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Leasing: anticipated interruption contract

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LEASING: ANTICIPATED INTERRUPTION CONTRACT *

ABSTRACT

I contratti di leasing finanziario prevedono, di solito, in caso di inadempienza del locatario delle clausole per la risoluzione anticipata del contratto. In Europa, in caso di inadempienza del locatario, la legislazione consente al locatore di ottenere i canoni scaduti non pagati maggiorati degli interessi di default ed i canoni non scaduti oltre al valore di riscatto attualizzati al tasso di leasing.

Financial leasing contracts usually include specific clauses for early termination of the agreement in the event of the lessee's default. In the European Union, in case of the lessee's serious material breach, the lessor is entitled to obtain the expired unpaid fees increased at a default interest rate, the fees not yet expired and the redemption price discounted at the leasing rate.

PAROLE CHIAVE

Leasing – risoluzione del contratto – analisi delle decisioni

Leasing – rescinding contract – economic decision analysis

1. Most of the existing literature addresses asset leasing contracts. Just to name a few, in 1978 Franks and Hodges[1] derive a simple formula for lease valuation and study the impact on their analysis of different tax rates and of different amounts of debt which may be displaced by the lease, or a few years before Myers, Dill and Bautista[2] examine the firm's lease in the case of borrow problem, or even Grenadier[3] implemented a model of equilibrium determination of lease rates in the event the lessee fails to pay.

The completion of the internal market for leasing required sufficient openness of European markets for competition between rules to take place. In 2017 (law no. 124 of

* Saggio sottoposto a revisione secondo il sistema per *peer review*.

[1] v. J. Franks, S. Hodges, *Valuation of financial lease contracts: a note*, The Journal of Finance, 1978, vol. 33, pp. 657-669.

[2] v. S.C. Myers, D.A. Dill, A.J. Bautista, *Valuation of financial lease contracts*, The Journal of Finance, 1976, vol. 31, pp. 799-819.

[3] v. S.R. Grenadier, *An Equilibrium Analysis of Real Estate Leases*, The Journal of Business, 2005, vol. 78, n. 4, pp. 1173-1214.

August 4) the Italian Parliament has introduced new rules on financial leases, they provide more clarity in case of breach by the lessee.

The contract of leasing is an agreement between a lessor and a lessee, allowing the latter the right to use a property owned or managed by the former for a stated period of time[4]. In a basic leasing contract, the lessor transfers the property of an asset to the lessee at a specified time; this occurs on condition that the lessee pays both the regular fees and the redemption price.

The intention of this paper is to study the lessor's convenience of advance termination of a leasing contract for material breach. As is known, leasing contracts[5] include contractual terms in the event that the lessee fails to pay the leasing fees. In compliance with the regulations of the European Union, in such a case the lessor is entitled to the return of the asset and the lessor is furthermore required to pay the lessee the proceeds of sale closed at market value, after deducting a sum equal to the amount of the overdue fees up to the expiry date, the outstanding fees, the capital share and the agreed price for the exercise of the final purchase option of the leasing asset, as well as any advance in expenses for the property repossession, its appraised value and conservation for as long as necessary to sell it[6]. It is understood and agreed that the lessor's credit rights on the residual value are left unprejudiced against the lessee, assuming that the proceeds of sale or any different transactions of the asset are less than the amount due by the lessee in pursuance of previous agreements. Finally, the expired unpaid fees are charged and increased at a default interest rate and will be capitalized in terms of simple interest accumulation determined by the contract.

When considering leasing contracts some problems may arise in the computation of a time dependent exercise boundary for the entire contract duration. The issue of choosing the time either to rescind or uphold a contract corresponds to solving an optimal stopping problem. In case of material breach the lessor may decide whether to request the immediate contract termination or await the optimal stopping time to terminate the contract and subsequently invest the amount collected into alternative assets.

This paper is organized as follow. After the introduction, we model the leasing problem in the next section and we explain the goal of the work and obtain the main equation of the dynamics of power prices.

2. In this section we introduce the model. The lessor gives an asset to the lessee. The lessee pays regular fees and the redemption price E at maturity n. Let's consider a leasing contract in which from a certain date forward the lessee no longer pays the fees. As a consequence, the lessor evaluates whether or not to rescind the contract at date z

[4] v. P.K Nevitti, F.J. Fabozzi, *Equipment leasing*, John Wiley & Sons ed., 2000.
[5] v. J. Franks, S. Hodges, *Valuation of financial lease contracts: a note*, cit.
[6] v. Law n. 124 of August 4, 2017.

by comparing it with the capital cost of an alternative investment. In order to fulfill this objective, we now introduce the model.

We call c the fees periodically due. Without loss of generality, we can assume that the lessee has been insolvent since the beginning, at time 0. It is easy to prove that assuming immediate insolvency does not change the generality of our conclusions. The credit at time t for the leasing company, in the case the lessee is insolvent, is the sum of two terms: the first term is the amount of the expired fees and accrued in simple interest accumulation at the arrears interest rate m, determined by contract: the second one is the outstanding fees and the redemption price E discounted by a lower force of interest δ, contractually established. For a known result on the amortization plans this corresponds to calculate the fees to expire but only in line capital according to the law n. 124. Before the entry into force of this law the force of interest δ was contractually established and was very small and this was to the lessor's advantage.

Summarizing the parameters of our model are:

- c annual fixed lease payment,
- E redemption price,
- n total number of lease payments,
- m arrears interest rate,
- $e^{-\delta}$ annual discount factor of unpaid fees.

Hence the lessor credit at time $t \in [0, n]$ in case of insolvency is:

$$f(t) = \sum_{j=1}^{[t]} c\big(1 + m(t-j)\big) + \sum_{j=[t]+1}^{n} ce^{-\delta(j-t)} + Ee^{-\delta(n-t)} \tag{1}$$

Note that $[t]$ is the integer part of t that is the largest integer number smaller than or equal to t. Furthermore

$$\sum_{j=1}^{[t]} \big(1 + m(t-j)\big) = [t]\left(1 + m\left(t - \frac{[t]+1}{2}\right)\right) \tag{2}$$

and

$$\sum_{j=[t]+1}^{n} ce^{-\delta(j-t)} = ce^{\delta t} e^{-\delta([t]+1)} \sum_{j=0}^{n-[t]-1} e^{-\delta j} \tag{3}$$

Let

$$a_{[t]} = e^{-\delta([t]+1)} \sum_{j=0}^{n-[t]-1} e^{-\delta j}$$

(4)

be the present value of $(n - [t] - 1)$ periodic payment annuity deferred for $[t] + 1$ years. We note that

$$a_{[k-1]}e^{\delta k} = 1 + e^{\delta k}e^{-\delta(k+1)} \sum_{j=1}^{n-k-1} e^{-\delta j} = 1 + e^{\delta k}a_{[k]}$$

(5)

Substituting (2) and (3) in (1) and considering (4) and (5), we have

$$f(t) = c[t]\left(1 + m\left(t - \frac{[t]+1}{2}\right)\right) + ca_{[t]}e^{\delta t} + E_0\, e^{\delta t}$$

(6)

where $E_0 = E\, e^{-\delta n}$ is the present value of redemption price E.

The function f is right-continuous because $[t]$ is right-continuous. Moreover, we have that:

$$\lim_{t \to k^-} f(t) = c(k-1)\left(1 + m\left(k - \frac{k-1+1}{2}\right)\right) + ca_{k-1}e^{\delta k} + E_0 e^{\delta k} =$$

$$= ck\left(1 + m\left(k - \frac{[k]+1}{2}\right)\right) + ca_k e^{\delta k} + E_0\, e^{\delta k} = f(k)$$

hence f is also left-continuous. We conclude that f is a continuous function.

In order to determine instantaneous interest rate, we calculate the derivative of f with respect to t (when t is not an integer). From (6) we have that:

$$f'(t) = c[t]m + ca_{[t]}\delta e^{\delta t} + E_0\delta e^{\delta t}$$

(7)

If t is an integer, we prove that the function f is not derivable if $\delta \neq m$ but admits left and right derivative. For $k = 1, 2, \ldots n$, we have:

$$f'_-(k) = \lim_{t \to k^-} f'(t) = c(k-1)m + ca_{k-1}\delta e^{\delta k} + E_0 \delta e^{\delta k}$$

$$f'_+(k) = \lim_{t \to k^+} f'(t) = ckm + ca_k \delta e^{\delta k} + E_0 \delta e^{\delta k}.$$

Notice that:

$$f'_-(k) = ckm - cm + ca_k \delta e^{\delta k} + c\delta + E_0 \delta e^{\delta k} = f'_+(k) - c(m - \delta)$$

(8)

The force of interest at time *t* of lessor credit, if *t* is not an integer, is

$$p(t) := \frac{f'(t)}{f(t)}$$

For $k = 1, 2, \ldots n$ and if $m > \delta$, when we move from left to right in a neighborhood of *t=k* the force of interest suddenly increases. From (6) and (8), the size of the jump is:

$$c\,\frac{m - \delta}{f(k)}$$

The aim of the lessor is to compare the force of interest *p* with opportunity cost of an alternative investment.

To this end we analyze the function p. To study the monotonicity of p over an interval $]\,k,\ k+1[$ with $k = 1, 2, \ldots n$, we study the sign of $p'(t)$ which is equal to the sign of:

$$g(t) = f''(t)f(t) - (f'(t))^2$$

(9)

We rewrite f on the interval $]\,k,\ k+1[$ as:

$$f(t) = \alpha_k t + \beta_k + \gamma_k e^{\delta t} \tag{10}$$

where:

$$\alpha_k = c[t]m > 0$$
$$\beta_k = c[t]\left(1 - \frac{m([t]+1)}{2}\right)$$
$$\gamma_k = E_0 + ca_{[t]} > 0$$

From (10) calculating the derivative of *f* and substituting in (9), it is easy to prove that

$$g(t) = \gamma_k \delta e^{\delta t}(\alpha_k \delta t + \delta\beta_k - 2\alpha_k) - \alpha_k^2$$

The inequality $g(t) \geq 0$ is equivalent to:

$$\alpha_k \delta t + \delta\beta_k - 2\alpha_k \geq \frac{\alpha_k^2}{\gamma_k \delta} e^{-\delta t}$$

We compare an increasing linear function with a decreasing exponential one.

So, for $k = 1, 2, \ldots n$, we have:

1. $g(t) \leq 0$ on $]k,\ k+1[$ and so $p(t)$ is decreasing on $]k,\ k+1[$
2. $g(t) \geq 0$ on $]k,\ k+1[$ and so $p(t)$ is increasing on $]k,\ k+1[$
3. $g(t)$ at first it is negative but then it ends positive on $]k,\ k+1[$ and so $p(t)$ has a local minimum on $]k,\ k+1[$.

On the basis of these observations, it will be possible to develop an analysis which will allow us to identify the optimum time to rescind the contract.

3. The intent of this paper was to illustrate the convenience of terminating a leasing contract in advance should the lessee stop paying the leasing fees. Under these conditions the lessor may bide his time in the hopes that the lessee should resume regular payments. Consequently, the lessor may opt not to demand the immediate contract termination, but the unpaid accrued fees the lessee is expected to pay will entail the application of default interest, which will be higher than the interest rate agreed. Therefore, the lessor may profit from deferring his contract termination request; in the event of contract termination, the asset will be sold and the proceeds of sale will be used to compensate the lessee for the past due unpaid fees increased at a default interest rate along with the residual value of the asset. The residual value of the asset was calculated by discounting at lease rate the outstanding fees and the (agreed) price for the exercise of the final purchase option. We estimated the lessee's convenience of rescinding the contract, calculating at its natural expiry the wealth obtained through the

capitalization - by means of an adequate term structure of interest rates - of the amount obtained from the rescission.