Leases often contain a variety of options written explicitly into the lease contract, modifying the rights and responsibilities that the landlord and tenant would otherwise face. Some options belong to the tenant, and some to the landlord. In general, it is rather complicated to quantify fully and rigorously the effect such options have on the value of the lease to either party. The most sophisticated approach involves the use of financial option valuation theory (OVT), which you were introduced to in Chapter 27. However, unlike the case there where the underlying state variable was the asset value as determined in the property asset market, for lease analysis, typically the underlying state variable is the rent as determined in the space market. Steve Grenadier and others have developed the application of OVT to lease valuation.

However, a less rigorous, more intuitive technique known as decision tree analysis (DTA) is sometimes used to quantify approximately option values in this context. In this appendix, we will demonstrate this approach for a simple numerical example of a tenant’s renewal option.

Consider again the example five-year lease A from section 30.3.2, with a nominal rent of $20/ SF. Recall that we estimated the effective rent of this lease at $15.44 from the landlord’s perspective, using a discount rate of 7 percent. Now suppose that the lease also grants the tenant an option to renew after five years, for another five years, at $20/ SF. The effect of this renewal on the effective rent from the landlord’s perspective can be quantified in four computational steps.

Step 1. Describe the subjective probability distribution of market rents at the time the option matures, based on current information. In our example, suppose the landlord believes that at the end of five years (the lease first term expiration date), there is a 50 percent chance that rents in the relevant space market will be $22/ SF, and a 50 percent chance that they will be $18/ SF. This expectation is depicted in a binomial branch diagram in Exhibit 30A-1A.

Step 2. Quantify the present value of the renewal option under each future scenario. Assuming the discount rate is still 7 percent, if market rents are $22/ SF, then the option to renew the lease for five years at $20/ SF will be worth...
Note that the landlord loses (and tenant receives) only the difference between the projected market rent ($22) and the option rent ($20) if the tenant elects to exercise the renewal option. Also note that as the rent is paid in advance (with no up-front concessions presumed for a new lease), the exercise of the renewal option has its initial $2 incremental impact at the end of Year 5 (beginning of Year 6), and so is not discounted in the computation of the Year-5 present value.

On the other hand, if market rents are $18/SF as of the end of Year 5, then the lease renewal option will be worth nothing, as there would be no point in the tenant renewing at $20 when she can get a lease for $18 in the then-prevailing market. So the option simply would not be exercised.

The decision tree representation of the conditional option value as of the end of Year 5 is shown in Exhibit 30A-1B.

**Step 3.** Quantify the risk-adjusted present value today (time 0) of the future option value. This is done in two steps that can usually be done in either order.⁴

\[ LPV_5 = \left( \frac{22 - 20}{1.07} \right) + \left( \frac{22 - 20}{1.07^2} \right) + \left( \frac{22 - 20}{1.07^3} \right) + \left( \frac{22 - 20}{1.07^4} \right) = 8.77 \]

⁴The order does not matter because of the distributive property of addition and multiplication: \[ \frac{[(0.5)x + (0.5)y]}{(1 + r)} = (0.5)x/(1 + r) + (0.5)y/(1 + r). \]
Step 3a. Discount each conditional future value back to the present. Normally, a pretty high opportunity cost of capital (OCC) should be used in this discounting because options tend to be pretty risky, especially if they are not deeply “in the money” (i.e., almost certain to be exercised). For example, if existing lease payments are discounted at 7 percent, and unlevered property cash flows are generally at, say, 9 percent, then future option values might discount at, say, 15 percent:

\[
\begin{align*}
PV(8.77 \text{ in 5 yrs.}) &= 8.77 / (1.15)^5 = 4.36 \\
PV(0 \text{ in 5 yrs.}) &= 0 / (1.15)^5 = 0
\end{align*}
\]

Step 3b. Sum across the possible scenario present values, weighted by their present subjective probabilities of occurrence. In this case,

\[
(0.50) 4.36 + (0.50) 0 = 2.18
\]

This gives the present value today of the lease renewal option. This is a negative value (or positive cost) to the landlord, who gives the option to the tenant.

Step 4. Convert the renewal option present value to an impact on effective rent. Using the annuity formula (for cash flows in advance), a PV of $2.18 equates to a five-year 7 percent annuity of $0.50 per year:

\[
0.50 = (7\%) (2.18) / \left\{(1 + 7\%) [1 - 1 / (1 + 7\%)^5]\right\}
\]

So the impact of the renewal option is to reduce the effective rent of lease A from $15.44 to $14.94 for the landlord.6

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5Note that the risk in the option will probably change over time as new information arrives relevant to the likelihood of option exercise. The difficulty of knowing the correct discount rate to employ in this step is a major weakness in the DTA approach (as compared, for example, to the more rigorous, but much more technical and complex, OVT-based approach).

6If the option alternatives involve different horizons, then the conversion to annualized values should be done in Step 2 rather than Step 4.