The sum-of-years' digits depreciation method: use by SEC filers

Thomas R. Noland
University of Houston

Abstract

The sum-of-years' digits depreciation method is an accelerated depreciation and amortization technique that is acceptable for financial reporting under U.S. and IASB accounting rules. Until 1981, it was an acceptable method for tax reporting in the U.S., and the aggressive nature of the method was an appealing characteristic for tax returns. Since 1981, little attention has been paid to its continued use in financial reporting. Academic research tends to group all accelerated depreciation methods together. However, declining balance depreciation methods are more appealing because they are more flexible, are easier to apply to partial periods, and have common characteristics with current U.S. tax depreciation law. This paper reports how SEC filers over the past four years have used the sum-of-years' digits method. It shows what type of companies use this method, what types of assets it is applied to, and what length of asset life is typically chosen. Sum-of-years' digits sees its most frequent use in the banking and regulated industries. It is primarily applied to intangible assets, such as acquired customer relationships. What is surprising for the non-regulated companies is that they are amortizing the assets more aggressively for financial reporting than they are for tax reporting. Possible motivations are discussed.

Keywords: sum-of-years' digits, accelerated depreciation, intangible assets, financial reporting

INTRODUCTION

Sum-of-years' digits is an acceptable depreciation and amortization method for use in financial reporting under U.S. generally accepted accounting principles (GAAP). The method is typically not taught in undergraduate introductory financial accounting courses (Albrecht, Stice, and Stice, 2008; Warren, Reeve and Duchac, 2007; Weygandt, Kimmel and Kieso, 2008), but is covered in intermediate financial accounting courses (Kieso, Weygandt and Warfield, 2010; Nikolai, Bazley, and Jones, 2010; Stice, Stice and Skousen, 2008). While there is a general belief that it is not commonly used in practice (Kieso, Weygandt, and Warfield, 2010, p. 542), no detailed analysis has been done in terms of the extent of use, the types of companies that use it, or the assets it is typically used with. For expositional ease, the remainder of the paper will use "depreciation" to refer to either the depreciation of tangible assets, or the amortization of intangible assets.

Prior to 1981, the methods available for tax depreciation were essentially the same as for financial reporting. Sum-of-years' digits was one of many acceptable methods of cost allocation. Academic research often focused on optimizing depreciation allocation (Schwab and Nicol, 1969; Sunley, 1971; Lere, 1980). From a regulatory perspective, conflicts most frequently arose from disagreements between taxpayers and the IRS over estimated useful lives. Companies preferred short asset lives to take maximum advantage of the depreciation tax shield. In 1971, the optional Class Life System was implemented. The system specified useful lives for different categories of assets. If a company depreciated an asset using the Class Life System estimated life, the IRS would not challenge it. Many companies, however, did not choose this option, and conflicts persisted. The depreciation issue was addressed again in the Economic Recovery Tax Act of 1981. This act introduced the Accelerated Cost Recovery System (ACRS) that specified both the life of the asset and the depreciation rate for tax purposes. At this point, sum-of-years' digits was no longer acceptable for tax purposes. The ACRS system has been modified several times since 1981 and is referred to as MACRS. At no time, since 1981, have companies been allowed to use sum-of-years' digits for tax depreciation. (Pratt and Kulsrud, 2005).

Academic research of depreciation method choice for financial reporting can be categorized into three overlapping major themes. The first theme deals with the impact and consequences of the depreciation method choice on the financial statement numbers (Reynolds, 1961; Livingstone, 1969; Barefield and Comiskey, 1971; Bowen, DuCharme and Shores, 1995). The second theme deals with attempts to measure the stock market reaction to depreciation method choice, or changes in depreciation methods (Archibald, 1972; Beaver and Dukes, 1973, Holthausen, 1981). The third theme focuses on how depreciation method choice may influence managers' economic decisions (Hatfield, 1944; Jackson, 2008; Jackson, Liu, and Cecchini, 2009). A detailed review of academic research on depreciation method choice and, more generally, accounting method choice can be found in Ricks (1982) and Fields, Lys, and Vincent (2001).

In table 1, Jackson, et al. (2009) report a steady decline in the use of accelerated depreciation methods during the period of 1988 to 2006. They classify companies into two categories: those companies using only straight-line depreciation and those companies using any accelerated depreciation method on any pool of assets. They report that in 1988, approximately 31 percent of companies applied some type of accelerated depreciation method to at least some asset categories. By 2006, use of accelerated depreciation had dropped to 14 percent of companies. They did not report on the types of accelerated depreciation methods used, or the

types of assets these methods were typically applied to. They also excluded from their analysis companies in the regulated and financial industries (SIC codes 4XXX and 6XXX).

This study makes a contribution to accounting literature by providing a detailed analysis of the application of sum-of-years' digits in practice. It provides information to policy makers by showing how the method is applied, and in what industries it is most frequently used. The study provides information to researchers by showing the extent of use, both across companies and within given companies. The results show that the primary application is to specific intangible asset categories in the financial and regulated industries. The study also provides information to accounting educators by reporting on the extent of use in practice and the likelihood that their students will someday encounter it.

The remainder of the paper is organized as follows. A brief description of accelerated depreciation methods and their relative strengths and weaknesses is presented. A description of the data collection process follows. The data is analyzed in the next section, and possible motivations for the use of sum-of-years' digits are suggested. The paper concludes by summarizing the findings and providing questions that can be addressed in future research.

ACCELERATED DEPRECIATION METHODS

Accelerated depreciation methods record large amounts of depreciation in the early years of an asset's life and small amounts of depreciation in the later years of an asset's life. For many types of assets, accelerated methods do a better job of mimicking the decline in the asset's fair value and productivity over time. Sum-of-years' digits and declining balance are both accelerated depreciation methods. This section provides a brief explanation of how they are calculated and their relative strengths and weaknesses.

Sum-of-Years' Digits Method

The sum-of-years' digits method is acceptable under both U.S. and international GAAP as an accelerated depreciation and amortization technique (although the IASB does not specifically list the sum-of-years' digits method):

> 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. That conclusion also applies to other methods, including the sum-of-the-years'-digits method, that produce substantially similar results. (FASB Codification 360-10-35-7)

> A variety of depreciation methods can be used to allocate the depreciable amount of an asset on a systematic basis over its useful life. These methods include the straight-line method, the diminishing balance method and the units of production method…The entity selects the method that most closely reflects the expected pattern of consumption of the future economic benefits embodied in the asset. (IAS 16, par 62)

The formula for sum-of-years' digits depreciation is:

$$\text{Annual Depreciation} = (\text{cost} - \text{estimated salvage}) * (n-p) / \text{SYD}$$

Where,

n = the asset's total estimated life in years
p = the number of prior periods the asset was used in years
SYD = the sum of the years' digits = 1 + 2 + 3 +… + n

SYD can also be calculated using either of the following formulas:

$$\text{SYD} = [n * (n + 1)] / 2 = (n^2 + n) / 2$$

This method is most easily applied if the company has a policy of allocating depreciation on assets acquired during the period on a whole-year basis. For example, they may take a full year's depreciation in the year of acquisition and no depreciation in the year of disposal. If the company allows for partial year depreciation, the application becomes somewhat more complex.

Declining Balance Method

The most popular type of accelerated depreciation method used in financial reporting is the declining balance method. This method is also used, in a modified form, for U.S. tax reporting. The method is unique in that it utilizes the book value of the asset (original cost – accumulated depreciation) instead of the depreciation base (original cost – salvage value). The formula is as follows:

$$\text{Annual Depreciation} = \text{book value of asset} * \text{the specified depreciation rate}$$

The specified depreciation rate chosen should be appropriate for the decline in productivity of the asset. A common rate chosen is twice the straight-line rate (double-declining balance). However, less aggressive rates can be used. This makes the declining balance method much more flexible than the sum-of-years' digits method.

One drawback of the declining balance method is that it doesn't depreciate the asset to its salvage value at the end of the asset's useful life. Companies use a variety of techniques to adjust for this problem. In some cases, they record the higher of double-declining balance or the straight-line depreciation calculation. This has the effect of using accelerated depreciation in the early years and straight-line in the later years. The following formula can also be used to calculate the exact depreciation rate that will allocate the depreciation base over the asset's useful life:

$$\text{Depreciation rate} = 1 - \sqrt[n]{\frac{\textit{Salvage value}}{\textit{original cost}}}$$

This formula cannot be applied to assets with zero salvage value.

A modified form of the declining balance method is used for tax reporting. Current U.S. tax law requires that a specific pattern of depreciation be used based on a series of asset

classifications. The law dictates both the tax life of the asset and the rate of depreciation allocated each year. The method is referred to as MACRS, and it is a hybrid of declining balance and straight-line. For approximately the first half of the asset's life, a declining balance calculation is applied (either double or 150%, depending on the length of the asset's life). Straight-line depreciation is used for the remaining life of the asset. In general, the tax life of an asset is shorter than the estimated life used for financial reporting. Most companies prefer to receive the tax benefit from MACRS earlier than they record depreciation on the financial statements.

DATA COLLECTION

A full text search was conducted using the Next-Generation EDGAR System. This search engine allows full text searches of EDGAR filings over the last four years. The full text of a filing includes all data in the filing as well as all attachments to the filing. The search period used in this study ran from June 1, 2006 to May 31, 2010. The forms searched were: 10-K and associated amendments, 10-KSB and associated amendments, 20-F (foreign filers) and associated amendments, and 40-F (Canadian filers) and associated amendments.

The EDGAR search engine supports Boolean search operators and stemming. The following Boolean search was conducted, with stemming: sum NEAR year NEAR digit. The NEAR statement captures all instances where the terms are within 10 words of each other, regardless of their order. Stemming captures variations of the words, such as "years", "year's", "years'", etc for the search term "years". This search captured instances with hyphenations, such as "sum-of-years digits." Once the potential occurrences were identified using the Next-Generation EDGAR System, a list of unique CIKs were identified. The CIK, or Central Index Key, is used on the SEC's computer systems to identify corporations and individual persons who have filed disclosures with the SEC. The firm's annual filings were collected using the standard EDGAR search engine and the CIK numbers. Each annual report was then examined to locate the discussion of the use of the sum-of-years' digits in depreciating or amortizing the company's assets. There were a total of 59 companies that specifically identified the use of sum-of-years' digits.

DATA ANALYSIS

Table 1 reports the 59 firms that disclosed the use of the sum-of-years' digits method classified by industry and asset category. There were a total of 15 two-digit SIC industries represented in the sample. Not surprisingly, users were concentrated in the banking (depository institutions) and regulated (communications) industries. Academic researchers often exclude the 4XXX and 6XXX series SIC codes, because companies in those industries may have incentives to report differently than in non-regulated industries (e.g., Jackson, et al., 2009). For example, in rate-regulated industries, companies adopt accounting methods that decrease current year's net income (see Khurana and Loudder, 1994, or Butler and Crawford, 2001). Of the 59 companies found to be using sum-of-years' digits, 34 companies (58 percent) are in either the 4XXX or 6XXX industries.

The banking industry, alone, accounts for just over 40 percent of the total number of companies. This concentration may be influenced by bankers' familiarity with the sum-of-years'

digits method. It is often used to calculate the payoff amount for early payment of consumer loans, such as auto loans, because it builds in a de facto early payoff penalty.

Those companies using the sum-of-years' digits method typically apply it to intangible assets. Of the 59 companies, 49 (including two in the miscellaneous category) applied the sum-of-years' digits to intangible assets, only. There were only eight companies that were applying the method to property, plant and equipment. Chemicals and allied products was the only two-digit industry that had more than one company using sum-of-years' digits for property, plant and equipment. This industry had two users. Clearly, these companies did not choose this method to ensure comparability with close competitors. The question arises as to whether this choice would result in a material difference in reported book value and depreciation expense for these companies.

The most common type of intangible asset that sum-of-years' digits was applied to was core deposits. This is unique to the banking industry and is recorded in an acquisition. Core deposits are made by customers in the bank's general market area. They are considered a very reliable source of funding, because these tend to be long-term banking relationships. In an acquisition, a bank may be willing to pay in excess of the fair value of the core deposits. This excess is reported as an intangible asset and amortized over its estimated life. There is usually no salvage value assigned.

The second most common type of intangible asset category is customer relationships. This is very similar to core deposits. These are often recorded at an acquisition and represent the estimated value of the customer relationships developed by the acquired company. Again, there is typically no salvage value assigned in this category. Core deposits and customer relationships represent 43 of the 59 cases found (73 percent).

Four companies used sum-of-years' digits for amortization of capitalized software costs. Three companies had capitalized costs associated with software to be sold; one company had capitalized costs for internal-use software. Technically, the use of the sum-of-years' digits method is not consistent with GAAP, as the FASB has specified the use of the higher of straight-line, or percentage-of-revenue (FASB, 1985).

Table 2 presents the average estimated life of the assets by category. This was calculated using the information companies disclosed in the footnotes. Core deposits were depreciated over an average of nine years. There was little deviation across companies, with most companies using either 9 or 10 years. There was greater variance across companies in the estimated lives of customer relationships, although the average life was also nine years. Software development costs were depreciated across three years for all companies. As would be expected, property plant, and equipment had a variety of estimated lives that were used. The average in that category was 14 years.

What is particularly interesting about the estimated lives of these assets is the potential impact on deferred taxes. Most intangible assets are depreciated over 15 years for tax purposes. This is the result of the Revenue Reconciliation Act of 1993. Prior to the act, goodwill was not depreciated for tax purposes. Consequently, acquiring companies in a merger would allocate the amount paid in excess of the fair value of the tangible assets to anything except goodwill. As Pratt and Kulsrud (2005) note, accountants became very creative in the allocation of these costs to a variety of intangibles with short estimated lives. "As long as the taxpayer was able to establish that the intangible was separate and distinct from goodwill and had a determinable useful life, the taxpayer was entitled to amortize the cost (Pratt and Kulsrud, 2005, p. 9-36)." The Revenue Reconciliation Act effectively standardized the tax life of intangibles at 15 years,

regardless of whether the economic life was more or less. Unlike most tangible assets, the estimated lives of these assets are often shorter than the tax life, creating a deferred tax asset. Companies are expensing the costs on the financial statements before they receive the tax benefits. This effect is magnified by using an accelerated depreciation technique, like sum-of-years' digits.

Even if the estimated lives of these assets were the same for financial reporting and tax reporting, the sum-of-years' digits method is more aggressive than the tax rules. Table 3 shows a comparison between the depreciation rates for sum-of-years' digits (SYD) and current tax law (MACRS) for assets with three-, five-, and fifteen-year lives. Assets are assumed to have a zero salvage value. This is consistent with company treatment of most of the asset categories reported in Tables 1 and 2. Depreciation is presented as a percentage of original cost. MACRS is a modified declining balance method that switches to straight-line approximately half way through the designated life of the asset. In addition, MACRS allocates a half year of depreciation in the year of acquisition. Consequently, an asset with a five year life is depreciated over six fiscal years. For exposition purposes, it is assumed that companies report a full year of depreciation for financial reporting in the year of acquisition.

Annual depreciation expense as a percentage of original cost under SYD and MACRS are reported in the first two columns of Table 3, respectively. The third column reports SYD accumulated depreciation in excess of MACRS. For the five-year and ten-year assets, the majority of the deferred tax asset is generated in the year of acquisition. Much of the difference is reversed out in Year 2, when a full year's depreciation is recorded under MACRS. The ten-year asset, however, will generate greater depreciation expense on the financial statements than on the tax return in Years 3 through 7. The difference in depreciation for the 15-year asset is much more profound. The initial difference is 7.5 percent of cost. Annual depreciation under SYD is consistently higher than under MACRS through Year 8. At that point, SYD depreciation has exceeded MACRS depreciation by approximately 21 percent of cost. Given that sum-of-years' digits is applied to mostly intangible assets, this appears to simulate what is happening in practice.

Potential Motivation for Using Sum-of-Years' Digits

The sum-of-years' digits method has several drawbacks. It not commonly used, so it lacks comparability with competitors and familiarity with financial statement users and preparers. It is awkward if the depreciation period does not align with the fiscal year. It usually will expense the asset cost faster on the financial statements than on the tax return. Given these limitations, why are these companies using this method?

Certainly, within the banking and regulated industries, companies may have industry-specific incentives to quickly expense these types of assets. All companies face the fact that most intangibles will have a shorter useful economic life than the 15-year tax life. For some companies, this method may be a holdover from when sum-of-years' digits was acceptable for tax reporting. Finally, this may simply be an attempt to match the expense in the same period as the revenues and benefits derived from these assets. Sum-of-years' digits is approximately as aggressive as double-declining balance and does not pose the problems declining balance methods have in allocating the depreciation base over the life of the asset.

An alternative explanation may be that these companies may be aggressively expensing these assets to avoid the cost of an impairment test and the unanticipated impact of an

impairment loss on the income statement. Under U.S. GAAP, a company must conduct an asset impairment test if events or circumstances suggest that the book value of the asset is not recoverable (FASB 360-10-05). The fair value estimate necessary for the impairment test may be very difficult and costly to generate. For items such as core deposits or customer relationships, it may be very difficult to prove that they have fair value in years subsequent to acquisition. Aggressively expensing these assets minimizes the chance of a potential impairment loss.

CONCLUSION

Sum-of-years' digits depreciation method is rarely used in practice. Its use is predominantly in the financial and regulated industries. It is most commonly applied to intangible assets, specifically to customer relationships (including core deposits in the banking industry) that were acquired during a merger. Accounting policy and education issues arise given how rarely this technique is used. Should this method be allowed in practice? Is it worthwhile, or necessary to specifically exclude it? Should practitioners encourage current users to switch to a more common method to improve comparability? How much, if any, exposure to this method do accounting students need? Given that the declining balance method is more flexible and is more closely related to the tax code, companies have little reason to use sum-of-years digits.

There are several implications for future research that arise from the analysis of the footnote disclosures. In particular, some companies had limited disclosure about their application of depreciation and amortization methods. When different methods were used across pools of assets, there was often little detail provided about the dollar amounts involved. Wide ranges of estimated lives were often given without any indication of the distribution within the range. Sometimes no estimated lives were provided. The companies in the analysis that used both sum-of-years' digits and declining balance sometimes did not disclose details on the rates used for the declining balance asset pools. A compelling question is why companies appear to be abandoning the use of accelerated methods in general, as noted in Jackson, et al. (2009). 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.

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Table 1 - Use of Sum-of-Years' Digits by Industry and Asset Category

2-digit SIC	Industry Name	Firms in Industry	Firms using SYD	Asset Categories				
				Core Deposits	Customer Relationships	Software Develop-ment	Property, Plant and Equipment	Misc.
26	Paper and allied products	**3,744**	**2**		1			1
28	Chemicals and allied products	**13,562**	**2**				2	
32	Stone, clay, glass and concrete products	**13,460**	**1**		1			
34	Fabricated metal products	**23,368**	**1**				1	
35	Industrial and commercial machinery and equipment	**20,927**	**2**			2		
36	Electronic and other electrical equipment and components	**13,391**	**2**		1		1	
37	Transportation equipment	**9,920**	**2**		1		1	
38	Measuring, analyzing and controlling instruments	**8,860**	**1**				1	
39	Miscellaneous manufacturing industries	**34,225**	**1**			1		
48	Communications	**41,513**	**8**		8			
50	Wholesale trade durable goods	**129,560**	**4**		3		1	
60	Depository institutions	**84,272**	**24**	22	1			1
63	Insurance Carriers	**19,366**	**2**		1		1	
73	Business services	**443,837**	**4**		3			1
80	Health services	**370,539**	**3**		1	1		1
	Totals		**59**	**22**	**21**	**4**	**8**	**4**

Table 2 - Average Estimated Life by Asset Category

	Number of Companies	Average Estimated Life
Core Deposits	22	9 years
Customer Relationships	21	9 years
Software Development	4	3 years
Property, Plant and Equipment	8	14 years
Miscellaneous	4	8 years

Table 3 - Comparison of SYD and MACRS Depreciation Rates‡

	SYD Annual Depreciation			MACRS Annual Depreciation†			Difference in Accumulated Depreciation (SYD - MACRS)		
Year	5-Year Life	10-Year Life	15-Year Life	5-Year Life	10-Year Life	15-Year Life	5-Year Life	10-Year Life	15-Year Life
1	33.33%	18.18%	12.50%	20.00%	10.00%	5.00%	13.33%	8.18%	7.50%
2	26.67%	16.36%	11.67%	32.00%	18.00%	9.50%	8.00%	6.55%	9.67%
3	20.00%	14.55%	10.83%	19.20%	14.40%	8.55%	8.80%	6.69%	11.95%
4	13.33%	12.73%	10.00%	11.52%*	11.52%	7.70%	22.13%	7.90%	14.25%
5	6.67%	10.91%	9.17%	11.52%	9.22%	6.93%	17.28%	9.59%	16.49%
6		9.09%	8.33%	5.76%	7.37%	6.23%		11.31%	18.59%
7		7.27%	7.50%		6.55%*	5.90%*		18.58%	26.09%
8		5.45%	6.67%		6.55%	5.90%		17.49%	26.86%
9		3.64%	5.83%		6.55%	5.90%		14.57%	26.79%
10		1.82%	5.00%		6.55%	5.90%		3.28%	25.89%
11			4.17%		3.28%	5.90%			24.16%
12			3.33%			5.90%			21.59%
13			2.50%			5.90%			18.19%
14			1.67%			5.90%			13.96%
15			0.83%			5.90%			2.95%
						2.95%			

†MACRS allocates one-half year depreciation in the year of acquisition

*Converts to straight-line depreciation

‡Assets are assumed to have a zero salvage value. Depreciation is presented as a percentage of total cost.