevelopment occurs. In the latter case, we consider entitling the ground lessee to a payoff equal to the market or depreciated value of the improvements to the land (the building). We find that both these alternatives enhance the value of the redevelopment option to the ground lessee and result in redevelopment that is more consistent with that which the fee owner would have undertaken.

The parameterization of our model resulted in a significant difference between the intensity of redevelopment for a fee owner and the baseline case for the ground lessee. In the fee owner cases, redevelopment occurs at a scale of 26.98 (Case 11), 79.13 (Case10) and 51.12 (Case 9) while in the baseline case for the ground lessee, redevelopment occurs at a scale of 2.93 (Case 1). In the extension option cases (Cases 7 and 8), redevelopment occurs sooner than in the case of the fee owner and later than in the baseline case but at development scales of 9.42 and 27.5 respectively. These scales are orders of magnitude greater than the baseline case but still not as intensive as the fee owner cases. The residual claim sharing options (Cases 3 through 6) illustrate that compensating the ground lessee for the undepreciated value of the improvements (Cases 5 and 6) results, not surprisingly, in high intensity redevelopment relative to the cases where the depreciated value of the improvements determines the payment (Cases 3 and 4). In all cases, however, the intensity of redevelopment is considerably higher than in the baseline case.

We also examine a more realistic step-up rent structure and find that the rent saving for the lessee arising from a step-up structure advances the timing of redevelopment and increases the intensity of redevelopment considerably (Case 2). Here, just by changing the escalation mechanism, the intensity increases from 2.93 to 5.26 and the timing of redevelopment drops from year 29 to year 17. This likely reflects the benefit of what, in effect, is a rent subsidy which increases as time passes. In practice, with a flat rent structure, market forces would probably cause the ground who negotiates a flat rent to pay a higher rate in earlier years and a lower rate in later years resulting in a flat contract with the same present value as an alternative mark-to-market contract.

We examined the parameterization of the model and explore how changes in the parameters might impact the redevelopment decisions by the lessee. The results of our analysis appear to consistent with our intuition and with prior work in this area.

Ground leases are common devises for local governments and agencies to facilitate the involvement of private entrepreneurs in the development of land. They are also useful devises for non-developer landowners to defer capital gains taxes but continue to earn income from the property. The nature of the contract is such that the landowner cedes control of the asset to the lessee for a significant period of time usually in excess of forty years. In a growing city, the probability that the highest and best use of a particular site will change is relatively high over that long time frame. Thus, ground lease contracts should provide incentives that encourage lessees to behave more like fee owners. This paper suggests some practical options to achieve second best outcomes consistent with this line of thinking.

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Table 1 – Comparisons of lease escalation and residual claim alternatives

1. Case Figure	2. Scale (Rent multiple)	3. Period 0 Value (NPV at τ) Mean NPV	4. Year	5. Lease escalation 0=mark-to-market (m-t-m) n= yrs until step-up	6. Land Growth Rate	7. Land Growth Rate Variance	8. Market Building Value Growth Rate	9. Building Value Growth Rate Variance	10. Interest Rate	11. Cap Rate	12. % Rent	13. Option to extend	14. Depreciation Rate = x%	15. Residual Claim	16. Prod. Eff. γ	17. PV to lessor Value of the leased fee.
1 Figure 1 1A D	2.93 (1.71)	346.37 (515.59) 331.48	29	0 m-t-m	1%	.30	2%	.20	5%	4%	0	No	1%	No	.50	500.58
2 Figure 1 2A D	5.26 (2.29)	339.81 (711.81) 396.80	17	5 step-up	1%	.30	2%	.20	5%	4%	0	No	1%	No	.50	634.38
3 Figure 2 1B D	5.65 (2.38)	346.37 (832.12) 503.68	14	0 m-t-m	1%	.30	2%	.20	5%	4%	0	No	1%	Yes	.50	602.58
4 Figure 2 2B D	12.65 (3.56)	339.81 (1177.14) 541.16	14	5 step-up	1%	.30	2%	.20	5%	4%	0	No	1%	Yes	.50	761.02
5 Figure 3 1B nD	21.07 (4.59)	346.37 (1532.8) 858.8	22	0 m-t-m	1%	.30	2%	.20	5%	4%	0	No	0%	Yes	.50	780.67
6 Figure 3 2B nD	16.57 (4.07)	339.81 (1223.34) 873.992	17	5 step-up	1%	.30	2%	.20	5%	4%	0	No	0%	Yes	.50	725.61
7 Figure 4 4A D	9.42 (3.07)	383.30 (1424.94) 477.98	37	0 m-t-m	1%	.30	2%	.20	5%	4%	0	Yes*	1%	No	.50	571.26
8 Figure 4 4A nD	27.5 (5.25)	383.81 (2522.15) 897.08	38	5 m-t-m	1%	.30	2%	.20	5%	4%	0	Yes*	0%	No	.50	852.34
9 Figure 1-4 F 50 D	51.12 (7.15)	400.00 (4581.71) 1149.36	46	NA	1%	.30	2%	.20	5%	4%	0	NA	1%	Yes (Fee Owner)	.50	NA
10 F 50 nD	79.13 (8.90)	400.00 (5755.26) 1165.09	47	NA	1%	.30	2%	.20	5%	4%	0	NA	0%	Yes (Fee Owner)	.50	NA
11 F 100 D	26.98 (5.19)	400.00 (3357.20) 731.67	46	NA	1%	.30	2%	.20	5%	4%	0	NA	1%	Yes (Fee Owner)	.50	NA

* Lessee has option to extend the lease by the number of periods that have passed if redevelopment occurs.

Table 2 – Percentage rents

Case Figure	Scale (Rent Multiple)	Period 0 Value (NPV at τ) Mean NPV	Year	Lease escalation 0=mark-to-market n=# yrs	Land Growth Rate	Land Growth Rate Variance	Building Value Growth Rate	Building Value Growth Rate Variance	Interest Rate	Cap Rate	% Rent	Option to extend	Depreciation Rate = x%	Residual Claim	Prod. Eff. γ
12 Figure 5	2.44 (1.56)	346.37 (495.13) 418.65	10	0	1%	.3	1%	.2	5%	4%	45%	No	NA	No	.50
13 Figure 5	2.70 (1.64)	346.37 (542.80) 341.18	23	0	1%	.3	1%	.2	5%	4%	50%	No	NA	No	.50
14 Figure 5	2.18 (1.48)	346.37 (266.90) 304.90	42	0	1%	.3	1%	.2	5%	4%	55%	No	NA	No	.50
15 Figure 5	1.07 (1.03)	346.37 (60.52) 265.77	48	0	1%	.3	1%	.2	5%	4%	60%	No	NA	No	.50
16 Figure 5	6.17 (2.48)	346.37 (732.15) 596.18	30	0	1%	.3	1%	.2	5%	4%	50%	No	2%	Yes	.50
17 Figure 5	26.46 (5.14)	346.37 (1093.75) 859.19	42	0	1%	.3	2%	.2	5%	4%	50%	No	0%	Yes	.50

Table 3 - Correlations

Case Figure	Scale (Rent Multiple)	Period 0 Value (NPV at τ) Mean NPV	Year	Lease escalation 0=mark- to-market n=# yrs	Land Growth Rate (correl)	Land Growth Rate Variance	Building Value Growth Rate (Correl)	Building Value Growth Rate Variance	Interest Rate	Cap Rate	% Rent	Option to extend	Depreciat ion Rate = x%	Residual Claim	Prod. Eff. γ
18 Figure 6	5.00 (2.24)	346.37 (759.76) 367.60	20	0	1% (0.00)	.3	1% (0.00)	.2	5%	4%	No	No	NA	No	.50
19 Figure 6	3.21 (1.79)	346.37 (608.84) 345.83	20	0	1% (0.25)	.3	1% (0.25)	.2	5%	4%	No	No	NA	No	.50
20 Figure 6	3.02 (1.74)	346.37 (456.41) 345.45	34	0	1% (0.50)	.3	1% (0.50)	.2	5%	4%	No	No	NA	No	.50
21 Figure 6	3.48 (1.87)	346.37 (653.52) 348.76	14	0	1% (0.75)	.3	1% (0.75)	.2	5%	4%	No	No	NA	No	.50
22 Figure 6	2.60 (1.61)	346.37 (542.99) 337.66	21	0	1% (1.00)	.3	1% (1.0)	.2	5%	4%	No	No	NA	No	.50

Table 4 – Growth rates

Case Figure	Scale (Rent Multiple)	Period 0 Value (NPV at τ) Mean NPV	Year	Lease escalation 0=mark-to-market n=# yrs	Land Growth Rate (correl)	Land Growth Rate Variance	Building Value Growth Rate	Building Value Growth Rate Variance	Interest Rate	Cap Rate	% Rent	Option to extend	Depreciation Rate = x%	Residual Claim	Prod. Eff. γ
23 Figure 7	5.79 (2.41)	417.93 (1129.95) 481.26	15	0	2%	.3	2%	.2	5%	3%	No	No	NA	No	.50
24 Figure 7	8.03 (2.83)	513.86 (1533.96) 741.24	3	0	3%	.3	3%	.2	5%	2%	No	No	NA	No	.50
25 Figure 7	17.38 (4.17)	644.51 (3528,32) 1214.30	13	0	4%	.3	4%	.2	5%	1%	No	No	NA	No	.50
26 Figure 7	22.91 (4.79)	644.51 (4119.09) 1228.99	14	0	5%	.3	5%	.2	5%	1%	No	No	NA	No	.50

Table 5 – Interest rates

Case Figure	Scale (Rent Multiple)	Period 0 Value (NPV at τ) Mean NPV	Year	Lease escalation 0=mark-to-market n=# yrs	Land Growth Rate (correl)	Land Growth Rate Variance	Building Value Growth Rate	Building Value Growth Rate Variance	Interest Rate	Cap Rate	% Rent	Option to extend	Depreciation Rate = x%	Residual Claim	Prod. Eff. γ
27 Figure 8	4.89 (2.21)	414.41 (918.29) 452.80	2	0	0%	.3	0%	.2	4%	5%	No	No	NA	No	.50
28 Figure 8	5.00 (2.24)	378.00 (791.75) 384.08	22	0	2%	.3	2%	.2	4.5%	3%	No	No	NA	No	.50
29 Figure 8	2.60 (1.61)	346.37 (542.99) 337.66	21	0	3%	.3	3%	.2	5%	2%	No	No	NA	No	.50
30 Figure 8	1.66 (1.29)	318.67 (32.21) 314.79	49	0	4%	.3	4%	.2	5.5%	1%	No	No	NA	No	.50
31 Figure 8	1.30 (1.14)	294.58 (28.32) 289.82	49	0	5%	.3	5%	.2	6%	1%	No	No	NA	No	.50

Table 6 –Production efficiency

Case Figure	Scale (Rent Multiple)	Period 0 Value (NPV at τ) Mean NPV	Year	Lease escalation 0=mark-to-market n=# yrs	Land Growth Rate (correl)	Land Growth Rate Variance	Building Value Growth Rate	Building Value Growth Rate Variance	Interest Rate	Cap Rate	% Rent	Option to extend	Depreciation Rate = x%	Residual Claim	Prod. Eff. γ
32 Figure 9	1.59 (1.12)	346.37 (0) 330.18	50	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.25
33 Figure 9	1.38 (1.14)	346.37 (168.23) 339.95	41	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.40
34 Figure 9	1.53 (1.21)	346.37 (199.02) 339.09	42	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.45
35 Figure 9	2.60 (1.61)	346.37 (542.38) 337.66	21	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.50
36 Figure 9	5.0 (2.42)	346.37 (850.72) 367.33	5	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.55
37 Figure 9	6.38 (3.04)	346.37 (1062.24) 445.02	3	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.60
38 Figure 9	54.85 (20.15)	346.37 (7004.19) 1774.83	1	0	1%	.3	2%	.2	5%	4%	No	No	NA	No	.75

Figure 1
Baseline Contract: Mark to Market Rents vs. Step-up Rents

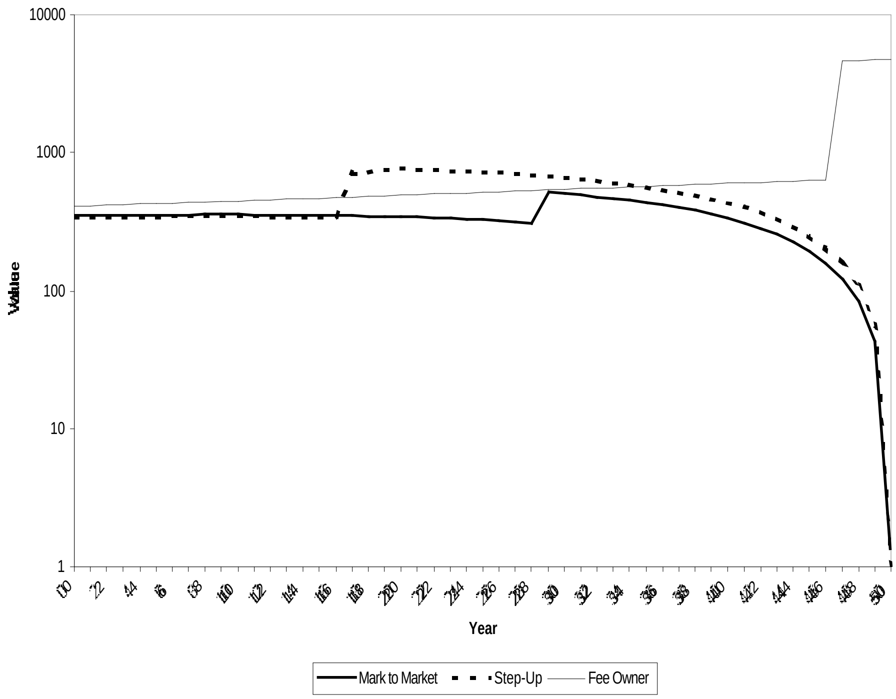


Figure 2
Baseline Contract with Depreciation and with Residual Claim

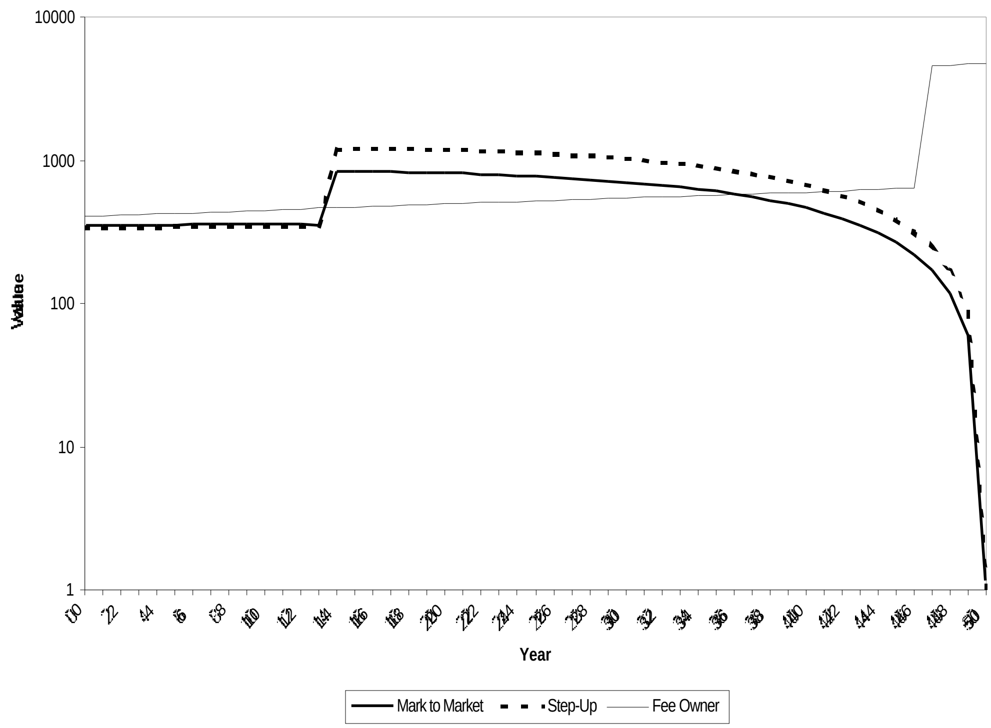


Figure 3
Baseline Contract without Depreciation and with Residual Claim

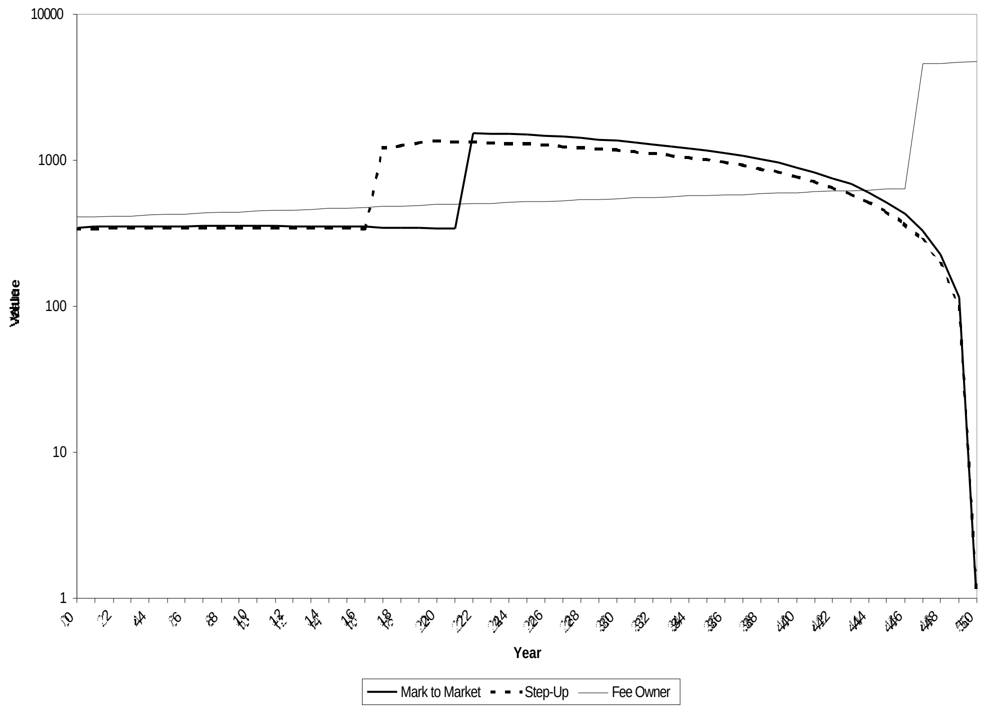


Figure 4
Baseline Contract with Lease Extension and with Depreciation

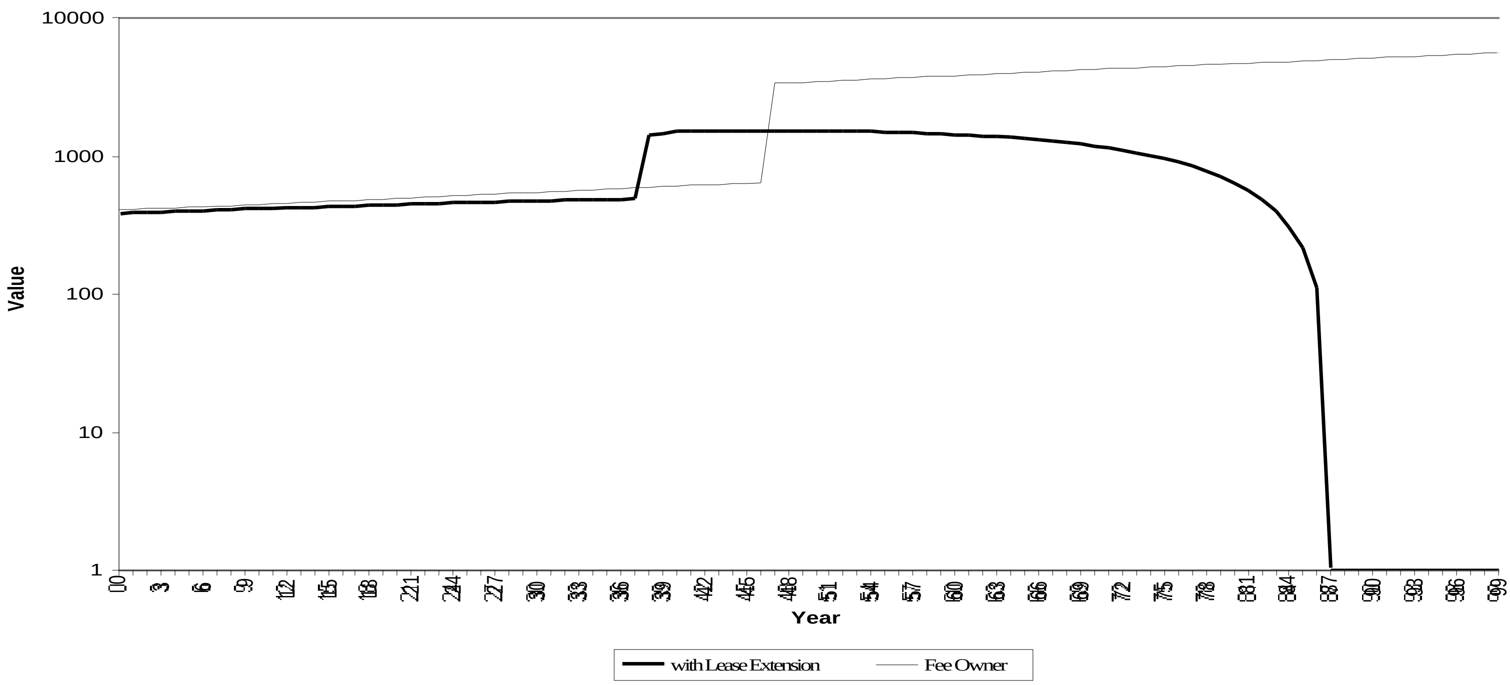


Figure 5
Ground Lease Payment as a Percentage of Building Rents

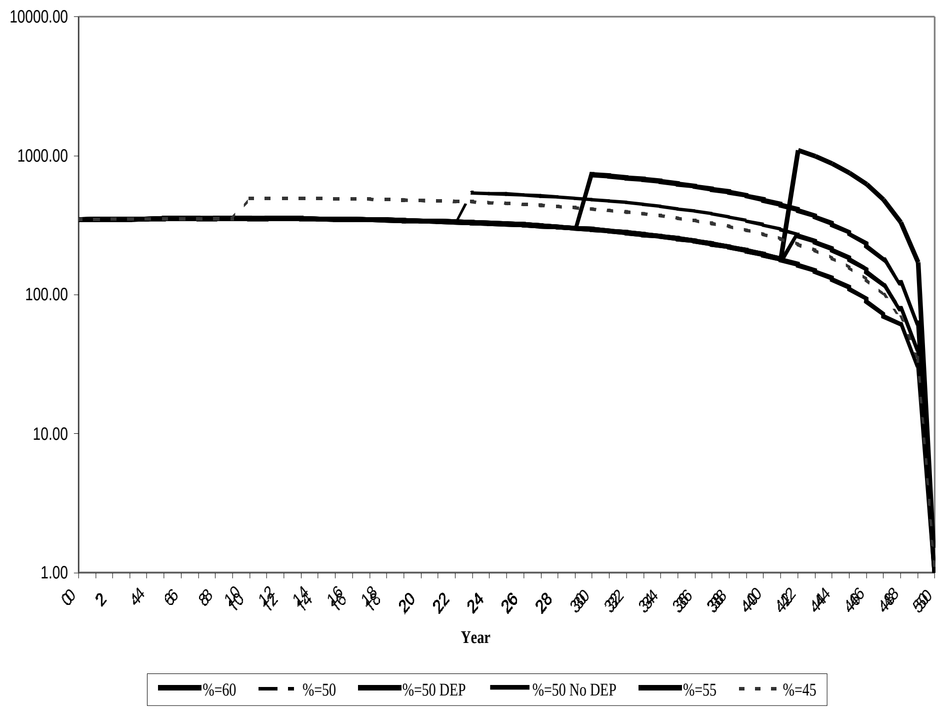


Figure 6
Impact of Changing Correlation Coefficient on Baseline Contract

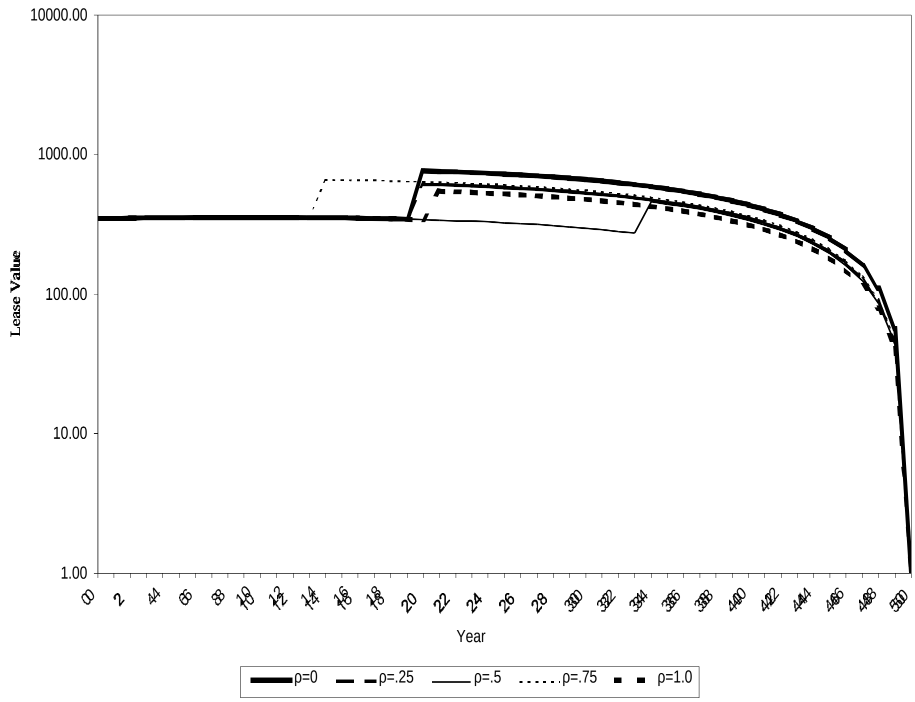


Figure 7
Impact of Changes in Rent Growth on Baseline Contract (g_1=g_2)

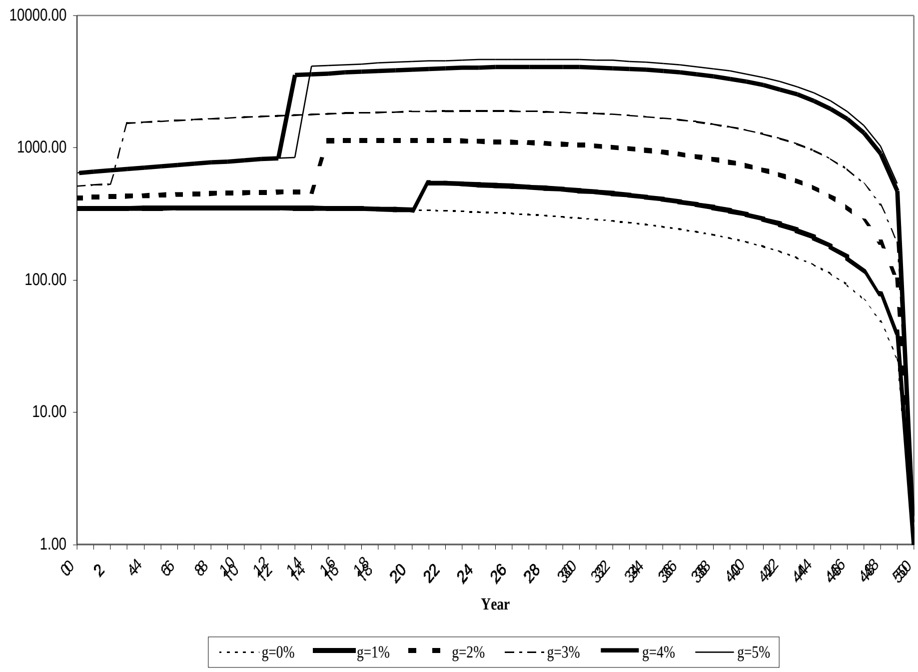


Figure 8
Impact of Changes in Discount Rate on Baseline Contract

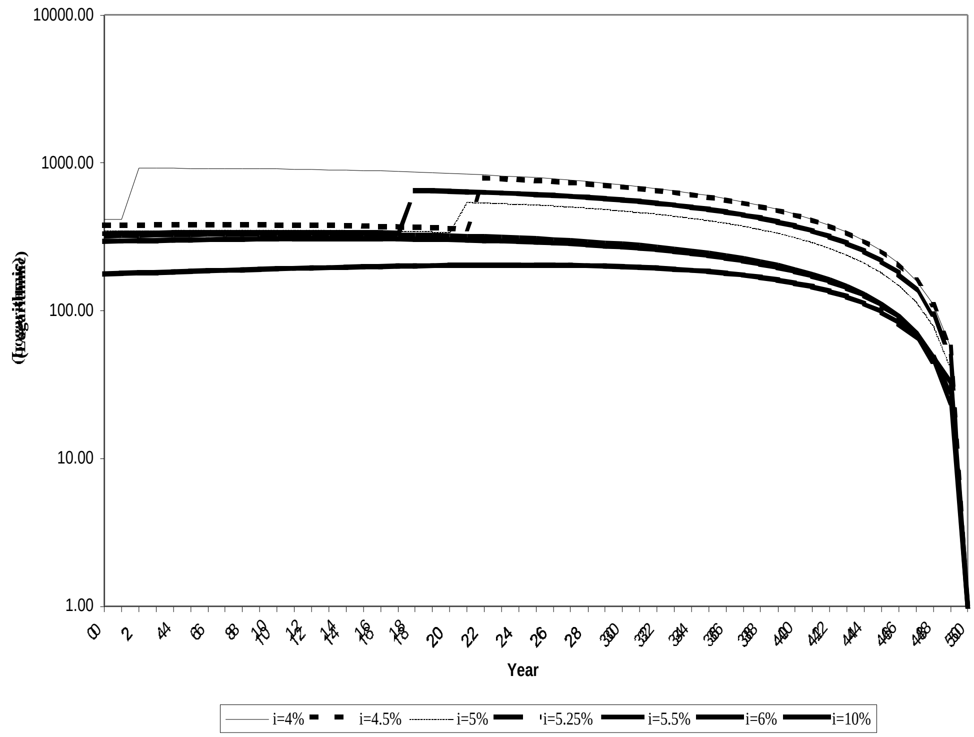
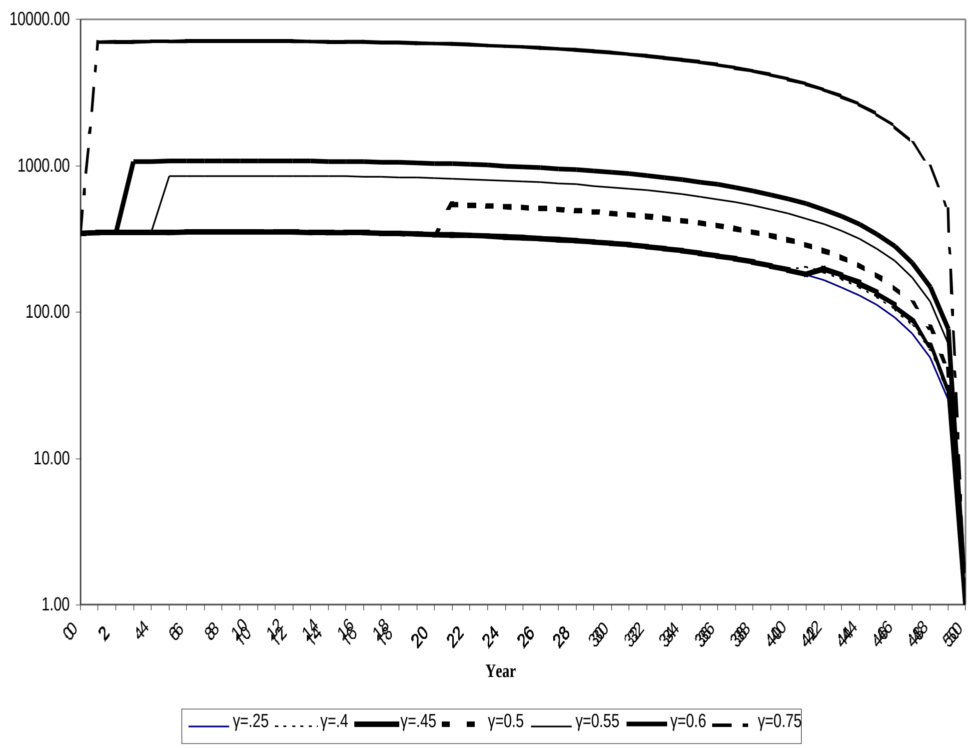


Figure 9
Impact of Changes in Production Efficiency on Baseline Contract



Endnotes

[1] Often a ground lease contract will include a clause which specifies the procedure for determining market rent at the time of adjustment. Usually, each party to the contract hires their own appraiser and both hire a third independent appraiser. The average value then becomes the basis for the base rent going forward.

[2] Sale treatment would normally cause the lessor to pay capital gains tax on the imputed sales price even thought the lessor retained the fee interest thus incurring an unnecessary tax obligation.

[3] Many heirs to the families granted lands by the King of Spain in what is now California today receive ground lease revenue from land developed in this century that was originally acquired as part of a rancho during the late 1700s or early 1800s. Much of this land is now in urban locations.

[4] Other options for tax deferral include an installment sale. If at least one payment is received in a subsequent tax year, any capital gains tax obligation may be paid pro rata based on the portion of the sale price deferred to the future period. Prior to the Installment Sales Revision Act of 1980, at least 30% of the sales price had to be received during the year of the sale and there had to be at least two payments. Another option is the 1031 exchange. In this case, a property is simply exchanged for another property and the tax basis of the original property is transferred to the new property. Thus the capital gains tax is deferred however, the reduced basis impacts the ability of the taxpayer to reduce taxable income through the depreciation expense on any improvements to the property

[5] The interest rate (yield) should be determined by adding a spread to an equivalent maturity risk free rate. The value of the land is the notional amount against which the rate is applied to determine the actual lease payment. That value should be a value of the land in highest and best use not the existing use. Some leases, particularly those having participation rents, have used the average of the last few years gross ground rental income (e.g., over three years) to determine the new base rent. This process, of course, may bear no relationship to the ground rent that might be determined through a valuation process. However, it has the advantage of being easy and cost effective to implement.

[6] Such a lease is called a ‘side-by-side’ lease in the United Kingdom and is common in that marketplace.

[7] This means that the rent attributable to the land takes on a value consistent with the most profitable use at the time of redevelopment.

[8] This is a strong assumption. However, relaxation of this assumption would unnecessarily complicate the model without providing further insight into the structure of the ground lease.

[9] The expenditure of capital increases density, not quality.

[10] The space per unit of land is usually called the FAR or floor area ratio.

[11] This is based on the Gordon growth model or growing perpetuity model where asset value is equal to CF/r-g. The denominator is equal to the overall capitalization rate.

[12] In some other legal systems, the ownership of buildings or improvements, independent from the land is an element of legislation enabling ground leases. For example, in Poland, the long-term land leasehold known as ‘perpetual usufruct’ grants the ground lessee an ownership interest in any improvements. Thus at the termination of the lease there is compensation.

[13] Another alternative would be to maximize the aggregate value of the leased fee and the leasehold and permit the two parties to bargain regarding the split of the cash flows and the costs. We leave consideration of this alternative for later research.

[14] In equilibrium, one would expect the market to price out the effect of different contractual arrangements in the environment at the time. In other words, if the market expected land rents to go up 1% per year, then a step-up contract would require a higher base rent than a mark-to-market contract. While such forces are certainly present in the marketplace, in this paper we wish to compare the effects of contract changes under ceterus paribus conditions.