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МОДЕЛИРОВАНИЕ ПРОГНОЗА ОЦЕНКИ ОСТАТОЧНОЙ СТОИМОСТИ В ДОГОВОРЕ ЛИЗИНГА

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Аннотация

Лизинг как способ финансирования набирает все большую популярность в какой-то мере заменяет классический банковский кредит в отношении финансирования оборудования. В течение последних десятилетий были сданы и продолжают сдаваться в аренду различные виды активов. Стоит отметить, что в настоящее время предлагается огромный ассортимент лизинговых продуктов, представленный различными независимыми лизинговыми компаниями, а также растет число банков, осуществляющих такие операции. Однако продвижение лизинга требует необходимость создания сектора управления рисками для компаний, предлагающих различные лизинговые продукты. В данной статье мы стремимся оценить жизненно важный параметр, который нельзя игнорировать в случае аренды оборудования: остаточная стоимость объекта лизинга. Мы рассматриваем и оцениваем некоторые модели оценки остаточной стоимости активов.

Ключевые слова: лизинг, стоимость остатка / лома, оборудование

A REVIEW OF THE FORECAST MODELS FOR RESIDUAL AND OR SCRAP VALUES ASSESSMENT IN A LEASE ARRANGEMENT

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Abstract

Leasing as a mode of financing is gaining popularity as a major mode of financial product and thus replacing the classical bank credit in some way with regards to Equipment financing. A variety of assets has been leased over the last decades and continue to be leased out, it is worthy to know that a huge range of leasing products offered by various independent leasing companies as well as an growing number of banks are also undertaking same. This advancement in the concept of leasing, however, calls for the need for establishing a risk management sector for these institutions offering various leasing products. We by this paper seek to assess a vital parameter which cannot be overlooked in the case of leasing an equipment; i.e, Residual and or Scrap or salvage value of a lease asset. Several models have been reviewed and assessed herein

Keywords: Leasing, Residual/Scrap value, Equipment

Introduction

Assessing the value of a lease arrangement as well as assessing the associated risk structure happens to be an evaluation of the scrap and or residual value of a leased asset and thus a very critical task to undertake in realizing these objectives. It is noteworthy that there are numerous considerations that influence the financing position of used equipment and consequently their residual and or scrap values. It is in view of that that we seek to come up with a model which could predict the residual and or scrap values accurately and thus incorporating all the variables that influence it.

This however goes without predicting the impossibility of constructing such a model that would forecasts the exact residual and or scrap values since the cost of a lease asset i.e. an equipment may be value shaped by way of the complexity of the structure of the markets within the economy. Nonetheless, there is the possibility of constructing a model that would provide an estimation of the residual and or scrap value and further assign an error period with regards to this estimated value. The error will however indicate how well the model will perform by way of predicting the residual and or scrap values. This model if its performance is acceptable could be employed as an estimation for the definite residual and or scrap value and there will be the expectation of it valuing precisely the agreement.

Methodology

[1] developed a theoretical model to predict the value of used equipment and their residual values using the demand and supply functions [1]. It is worthy to note that both functions are dependent on a consumers' income level as well as the cost of an equipment in respect of the year of the equipment. His assumption was that the supply functions of used equipment were perfectly inelastic depending on income and price levels of the equipment, the demand function on the other hand was solely pertinent for the price derivations; and as such the approach concentrated on the assessment of the demand functions. All other things being equal the addition of several assumptions resulted that the demand for an equipment of i years is not affected by the cost of all other equipment in respect of

the age but solely from the costs of similar equipment aging i-1 and i + 1 years. Furthermore, a consumers' budget for the purchase of an equipment of say ***i*** years is dependent on the income position as well as his preference of a particular equipment.

Subsequently, in considering a consumer with specific income and preference, the consumer may have what it takes for an equipment of say i years only and only if the price range is within a specific range. This range will however have a lower boundary with the maximum cost of the equipment which is i -1 as the consumers' budget which he could afford. On the other hand, the upper boundary may also be defined, and could be described as the maximum cost of an equipment which is *i* years budgeted for by the consumer. In a situation where the actual cost is below the lower boundary of the range, the consumer will then be able to afford the *i-1* year old equipment. If the table turns and the actual cost is above the budget of the consumer i.e. if the upper limit, the consumer is willing to acquire an equipment i + 1 year old.

Consequently, the demand for an equipment which is i year old could be derived by consolidating all the demand functions of each and every consumer. Afterwards, the consolidated demand functions could further be expressed by way of the income and preference distributions which are presumed to be independent of the income. Our consolidated demand function Di for an equipment of i years could then be expressed as;

$$\boldsymbol{D_i = \int_0^{\infty} F(W,w)dw \int_{\frac{1}{w}G_i(P_i)}^{\frac{1}{w}G_{i-1}(P_{i-1})} f(u)du,}$$

In this case our frequency function is $\boldsymbol{F(W,w)}$, the income level w is thus determined by the national income W, the frequency function f(u) of the variables u however indicates tastes or preferences. $\frac{\mathbf{1}}{\boldsymbol{w}}\boldsymbol{G_i}(\boldsymbol{P_i})$ and $\frac{\mathbf{1}}{\boldsymbol{w}}\boldsymbol{G_{i-1}}(\boldsymbol{P_{i-1}})$ however assigns the boundaries of the range and or intervals for the preference and or tastes of consumers this is however determined the purchasing decision for an equipment of i years and its also dependent on the actual price of the equipment also of i years and $i-1$ through the function represented by $\boldsymbol{G_i}$ and $\boldsymbol{G_{i-1}}$ as well as the income. Another variable Pi thus determines the actual cost of an equipment which is i years. The last integral class is that of the specific demand function in relation to the level of income as well as the ratio of the integration to the yield w, the consolidation of all specific demand functions. In deriving the frequency function f(u), we employ the cross-sectional analysis for our assessment. This notwithstanding, the presumption could be simplified further to replace the frequency function $\boldsymbol{F(W, w)}$ this is done by way of the distribution of income within a particular year. This approach as well as that of the estimating of the frequency functions of consumers' preferences and or tastes are however employed in determining $\boldsymbol{G_i}(\boldsymbol{P_i})$**.** Nonetheless, having realized the demand for an i year old equipment it is however possible to assess the cost of that i year old equipment.

It is indeed a fact that the option theory could be employed, which is from however from the theoretical perspective of finance and thus evaluates the scrap and or residual value. This model is however not entirely fashioned for equipment leasing but for all kinds of leasing in general; in a situation where it is appropriate to a diversity of assets under leasing. An illustration from the works of [2] thus describes the residual and or scrap value as ST for a leased asset to with price X we then deduce

$$\boldsymbol{S_T} = \boldsymbol{max}\,(\mathbf{0}, \boldsymbol{S_T} - \boldsymbol{X}) + \boldsymbol{X} - \boldsymbol{max}\,(\mathbf{0}, \boldsymbol{X} - \boldsymbol{S_T}).$$

Now we obtain the PV i.e. the present value of the residual value by generating the PV of the specific term on the right part of our equation; having done that we can then express the PV of the residual and or scrap value as the sum of the present value of the residual value can be expressed as the sum of the worth or value of a given call option with X as the exercise price whereas the PV of the exercise price less the value of a put option with X as its exercise price. We can however not employ either the option pricing model of [3] in this perspective this is because the assumptions are quite restrictive with regards to the market for lease equipment and or assets. Most researchers went about this problem by employing the option pricing model thus with the stochastic dividend yield of [4]; this notwithstanding, the works of [2] suggest that putting this model in a more practical way is yet to be proven. It is also worthy to note that [5] describes a model which does not necessarily require a larger datasheet and in actual fact no data at all; the model however takes into account the possibility of uncertainties, thus it does not only forecast residual and or scrap values but also gives opinion as to the probability of there being a deviation from the values it predicts; and because of that the model is segmented with four components that stimulates the devaluation of a lease asset. It’s quite fundamental to know that the components are not limited to;

- Useful life of the lease asset,
- Economic obsolescence (i.e., new regulatory standards, compliances etc),
- Technical obsolescence (i.e. modified and more efficient technological modules) and
- the correlation that exist between the various components.

The useful life of the asset takes into account the period of depreciation of an asset from the time it is worth and or has a value of 100% to a devaluation in value of zero percent. The value of an assets useful life usually ranges between some factors subject to the assets level of usage and or quality of the asset and as such requires estimation. In the case where some data points have already been established, we can then get empirical distribution of information about values of the useful life of an asset as well as the probabilities of the values of the assets. We then predefine a depreciation pattern which will only include the age of the asset as well as the value of the assets useful life. Most researchers however employed the linear depreciation pattern with regards to age in their clarifications however they also provide other alternatives.

With regards to economic obsolescence, it is however modelled as a time series of a single factor for the entire useful life of the leased asset taking into account all changes in view of the depreciation pattern by way to economic conditions.

The technological obsolescence in its modelling is quite analogous. In the event, we are to use an existing dataset, it is better to employ an autoregressive time series model in both considerations.

In the case of a correlation between the three components an assessment is done so as to specify the way and degree of the impact. Going by the notion of a linear depreciation pattern we could express the model as;

$$\boldsymbol{V_t = V_0\,(1 - \frac{t}{n}) \prod_{i=1}^{t} (1 + k_i)(1 + \tau_i)},$$

In this case $\boldsymbol{V_t}$ represents the value of the asset as a percentage on the basis of the new price, time t, as well as the random variable for the useful life of an asset n whereas t and t are the economic and technological impact factor for a time period t. we can however employ this model in simulating the residual and or scrap values as well as estimating the probability distribution function for values.

The works of [6] describes a model which is system theoretically based, however details of the model are not readily available since its practicality is for sole purposes; this is however a way to make known other available approaches employed in evaluating the issues of forecast of residual and or scrap values.

Researchers [7] in their work developed an econometric module in predicting the price of equipment i.e. price of automobiles in the case of two-year old automobiles. Results from their work suggested the case of multicollinearity, i.e. a module which uses explanatory variables that is highly correlated, is likely to cause serious problems for its use in econometric models in envisaging the prices of vehicles. They concluded by stating that having included o many independent variables by way of the number of observations could be the reason of a multicollinearity. The partial least squares regression is also an econometric model which could be used in accounting for the cause of multicollinearity. The rationale behind the model is however to obtain the pertinent data of the explanatory variables in observing the dependent variables [7]. According to them, the relevant variables were identified in the order of their level of covariance in observing the dependent variable of the price a vehicle which was two-years-old; and the value was supposed to show the strength in view of the relationship that existed between the variables.

These researchers however contended that the estimation of the variance and correlation were better indicators for the identifying the significant variables. The variance of the essential variables measured by the impact of certain factors while the correlation with the price of used vehicles computes the consequence of this specific effect [7]. This notwithstanding, [7] however developed a modified partial least squares regression which however identified significant variables based on the criteria of variance as well as correlation. This approach could be compared to the partial least squares regression as well as three other methodologies which seeks to resolve the issue with regards to multicollinearity.

[8] as a way to deduce a model to review gains and loses more especially in the auto leasing industry, a regression equation which forecasts the residual and or scrap values of used vehicles in terms of percentages regarding the manufactures price at retail shops by vendors; however, due to the fact that the deviation of residual values were indispensable in its deduction the superordinate risk model as well as the regression model were presented without an estimations of its performance; the model however specified the average depreciation curves in respect of market segmentation in America with monthly data between the period of 1994 to 1997.

The depreciation model employed in estimation by way of the regression analysis to the form as expressed below

$$\log\left(\frac{current\ market\ value}{MSRP}\right) = \beta_0 + \beta_1(model\ age) + \beta_2(model\ age\ )^2 + \sum md_i$$

i.e. $\boldsymbol{md_i}$, $\boldsymbol{i = 1, \ldots, 11}$ are the monthly dummy variables which indicates monthly seasonal effects whereas the MSRP is the retail price as suggested by the manufacturer of an equipment.

Another approach in estimating prices of used equipment as against the computational methodology as proposed by the works of [9]is the application of two ways in assessing the issue i.e.

- The artificial neural network with back- propagation
- An adaptive neuro-fuzzy inference system.

The artificial neural network, as its name implies uses an artificial neural network which thus adjusts the parameters backwards by associating the estimated price of the used equipment with the actual price of the used equipment. The adaptive neuro-fuzzy interference system thus divides the input variables into different sets by way of the fuzzy logic or, basically into some form of an “if-then” guidelines. The artificial neural network however assesses the parameters of the predefined purposes for each of the sets; and finally, it assesses the sole output function deduced by way of the weighting of the predefined purposes.

Conclusion

It is worthy to take a critical look at the background of residual and or scrap or salvage value risk, which is quite important to both a lessee as well as the lessor. It is quite essential to consider of options to the approaches employed in the research. This stems from the fact that most consumers consider several factors not limited to tastes and or preferences in deciding the lease arrangement to consider, however these may vary strongly over time and as such there is need for both the lessee and lessor to be mindful of residual risk as well as other forms of risk. Consequently, the problem begins with whether or not residual values may be ascertained by market forces thus describing the market situation of an equipment rather than consumers' tastes and or preferences. We however replaced consumer’s valuation of features of an equipment to be leased by factors that determines a market situation of equipment leases. The variables employed were quite measurable and, furthermore, relatively accessible in comparison to consumers' preferences. notwithstanding, it is expedient to evaluate residual values not just in terms of ageing in terms of the lease asset but also a series of established age over a time period. Generally, lease agreements have a lease term to mature. However, it is worthy to ask how residual values of equipment change over time and how its impacts relate during several periods of time.

References

1. Farrell, M. J. (1954). The demand for motor-cars in the United States. Journal of the Royal Statistical Society, 117(2):171{201.

2. Lee, W. Y., Martin, J. D., and Senchack, A. J. (1982). The case for using options to evaluate salvage values in financial leases. Financial Management, 11(3):33{41.

3. Black, F. and Scholes, M. (1973). The pricing of options and corporate liabilities. The Journal of Political Economy, 81(3):637{654.

4. Geske, R. (1977). The valuation of corporate liabilities as compound options. Journal of Financial and Quantitative Analysis, 12(4):541{552.

5. Rode, D. C., Fischbeck, P. S., and Dean, S. R. (2002). Residual risk and the valuation of leases under uncertainty and limited information. Journal of Structured Finance, 7(4):37{49.

6. Jost, A. and Franke, A. (2005). Residual Value Analysis. Working paper presented at the 23rd International Conference of the System Dynamics Society in Boston 2005. Available at http://www.systemdynamics.org/conferences/2005/proceed/papers/ JOST158.pdf. 02.09.2011.

7. Cheng, B. and Wu, X. (2006). An modied PLSR method in prediction. Journal of Data Science, 4(3):257{274.

8. Smith, L. D. and Jin, B. (2007). Modeling exposure to losses on automobile leases. Review of Quantitative Finance and Accounting, 29(3):241{266.

9. Wu, J.-D., Hsu, C.-C., and Chen, H.-C. (2009). An expert system of price forecasting for used cars using adaptive neuro-fuzzy inference. Expert Systems with Applications, 36(4):7809{7817.