Comparative analysis of methods of computing building depreciation

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Abstract

Decisions for investment, buying and selling of asset depend upon its market value. Issues arise in arriving at the actual value of the asset as well as computing the rate of returns from it. The value of assets and in turn property gradually reduces on the account of its use and with age. This reduction in the value is essential to be computed to arrive at exact estimate of current worth of the asset. Numbers of methods to compute depreciation are available. It is required to make appropriate choice of method and arrive at optimum cost of depreciation and value in turn. This can be achieved by comparing the available methods. The present study attempts to analyze applicability of available methods and compares their advantages and disadvantages.

Keywords: Asset, valuation, building depreciation, book value

1. Introduction

An asset's market value is its current worth in an open market with due consideration to its age, condition and quality. As age progresses, asset's condition and quality is hampered irrespective of its use. It is common experience that physical objects are subject to wear and tear and deterioration. The value of assets thus gradually reduces which is known as depreciation. Housing, one of the basic needs of human, accounts to high percentages of national transactions per year [1]. The real estate sector has grown to such a monetary size that even minute variations have significant effect on the country's economic development [2]. Land and property are main components of real estate whose value varies due to demand and supply conditions [3]. Hence, for a developing real estate market, a common issue that normally emerges is the measurement of property values for investment purposes [4]. Value is accurately arrived at when computation of depreciation is accurate. Various methods of depreciation calculation are used for purposes such as buying, selling, lending, discarding, tax payment, insurance etc of property. This study aims at comparing depreciation methods applicable to building depreciation computing and discussing their relative merits and demerits.

1.1. Asset Depreciation

Depreciation may be defined as the permanent continuous diminution in the quality, quantity or value of an asset. The definition given by Institution of chartered accountants of India forming a part of their accounting standard states that depreciation is a measure of the wearing out, consumption or other loss of value of a depreciable asset arising from use, effluxion of time or obsolescence through technology and market changes [5]. Hotelling [6] defined depreciation as the decrease in value of a particular machine, where value is defined as the annual rental value plus a scrap value. Depreciation is an income tax deduction that allows a taxpayer to recover the cost of certain property. It begins when a taxpayer places property in service for use in a trade or business or for the production of income. The property ceases to be depreciable when the taxpayer has fully recovered the property's cost or other basis or when the taxpayer retires it from service, whichever happens first [7].

1.2 Causes of depreciation

Baum [8], Barreca [9] and Mansfield [10] attribute the causes of depreciation to physical deterioration, functional obsolescence or aesthetic obsolescence and economic obsolescence. Physical depreciation occurs due to usage of the asset, manner of usage, structural defects, environmental, natural

force and accidental aspects. Economic obsolescence occurs as a result of decrease in desirability or value resulting from economic forces off the property. Functional obsolescence occurs if assets have become outdated mainly due to their planning and designing being unsuitable for present day requirements. Modern technologies make old buildings obsolete due to introduction of new methods, materials, procedures.

The proper estimation of depreciation for valuation purposes is of crucial importance for arriving at correct estimate of value. It has the potential to reduce the variation that usually exists between values declared by valuers on the same property [11]. The choice of the depreciation method can impact revenues on the income statement and assets on the balance sheet. Limited numbers of studies have been made to determine the best method in terms of accurately calculating book values and measuring true depreciation [12]. Studying such methods and their relative advantages and disadvantages would guide the stakeholders to choose appropriate method for their respective application.

2. Methods of depreciation

Most types of tangible property, such as buildings, machinery, vehicles, furniture, and equipment except land are depreciable. This study is limited to depreciation methods implemented to buildings. Assessment of depreciation is based on historical cost, expected useful life and estimated residual value of the depreciable property. Determination of useful life of the property is a matter of estimation and is normally based on various factors including experience with similar types of properties. Residual value can be determined on the basis of residual value of similar properties having reached the end of their useful lives and operated under similar conditions.

2.1 Building depreciation

Fixed assets differ from each other in their nature so widely that the same depreciation methods cannot be applied to each. Calculating building depreciation can be compared with each other by computing depreciation of same property using different methods. The estimation of depreciation for valuation purposes has been a subject for a number of empirical studies. There is however no consensus within the valuation profession as to which approach to estimating accrued depreciation addresses the key elements that are of concern to the valuer viz; age, level of condition and functional obsolescence [11]. A variety of depreciation methods can be used to allocate the depreciable amount of an asset on a systematic basis over its useful life. The entity selects the method that most closely reflects the expected pattern of consumption of the future economic benefits embodied in the asset [13].

It is assumed that a property without land is purchased for 20 Million on 1st January 2013. The scrap value is estimated at 10% of the cost at the end of 75 years of useful life of the asset. Considering 4% rate of interest to calculate sinking fund, the depreciation cost would be computed as given below.

Given data:
i = 4%,
n = 75 years,
Cost (C) = INR 20,00,000
Scrap value (S) = INR 2,00,000

2.1.1. Straight line method

In this method, the cost of the asset less scrap value, if any, at the end of its expected life is divided by the number of years of its expected life and each year a fixed amount is charged in accounts as depreciation.

$$\text{Annual Depreciation} = \frac{[(Cost\ of\ property\ -scrap\ value\ )]}{Estimated\ \ life\ of\ property}$$

$$= \frac{(C-S)}{n}$$

$$= \frac{(20{,}00{,}000-2{,}00{,}000)}{75}$$

= INR 24,000

Effect of straight-line method is a stable and uniform reduction in revenues and asset values in each year of the asset's useful life since same depreciation expense is charged every accounting period throughout an asset's useful life.

2.1.2. Sinking fund method

This method is also known as increasing charge method. Under this method, a fund known as depreciation fund or sinking fund is created which is so calculated that the annual sum credited and accumulating throughout the life of the asset may be equal to the amount which would be required to replace the old asset.

To compute the sinking fund, sinking fund installment (Si) is computed as shown below. It is computed using appropriate rate of interest. Sinking fund installment and amount of sinking fund as depreciation amount at the end of first year of useful life of property is given below:

$$Si = (C\text{-}S)x \frac{i}{[(1+i)^n] - 1}$$
$$= (20,00,000 - 2,00,000)\ x\ \frac{0.04}{[(1+0.04)^75] - 1}$$
$$= \text{INR } 4011.14$$

Accumulated sinking fund at the end of second year can be calculated as follows,

$$Sf = Si\ x\ \frac{[(1+i)^m] - 1}{i}$$
$$= 4011.14\ x\ \frac{[(1+0.04)^2] - 1}{0.04}$$
$$= \text{INR } 8182.73$$

Si= Sinking fund installment
Sf= Sinking fund to be set aside as depreciation
m= Year at which depreciation is computed

Amount of sinking fund increases as property maintenance grows at the later stages of life. It imposes a smaller portion of the total depreciable amount at each interval of time. Starting with a very small amount of depreciation, it goes on increasing at a smaller pace. Sinking fund method is generally implemented for income producing properties like real estate.

2.1.3 Sum of year's digit method

Sum of the Years' Digits (SYD) method is an accelerated method of depreciation. The straight-line method leaves a company exposed to a much greater probability of an unexpected asset impairment loss. Especially with assets that may lose value quickly, may be difficult to estimate fair values, or may suddenly become obsolete, the accelerated methods provide a more predictable cost allocation across useful lives [14].

The SYD is found by estimating an asset's useful life in years. For n years SYD= 1+2+3+4……..+n. Amount of depreciation at the end of second year of useful life would be as follows,

$$Depreciation = (C - S) \times (Remaining\ estimated\ life/SYD)$$
$$= (20,00,000 - 2,00,000) \times (74/2850)$$
$$= \text{INR } 46,736.8$$

Sum-of-years digits is a depreciation method that results in a more accelerated depreciation of the asset thus reducing revenues and properties more rapidly, thus is generally implemented for machinery depreciation as opposed to building depreciation.

2.1.4. Declining balance method

It is an accelerated method of depreciation which offers benefits that make up for the lack of a constant expense over time. The declining-balance method is an example of one of the methods that meet the requirements of being systematic and rational. If the expected productivity or revenue-earning power of the asset is relatively greater during the earlier years of its life, or maintenance charges tend to increase during later years, the declining-balance method may provide the most satisfactory allocation of cost (Noland T.R. 2010). In this method, the asset is depreciated at fixed percentage through the life of the building. But the capital sum or base goes on reducing every year by an amount equal to the depreciation of previous year. The rate of depreciation either may be assumed or can be computed. Depreciation at the end of first year would be as follows.

Declining Balance Rate = (100/ Life of the property) or can be assumed (Approximately 1.5%)

Depreciation for 1st year
= Book Value x Declining Balance Rate
= 20,00,000 x 1.5/100
= INR 30,000

Depreciation for 2nd year
= (20,00,000-30,000) x 1.5/100
= INR 29,550

Total depreciation till date is taken into account to compute the book value of latest year under consideration. Since book value goes on reducing with age, the depreciation amount also goes on reducing.

2.1.5. Double Declining balance method

Double-declining balance is a type of accelerated depreciation method and records higher amounts of depreciation during the early years of property's life and lower amounts during later years. Depreciation expense for a year is determined by taking the asset's cost less its accumulated depreciation and multiplying this amount by the rate of depreciation. With this method the rate of depreciation is doubled than that given by declining balance method. Rate of depreciation assumed is 3%.

$$\text{Double Declining Balance Rate} = 2\left(\frac{100}{\text{Life of property}}\right)$$
Depreciation for 1st year
$$= \text{Book value} * \text{Double declining balance rate}$$
$$= 20,00,000 * \frac{3}{100}$$
$$= \text{INR } 60,000$$

Depreciation for 2nd year
$= (20{,}00{,}000 - 60{,}000) * \frac{3}{100}$
= INR 58,200

This method also considers the book value of the property and applies depreciation rate to the same thus giving descending values of depreciation. Since this method depreciates the property at a faster pace in the early years, the initial depreciation is high.

3. Observations

Table 1 gives the depreciation amount per year calculated using methods mentioned above for particular years of the entire life of the building. Table 2 gives the accumulated depreciation i.e. cumulative sum of the depreciation amount per year.

Table 1: Variation in depreciation amount for Building depreciation

	Depreciation amount by				
End of Year	Straight line method	Sinking fund method	Sum of years digit method	Declining balance method	Double declining balance method
5	24000	4011	44,842	28,240	53,118
15	24000	4011	38,526	24,279	39,170
25	24000	4011	32,211	20,873	28,885
35	24000	4011	25,895	17,945	21,301
45	24000	4011	19,579	15,428	15,708
55	24000	4011	13,263	13,264	11,583
65	24000	4011	6,947	11,404	8,542
75	24000	4011	632	9,804	6,299

Table 2: Variation in accumulated depreciation amount

	Accumulated depreciation amount by				
End of Year	Straight line method	Sinking fund method	Sum of years digit method	Declining balance method	Double declining balance method
5	120000	22,476	2,30,526	1,45,567	2,82,532
15	360000	83,178	6,44,210	4,05,687	7,33,498
25	600000	1,73,153	9,94,737	6,29,321	10,66,051
35	840000	3,06,457	12,82,105	8,21,586	13,11,283
45	1080000	5,03,900	15,06,316	9,86,881	14,92,124
55	1320000	7,96,284	16,67,368	11,28,991	16,25,480
65	1560000	12,29,204	17,65,263	12,51,167	17,23,820
75	1800000	18,70,152	18,00,000	13,56,205	17,96,338

Table 3 gives the book value i.e. cost less depreciation of the building at the end of the given years. Table 4 shows the depreciation amount by each method for given years as a percentage of total cost of the property.

Table 3: Variation in book value

	Book value by				
End of Year	Straight line method	Sinking fund method	Sum of years digit method	Declining balance method	Double declining balance method
5	18,80,000	19,77,524	17,69,474	18,54,433	17,17,468
15	16,40,000	19,16,822	13,55,790	15,94,313	12,66,502
25	14,00,000	18,26,847	10,05,263	13,70,679	9,33,949
35	11,60,000	16,93,543	7,17,895	11,78,414	6,88,717
45	9,20,000	14,96,100	4,93,684	10,13,119	5,07,876
55	6,80,000	12,03,716	3,32,632	8,71,009	3,74,520
65	4,40,000	7,70,796	2,34,737	7,48,833	2,76,180
75	2,00,000	1,29,848	2,00,000	6,43,795	2,03,662

Table 4: Depreciation as a percentage of total cost of property

End of Year	Straight line method	Sinking fund method	Sum of years digit method	Declining balance method	Double declining balance method
5	1.2	0.20	2.24	1.41	2.66
15	1.2	0.20	1.93	1.21	1.96
25	1.2	0.20	1.61	1.04	1.44
35	1.2	0.20	1.29	0.90	1.07
45	1.2	0.20	0.98	0.77	0.79
55	1.2	0.20	0.66	0.66	0.58
65	1.2	0.20	0.35	0.57	0.43
75	1.2	0.20	0.03	0.49	0.31

4. Comparison of results

Comparison of the yearly depreciation installment (Figure 1) shows that, depreciation by straight line method and sinking fund method is shown by a horizontal line which represents equal distribution of depreciation. Sinking fund method has the lowest depreciation cost per year as compared to straight line depreciation cost (Table 1). Less depreciation amount is possible since the accumulated depreciation cost is the result of applied compound interest. Depreciation by declining balance method, double declining balance method, sum of years digit method show a decreasing profile with age of property, i.e. the amount of depreciation goes on reducing as the age increases. Double declining balance method depreciates the asset with highest amount and sinking fund method with lowest amount in the first year. Line representing sum of year's digit depreciation has a constant slope.

As seen from Figure 2, the end result for almost all methods except declining balance method is the same but is traced by varying paths. Accumulated depreciation for sinking fund method is shown by a concave line. It is the least for any particular year and the rate of increase is also

minimum. Accumulated depreciation of straight line method shows a constant slope line with constant rate of increase. Other methods are represented by convex lines with double declining balance method with highest rate of increase (Figure 2). For methods other than sinking fund method, interest on depreciation cost is neglected and hence a higher installment needs to be paid in terms of depreciation cost. Accumulated depreciation by declining balance method shows that the property does not get depreciated to its full extent and has a decent value even after its expected life is over (Table 2).

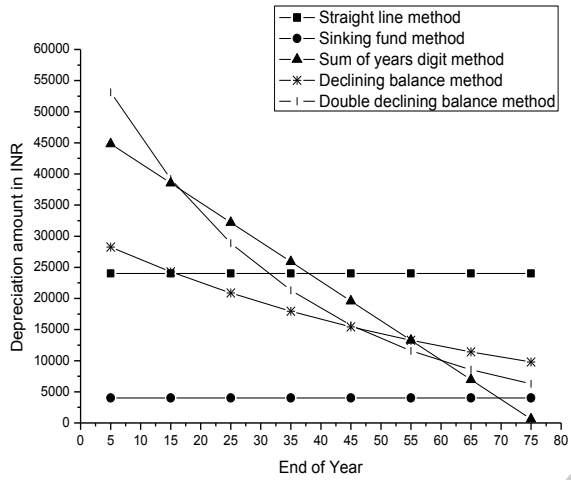

Figure 1: Yearly building depreciation

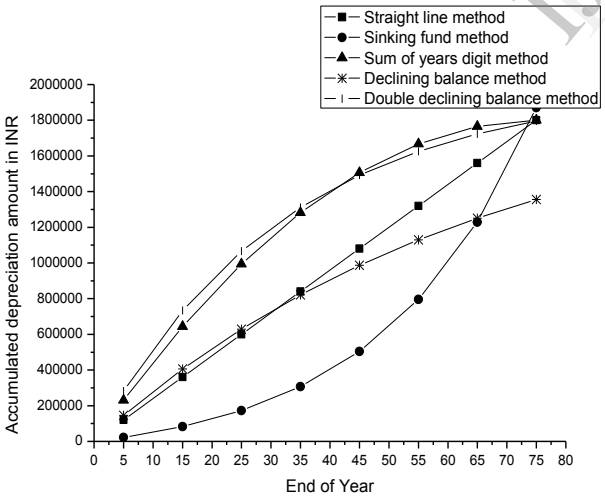

Figure 2: Accumulated depreciation amount

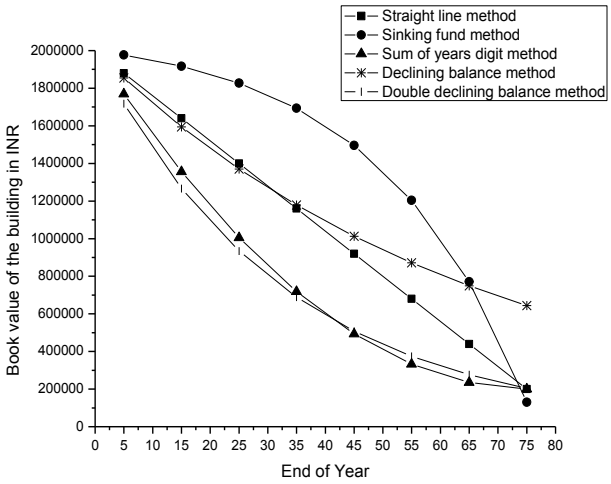

Figure 3: Book value of the building

As seen from Figure 3 depicting variation in book value, the line representing sinking fund method is convex and gives higher book value of the property at any time. Declining balance method, double declining balance method and SYD method show concave profile indicating higher rate of decrease in book value. Straight line method is represented by a line with constant slope. For declining balance method, the book value at the end of expected life does not reach its scrap value and is very high as compared to book value by other methods. Other methods arrive at approximately same book value at the end of expected life (Table 3).

Table 4 shows that sinking fund method allows a low percentage of the entire cost than all other methods. It adopts depreciation as low as 0.2% of total cost which is less than the minimum percentage by straight line, declining and double declining balance method. Since this method adopts a constant percentage, its scrap value goes lower than other methods. SYD method draws a high percentage of total cost initially but reaches the least percentage in the last few years of expected life.

5. Conclusion

The easiest and most widely used method is straight line depreciation method. Hence it is applied to get rough estimate of depreciation amount for any type of asset. It is beneficial to use accelerated methods such as sum of years' digit method, declining and double declining balance method for income tax calculations. Sum-of-years' digits depreciation method is rarely used in practice for building depreciation calculation and it finds use in the financial and regulated industries. Double declining balance method is the most suitable and

recommended method to compute tax since it shows least current worth of property reducing the tax payable. Sinking fund method gives a constant value of depreciation in terms of sinking fund installment and the amount of depreciation is generally very low as compared with other methods. As it considers rate of interest, it gives more realistic value and thus is useful for computing depreciation for properties with large life span. Hence, this method is normally used for real estate. It proves beneficial to the seller as depreciation represented by the percentage of total cost is the least, giving higher value of the property at the time of sale as compared with other methods of computing depreciation.

It can be concluded that the amount of depreciation expense recorded in each year of a property's life depends on the method that is used. This means that the amount of net income or benefits from the property that is reported can vary, depending on the depreciation method used. Specific depreciation methods can be used for special types of assets provided; they are used consistently over time. This facilitates the users to compare the financial statements of the property for tax calculation purposes and compare results across periods.

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