Department of Managerial Accounting

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The analysis of the relation between depreciation and financial lease from the point of view of the lessor

Ph.D. dissertation

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Contents

1 Reasons for the choice of subject and research history

Financial lease is a form of tangible asset purchase financing also widespread in Hungary. Its specificity lies within the fact that contrary to other versions of extracorporate fund raising within the frameworks of financial lease the **property right** of the leased object to be incorporated in the operation of the enterprise stays with the **lessor** during the maturity of the transaction, but its right of use and the burden of bearing the related costs get to the lessee. Since the right of use also implies the right of gaining benefits, from the accounting point of view the leased asset is shown by the lessee in his books. Within the framework of the transaction the **lessee** has the opportunity to **realize** all **benefits** achievable by the operation of the asset and to cover all liabilities originated from financial lease by the gross operating surplus produced by it during maturity. The maintenance of the asset's property right by the lessor can eventually be also interpreted as a need for gross operating surplus produced by the asset – adapting to the rate of provided financing. Thus the **debit** appearing at the lessor originated from financial lease **and the yield producing ability of the asset constitute a closed structure.** It means that financing from the recovery point of view relies on the yield producing ability of the asset and not the direct cash-flow generating ability of the owner or operator – this is why it is qualified as asset based financing –, and adapting to this the leased object provides the only physical collateral of the transaction.

The consequence of the previous line of thinking is that – interpreting financial lease as asset based construction – the '**depreciation**' of the leasing claim has to adapt to the development of the asset's yield producing ability. Thus during the planning of the future development of its capital claim (during the formation of the transaction's calculation) the lessor has to take into consideration how the value of the asset – eventually embodying its future services – develops, i.e. how the asset used by the lessee is expected to depreciate. It is **underpinned** by the market price development of the leased object since through the change in prices from one period to the other the efficient market prices the change in the asset's **yield producing ability**.

In the dissertation within the framework system of the above introduced connections I examine the relation between the **calculation** of leasing transactions and the **depreciation of the leased object**: whether in their relation the asset financing feature applies, how their relation developed as a result of the intensification of leasing market activity and what consequences the transformation of financing practice might have.

1.1 The structure of the dissertation

Besides the main interfaces of the topic I divided the dissertation into four well-separated parts. In the **first part** built up by Chapters 2-3. I examine the financial significance and factors of depreciation based on the following main dimensions:

- the overview of the relation between depreciation, corporate profitability and cash flow,
- the valuation theory based approach of depreciation, the introduction of its role in corporate capital maintenance,
- the approach of depreciation based on actual change in value,
- the identification of factors influencing depreciation.

After highlighting the relation of depreciation to asset value and profitability and the significance of its accounting as part of the corporate yield, I will switch to the accounting display of depreciation, since the theoretical category is able to fulfill its economic significance through its mapping within the framework of accounting.

In the **second part** I discuss the following important accounting theoretical considerations:

- the accounting display of depreciation and its factors,
- the attitude of accounting towards depreciation based on actual change in value,
- the evaluation features and differences of tangible assets in Hungarian and international accounting.

After the overview of the accounting approach of depreciation and putting the valuation approach into accounting frameworks – as a theoretical foundation of the topic of the thesis from two sides – in the **third part** (Chapters 5-6.) based on the theoretical statements of the first two parts I will detail:

- the concept and market significance of financial lease as asset based financing,
- the interfaces of financial lease and the valuation approach of depreciation,
- the foundations for the existence of empirical research and its hipotheses.

Finally after laying down the theoretical and practical foundations of the topic in the **fourth** bigger **part** (last two chapters) I carry out the empirical examination of my hypotheses and reflecting on the theoretical aspects I will reach the conclusions and summarize the possible further directions for examination.

1.2 An overview on literature and the foundation for empirical examinations

1.2.1 The factors of depreciation and its financial significance

The **recognition of the role of depreciation** can be traced back to the era of the asset and capital intensive great industrial revolution and it first gained importance through the role of depreciation allowance in replacement. It was discovered connected to this that without the grasping of value transfer of tangible assets durably utilized during the activity of the enterprise and its accounting against revenues capital and at the same time yield producing ability cannot be maintained in the long term, either. In case of normal operating conditions the part of corporate yield not necessary to maintain capital stock invested in the enterprise – as a revenue surplus above the amount of depreciation allowance – can be divided. However the question also to be found in the literature of depreciation arises: should **capital maintenance** be directed towards the maintenance of the initial physical asset or capacity, or the starting capital value or the initial yield producing ability? Although physical capital maintenance and capital maintenance in value cannot be separated from each other, primarily value maintenance was highlighted since the operation of capital good is directed **towards the establishment of value**. Value in the economic sense means the same as **utility** and utility is embodied in **generating** revenues and **yield flow**. Based on this thought capital good and the produced yields are unseparable, according to Fisher, it's only about the former being a stock and latter a flow feature of equity (Fisher 1896). In this context depreciation is eventually the yield consumed. Since the services of durable assets are usually produced throughout years, the yield consumption embodied in depreciation affects more entrepreneural periods. Their **evaluation feature** is originated from this characteristics: the problem of determination of depreciation allowance[1]. Certainly it was a subject to debate whether a true, **real depreciation allowance method exists**, which allocates the value of the asset proportionally to the rate of their actual value transfer to the individual periods of production. The three corresponding bigger theoretical directions are the theory of reserve produced for future replacements, the allocation of initial costs to the useful lifespan and the depreciation allowance mapping the actual, observable change in value.

[1] Depreciation allowance means the allocation of the asset's value transfer during the business activity to operational subintervals and its P&L side accounting.

From the point of view of the topic of my dissertation I examined the latter, **depreciation allowance based on actual change in value** and its factors in details. Ladelle (Ladelle 1890) identifies the allocation of depreciation to individual periods as the value 'contributed to' the use of an asset (which within the described theoretical frames is equal to the amount paid for the use). As illustration he considers an asset which is utilized by more owners, not in the form of common asset use, but as a utilization sequence through (y) periods.[2] Within this frame the corresponding 'asset enjoyment' value (b_s) of the (s) aged asset should be borne by each owner. But since in his example the owner using the asset for the first time has to pay the total value of the asset (V_0) in the beginning of the utilization period,[3] the owner will give effect to an interest rate (r) for its net investment ($V_0 - b_s$) towards the next owner taking over the asset in the end of its utilization period for a given sum (V_1). Thus the corresponding interim depreciation allowance (d_s) can be described by the following formula:

(1) $d_1 = V_0 - (V_0 - b_s) \times (1 + r)$; where b_s is due in the beginning of the utilization period and $(V_0 - b_s) \times (1 + r) = V_1$ and

$V_0 = \sum_{s=1}^{y} v_s = \sum_{s=1}^{y} \frac{b_s}{(1+r)^{s-1}}$; in a general form:

(2) $d_s = V_{s-1} - V_s = V_{s-1} - (V_{s-1} - b_s) \times (1 + r)$; rearranged

(3) $d_s = b_s - (V_{s-1} - b_s) \times r$

Wright pointed out the valuation theoretical aspects of Ladelle's work (Wright 1967), since the second term of the right side of equation (2) is nothing else but the residual service value of the asset, which based on (2) can be easily expressed through a small rearrangement the following way. If:

(4) $V_s = (V_{s-1} - b_s) \times (1 + r)$, then $V_{s-1} = b_s + \frac{V_s}{(1+r)}$

(5) $V_s = b_{s+1} + \frac{V_{s+1}}{(1+r)}$,

then on the right side of equation (5) continuing the expansion of the second term of the sum for the whole asset lifespan, we get to the usual capitalisation formula:

(6) $V_{s-1} = b_s + \frac{b_{s+1}}{(1+r)} + \frac{b_y}{(1+r)^{y-s}} = \sum_{s=1}^{y-s} \frac{b_y}{(1+r)^{y-s}}$

[2] This way the level of demand for the asset's services is ensured for all future periods and can be pre-calculated.
[3] I denote the value of the asset V – which under certain market conditions is equal to the asset's market price.

The **asset value** used for the determination of depreciation allowance – as the sum of service values – **can be specified in various ways** considering different circumstances:

- through the direct observation of market prices,
- as the present value of remaining service values (as it is also shown by formula (6) based on Ladelle's deduction) or
- through the user cost approach.

According to the user cost approach the value of asset service for unit period (u_s) can be determined as the sum of the alternative cost of asset investment (as minimum profit expectation) and periodical depreciation. The widely discussed connection can be easily recognized, if we transform equation (1) assuming an end-of-period yield flow:

$$u_1 = b_1 = P_0 \times (1 + r) - P_1 \rightarrow$$

$$u_1 = b_1 = P_0 \times r + (P_0 - P_1), \text{ generally} \quad (7)$$

$$u_s = b_s = P_{s-1} \times r + (P_{s-1} - P_s)$$

In order to determine ex-post user cost in formula (7) the end of period – used – asset prices are required, which knowing the factors influencing depreciation can be derived from the changes of certain features of the new asset. Literature interpretes the asset's **change in value as a result of three effects**.

1. **Deterioration** based on Griliches' use of concepts has two factors: on the one hand exhaustion, on the other hand decay (Griliches 1963). Due to exhaustion the asset's remaining useful lifespan decreases, thus the asset gets nearer to the date of its retirement. As a result of decay the efficiency of the asset changes, which means that more time is needed for unit service or the asset is capable of less service within unit time. As a consequence of exhaustion the elements of the sequence on the right side of equation (6) decrease by one, while as a result of decay one unit of service is worth less.
2. **Obsolescence** is a consequence of embodied and disembodied technological developments. In case of the former technological development is embodied in a more developed version of an asset already existing on the market, while in case of the latter a complete change in technology is observable: a new asset appears on the market, which replaces the previous assets as an alternative technology fulfilling the same functions. Based on Hulten's differentiation as a result of disembodied technological development assets of the newer, technologically more developed years affect the exhaustion/retirement practice of the former assets (they bring it closer in time); and according to embodied

technological development the assets of later years are qualified more efficient compared to the older (Hulten 1992).

Obsolescence gets into the scope of examination as a factor, due to which the prices of an asset of age (s) at $t=\tau$ and $t=\tau+s$ dates – contrary to the former – can not be considered the same, so the asset specific change in price is not zero (τ describes any optional future date (t)).

3. The third factor of the change in price is **revaluation**, which is a result of the asset specific change in price contributable to the changes in the asset's demand/supply (and connected to technological development) and the additionally appearing general change in price. In case of the general change in price – as a so far neglected factor – independently from the existence of technological development it does not apply that the values of a given asset of age (s) at dates $t=\tau$ és $t=\tau+s$ can be considered equal.

The present value of the future service values representing the value of an asset of given age **can be derived considering efficiency and revaluation, knowing the rental charge** (service value) **of the new asset**. However, in order to be able to derive the value of **a used asset of a given age** from the value of a new asset (its rental charge), we need to know the asset lifespan efficiency and the asset lifespan revaluation traces, the joint result of which two effects is the total change in asset value observable besides the diagonal of the following table.

Age of asset/Time	T=0	t=1
s=0	$P_{t,s} = a$	$P_{t+1,s} = c$
s=1	$P_{t,s+1} = b$	$P_{t+1,s+1} = d$

1. Table – The simplified scheme of factors influencing change in value

The (t,s) → (t+1, s+1) change in value demonstrated by the matrix can be broken down the following way. The loss in efficiency occurring as a result of deterioration (exhaustion and decay) and embodied obsolescence can be interpreted as the difference between the values of assets of ages (s) and (s+1) expressed by the unchanged prices of a given year. Furthermore, the effect of revaluation can be described based on the difference between the values of an asset of a given user lifespan at dates (t) and (t+1) (in the matrix a horizontal shift in the right direction). The literature on depreciation uses the name 'age effect' for the former and 'time effect' for the latter, see e.g. (Hulten, Wykoff 1981c), (Hulten, Wykoff 1996), (Hulten 2008). One branch of the theory identifies depreciation as the age

effect, so it excludes the consideration of time effect, the effect of revaluation from depreciation. For the depreciation identified this way the concept of **economic depreciation** or cross sectional depreciation is also used, which expresses the decrease in the financial value of capital goods originating from aging, and capital value in the real sense is what we need to reinvest in order to preserve the intact of capital stock. Economic depreciation serves in order to define the value of assets at a given date, but from the yield perspective depreciation can be interpreted not as stock, but as flow variable – which is measurable during the period between two dates –, so accordingly it also has to include the effect of revaluation. Considering this, Hill sees depreciation allowance as **time series depreciation**, which involves all factors of the shift besides the diagonal of the table. (Hill 1999), so it represents the depreciation approach based on total change in value. Hereinafter I use time series depreciation ensuring nominal capital maintenance for the concept of depreciation allowance, which matches the nominal yield concept applied by the current system of accounting.

If we want to express the service value for a given period in the form of user cost or in other words implicit rental charge introduced in formula (7), then we need to break down the change in asset value (P_{s-1}–P_s) into **the effects of factors influencing the change in asset value**. Based on the table Formula (7) can be written in the following form:

(8) $$b_1 = a \times r + (a - d).$$

During the breakdown of (a → d) change in value – as depreciation allowance – let us first consider the inclusion of the age effect regarded as cross-sectional depreciation by Hill. Let us see the economic depreciation rate showing the ratio of the prices of a new and a one-year-old – used – asset using the prices of the end of period 0 (beginning of period t=1).

(9) $$1 - \delta_0 = \frac{d}{c}$$

Substituting Formula (9) in the preceding, the user value of the asset is equal to the sum of alternative cost, cross sectional depreciation and revaluation.

(10) $$b_1 = a \times r + c \times \delta_0 + (a - c)$$

If we also involve inflation (ρ) appearing in the date effect in the examination, then with its help equation 0 can be further developed the following way:

if $(1+\rho)=\frac{c}{a}$, then

(11) $b_1=(r-\rho)\times a+(1+\rho)\times\delta_0\times a;$

Thus based on Formula (11) the service value of an asset in a given period can be expressed from the price of the new asset (of age s=0), knowing the general change in price level, the economic depreciation including asset specific change in price and the interest rates. It means that the rental charge of the asset has to cover the alternative cost of the investment in the asset and the time series depreciation of the asset. **And should the investor deduct a return** from the gross operating result achieved by the operation of the asset **higher** than what could result from the consideration of the depreciation originating from the asset's use and revaluation, then the **future maintenance of its invested capital is not ensured** for him.

1.2.2 The accounting approach of depreciation

Depreciation serving the representation of the absorption of future return producing ability and its maintenance at the same time **is able to perform** its unique double **function** through its accounting as cost **within the framework of accounting**. Bélyácz identifies the role of **depreciation** in accounting as a cost allocational problem (Bélyácz 1993), but in the light of a fundamental principle of Hungarian accounting provisions it gains an extended and in a way different meaning. According to the matching principle „during the determination of the result of a given period we need to consider the realized revenues of the completion of activities in a given period and the costs corresponding to the revenues, independently from the financial achievement. Revenues and costs have to be connected to the period when they economically occurred." (Hungarian Accounting Standard 15.§ (7)) According to the former contextual principle it is obvious that accounting does not consider depreciation allowance as a category separable from the returns generated by an asset, and the base of its method of accounting should be the revenue producing ability of the asset.

Depreciation allowance apart from being accounted as cost gains content in one more aspect from the accounting point of view. The accounted depreciation on the other hand corrects the recognition value of the asset, appears as an item decreasing that; it has to present the asset of the enterprise with a so-called book cost or actualised past cost decreased by accumulated depreciation in its balance. Depreciation **transfers the recognition value of an asset to** some kind of **current value** and the value is a result of the application of some kind of valuation, valuation method – ranking characteristics, preferences. The determination of depreciation

requires numerous estimates based on the currently valid accounting provisions, too, compared to which the significance of estimations appears even more pronounced in the valuation approach. The valuation approach is also confronted by the valid – although from this particular point of view changing – accounting theory through its future orientation since a fundamental feature of accounting is that it typically processes events happened in the past, its evaluation approach is significantly affected by the principle of prudence.

Despite all of this, the Hungarian and international **accounting provisions** described above provide **opportunity** for the time series depreciation (the sum of economic depreciation and revaluation) and capital gain or loss[4] incorporating the **components of change in asset value to appear in the documents of financial reporting**. Although reflecting change in market value is an obvious objective of reporting, the display of the factors of change in value in yield is not identified clearly in case of either frameworks with the asset's total change in value, moreover the fraction of total change in value to be assigned to the product of the business activity is not clearly laid down, either. In an indirect way we can conclude that according to the intention of regulators – in case of strive for capital maintenance – only the part remaining after the accounting of depreciation covering the total change in value for assets can be withdrawn from the revenues produced by durable assets through the distribution of profit, and under ideal circumstances depreciation allowance has to get close enough to the sum determined this way.

1.2.3 The connection between depreciation and financial lease

Should the **purchase** of a depreciating **asset be financed from external source**, then the creditor will also become interested in the asset's utilization, the development of the produced revenues and the determination of depreciation accounted against them – also expressing asset use. A **special form** of asset purchase from an external source is asset based (structured) financing, within this **financial lease**.

In Hungary leasing market is the nearest to the competitive circumstances according to its width and depth from the point of view of the market of financial assets and credit market. Competitive market prices the yield producing ability of an asset for a given period

[4] Due to uncertainty the asset value forecast ex ante in the past (at t-1 date) usually differs from the actual, ex post value and the expectations relating to the factors influencing the development in asset value can be also different between dates (t-1) and (t). Thus besides deterioration and revaluation as factors influencing the asset value a third factors is also built in the change in value, which is called capital gain or loss by foreign authors (e.g. Hill, Schreyer).

through the change in prices from one period to the other, which change in price is equal to the service value and user cost of an asset for a given period. Thus approaching leasing as asset based financing the leasing rental (rental charge) of the leased object should adapt to the asset's change in market value (at the same time yield producing ability). Furthermore, eventually thinking within an economic framework **the return on capital of two economic actors depend on the operation of the asset** – as collateral – by the lessee: the lessee wants to provide cover for the replacement of the asset through the accounting of the occurring depreciation allowance, and the lessor wants to finance further exposure from the claim relating to the yield produced by the operation of the asset (gross operating surplus) and recovered by the lessee to him.

The financial-accounting aspects of the lessee and the lessor thus coincide besides the transaction, the interest of both of them is to align the value development of the asset appearing in their books (which in case of the lessor is the claim) to the leased object's market value development, according to the depreciation theory their long term operation and maintaining capital intact is only ensured in this case. **The question is that** compared to the rate of the theoretical periodical service value (b_s) reflected on a theoretical plane and the equivalent user cost (u_s)

- **which amount of yield the lessor is able to produce** with the asset → thus what is its actual asset based liability fulfilling ability and
- **what return the lessor expects.**

From the two relations **through the empirical examinations of the thesis** I focus on the second. Approaching from the point of view of the lessor I first focus on the examination of the relation between the development in asset value (time series depreciation) and the exposure planned to finance according to the calculation of the leasing transaction, which are supplemented by further assumptions pointing towards the results of their relations.

2 The methodology and hypotheses of the examination

2.1 The summary of the assumptions providing background for the research

In the books of the lessor according to the calculation of the transaction the self financed fraction of the asset's recognition value not paid by the lessee appears as leasing claim.[5] From the point of view of the empirical examinations of my dissertation I consider **finance lease** being **asset based financing** as a fact and the asset with an efficient market is able to produce a gross operating surplus observable in its change in market price during a given period – independently from its operator.

The **depreciation of the leased object** has to be **accounted by the lessee** during the maturity of the transaction as a cost connected to the possessing and utilization of the asset. The lessee has a freedom of choice between the depreciation methodologies and processes within the framework provided by accounting regulations. However through the use of the asset such a quantity of yield has to produced that provides opportunity for the maintenance of business activity: capital maintenance and the payment of leasing liability.

The leased object produces gross operating surplus for the lessee, but since the asset is financed from external source, the part of operating surplus produced by the asset and exceeding the depreciation is granted as revenue also accounted in yield for the lessor, after the amount of financing share not paid by the lessee, to an extent determined by the transactional interest rate. Should the lessee withdraw a yield higher than the one incurring by considering the depreciation originating from the use and revaluation of the asset from the gross operating surplus achieved by its operation (account lower depreciation allowance), then the preservation of its capital invested in the asset is not ensured for him. This is why the **accounting of depreciation mapping actual change in value is significant** from the valuation approach point of view. During the wording of the hypotheses I assume that the decrease or 'depreciation' of the called-up capital appearing in the books of the lessor observable in the planned transaction calculation has to adapt to this change in value from the

[5] According to the Government Regulation on the accounting features of leasing enterprises – as financial institutions – (Government Regulation 250/2000. (24. XII.)) within the framework of the leasing transaction the 'sum invoiced' towards the lessee in the beginning of maturity, related to the asset constituting the subject for leasing 'does not contain the sum of interest on the claim relating to financial leasing'. (250/2000. GR 5.§ (5) h)) The interest on the capital claim is displayed in the sum determined by the calculation connected to the individual lease payments as short term claim in the books of the lessor, and is in no form part of the long term capital claim related to the transaction.

same consideration (capital maintenance), during the determination of which the lessor is able to consider all factors presented in equation (11) due to the market knowledge of the lessor, which have an effect on the economic depreciation and revaluation of the asset and appear in the market prices of the asset.

The former logical derivation matches the essence of asset based financing well, according to which on a theoretical plane **the value of the asset always has to provide cover for the claim originating from the financing of the asset,** so the tracking of the asset value's depreciation is of fundamental interest and utmost significance for the lessor from this point of view, too. And should the lessor want to realize a revenue from the rental on a level above the yield provided by the asset's change in market value, it is only possible if the lessee

- uses the asset with such an intensity that it is able to produce the gross operating surplus corresponding to the rate of rentals or
- its creditworthiness (cash-flow producing ability) is excellent independently from the operation of the asset, too.

The **increasing competition** typical for the years before the evolution of the financial crisis did not leave the supply side of the financial leasing branch untouched, either. Leasing companies served their clients with transactions developed less and less risk consciously (considering asset and client profitability) responding to market saturation. The **financing** structure has become **more risky** not only because of the switch towards foreign exchange based deals, but disregarding this, also based on its **relation towards the value development of the underlying asset**. The increase in the risk appetite compared to the asset value can become extremely unfavourable in case of constructions such as financial lease, where the leased object is the only collateral of the funder beyond the transaction and the habits of asset use influencing the value development of the leased object fall out of his own scope.

I will present the change in Hungarian financial lease practice between 1999 and 2008 based on the valuation approach of depreciation with the help of the hypotheses of the dissertation, approaching financial lease as asset based financing. I will also search for those transaction features, in case of the existence of which the capital maintenance of the lessor is more/less ensured independently from the client's creditworthiness, only tracing back to the more important parameters of the leasing construction – which are determined by the lessor and can also influence the use of the leased object by the lessee.

2.2 The database and hypotheses constituting the base for empirical examination

The **hypotheses examined** in the thesis are the following:

H1: The capital value function planned according to the calculation of leasing transactions[6] is in connection with the time series depreciation of the leased object determined by market prices.

H2: A date (period) can be identified, from which on a change can be observed in the capital value function of leasing transactions based on calculation.

H3: The change in capital value function takes place without a significant amendment in the function describing the time series depreciation of the leased object.

H4: The well and less well performing transactions can be separated from each other through the difference of factors influencing the capital value function.

H5: Such capital value function influencing factor combinations can be identified, which independently from the clients' ability to pay can effect the performance of transactions.

The empirical examinations are based on a **database** including the data related to the leasing transactions of a leasing company operating in Hungary, which includes only **financial lease transactions** on new vehicles **of active or closed status**. Due to the sensitivity of the pieces of information constituting a base for the analysis (business and bank secret) and the high number of funders I had no opportunity to involve the transaction stock of all leasing companies operating in Hungary in the examination of the hypotheses. However, based on the intensity of the competition developed in the 2000's it can be assumed that the financing practice of the leasing company providing the data represents the behaviour of the complete market, so the expectation of generalization of conclusions is not violated. Since depreciation is interpreted in the context of change in market value of assets relating to the hypotheses, in the analysis I need to concentrate on the leasing transactions of the assets with extensive market. Accordingly I chose **motor vehicles** among tangible assets and more specifically those leasing transactions, which are directed towards the financing of yield producing assets. From this point of view an asset is qualified as yield producing if it is not leased by a private person, thus its operation serves business objectives. The examination of

[6] This is equal to the the calculated principal function which describes the planned capital claim of the lessor during the maturity.

the stability of financing practice in time is an important aspect from the point of view of controlling hypotheses and reaching conclusions. For the sake of this the initial database contains information about the transactions of 10 years: it is built up by transactions, which were realized **in the period between 1999 and 2008**. I determined the end date of the period considering more aspects retrospectively. A significant fall could be observed in the number and volume of placings due to the financial crisis after 2008, which decreases the representativity of the data of the following years, and these transactions cannot be compared to the transactions of the previous period from the risk (fulfillment, repayment) point of view, either. On the other hand a high percentage of these transactions is of long maturity (extending to 5 years), which means that some of the data relevant from the point of view of the analysis are not yet available in case of the transactions following 2008.

The data used for testing the hypotheses can be arranged around five major sets of data:

- ASSET DATABASE → the relevant information on assets
- TRANSACTION DATABASE → the characteristics of financing constructions of assets
- CALCULATIONAL DATABASE → the planned repayment schedule of individual leasing transactions regarding the complete maturity
- DEPRECIATION DATABASE → depreciation percentages interpreted as average annual time series depreciation
- EXECUTIONAL DATABASE → the data relevant from the point of view of judgment on execution of transactions (clients).

Following the sample from an initial database containing a high number of elements (the data of 20,000 assets and transactions) in the **analysed database** I had altogether 1000 transactions for the period of 10 years between 1999 and 2008 to control the assumptions. The sample ratio reflected on the initial database is 1000/19421 (5,15%), regarding the sample database after data cleaning 1000/7725 pieces (12,94%).

3 The results of the dissertation

3.1 Methods of examination of the hypotheses and conclusions

The **first hypothesis** examines the existence of the relation between the capital value function planned according to the calculation of the transaction and the time series depreciation of the asset.

H1: The capital value function planned according to the calculation of leasing transactions is in connection with the time series depreciation of the leased object determined by market prices.

As the first step of testing the hypothesis I checked the presence of factors commonly interpreting the development of variables capital value function and depreciation process with the help of **factor analysis**. In the first step of the examination I did not differentiate between the individual capital value function-depreciation process pairs besides the initial year of transactions, I tested the transactions of 10 years together. According to the obtained results three principal components of eigenvalue above 1 exist, which together explain the total variance of the variables in 99.78%. From the three principal components 98.95% of the total explained variance can be connected to the first component. Thus the results show that there exists a common factor shaping capital value and depreciation processes the same way, but its explanatory power is completed by further factors. The presence of the latter can also refer to the fact that regarding the individual years differences can be discovered in the factors influencing the relation between the two value processes, so I repeated the factor analysis for the 10 years individually, too. According to the results of the factor analysis carried out annually one common factor explains the variance of the two variables to an extent of 98.45-99.40% in almost every year.

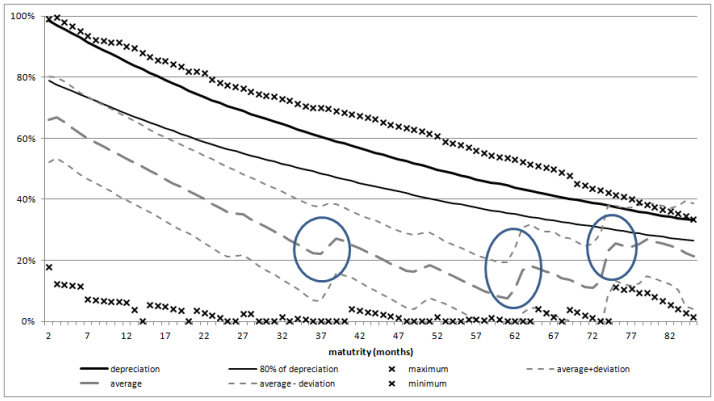

Figure 1. – The relationship between average depreciation and capital value function

However the factor analyis does only underpin the fact of the connection between the two value processes, it does not provide information about its quality. For its sake the further examination of the relation between the two value processes is reasonable with the help of **graphic display**. By separating the transactions of different maturity causing the breakpoints indicated in the figure, transactions of short and long term maturity can be differentiated from more points of view considering the relation between capital value function and depreciation. In case of transactions of longer maturity the average financing ratio (also named loan to value – abbreviated as LTV – which is equal to the ratio of capital value and asset value) is higher, but financing matches depreciation process more, which is reflected by the fact that in case of longer maturity the difference between depreciation process and average capital value ratio changes to a smaller extent during maturity. The average deviation of the capital value function of transactions of shorter maturity is higher than that of transactions of longer maturity, the full range of data measured by the difference between maximums and minimums in case of transactions of shorter maturity exceeds the ones observable in case of longer maturity in all comparable months, which from the lessor's side can refer to more homogenous financing practice in case of transactions of longer maturity. By continuing through the **examination of LTVs** it can be said that the funder builds in a buffer of at least 10-20% in its planned outstanding compared to the market value of the financed asset in an overwhelming part of the cases. However, the financing ratio is not constant during the maturity of the transactions, which is possible if capital value function is steeper than the depreciation process of motor vehicles.

According to the above described, **hypothesis H1 can be accepted**, and it has been justified that during the planning of its liability the lessor takes the time series depreciation of the leased motor vehicle based on market knowledge into consideration.

In the **second hypothesis** I examined to what extent the lessor follows a homogenous practice from the point of view of capital value function planning, can any changes of tendency be observed in the period between 1999 and 2008.

H2: A date (period) can be identified, from which on a change can be observed in the capital value function of leasing transactions based on calculation.

As the first step of the examination of the hypothesis I calculated **Pearson's correlation coefficient** for transactions between asset value process and depreciation process pairs for the period of examination for each year, separated for short and long maturity. Based on the

tendency of average values of minimums and maximums in time it can be concluded that correlation shows a slightly decreasing and takes increasing range according to the matching trendlines from 1999 towards 2008. Both the absolute and average values refer to a quite high correlation between the two variables, which means a further justification from the point of view of hypothesis H1. However the high correlation can be likely contributed to the fact that both functions are monotonously decreasing. Based on this I further examined the change in capital value function with the help of an alternative methodology. I obtained information about the tendencies of changes in factors determining capital value function in time (downpayment, residual value, maturity, steepness) with the help of graphic display in advance. After this with the help of **variance analysis** interpreted for 10 years as dependent variable I underpinned that the transactions of the period can be differentiated through three factors: downpayment, residual value, maturity. Based on the connected figures, by separating the 10 year period for two parts and running variance analysis for the periods 1999-2003 and 2004-2008, the 'F' values[7] of the two periods are much higher than interpreted separately for 10 years, which means that the transactions can be significantly differentiated – based on their maturities, downpayment and residual value – depending on whether they were initiated before January 2004 or afterwards.

As a result, **I accept hypothesis H2 and identify 2003/2004** as a turning point, based on which a significant change – increase – can be observed in the capital value function of leasing transactions.

In the **third hypothesis** I examine the change in capital value function between the two periods further taking the time series depreciation of motor vehicles – and its development in time – into consideration.

H3: The change in capital value function takes place without a significant amendment in the function describing the time series depreciation of the leased object.

For the examination of the hypothesis I set up an **alternative hypothesis**:

$H3_0$: The coefficient of capital value ratio and depreciation is constant through the complete maturity in the years between 1999 and 2008.

According to the counterhypothesis I assumed that even if the capital value ratio itself changes with time in the mentioned period, its change will follow the change in the function

[7] F indicates the ratio of difference squares between the groups and inside the group.

describing the depreciation process, which means that the LTV describing the relation between the two variables is constant. The observations based on hypotheses H1-H2 yet point towards the financing practice having changed, so as a result of the increase in the risk appetite of the lessor leasing as a financing structure started to lose its closed feature more and more. Connected to the counterhypothesis related to the identity of LTVs – depending on the fulfilment of the assumption related to the equality of deviations – I tested with **two-sample T-test or Welch-test**[8] for short and long maturity separately if the monthly average of groups based on the successive years is equal or how significant their difference is.

The difference proves to be significant in case of all comparisons for almost every month (>0,1), so the probability of the difference being merely chance is less than 90%, thus I reject the counterhypothesis related to the equality of financing shares, at the same time I **accept hypothesis H3**.

With the **fourth hypothesis** my objective is to underpin empirically that the parameters to be influenced by the lessor considered during the establishment of the financing construction are connected to the transaction's repayment risk.

H4: The well and less well performing transactions can be separated from each other through the difference of factors influencing the capital value function.

I characterised the repayment risk of transactions based on two indices: the average number of payment notices and the ratio of the maximum delay during maturity to the initial accounting investment of the lessor (asset value decreased by downpayment). I involved only those transactions in the statistical examinations – in order to filter the effect of financial crisis – in case of which at least 75% of the maturity was over until the end of 2009. I managed to gather the 820 transactions determined this way into three clusters with the Ward-type process of **hierarchical cluster analysis:**

Variable/ Cluster	Maturity	Residual value	Downpayment	Number of payment notices/month	Ratio of greatest delays
1	Shorter	significantly lower	Average	Average	average
2	Significantly shorter	significantly higher	Lower	Higher	significantly higher
3	Significantly higher	significantly lower	Average	Average	lower

2. Table – The relation of cluster averages to the main average of variables

[8] Assuming equal deviations (the significance value of Levene test being >0,1), t-test can be considered as relevant statistics, otherwise the Welch-test.

According to the obtained results the highest repayment risk belongs to the low downpayment-high residual value-short maturity transaction parameters. Since the clusters differ to a very small extent according to downpayment, using the more finetuned classification based on the three factors (see Table 3.) I continued the analysis pointing towards the more precise statements with **variance analysis**.

Factor	Direction of change in factor compared to the total sample average							
Downpayment	lower (L) 0				higher (H) 1			
Maturity	L 0		H 1		L 0		H 1	
Residual value	L 0	H 1	L 0	H 1	L 0	H 1	L 0	H 1
Group (-code)	000	001	010	011	100	101	110	111

3. Table – The size of transaction parameters compared to the total sample average

Variance analysis showed the transactions of more and less favourable repayment characteristics can be clearly distinguished by both the fact of problematicness (number of notices) and its extent (relative amount of delay). The transactions marked by dash arrow in Table 3. proved to be worse, while the ones marked by plain arrow better:

- shorter maturity and higher residual value determine worse performance
- longer maturity, lower residual value determine better performance.

Based on this it has been justified that the financing strategy of the lessor related to the combination of downpayment, residual value, maturity has a consequence for the performance of transactions, so **I accept hypothesis H4**.

The conclusions of hypothesis 4 can be traced back to asset risk – connected to depreciation – only if the above statements are true independently from the client's ability to pay. In hypotheses H5 I continued the empirical examinations completed by this point of view.

H5: Such capital value function influencing factor combinations can be identified, which independently from the clients' ability to pay can effect the performance of transactions.

Based on the results of the connected cluster analysis and **variance analysis,** according to the quantitative client rating reflecting the clients' ability to pay no significant differentiation can be made between transactions of worse performance belonging to groups '001' and '010' and those of better performance belonging to groups '101' and '110', so I consider **hypothesis 5** as **justified**.

3.2 Conclusions and the potential uses of the results, further possible research directions

The empirical examinations justified that besides the existence of the connection between capital value and depreciation process, during the development of the financing strategy the lessor only concentrates on keeping its **current capital liability** continuously **below the market value of the asset** during maturity. The reason for this is that compared to the future 'estimated' service value reflecting in the development of market prices the remaining service values of the asset operated by the lessee can differ depending on the habits of asset use. However the lessor cannot control the exhaustion and decay (together deterioration) influencing the value of the asset since the deterioration of the vehicle is determined by the lessee's business practice. Thus he includes the factors influencing the time series depreciation of the asset (deterioration, obsolescence and revaluation) and the related uncertainty in the planning of its financing by trying to get a certain percentage of the future service value produced by the asset advanced by the lessee in the form of downpayment. A deviation can be experienced between the capital calculation of leasing transactions and market depreciation regarding formality, too: capital process can be described by a concave, while depreciation by a convex function. Based on this the capital value function planned according to the calculation of the lessor is not suitable for the planning of depreciation at the lessee, except for the case when the lessee uses the asset with such an intensity that it produces the yield corresponding to capital value function during maturity (the shape of the curves can still be a question in this case, too), so compared to the normal market depreciation it depreciates the asset to a higher extent and the – assumed – theorethical depreciation of the asset is faster.

The control of asset use – and at the same time yield producing ability – by the lessor is enabled by the determination of three important transaction parameters: downpayment, residual value and maturity. The **financing practice of the leasing market** was **transformed in the middle of the 2000's** based on these parameters due to increasing competition intensity, outplacements shifted towards transactions with a combination of lower downpayment, higher residual value and slightly growing maturity. This adaptation took place **independently from the change in factors** actually **shaping** the **asset value** beyond, as a consequence of which LTVs increased for the complete maturity. The decrease in downpayment and the increase in residual value in case of constant maturity – interpeting

leasing as asset based financing – implies that the lessee will have the chance to produce a yield above the leasing payment for the period by using the leased object earlier and for longer termi n the frame of maturity (in Figure 2. t_p and t_m will be pushed forward and $t_m/(t_e-t_p)$ increase). However after the realization of the yield surplus originating from the more intensive asset use his willingness to pay will be lower independently from his ability to pay, so it is realistic that the lessor will face higher asset risk. If compared to the initial situation shown by Figure 2. only the residual value increases caeteris paribus, then t_p will be pushed later in time, and theoretical depreciation will get so close to capital value function, that it will be not worth for the lessee to operate the asset after point t_p further.

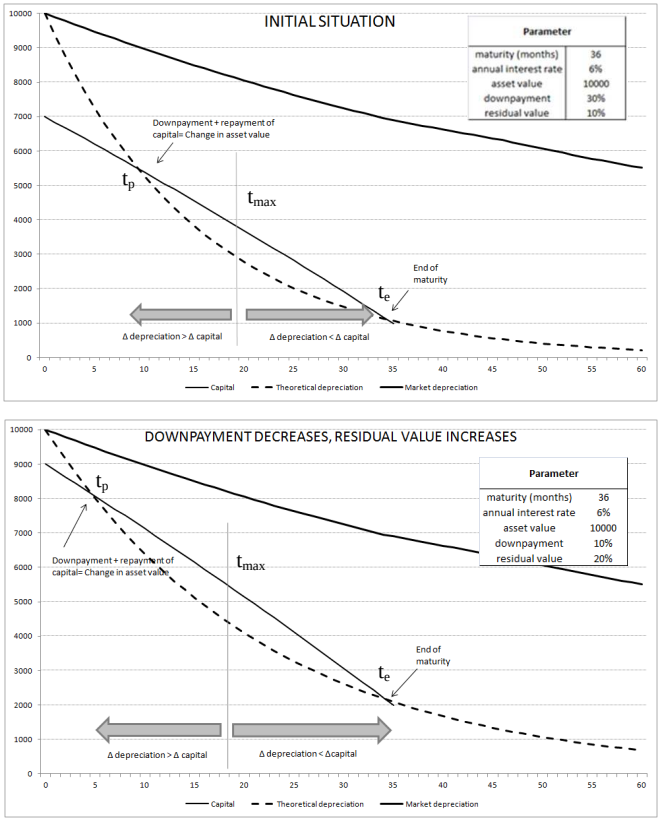

Figure 2. – The relation between capital value function and theoretical depreciation

The empirical examinations of the dissertation pointed out that constructions of **lower maturity and higher residual value** prove to be **riskier** independently from downpayment, while the longer maturity, lower residual value combination predicts better repayment, without taking the clients' performance ability into consideration. Thus the financing with higher residual value and lower downpayment realized after 2003 would have been dangerous for the capital maintenance of lessors even if this tendency had been accompanied by a switch towards the financing of transactions of better ability to pay. However since due to the 'asset based' feature of financial lease leasing companies performed the clients' ability to pay

primarily in order to fulfill legal provisions, without paying much attention to its content, the effects of their asset risks could not be/cannot be mitigated by a client portfolio of better quality.

It can be concluded that although the profitability of an asset can be usually interpreted in a corporate context, in case of financial lease **the features of asset use and profitability independent of companies can** also **be discovered,** so financial lessors can actively influence the quality of their transactions by the more important parameters of their constructions. In this context the relation between **theoretical depreciation** and **capital value function** prove to be **decisive factor**: where and what distance the difference between the two functions imply in relation to maturity.

All in all, taking the long term sustainability of their operation into consideration during the establishment of their credit policies, the lessors will act the right way if

i) during the foundation of their calculation they follow the development of factors influencing asset value (initial depreciation, useful lifespan, residual value) on the market or

ii) should they differ from it, they do it knowing that this way they control the asset use habit of the lessor to a certain extent and they run an asset risk that cannot be directly controlled by themselves.

So from the point of view of the transaction's **return and quality of execution, and credit risk** the LTV through which the lessor exposes his transactions is not individually **decisive**, but also **the amount of theoretical depreciation the lessor 'forces out' of the lessee and how he divides the yield embodied in depreciation between the contracting parties through the transactional parameters.**

Many further dimensions of the topic chosen for the subject of my dissertation **could constitute the base for further examinations**. These can include e.g. the examination of the relation between the interest income realized by the lessor and asset profitability, the development of repossession risk – covering the value of the asset repossessed as collateral compared to the existing debit of the lessor –, and the analysis of the function of foreign currency-based financing in leasing (and within the framework of asset based financing construction). However, a switch towards the previous research directions is limited in space because of the financial crisis that occurred in 2008. A key supplement to the analysis can be the expansion of the examinations towards the practice of further lessors, but also approaching from the lessee's side the research of differences between the habits for use or depreciation of assets possessed within the frames of financial lease and those of own possession.

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