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A Proposal for Classifying Leasing in Portfolios

Doutor/Ph.D. André Luiz Bufoni ORCID iD, Doutor/Ph.D. Marcelo Álvaro de Macedo ORCID iD

UFRJ, Rio de Janeiro, RJ, Brazil

Doutor/Ph.D. André Luiz Bufoni

0000-0002-3568-0590

Programa de Pós-Graduação/Course
PPGCC - UFRJ

Doutor/Ph.D. Marcelo Álvaro de Macedo

0000-0003-2071-8661

Programa de Pós-Graduação/Course
PPGCC - UFRJ

Resumo/Abstract

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Modalidade/Type

Artigo Científico / Scientific Paper

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Abstract: This study aims to propose a new lease classification based on lease portfolio maturity. Although several norm examples, the IFRS was utterly unspecific about the "lease reasonable characteristics' behaviors and points" for portfolio classification and left to the company in practical transition expedient to demonstrate that this approach would not differ materially from applying to individual leases. We calculate, interpret and demonstrate numerically the proposal based on lease terms and inflection points. Results show leases can be classified into 3 categories delimited by depreciation-amortization point and expenses-amortization point. The proposal has more disclosure and informative benefits than the current individual contract presentation.

Keywords: leasing, portfolio, IFRS 16, classification, inflection points

INTRODUCTION

By the end of the last century, accounting practitioners were concerned that the financial impacts of some new IFRS norms would not be only significant in the disclosure but in costs, systems, covenants, processes, taxes, and key performance measures (Delloite, 2016; IFRS, 2016; Wieczynska, 2016). This matter in the accounting for the Leasing case was plausible since Duke et al. (2009) showed how companies could hide billions of liabilities and enhance retained earnings, income, and ratios, by just acquiring assets and then leasing back these assets to the companies as synthetic leases (see also Duke & Hsieh, 2006). The BAU – Business as Usual is to avoid lease capitalization by designing ad hoc contracts (off-balance) (Bryan et al., 2010; Dechow et al., 2011; Duke & Hsieh, 2006; Morales-Díaz & Zamora-Ramírez, 2018; Tănase et al., 2018).

The studies on possible economic changes of lease capitalization are IFRS earlier and classified the predicted consequences as positive or negative, direct or indirect, and intended or unintended. However, some of these predicted changes' results were still unexpected and contradictory, misleading, and unpredictable in direction, revealing a shortcoming in our knowledge about the lease behaviors (Beattie et al., 2006; Brüggemann et al., 2013; Giner et al., 2019; Imhoff et al., 1997; Ron van Kints & Louis Spoor, 2019; Wieczynska, 2016).

Most studies use capitalization research inductive methods inferred from empirical (self) comparative content analyses (IFRS, 2016), simulations (Giner et al., 2019), in sectors or case studies (Duke & Hsieh, 2006; Górowski -et al., 2022; Joubert et al., 2017; Öztürk & Serçemel, 2016; Tai, 2013) or a cross-sectional sample of global and local large listed firms (Bourjade et al., 2017; Delloite, 2016; EY Global, 2021; Kusano, 2018; Lim et al., 2017; Nuryani et al., 2015; PwC, 2014).

The heterogeneous samples made their results dependent on industry (Beattie et al., 1998; Durocher, 2008), size and country (Branswijck et al., 2011), firm exposure to leasing (Morales-Díaz & Zamora-Ramírez, 2018), and debt maturity (Khoo & (Wai Kong) Cheung, 2022). Thus, generic, different life points and cross-sectional studies have a diminished utility when trying to predict the impacts of lease capitalization for any case, from any industry.

Because analyses result would have a huge asymmetric distribution variance, literature generally commends the use of a portfolio approach with a single discount rate for a portfolio of leases with “reasonably” similar characteristics (Bufoni & Macedo, 2023; IFRS, 2016; KPMG, 2017).

This study aims to propose a new lease classification based on lease portfolio maturity. Although several examples, the IFRS (2016 B1-C10) was utterly unspecific about the “lease reasonable characteristics’ behaviors and points” and left to the company in practical transition expedient to demonstrate that this approach would not differ materially from applying to individual leases (Bufoni & Macedo, 2023; KPMG, 2017).

The remainder of this document is organized as follows: In the next section, we will present the primary terms, and their relationship, and discuss the financial consequences and expected behavior of a lease contract. In the third part, we effectively propose the lease maturity division based on the last section. Finally, we depict the proposal numerically and draw some conclusions.

DEFINITIONS

This part defines, shows in detail, and describes behaviors of the lease terms: liability amortization and residue, right of use asset depreciation and residue, interests, and lease payment. At some point in time, these terms collide having the same value. By convention, we will call these points inflection points or tau points (τ) explained after the leasing terms.

We do not intend to mathematical demonstrate the calculation of the terms or points, because it was the object of another previous work[1]. The formula for each term is in Appendix A. The most important is to describe the behavior and demonstrate the financial consequences of each part. For this intent, we will show a hypothetic lease of 25 periods (Figure 1) with all terms discussed here.

Leasing terms (lines)

- **Interests (green)** – Initially are based on the final value. The behavior is not linear, but the rate (acceleration or derivative) is negatively Euler constant ($-e^i$). Interest meets amortization at some point if (and only if) the final value is greater than two times the present value (Appendix A, Equation 7).
- **Amortization (orange)** – Amortization is based on the present value and also increases at an Euler constant rate (e^i). Amortization meets depreciation, interest and expenses, and each of these points has a different financial meaning (Appendix A, Equation 5).
- **Payment (purple)** – Because of the interest and amortization constant variation rate, and the payment is interest plus amortization, payment is constant in time. The payment is a proxy of the operating lease expense with capitalization consequences (renting) (Appendix A, Equation 4).
- **Depreciation (red)** – Depreciation is constant in time and the reference for the moment expenses are greater than payment (tau_er).
- **Expenses (blue)** – Expenses are the sum of depreciation and interest. Until depreciation and interest meet (tau_da), the expenses will always have a higher impact on results than the simple operations lease renting expense. Because of the interests part of expenses, the value is not linear either.

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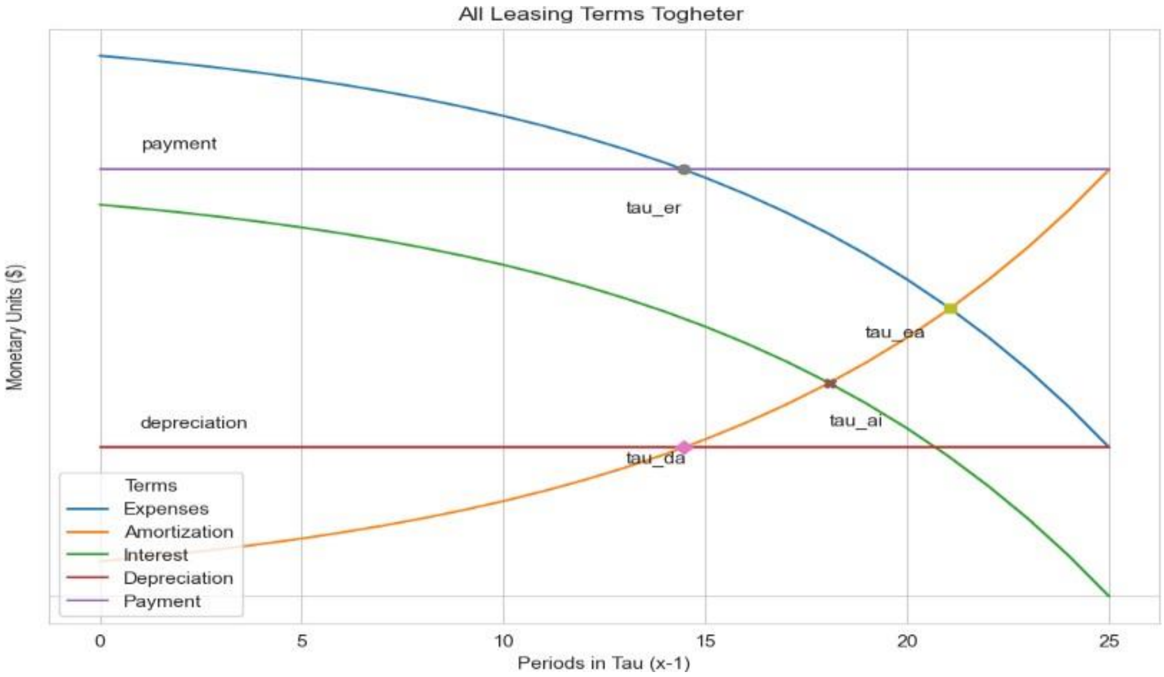
[1] Keep it not cited, because it was not already published, and for the Congress anonymization reasons

Figure 1 – All Leasing terms



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Interest Rate

For this work aim, the interest will be constant and capitalized continuously [Equation 1]. The reason to choose a continuously capitalized rate is threefold. In one way, it simplifies the calculations and their meaning. Conversely, it maximizes the outcome's effect, always depicting the "best/worst" scenario. Finally, this solves the problem of a discontinuous function where an inflection point might not exist.

Suppose that the present value (*PV*) was invested for n years by a rate i of interest capitalized k times per n years. The final value (*FV*) would be:

$$FV(n) = PV.(1 + \frac{i}{k})^{kn}$$

In a continuous way where $\lim_{k \to \infty} (1 + \frac{i}{k})^{kn}$ FV tends to:

$$\boxed{FV(n) = PV.e^{in}} \qquad [1]$$

Right-of-Use Assets and the Linear Depreciation

We approach asset depreciation in the same way. That is, given an asset value R, depreciated x times, and $x \to \infty$, the depreciation rate D will be constant. Because the depreciation function is linear, the second derivative is always zero, and instant depreciation (D') would be:

$$D' = \frac{\partial y}{\partial x} = -\frac{1}{n} \times x = -\frac{1}{n} \qquad D_0 = -\frac{R}{n} \qquad \{n | n \in N^*; n \geq 1\}$$

The problem now is simple. The residual asset (R_r) after x depreciation periods will be as follows, and when x equals n the asset is fully depreciated or $R = 0$:

$$R_r = R - xD = R - \frac{x}{n}R$$

$$\boxed{R_r = R\,(1 - \tfrac{x}{n})} \tag*{[2]}$$

Liability Properties and the Exponential Amortization

Next, inline, we have the interest expense on the lease liability. According to IFRS 16 [47-49], the lease liability and the related interest expense should be presented separately, the same as for the right-to-use asset and the respective depreciation charge.

In contrast with the right-of-use, where each period during the lease term should have the same constant rate used in the initial measurement of the Lease [41-45], interest expenses and liability amortization has exponential, not linear behaviors.

Thus, the lessee should expect a (hidden) difference between the accounting for right-to-use assets and the liability amount. How we are using interests capitalized continuously, as seen in Equation 1, our payments calculation (*PMT*) over net present value (*NPV*) must be adapted from the traditional geometric progression sum formula [Equation 4]:

$$PMT \times \frac{e^{in} - 1}{e^{i} - 1} = NPV \times e^{in}$$

$$\boxed{PMT = NPV \times \frac{e^{in}(e^{i} - 1)}{e^{in} - 1}} \tag*{[3]}$$

being $(e^{i} - 1)$ the periodic effective interest rate, so $NPV(e^{i} - 1) = J_1$::

$$PMT = J_1 \times \frac{e^{in}}{e^{in} - 1}$$

Now, after some modifications, we can demonstrate that the x^{th} liability amortization (A_x) is equal:

$$\boxed{A_x = NPV\frac{e^{i(x-1)}(e^{i} - 1)}{e^{in} - 1}} \tag*{[4a]}$$

Or, using J_1 notation:

$$\boxed{A_x = J_1\frac{e^{i(x-1)}}{e^{in} - 1}} \tag*{[4a]}$$

If in each period the term e^{i} adjusts the net present value [Equation 3], we expect the same behavior for the amortization part of a payment. Indeed, e^{i}explains the entire amortization variation during the lease term [Equation 3]:

$$NPV = \sum_{1}^{n} A_1 e^{i(x-1)}$$

Thus, the amortization sum is a geometric progression sum with a e^{i} ratio as well, then for $\{x \in R | 0 \leq x \leq n\}$ the cumulative amortization (A_c) is:

$$\boxed{A_c = A_1 \frac{e^{ix} - 1}{e^{i} - 1}}$$

But, considering that A_1 can be substituted as in Equation 5b, then:

$$A_c = NPV \frac{e^{i} - 1}{e^{in} - 1} \times \frac{e^{ix} - 1}{e^{i} - 1}$$

$$\boxed{A_c = NPV \frac{e^{ix} - 1}{e^{in} - 1}} \qquad [\ 5]$$

and because PMT is constant, $PMT = J + A$, and they are inversely proportional in time, interest (J) in period x is

$$J_x = NPV \times \frac{e^{in}(e^{i} - 1)}{e^{in} - 1} - NPV \frac{e^{ix}(e^{i} - 1)}{e^{in} - 1}$$

$$\boxed{J_x = NPV(e^{i} - 1) \left(\frac{e^{in} - e^{i(x-1)}}{e^{in} - 1}\right)} \qquad [6a]$$

Again, being $(e^{i} - 1)$ the interest rate, so $NPV(e^{i} - 1) = J_1$:

$$\boxed{J_x = J_1 \left(\frac{e^{in} - e^{i(x-1)}}{e^{in} - 1}\right)} \qquad [6a]$$

To maintain a constant PMT, and considering that $A_1 = {}^{J_1}/_{(e^{in} - 1)}$:

$$-\Delta J = \Delta A$$

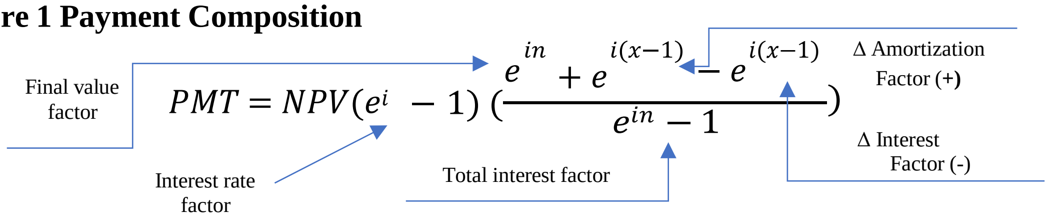
Now, we can see why PMT is constant and how the interest and amortization variation $e^{i(x-1)}$ nullify each other. The result is the same as [Equation 3]:

$$PMT_x = J_x + A_x$$

$$PMT = NPV(e^{i} - 1) \left(\frac{e^{in} + e^{i(x-1)} - e^{i(x-1)}}{e^{in} - 1}\right)$$

$$PMT = NPV \frac{e^{in}(e^{i} - 1)}{e^{in} - 1}$$

Figure 1 Payment Composition



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The payment is the final value of the ratio of the periodic-total interests, where the interest decreases while the amortization increases. Figure 1 sums up the relationship among the terms, and we will use all these formulas in our comparisons. Finally, we opt to show the rates (derivatives) and areas (integrals) comparison in the following effect analysis to enrich the presentation with graphics and numeric examples.

The Tau Simplification

Many points calculated in this work are exponential logarithm equations where we must extract x from the term $e^{i(x-1)}$. Off course, in many cases $(x-1)$ could add some unnecessarily complicated calculations and we decided to substitute x for tau (τ), where:

$$\tau = x - 1$$
$$x = \tau + 1$$

So, if a point τ_{da}= ln e^{c} = 15 the "real" x in this case is $x = \tau_{da} + 1 = 16$. These simplifications are present in many areas of math, like delta in Bascara ($\Delta = b^2 - 4ac$).

Leasing inflection points (τ)

Leasing inflection points are points where two or more terms have the same value in time. These points are generally exponents in equations like the n in $(1+i)^n$ equation. Extracting the point ever demands the use of logarithmic properties, especially in amortization and interest cases (check Appendix A, 5 and 7 Equations), which could add unnecessary mathematic complications. In this case, we opt to use the Greek letter tau, substituting the $(x-1)$. This will only make the difference at the end, in numeric examples, present here later.

The inflection term is generally used in math to designate derivative signal change from positive to negative. In lease case, it denotes the change of terms signal from increasing to decreasing behavior like asset-liability difference, or positive to negative like expenses-payment point.

The analysis of each point's behavior goes from Figure 1 top to bottom. The meaning of each point is explained as follows:

- **Tau_er** – Expenses-renting or expenses-payment point. The point marks the time when the expenses have the same value as the lease payment. In normal conditions, payment is a proxy for asset renting in operating leasing. That is, in the case of a change from operating to financial lease registration, before this point will harm income, after, net income will benefit itself with lower expenses (depreciation + interests) (Appendix A, Equation 9).
- **Tau_ea** – Expenses-amortization point. This is the point where the impacts of liability and equity balance each other. Because the balance sheet Assets effect is constant, because depreciation and payment are constant, before this point, indebtedness indicators worsen and after go better (Appendix A, Equation 10).
- **Tau_ai** – Amortization-interest point. The difference in value from tau_ea is always half of the depreciation. This is the point of the lease payment series where the amortization part becomes greater than the interest part. As seen, this point not always exists, depending on the discount rate (i) and lease lifetime (n) (Appendix A, Equation 8).
- **Tau_da** – Depreciation-amortization point. Because of the relation $J + D = A + J \therefore A = D$ this is the same point in time that tau_er. There is a reason for this. Tau_da is the

point where liability and asset differences are at maximum (Appendix A, Equation 9 too).

Liability Payment Composition – Amortization x Interest (AI point)

According to IFRS 16, in their income statement lessee and the lessor shall include separate lines for (1) amortization expense, (2) interest expense, and (3) lease variable payments (Tănase et al., 2018). An interesting finding of this work is the behaviors of the leasing payment composition. Depending on the interest rate i and the lease term n, the interest part J can be greater than the amortization A at the first payment (PMT_1). Here we will demonstrate that this is true if, and only if, $e^{in} > 2$. Both A_1, J_1 values are equal when we have a perfect dichotomy, where the final value FV is $2 \times NPV$ or, from [Equation 1], $e^{in} = 2$, and when $J = A = {}^{PMT}/_{2}$.

If so, we can use amortization as a reference since both were calculated based on the A increment. Therefore, we will use the artifice of $r = x - 1$, which has the convenience of simplifying the calculations and avoiding the $x = 0$ effect.

If so, we can use amortization as a reference since both were calculated based on the A increment. Here we opt to use

$$J_x = J_1 \left(\frac{e^{in} - e^{ic}}{e^{in} - 1}\right); A_x = J_1 \frac{e^{ic}}{e^{in} - 1}$$

$$e^{in} - e^{ic} = e^{ic}$$

After the properties of the natural logarithm, we will discover that interests and amortization will meet at r point:

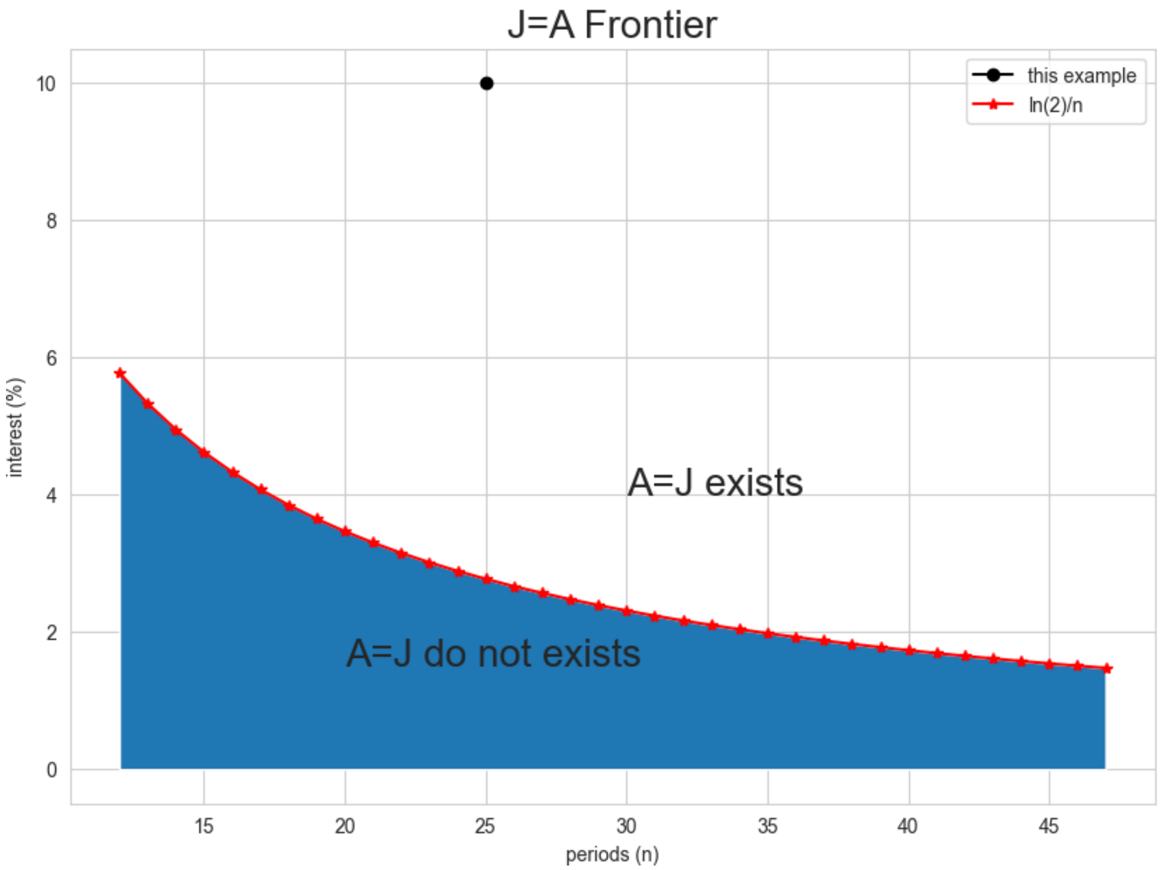
$$\boxed{r_{ai} = \frac{\text{in} - \ln(2)}{i}} \qquad [7]$$

We deduct that the interest rate frontier where $J = A$ exists, or $r \geq 0$; $i \geq {}^{\ln(2)}/_{n}$; $e^{in} \geq 2$. For example, Figure 2 shows our 10% interest scenario:

$$J = A = \frac{PMT}{2} \; \{e^{in} | e^{in} \geq 2\}$$

We can see in this analysis that a firm during IFRS 16 transition having portfolios before tau momentum clearly will suffer more of this kind of impact than those whose contracts are after this momentum. IFRS (2016, p. 45) superficially cited this consequence, although unspecific about why and how it happens, what only can be seen understanding this inflection point.

Figure 2 Interest Rate Frontier



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Depreciation x Amortization (DA point)

What concerns the amortization and the interests told before, the same happens to the amortization and asset depreciation.

It is easy to see that the amortization is not linear and as far as the interests are greater than zero, amortization will meet depreciation in the lease term second half. Formally, if the depreciation D is constant in time, but according to [Equation 4] A_1 grows e^i per period, and the global maximum of the liability-asset difference occurs in $A_x = D$,

$$\boxed{r_{da} = \frac{\ln\left(\frac{D}{A_1}\right)}{i}}$$

Alternatively, simplifying by NPV in both terms:

$$\boxed{r_{da} = \frac{\ln\left(\frac{e^{in}-1}{n(e^{i}-1)}\right)}{i}} \qquad [8]$$

The r_{da} point is the only amortization point during the lease term in which the amortization meets the depreciation value. Interestingly, this point is value-independent [Equation 9]. In any other situation, the lessee would expect accounting side effects. In this matter, we emphasize the profound impact of the term change, mainly caused by the depreciation rate.

Interests + Depreciation x Renting Expenses (ER point)

We added this part after reviewing the literature because it was cited in several reports and studies as one of the factors that impact income when we capitalize on operating leases. Furthermore, the difference could be one issue in the enormous variance found in those studies. Then, we considered the assumptions of this study: the implicit interest rate is the borrowing rate, which makes the renting expenses equal to the capitalized lease payment. If so, after some graphical representation, we discovered that we have already calculated this inflection point. Because of the properties of the lease payment and the opposite behavior of the interest value, we will see that the inflection point is:

$$J + D = PMT$$

$$J + D = J + A \therefore A = D$$

Thus, the point at the interest plus the depreciation expense meets the renting costs is the exact point that the amortization meets the depreciation point.

$$\boxed{r_{er} = r_{da} = \frac{\ln\left(\frac{D}{A_1}\right)}{i}}$$

Supposing that the payment surrogates asset renting value in Operating Lease, before this point firms would have a negative result impact changing to a Capital Lease accounting for. After, the impact would be positive in plain profit and EBITDA since interests and depreciation are not included in the indicator.

Expenses meet Amortization (EA point)

Furthermore, how the amortization and the expenses curves are perfectly symmetric (double-edged), we can say that the point they meet is just (a) the average value of payment and depreciation or (b) the average value of first expenses and the first amortization. We can use both functions to calculate when it will happen. Generally, using the A_x amortization equation (5b):

$$r_{ea} = \frac{\ln\left(\frac{ea_{tau}(e^{in}-1)}{J1}\right)}{i} \qquad [9]$$

Theoretically, when interest tends to zero, payment value and amortization slope tend to depreciation. Indeed, the three lines overlay each other, and it is impossible to calculate any point. Furthermore, because of the amortization and expenses slope module reduction to meet payment and depreciation respectively (zero interest) at lease term, reductions in interests do not have a proportional reduction in leverage point but in indicators.

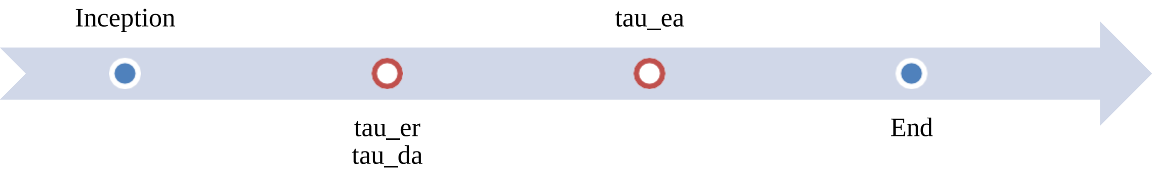
The analysis shows that at this (late) inflection point results and amortization reverse or, henceforth, the indebtedness indicators that use Liability and Equity that were getting worst, now tend to be better (Leverage Indicator).

PROPOSAL

Lease Phases

This study aims to propose a new lease classification based on lease portfolio maturity. The proposal is to divide the leasing into three categories, fully described in this section and summarized in Table 1. This part is an interpretation of the statement behavior in the face of leasing maturity, divided by leasing inflection points (Figure 2).

Figure 2 – Lease financial phases



Source: Authors

The interpretation follows two streams: (1) in the case of operating to financial lease conversion (capitalization); and (2) in a normal financial lease contract.

Capitalization

In the case of capitalization, there are two momentum that matter. The inception point where, nevertheless the condition, has an impact on assets and liabilities by recognition, null before. Furthermore, there is a result impact since opposite to renting expenses, interest paid is a non-operational expense, positively impacting operational results. Depreciation and interest are non-cash expenses, positively impacting EBITDA. Both impacts can be calculated using Appendix A Equations 5 and 7.

The second momentum is the tau_er point when expenses meet payment/rent (Equation 9). After this point, expenses are lower than the recognized operating leasing renting, thus the income will suffer a gross, operational, and EBITDA positive impact, in a capitalization case.

Financial Lease

In the normal financial lease contract flow, the tau_er has the same importance for a different reason. Because of the payment composition, the point expenses meet payment (depreciation + interest = interest + amortization) happens at the same time depreciation meets amortization (tau_da). Thus, we can classify operational leasing in the same way we classify financial leases (henceforth before and after tau_da).

In a financial lease, the point tau_da (depreciation meets amortization) is the point where the difference between the right-to-use asset and the liability finds its apex, with two consequences. First, tau_da is the worst total indebtedness scenario (total assets divided by total liabilities). Before this point, the difference increases. After this point the difference reduces. The second is another way to see the expenses-renting point. Because of the fundamental accounting equation, this is the point where the variations of the results become positive:

$$\Delta A = \Delta L + \Delta Eq + R - E \qquad [10]$$

Where Δ is for value variation, A is the Total Assets, L is the Total Liabilities, Eq is the Equity, R is the Revenues, and E – Expenses. Any difference in asset-liabilities variation will directly impact the results (and Equity).

The other point to consider is the point that expenses meet amortization (tau_ea). As we can see in Equation 1, expenses and amortization are on the right side of the equation but in different groups. Hence, considering that depreciation and payment on the left side do not vary, ceteris paribus, the expenses-amortization is the worst lease debt-to-equity ratio indicator (DE). Only after this point, does the DE indicator subtly decreases.

$$D + PMT = A - E \tag{2}$$

Where D is depreciation, PMT payment, A amortization, and E expenses. Amortization is the same as ΔL (liabilities value variation).

Table 1 depicts the lease category limits, debt and capital structure and the expected capitalization impact on results. Asset and liability recognition impact in capitalization cases is as lower as the maturity of the contract. The same happens to interest expenses. The exception is amortization, the only one that does not decrease nor is constant.

Table 1 – Lease Portfolio Categories

Category	Limits	Debt and Capital Structure	Capitalization Results Impact
	Inception	Asset and Liabilities' full impact	Results impact changes from Renting to Depreciation and Interest
1	↓	Capitalization risk augmented. Asset and Liabilities high impact. Expenses are greater than renting. Total Indebtedness increasing	Higher positive impact on EBITDA and Operational Income. A negative impact on the results total.
	Tau_da	Asset-liabilities difference apex	Expenses equal payment. No impact on the results total. Positive impact on EBITDA and Operational results.
2	↓	Asset-liabilities medium impact. Decapitalization risk increasing. Expenses are lower than renting. Total indebtedness decreasing, but the Debt-to-Equity indicator is still increasing	Positive impact on EBITDA, Operational and Total results. Interest expenses exponential reduction.
	Tau_ea	Liability-equity difference apex	Interest expenses near the depreciation value
3	↓	All debt indicators decreasing.	Diminished interest expenses value effect on results
	End		

Source: Authors

NUMERICAL EXAMPLE

The simulation considers a $10,000 lease with 12 periods and a discount rate of 7% p.p. As Figure 1, Figure 2 shows all leasing terms and points calculated using Appendix A formulas.

In Table 1 we calculate every term necessary to delimit and classify the leasing category. However, to compare Figure 1 with the leasing terms and points and Table 2 with lease classification according to our proposal, keep in mind that for math simplification, tau points are $r = x - 1$. That's the reason why in Figure 2 depreciation-amortization point is $r = 5.91$ and in Table 1 $x = 6.91$.

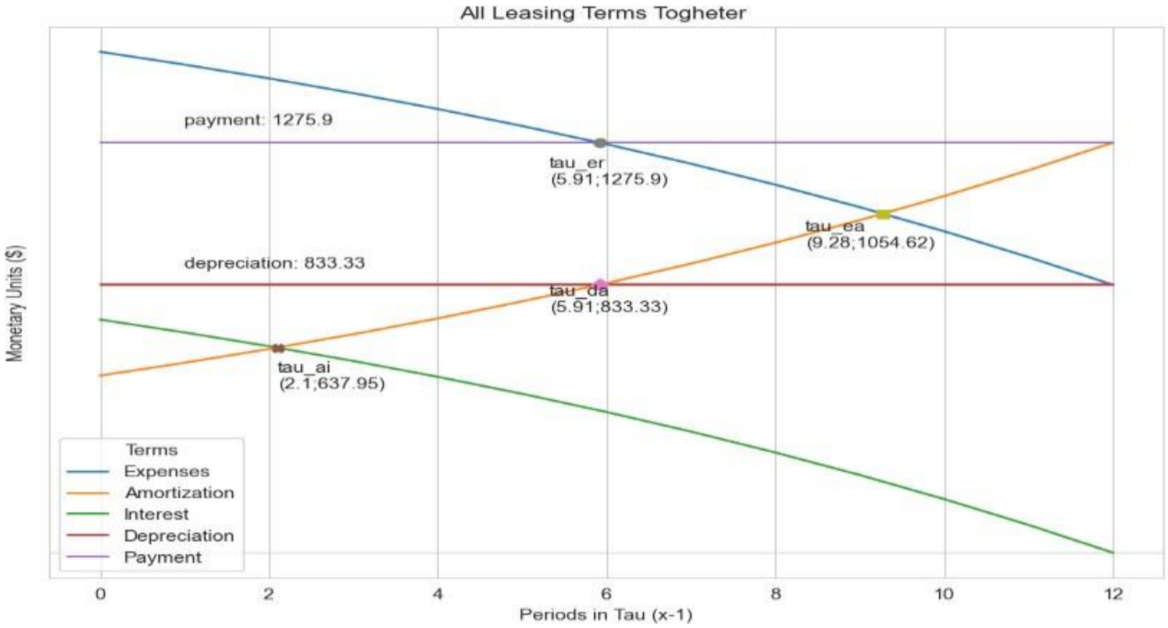
Table 2 – Example classification

Cat	Division Point	x	interests	amortization	depreciation	payment	expenses
1		1	725.08	550.82	833.33	1,275.90	1,558.41
		2	685.14	590.76	833.33	1,275.90	1,518.47
		3	642.31	633.59	833.33	1,275.90	1,475.64
	Amortization Interests	3.09	637.95	637.95			
		4	596.37	679.54	833.33	1,275.90	1,429.70
		5	547.10	728.81	833.33	1,275.90	1,380.43
		6	494.25	781.65	833.33	1,275.90	1,327.58
	Depreciation Amortization*	**6.91**		**833.33**	**833.33**	**1,275.90**	**1,275.90**
2		7	437.57	838.33	833.33	1,275.90	1,270.90
		8	376.79	899.11	833.33	1,275.90	1,210.12
		9	311.60	964.31	833.33	1,275.90	1,144.93
		10	241.68	1,034.23	833.33	1,275.90	1,075.01
	Expenses Amortization	**10.27**		**1,054.62**			**1,054.62**
3		11	166.69	1,109.22	833.33	1,275.90	1,000.02
		12	86.26	1,189.64	833.33	1,275.90	919.59

*also expense-amortization point

Source: Authors

Figure 2 - Simulation Terms



Source: Authors

Notice also the differences between Figure 1 and Figure 2. Figure 1 is the same leasing but with a 25-year term and a 10% discount rate. For example, the interests are lower than depreciation during all lease terms, and the amortization-interest (tau_ai) occurs almost in the second period, while in Figure 1 it occurs almost in the 18th period. The possibility to classify these two contracts in the same portfolio shows that the proposal can be used to join leases with different characteristics. That would be an improvement in proving these categories has similar characteristics. Off course more empirical studies using this classification are necessary.

CONCLUSION

The heterogeneous samples, different life points and cross-sectional studies, size and country, firm exposure to leasing, and debt maturity could cause a huge asymmetric distribution variance on estimated results of lease capitalization and disclosure of risk exposure. Thus, the literature generally commends the use of a portfolio approach with a single discount rate for a portfolio of leases with unspecific and discretionary "reasonable" similar characteristics.

This work presents a lease maturity classification portfolio proposal, based on leasing terms behaviors and their inflection points (Table 3). Each inflection point has a different meaning along with the terms it represents.

Table 3 - Lease Inflection Points

Point	**Acron.**	**Formula** ($\tau = x + 1$)	**Meaning**
Amortization Interests	AI	$\tau_{ai} = \frac{in - \ln(2)}{i}$	Before the point, payment composition has more effect on results than after when capital effects are greater.
Depreciation Amortization	DA	$\tau_{da} = \frac{\ln\left(\frac{e^{in} - 1}{n(e^{i} - 1)}\right) -}{i}$	The inflection point reverses from increasing assets and liabilities differences to decreasing differences.
Expenses Renting	ER	$\tau_{er} = \frac{\ln\left(\frac{e^{in} - 1}{n(e^{i} - 1)}\right)}{i}$	Same as DA point. From operating to capital lease, before point firm harms results. After expenses are lower than renting.
Expenses Amortization	EA	$\tau_{ea} = \frac{\ln\left(\frac{ea_{tau}(e^{in} - 1)}{J1}\right)}{i}$	Leverage point, before the point leverage increases, after decreases

Source: Authors

The contract classification proposal is divided into 3 distinct parts: (1) inception to tau_da, (2) tau_da to tau_ea, (3) tau_ea to lease end. Each category has debt, results, and capitalization differences.

In the first category, firm structural asset-liability impacts are greater while montant and residues are near the entire contract value and expenses greater than the leasing payment, used as a proxy of asset renting. However, the EBITDA cash measure has a great benefit, because interest and depreciation expenses are not included in EBITDA results. The same happens with the operational results since interests are financial, not operational expenses. At the same point (tau_da), lease liability and right of use asset difference reach the apex, with direct consequences to the firm's Equity but decreasing as amortization increases and interest expenses decrease. This is also the worst Total Debt Indicator (TDI - debt/asset) scenario.

In the second category, the expenses are lower than asset renting in an operating lease. This means that the benefit to the results extends to total net income, beyond EBITDA and operational results. The structural impact is smaller as cumulative amortization and depreciation increase. Until de next divisional point (tau_ea), despite the decreasing TDI, the Debt-to-Equity indicator steepens and after the point subtly reduces.

In the third category, capitalization structural risk is low, the debt measures relax, and interests and results impacts are low. The EBITDA benefits reduces but not the operational income, because depreciation is stable.

Regarding the utility of this maturity portfolio proposal, we believe that the classification can be used for different discount rates and different lease terms. Using the Appendix A formulas you can do it individually, which leads us to the conclusion that the portfolio presentation has not only disclosure and informative utility but a control and management function.

REFERENCES

Beattie, V., Edwards, K., & Goodacre, A. (1998). The impact of constructive operating lease capitalisation on key accounting ratios. *Accounting and Business Research*, *28*(4), 233–254. https://doi.org/10.1080/00014788.1998.9728913

Beattie, V., Goodacre, A., & Thomson, S. J. (2006). International lease-accounting reform and economic consequences: The views of U.K. users and preparers. *The International Journal of Accounting*, *41*(1), 75–103. https://doi.org/10.1016/J.INTACC.2005.12.003

Bourjade, S., Huc, R., & Muller-Vibes, C. (2017). Leasing and profitability: Empirical evidence from the airline industry. *Transportation Research Part A: Policy and Practice*, *97*, 30–46. https://doi.org/10.1016/J.TRA.2017.01.001

Branswijck, D., Longueville, S., & Everaert, P. (2011). The Financial Impact of the Proposed Amendments to IAS 17: Evidence from Belgium and the Netherlands. *Journal of Accounting and Management Information Systems*, *10*(2), 275–294. https://econpapers.repec.org/article/amijournl/v_3a10_3ay_3a2011_3ai_3a2_3ap_3a275-294.htm

Brüggemann, U., Hitz, J. M., & Sellhorn, T. (2013). Intended and Unintended Consequences of Mandatory IFRS Adoption: A Review of Extant Evidence and Suggestions for Future Research. *Https://Doi.Org/10.1080/09638180.2012.718487*, *22*(1), 1–37. https://doi.org/10.1080/09638180.2012.718487

Bryan, S., Lilien, S., & Martin, D. (2010). The Financial Statement Effects of Capitalizing Operating Leases - ProQuest. *The CPA Journal*, *80*(8), 36–41. https://www.proquest.com/openview/81f4a18dcdcc3fea943ffe2e39facb38/1?cbl=41798&pq-origsite=gscholar&parentSessionId=fsCa9nQIdH4yldi%2BTi5Y6HQH9iJvJg7%2FDF4iXsKXUsQ%3D

Bufoni, A., & Macedo, M. (2023, September). Read my LIPS – Leasing Inflection Points: Precisely Forecasting Lease's Capitalization. *Enanpad 2023*.

Dechow, P. M., Ge, W., Larson, C. R., & Sloan, R. G. (2011). Predicting Material Accounting Misstatements*. *Contemporary Accounting Research*, *28*(1), 17–82. https://doi.org/10.1111/J.1911-3846.2010.01041.X

Delloite. (2016, June). *Leases — A guide to IFRS 16*. https://www.iasplus.com/en/publications/global/guides/ifrs-16

Duke, J. C., & Hsieh, S. J. (2006). Capturing the benefits of operating and synthetic leases. *Journal of Corporate Accounting and Finance*, *18*(1), 45–52. https://doi.org/10.1002/JCAF.20262

Duke, J. C., Hsieh, S. J., & Su, Y. (2009). Operating and synthetic leases: Exploiting financial benefits in the post-Enron era. *Advances in Accounting*, *25*(1), 28–39. https://doi.org/10.1016/J.ADIAC.2009.03.001

Durocher, S. (2008). Canadian Evidence on the Constructive Capitalization of Operating Leases*. *Accounting Perspectives*, *7*(3), 227–256. https://doi.org/10.1506/AP.7.3.2

EY Global. (2021). *IFRS video: Effects of implementation of IFRS 16 Leases for large entities*. https://www.ey.com/en_gl/ifrs-technical-resources/ifrs-video-effects-of-implementation-of-ifrs-16-leases-for-large-entities

Giner, B., Merello, P., & Pardo, F. (2019). Assessing the impact of operating lease capitalization with dynamic Monte Carlo simulation. *Journal of Business Research*, *101*, 836–845. https://doi.org/10.1016/j.jbusres.2018.11.049

Górowski, I., Kurek, B., & Szarucki, M. (2022). The Impact of a New Accounting Standard on Assets, Liabilities and Leverage of Companies: Evidence from Energy Industry. *Energies 2022, Vol. 15, Page 1293*, *15*(4), 1293. https://doi.org/10.3390/EN15041293

IFRS. (2016). *IFRS 16 Leases Effects Analysis International Financial Reporting Standard®*. https://www.ifrs.org/content/dam/ifrs/project/leases/ifrs/published-documents/ifrs16-effects-analysis.pdf

Joubert, M., Garvie, L., & Parle, G. (2017). Implications of the New Accounting Standard for Leases AASB 16 (IFRS 16) with the Inclusion of Operating Leases in the Balance Sheet - Document - Gale Academic OneFile. *Journal of New Business Ideas and Trends*, *15*(2). https://go.gale.com/ps/i.do?id=GALE%7CA568570483&sid=googleScholar&v=2.1&it=r&linkaccess=fulltext&issn=14468719&p=AONE&sw=w&userGroupName=ufrj_brcap

Khoo, J., & (Wai Kong) Cheung, A. (2022). Managerial ability and debt maturity. *Journal of Contemporary Accounting & Economics*, *18*(1), 100295. https://doi.org/10.1016/J.JCAE.2021.100295

KPMG. (2017). *Lease Discount Rate: What's the correct rate? IFRS 16*.

Kusano, M. (2018). Effect of capitalizing operating leases on credit ratings: Evidence from Japan. *Journal of International Accounting, Auditing and Taxation*, *30*, 45–56. https://doi.org/10.1016/J.INTACCAUDTAX.2017.12.008

Lim, S. C., Mann, S. C., & Mihov, V. T. (2017). Do operating leases expand credit capacity? Evidence from borrowing costs and credit ratings. *Journal of Corporate Finance*, *42*, 100–114. https://doi.org/10.1016/J.JCORPFIN.2016.10.015

Morales-Díaz, J., & Zamora-Ramírez, C. (2018). IFRS 16 (leases) implementation : Impact of entities ' decisions on financial statements NIIF 16 (arrendamientos): impacto de las decisiones de la empresa en los estados financieros. *Aestimatio: The IEB International Journal of Finance*, *17*, 60–81. https://doi.org/10.5605/IEB.17.4

Nuryani, N., Heng, T. T., & Juliesta, N. (2015). Capitalization of Operating Lease and Its Impact on Firm's Financial Ratios. *Procedia - Social and Behavioral Sciences*, *211*, 268–276. https://doi.org/10.1016/J.SBSPRO.2015.11.034

Öztürk, M., & Serçemel, M. (2016). Impact of New Standard "IFRS 16 Leases" on Statement of Financial Position and Key Ratios: A Case Study on an Airline Company in Turkey. *Business and Economics Research Journal*, *7*(4), 143–143. https://doi.org/10.20409/BERJ.2016422344

PwC. (2014). *IFRS adoption by country*. http://www.pwc.com/us/en/issues/ifrs-reporting/publications/assets/pwc-ifrs-by-country-2014.pdf

Ron van Kints, R. E. G. A., & Louis Spoor, L. L. (2019). Leases on balance, a level playing field? *Advances in Accounting*, *44*, 3–9. https://doi.org/10.1016/J.ADIAC.2018.11.001

Tănase, A. E., Calotă, T. O., & Oncioiu, F. R. (2018). The Impact of IFRS 16 on the Companies' Key Performance Indicators: Limits, Advantages and Drawbacks. *Academic Journal of Economic Studies*, *4*(1), 54–59.

Wieczynska, M. (2016). The "Big" consequences of IFRS: How and when does the adoption of IFRS benefit global accounting firms? *Accounting Review*, *91*(4), 1257–1283. https://doi.org/10.2308/ACCR-51340

APPENDIX A – EQUATIONS TABLE

#	Description	Formula
1	FV capitalized continuously	$FV(n) = PV.e^{in}$
2	Residual right-of-use asset	$R_r = R\left(1 - \frac{x}{n}\right)$
3	Asset residual area	$R_a = \int_0^n R_r\left(1 - \frac{x}{n}\right) = \frac{R_r x}{2}\ a.u.$
4	Lease payment	$PMT = NPV \times \frac{e^{in}(e^{i} - 1)}{e^{in} - 1}$
5	The x^th^ payment amortization part	$A_x = NPV \frac{e^{i(x-1)}(e^{i} - 1)}{e^{in} - 1}$
6	Cumulated Amortization	$A_c = NPV \frac{e^{ix} - 1}{e^{in} - 1}$
7	The xth payment interest part	$J_x = NPV(e^{i} - 1)\left(\frac{e^{in} - e^{i(x-1)}}{e^{in} - 1}\right)$
8	Amortization meets interest point	$r_{ai} = \frac{\text{in} - \ln(2)}{i}$
9	Amortization meets depreciation point	$r_{da} = \frac{\ln\left(\frac{e^{in} - 1}{n(e^{i} - 1)}\right)}{i}$
10	Expenses meet Amortization point	$r_{ea} = \frac{\ln\left(\frac{ea_{tau}(e^{in} - 1)}{J1}\right)}{i}$
11	Residual max difference point	$r_{max} = ln\left(\frac{D(e^{i} - 1)}{A_1 \times i}\right) \times \frac{1}{i}$
12	Liability residual area	$L_a = \int_0^n A_1\left(\frac{e^{in} - e^{ix}}{e^{i} - 1}\right)\ a.u.$

Source: Authors

A = amortization; D = Depreciation; e = Euler's constant; FV = Final value; i = interest rate; J = interest value; L = liability; ln = natural logarithm; n = leasing term; NPV = net present value; PMT = payment; PV = present value; r = residuals; R = right of use asset; x = x^{th} lease period