Volume Title: Accelerated Depreciation in the United States, 1954–60

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Volume Publisher: NBER

Volume ISBN: 0-870-14457-X

Volume URL: http://www.nber.org/books/ture67-1

Publication Date: 1967

Chapter Title: Introduction to "Accelerated Depreciation in the United States, 1954–60"

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Chapter URL: http://www.nber.org/chapters/c0926

Chapter pages in book: (p. 3 - 24)

ACCELERATED DEPRECIATION IN THE UNITED STATES 1954–60

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INTRODUCTION

The Occasion for This Inquiry

Accelerating economic growth has been one of the principal concerns of federal tax policy during much of the postwar era. Widely divergent views have been expressed on the potential of tax policy for affecting the rate of the nation's economic progress and on the elements of tax policy which are consequential in this regard.[1] A substantial consensus has developed, however, that more rapid growth involves the allocation of a larger share of the economy's resources to fixed capital formation. Liberalizing the rules governing the determination of depreciation charges for income tax purposes is deemed by many to be one of the principal measures of tax policy for this purpose.

Three principal approaches to depreciation liberalization have been urged. One is to substitute replacement cost for original cost as the basis for the depreciation deduction. A second is to alter the pattern of the depreciation deductions so that a larger part of the depreciable amount is charged against income in the earlier years of the asset's service life. A third is to shorten the period of time over which the costs of depreciable facilities are to be charged, as depreciation, against income. Of these three, the last two have in fact been provided in 1954 and 1962, respectively. Acceleration [2] of depreciation allowances was incorporated in the Internal Revenue Code of 1954, which expressly authorized taxpayers to use the declining-balance method with an annual depreciation rate twice the straight-line rate, or the sum-of-the-years-

[1] See, for example, Joint Committee on the Economic Report, *Federal Tax Policy for Economic Growth and Stability,* Papers Submitted by Panelists Appearing before the Subcommittee on Tax Policy, Joint Committee Print, 84th Congress, 1st Session, November 9, 1955.

[2] As used in this discussion, the term "accelerated" characterizes depreciation methods which allow the taxpayer to charge off more of the depreciable cost of a facility in the early years than under the straight-line method.

digits method, or any other method which in any year in the first two-thirds of the asset's life yields cumulative allowances not in excess of those generated by use of the declining-balance method. Shortening of service lives was effected by administrative action in the Revenue Procedure 62-21 of July 1962.[3] Substitution of replacement cost for historic cost has not yet been adopted in the United States.[4]

A number of countries have made substantial use of depreciation policy to affect the volume and direction of investment in depreciable facilities. The Swedish experiment with so-called "free depreciation," under which corporate taxpayers might write off the full cost of facilities in the first year, is probably the best-known and most widely cited innovation in this policy area during the period before World War II. In the postwar years, a wide 'variety of special depreciation arrangements, including initial allowances, investment allowances, and price-index adjustments of depreciable basis, have been used in many countries. Authorizing or requiring the use of the so-called declining-balance method of depreciation in lieu of the straight-line method has been a widely adopted change in policy. In many instances, these postwar measures were taken in conjunction with programs aimed at speeding reconstruction or at spurring capital formation in critical or bottleneck

[3] Shortened service lives were also provided—but on a selective basis—in the form of five-year amortization allowances on defense and defense-related facilities for which certificates of necessity were issued during World War II and the Korean emergency. Certification of facilities was terminated as of December 31, 1959.

[4] The investment credit, enacted as part of the Revenue Act of 1962, may be deemed to be a limited approximation thereto since it permits, in effect, total capital recovery allowances in excess of the original cost of the facilities for which the credit may be claimed. For a description of the credit as amended by the Revenue Act of 1964, see Senate Report No. 830, on H.R. 8363, Revenue Act of 1964, 88th Congress, 2nd Session, pp. 40–45. Both the Revenue Procedure 62-21 and the investment credit represent important developments in this area of tax policy; they warrant more detailed examination than could be afforded in this study. For a preliminary examination, see Norman B. Ture, "Tax Reform: Depreciation Problems," *The American Economic Review*, May 1963, pp. 334–353; George Terborgh, *New Investment Incentives, The Investment Credit and the New Depreciation System* (Machinery and Allied Products Institute); E. Cary Brown, "Tax Incentives for Investment," *The American Economic Review*, May 1962, pp. 335–345; William H. White, "Illusions in the Marginal Investment Subsidy," *National Tax Journal*, March 1962, pp. 26–31; Sam B. Chase, Jr., "Tax Credits for Investment Spending," *National Tax Journal*, March 1962, pp. 32–52. See also Lawrence Bridge, "New Depreciation Guidelines and the Investment Tax Credit Effect on 1962 Corporate Profits and Taxes," U.S. Department of Commerce, Office of Business Economics, *Survey of Current Business*, July 1963, pp. 3–9.

industries. In any event, the enactment in the United States of the accelerated depreciation provisions in 1954 and of the investment credit provisions in 1962, as well as the administrative shortening of service lives in the latter year, had abundant precedent in other countries.[5]

Although there are significant differences among the various types of depreciation changes they have a number of major effects in common which are widely supposed to contribute to more rapid fixed capital formation.[6] These effects are briefly examined in a later section of this chapter.

Before one turns to measuring the impact of depreciation changes on capital formation, however, it is necessary to determine whether taxpayers change their depreciation practices when permitted to do so by changes in depreciation rules. Whether the increase in the rate of return or in cash flow, or the reduction in risk, or any of the other consequences of using an accelerated method in lieu of straight-line depreciation will lead to a small or large increase in capital outlays depends first of all on the extent to which taxpayers adopt the accelerated method. It is also pertinent to ask whether there are some characteristics which systematically distinguish taxpayers who do take advantage

[5] The role of depreciation policy changes in postwar development policies in several European countries and in Japan is discussed in detail in *Foreign Tax Policies and Economic Growth,* A Conference Report of the National Bureau of Economic Research and the Brookings Institution, New York, National Bureau of Economic Research, 1966.

[6] Although other considerations were adduced by the Administration and the tax-writing committees of the Congress in regard to the depreciation provisions in the Internal Revenue Code of 1954, principal emphasis was given to the effects of the proposed changes in promoting private investment in depreciable facilities. In connection with Revenue Procedure 62-21, the new service lives and the procedures for adjusting them to each taxpayer's replacement pattern were represented as necessary to make depreciation practices more realistic, but at least equal emphasis was given to the effects of these revisions in encouraging modernization of production facilities, increasing productivity in the industrial sector, and improving the competitive position of the United States in international markets. See *Budget Message of the President,* January 21, 1954, p. 719; Statement by the President, August 16, 1954 (reproduced as Exhibit 38 in the 1954 Annual Report of the Secretary of the Treasury, p. 233); Statement by Secretary of the Treasury George M. Humphrey before the Senate Finance Committee, April 7, 1954 (reproduced as Exhibit 35 in the 1954 Annual Report of the Secretary of the Treasury, pp. 227–228); Report of the Committee on Ways and Means on H.R. 8300, House Report No. 1337, 83rd Congress, 2nd Session, March 9, 1954, p. 24; Report of the Committee on Finance on H.R. 8300, Senate Report No. 1622, 83rd Congress, 2nd Session, June 18, 1954, p. 26; Statement by Secretary of the Treasury Douglas Dillon, July 11, 1962; Statement of the President, July 11, 1962.

of depreciation liberalization from those who do not; identification of these characteristics may be essential in evaluating the likely effects of such changes.

The purpose of this study, then, is to examine the extent to which business income taxpayers made use of the accelerated depreciation methods afforded by the Internal Revenue Code of 1954 and to indicate the magnitude of the change in corporations' depreciation allowances and tax liabilities resulting from the use of these methods. In addition, the nature of the effects of depreciation acceleration on investment decision making is briefly discussed in a later section of this chapter. A large number of factors besides tax considerations, of course, enter into this decision making, and it is difficult to isolate the weight of tax variables therein. With this caution in mind, we offer rough estimates of the effects of the use of accelerated depreciation on corporate investment in depreciable facilities in 1959.

Interpretation of these findings should take into account the fact that they are derived from data covering only the first several years of experience with the accelerated depreciation provisions. In the succeeding years, both the extent and character of taxpayer response may have changed.

The Data

The Statistics Division of the Internal Revenue Service has sought to provide some information about the number of companies using each of the principal depreciation methods and the amounts of depreciation generated thereby. For partnerships and sole proprietorships, such data are available only for the taxable year 1959.[7] For corporations, data have been obtained from special samples for each of the taxable years 1954–61. For the taxable years 1954, 1955, 1957, and 1960, data on corporations are taken from large samples, roughly equivalent in 1957 and 1960 to the regular *Statistics of Income* samples of corporate returns and characterized by roughly the same magnitudes in sampling variability. However, since the frequencies are estimated from company returns which showed method of depreciation, and since not all returns include these data, the frequencies will aggregate to less than the respective taxpaying populations. For 1954, 1955, 1957, and 1960, the data

[7] U.S. Treasury Department, Internal Revenue Service, *Statistics of Income, 1959–60, U.S. Business Tax Returns*, pp. 34–41, 90–99.

show numbers of returns and amount of depreciation by method, industrial division, and size of total assets. For the taxable years 1956, 1958, and 1959, the samples are limited to large corporations, cover roughly 1,000 returns, and show only the number of returns and amount of depreciation by method.

The data on partnerships for the taxable year 1959 show number of businesses, amount of depreciation, and amount of depreciable assets by method, industry division, and size of net profits and net receipts. In the case of sole proprietorships for the same period, the number of businesses and amount of depreciation are shown by method, industry, and size of business receipts.

A substantial amount of data about corporations' depreciable property on hand in the taxable year 1959 is provided by the Statistics Division, in a special compilation entitled the "Life of Depreciable Assets," or LDA. These data were taken from the depreciation schedules of 55,000 out of the 163,000 corporation returns in the regular *Statistics of Income* sample. The regular sample was modified initially by outright elimination of life and mutual insurance companies and by a reduced sampling rate for certain special classes of companies. In addition, not all of the returns included in the modified sample contained depreciation schedules sufficiently complete to be usable for the tabulation. For the returns of companies with total assets of $50 million or more, a field follow-up was used to obtain the data missing from the depreciation schedules in the returns. The reduction in the sample size, of course, increases the relative sampling variability. In addition, since not all of the returns in the regular sample yielded usable data, and because neither the nonresponse nor the field follow-up represented random distributions, there are possible biases in the estimates. The 55,000 returns in the study represent an estimated 557,000 corporate returns, about 52 per cent of the total filed for the year. The amount of depreciation of the represented returns was about $12 billion, 59 per cent of the total claimed for the year. The depreciable assets on these 557,000 returns total about $281 billion; this is 71 per cent of the amount shown in the balance sheet statistics derived from the regular *Statistics of Income* sample for 1959–60.

This compilation presents highly detailed information on the amount of depreciable facilities, accumulated depreciation, and current depreciation for assets in taxpayers' accounts for the taxable year 1959, by

method, industry, type of asset, assigned service life, and size of total assets. No count of returns is associated with the amount of asset data, however. Moreover, the degree of detail with which the data are presented varies with the cross classification. For example, the cross classifications with method, size class, and service life provide only for nine industry divisions and six asset types.

A more detailed description of these data is provided in Appendix B.[8]

The Depreciation Rules in the
Internal Revenue Code of 1954

The Internal Revenue Code of 1954 specifically authorizes a taxpayer to compute depreciation allowances by use of the straight-line method, the declining-balance method at a rate not to exceed twice the straight-line rate,[9] the sum-of-the-years-digits method, or by any other method which in any year during the first two-thirds of the asset's life yields cumulative allowances not in excess of those generated by use of the declining-balance method.[10] The straight-line method allocates the depreciable basis of the facility—its cost less its estimated salvage value—over its service life in equal annual installments. With a service life of N years, annual depreciation per dollar of depreciable basis is $\frac{1}{N}$. Under the declining-balance method, a fixed depreciation rate, not to exceed $\frac{2}{N}$, is applied to the remaining undepreciated balance in the asset account. The taxpayer may at any time switch from declining-balance to straight-line; it will be advantageous to do so when the latter method, by dividing remaining cost by remaining service life, yields a larger amount than the former. Up to the switch, annual declining-balance depreciation per dollar of asset cost is $\frac{2}{N}$ in the first year (assuming the asset is acquired at the beginning of the year), $\frac{2}{N}\left(1 - \frac{2}{N}\right)$ in the second year, $\frac{2}{N}\left(1 - \frac{2}{N} - \frac{2}{N}\left[1 - \frac{2}{N}\right]\right)$ in the third year, etc. In summary form,

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[8] For a more detailed discussion of the LDA sample, see also U.S. Treasury Department, Internal Revenue Service, *Statistics of Income, 1959, Supplementary Depreciation Data from Corporation Income Tax Returns*, pp. 1–9.

[9] While not specifically authorized in the statute, the declining-balance method at 150 per cent of the straight-line rate was allowed under prior law.

[10] Section 167(b).

this may be written for any year as $\frac{2}{N}\left(1 - \frac{2}{N}\right)^{M-1}$, where $M =$ the number of years, including the current year, for which depreciation has been deducted. After the switch, annual depreciation is

$$1 - \sum_{M=1}^{S} \frac{2}{N}\left(1 - \frac{2}{N}\right)^{M-1} \div (N - S + 1),$$

where S is the year in which the switch is made. The switch will be made beginning with the year $S = \frac{N}{2} + 2$, where N is an even number, and with the year $S = \frac{N-1}{2} + 2$, where N is an odd number.[11] In the sum-of-the-years-digits method (hereafter referred to as SYD), a continually decreasing ratio is applied to the asset's original cost less estimated salvage. The ratio in any year has as its numerator the number of years of service life remaining (including the present year) and as its denominator, the sum of the numbers representing the successive years in the estimated life of the asset. Thus, the first year's depreciation charge on a five-year asset would be 5/15 (i.e., 5 over the sum of $1 + 2 + 3 + 4 + 5$) and the second year's depreciation would be 4/15 of the asset's cost less salvage. In summary form, the allowance for any year is $\frac{2(N + 1 - M)}{N(N + 1)}$.

[11] The switch will be made when

$$1 - \sum_{M=1}^{S} \frac{2}{N}\left(1 - \frac{2}{N}\right)^{M-1} \div (N - S + 1) = \frac{2}{N}\left(1 - \frac{2}{N}\right)^{S-1}.$$

The summation may be expressed as

$$\frac{2}{N}\left[1 + \left(1 - \frac{2}{N}\right) + \left(1 - \frac{2}{N}\right)^2 + \cdots \left(1 - \frac{2}{N}\right)^{S-1}\right] =$$

$$\frac{2}{N}\left[\frac{\left(1 - \frac{2}{N}\right)^S - 1}{\left(1 - \frac{2}{N}\right) - 1}\right] = 1 - \left(1 - \frac{2}{N}\right)^S.$$

Substituting gives

$$\left(1 - \frac{2}{N}\right)^S = (N - S + 1)\frac{2}{N}\left(1 - \frac{2}{N}\right)^{S-1}, \text{ which becomes } S = \frac{N}{2} + 2.$$

Since the depreciation deduction is for a full year, $S = \frac{N-1}{2} + 2$, where N is an odd number.

The declining-balance method at twice the straight-line rate, the sum-of-the-years-digits method, and any other unspecified but equivalent method are authorized only for property to which a service life of three years or more is assigned. Moreover, these methods can be applied only to property produced after December 31, 1953, and acquired new by the taxpayer after that date.

Prior to the effective date of the 1954 Code, the law did not specify the method which a taxpayer could or could not use in computing annual depreciation charges. Straight-line depreciation, however, was generally employed, although any taxpayer was entitled to use any other method provided that he could justify its use on the basis of his own experience or that of his industry. Such a justification ordinarily required evidence that the pattern of exhaustion of economic serviceability of the asset differed significantly from that described by the straight-line method. Evidence of this sort would not generally be readily available and might require detailed and expensive annual appraisals. Relatively few taxpayers presumably were able to establish that the straight-line method was not the appropriate way in which to spread the cost of a depreciable facility over its useful life.

While criticism of pre-1954 depreciation policy was directed to a number of its features, including the restriction of total depreciation charges to original cost less salvage value and the allegedly excessive length of service lives indicated by Bulletin "F," the major focus of the legislative action in 1953–54 was on the timing of the distribution of depreciation allowances over an asset's service life. Use of the straight-line method, which distributes recovery of an asset's cost in equal amounts per year over its service life, it was claimed, provides an unrealistic measure of the actual pattern of exhaustion of an asset's value to the taxpayer through time.[12] According to this argument, a depreciation pattern which implies a relatively large reduction in the asset's value in the first year of its life and successively smaller increments thereafter more accurately measures the loss of value over time. This pattern is approximated by use of the declining-balance or SYD methods.

[12] One of the most careful and detailed arguments to this effect was presented to the Committee on Ways and Means by George Terborgh for the Machinery and Allied Products Institute. See *General Revenue Revision*, Hearings before the Committee on Ways and Means, House of Representatives, 83d Congress, 1st Session, Part 2, pp. 743–759. See also Terborgh's *Realistic Depreciation Policy*, Machinery and Allied Products Institute, 1954.

Use of either of these methods results in larger depreciation allowances in the early years and smaller allowances in the later years of life of an asset than those produced by use of the straight-line method (total allowances under each of the methods, of course, are virtually the same). In the case of an asset with a ten-year service life, for example, the annual allowance under the declining-balance method will exceed the straight-line allowance for the first four years (disregarding salvage values). Under SYD, annual allowances will be greater than the straight-line charge for the first five years.[13] Although the number of years during which the accelerated allowances exceed the straight-line charge varies directly with the service life of the asset, the fraction of the asset's service life over which accelerated exceed straight-line allowances diminishes with length of the service life. As service life increases, the fraction falls toward one-third, in the case of declining-balance, and toward one-half in the case of SYD.

Allowances under the SYD method exceed those under the straight-line method for a larger fraction of an asset's service life than do those under the declining-balance method.[14] If N equals the asset's service life and M equals the number of years, including the current year, for which the depreciation deduction has been claimed, then the declining-balance allowance will just equal the straight-line deduction when $M = 1 + \dfrac{\log \frac{1}{2}}{\log \left(1 - \dfrac{2}{N}\right)}$. The SYD deduction will just equal the straight-line allowance when $M = \dfrac{N + 1}{2}$.[15] For any given N,

$$\frac{N + 1}{2} > 1 + \frac{\log \frac{1}{2}}{\log \left(1 - \dfrac{2}{N}\right)}.$$

[13] Assuming the asset is acquired at the beginning of a year.

[14] Assuming no salvage value need be taken into account in computing the SYD allowance (see below).

[15] The break-even point is that value of M at which the declining-balance or the SYD allowances just equal the straight-line deduction. The straight-line allowance in any year is $1/N$ times the asset's cost. The declining-balance deduction may be represented as $\dfrac{2}{N} \dfrac{(N - 2)^{M-1}}{N}$ times the asset's cost, in any year. Equality between these two gives

$$\frac{2}{N} \frac{(N - 2)^{M-1}}{N} = \frac{1}{N}$$

$$\left(1 - \frac{2}{N}\right)^{M-1} = \frac{1}{2}$$

The break-even points for assets of various service lives are shown in the following table, where M equals the year or fraction thereof in which the depreciation allowance computed under the declining-balance or sum-of-the-years-digits method is just equal to that under the straight-line method, assuming that the facility was acquired at the beginning of a taxable year.

Service Life (years)	M, Computed by Declining-Balance	M, Computed by Sum-of-Years-Digits
3	1.6	2.0
4	2.0	2.5
5	2.4	3.0
10	4.1	5.5
15	5.8	8.0
20	7.6	10.5
25	9.3	13.0
33	12.0	17.0

The accumulated excess of accelerated over straight-line allowances in those years in which the declining-balance and SYD allowances are greater than straight-line similarly varies with the service life of the facility. For example, the declining-balance method yields cumulative depreciation allowances 45.8 per cent greater than straight-line during the first 4.1 years, in the case of a 10-year asset, and 43.8 per cent greater than straight-line during the first twelve years, in the case of a facility with a service life of 33 years. The accumulated excess of SYD

$$(M - 1) \log \left(1 - \frac{2}{N} \right) = \log \frac{1}{2}$$

$$M = 1 + \frac{\log \frac{1}{2}}{\log \left(1 - \frac{2}{N} \right)}$$

The SYD allowance in any year is $\frac{2(N + 1 - M)}{N(N + 1)}$. Setting this equal to $\frac{1}{N}$, the straight-line allowance in any year, we have

$$\frac{2(N + 1 - M)}{N(N + 1)} = \frac{1}{N}$$

$$2(N + 1 - M) = N + 1$$

$$M = \frac{N + 1}{2}$$

over straight-line allowances is 40.5 per cent during the first 5.5 years, for a 10-year asset, and 47.0 per cent during the first seventeen years, for a 33-year facility. The proportionate accumulated excesses [16] of declining-balance and of SYD over straight-line allowances (for various service lives) are shown in the following table.

Service Life (years)	Excess as Per Cent of Asset's Cost		Excess as Per Cent of Accumulated Straight-line Allowance	
	Declining-Balance	SYD	Declining-Balance	SYD
3	26.4	16.7	48.5	25.0
4	25.0	17.5	50.0	28.0
5	22.0	20.0	46.6	33.3
10	18.8	22.3	45.8	40.5
15	17.7	23.3	45.3	43.8
20	17.0	23.7	45.0	45.1
25	16.7	24.0	44.8	46.2
33	16.0	24.2	43.8	47.0

Whether or not allowances under the accelerated methods conform more closely than those under the straight-line method with the actual loss of value of an asset year by year, the change in the law to authorize the use of accelerated methods clearly affords benefits to the taxpayers availing themselves of this privilege. If indeed the accelerated depreciation methods correctly represent the actual pattern of loss of value in use, then the de facto constraint in the pre-1954 law to use straight-line depreciation involved understatement of depreciation, overstatement of taxable income, and consequently overpayment of taxes in the early years of an asset's life. During the later years, depreciation was overstated, taxable income was understated, and taxes underpaid. With an unchanging tax rate, of course, the overpayments and underpayments of taxes just cancel out with respect to any one asset. Nevertheless, the overpayments represent a series of interest-free loans by the taxpayer to the government, while the subsequent underpayments represent repayments of the loans by the government to the taxpayer in increas-

[16] Up to the break-even year (see text table above) in which accelerated allowances equal straight-line allowances. In the case of declining-balance, the amount of the excess in the break-even year was determined by straight-line interpolation, which slightly overstates the excess.

ing annual installments. The use of either declining-balance or sum-of-the-years-digits depreciation instead of straight-line, accordingly, reduces or eliminates these interest-free loans. It therefore benefits the taxpayer to the extent determined by the appropriate earnings rate which he can realize on the additional funds released to him during the early years of the asset's use, less the loss of earnings on the extra funds he would realize under straight-line depreciation in the later years of the asset's use.

If, on the other hand, the real pattern of depreciation is best described by use of the straight-line method, the adoption of an accelerated depreciation method involves the government's affording the taxpayer a series of interest-free loans in the early years of the asset's use and the repayment of such loans in increasing annual installments in the later years. In this event, the taxpayer is benefited, again in an amount depending on the rate of earnings he can realize on the advance of funds to him.

The change in the timing of tax liabilities, and therefore of after-tax receipts, over the lifetime of an asset, resulting from using accelerated rather than straight-line depreciation, increases the present value of the depreciation deductions; hence, it increases the value of the net returns which may be realized upon investment in depreciable facilities. The amount of this increase depends on the rate at which the taxpayer discounts future receipts, the length of life of the asset, and the marginal tax rate. Given the tax rate and the discount rate, the increase in the present value of the depreciation deductions will grow with the asset's service life up to a point and then diminish; given the tax rate and service life, the increase in present value grows with the discount rate up to a point beyond which it falls. Table 1 illustrates these relationships, using SYD as the accelerated depreciation method.

An alternative way of expressing the effect of acceleration of depreciation allowances is as the change in the rate of return realizable on a given outlay for depreciable facilities. Table 2 shows both the percentage point and percentage increases in rates of return resulting from using declining-balance or SYD in lieu of straight-line, at selected service lives and at various rates of return under the straight-line method.

It is evident from the table that the increase in internal rate of return resulting from use of either accelerated method in lieu of the straight-line method is quite limited, whether viewed as the absolute percentage

point change or as the relative increase. (It does not follow that the investment response to such limited changes is equally constrained; see the discussion below, pp. 17–22.) The table also shows that for assets with relatively short service lives, the declining-balance method is more profitable than SYD, if salvage value is ignored. As noted above, how-

TABLE 1

Present Worth of Depreciation Deductions as
Per Cent of Asset Cost

Service Life (years)	SYD Discount Rates of (per cent)			Straight-Line Discount Rates of (per cent)			SYD Minus Straight-Line Discount Rates of (per cent)		
	4	12	20	4	12	20	4	12	20
10	85	66	50	81	55	39	4	11	11
20	75	48	33	68	36	22	7	12	11
30	68	38	25	57	25	15	11	13	10
40	61	31	20	49	20	11	12	11	9
50	56	26	16	43	16	9	13	10	7
100	37	14	9	24	8	5	13	6	4

Source: E. Cary Brown, "The New Depreciation Policy Under the Income Tax: An Economic Analysis," *National Tax Journal,* March 1955, p. 92.

ever, salvage value reduces the depreciable basis of assets for purposes of SYD depreciation computations but not for the declining-balance allowances. The greater the estimated salvage, the longer the service life for which use of declining-balance will be preferable to SYD; alternatively, for any given service life, the greater the salvage value, the greater is the advantage—or the smaller the disadvantage—in using declining-balance in lieu of SYD.[17] The Revenue Act of 1962 provides for disregarding salvage value up to 10 per cent of the facility's cost (or other basis) in computing straight-line and SYD allowances on

[17] For a rigorous statement of this interrelationship, see Sidney Davidson and David F. Drake, "Capital Budgeting and The 'Best' Tax Depreciation Method," *The Journal of Business* of the University of Chicago, October 1961, pp. 442–452.

TABLE 2

Increase in Rate of Return from Use of Accelerated Depreciation

| Service Life (years) | Rate of Return Under Straight-Line Method[a] of | | | | | |
| | 5 Per Cent | | 10 Per Cent | | 15 Per Cent | |
	Declining-Balance	SYD	Declining-Balance	SYD	Declining-Balance	SYD
	Percentage Point Increase in Rate of Return					
5	.71	.70	1.34	1.20	1.89	1.56
10	.66	.79	1.11	1.37 .	1.50	1.79
20	.55	.79	.90	1.23	1.19	1.46
30	.48	.73	.77	1.02	.95	1.19
50	.41	.59	.59	.72	.69	.83
	Percentage Increase in Rate of Return					
5	14.20	14.00	13.40	12.00	12.60	10.40
10	13.20	15.80	11.10	13.70	10.00	11.93
20	11.00	15.80	9.00	12.30	7.93	9.73
30	9.60	14.60	7.70	10.20	6.33	7.93
50	8.20	11.80	5.90	7.20	4.60	5.53

Source: George Terborgh, *Effect of the New Tax Depreciation Methods on the Earnings of Depreciable Assets,* Machinery and Allied Products Institute, 1956, pp. 13, 17.

[a]Rate of return is that rate at which cash flow (i.e., profits and depreciation after tax) attributable to a facility over its service life must be discounted to be equal to the facility's cost. These computations assume that the investment is financed entirely from equity capital. Somewhat larger increases in rates of return on the equity share of the investment would be realized if the investment were financed in part with debt.

property acquired after October 16, 1962. This tends to favor use of SYD depreciation.[18] On the whole, declining-balance is advantageous for short-lived assets, while SYD is preferable for facilities with long service lives.

Tables 1 and 2 illustrate the fact that a given change in depreciation rules, undifferentiated to take account of differences in discount rates and service lives, is likely to have differing effects among a heteroge-

[18] See Davidson and Drake, "The 'Best' Tax Depreciation Method—1964," *The Journal of Business* of the University of Chicago, July 1964, pp. 258–260.

neous taxpaying population.[19] A neutral depreciation system would alter the effective tax rate on the return allocable to depreciable facilities by the same fraction, irrespective of the differences in discount rates or service lives. A depreciation system which met this test would afford annual allowances equal to the reduction in the capital value of the asset, measured as the present worth of the income stream remaining at the end of the taxable year. As a practical matter, such a depreciation system would be extremely complicated, probably impossibly so. Depreciation systems of the type long in use in the United States and elsewhere, however, are unneutral in this sense.

Changes in depreciation rules, such as those effected by the Internal Revenue Code of 1954, might move in the direction of greater tax neutrality, if use of an accelerated method were to result in a smaller dispersion of effective rates of tax among assets with varying service lives than results when straight-line depreciation is used. Similarly, the change to an accelerated method would be deemed to be a step toward tax neutrality if, at any given service life, the differences in effective rates of tax from one discount rate to another were reduced. Table 3 suggests that, compared with straight-line, the accelerated methods slightly reduce the dispersion in effective rates of tax as among service lives, given the discount rate, and as among differing discount rates at any service life. Within the context illustrated here, however, the movements toward and away from greater neutrality resulting from adoption of the accelerated methods are not substantial.

The impact of these differential changes in effective rates of tax, and hence in rates of return, on the allocation of investment depends on the rate-of-return elasticities of demand for depreciable facilities. These elasticities, in turn, vary with differences in the production methods among taxpayers. The increase in the present value of depreciation deductions can be viewed as a reduction in the cost of the depreciable facilities involved. Other things being equal, this increases the stock of such facilities which the taxpayer wants to use in combination with other agencies of production (this is a "one-shot" effect, i.e., for any given change in depreciation rules there is a once-and-for-all change in the desired stock). The amount of this increase depends on the possi-

[19] Richard A. Musgrave provides a formal statement of the differential effect of a given set of depreciation rules, or changes therein, in *The Theory of Public Finance,* New York, 1959, pp. 336–346.

TABLE 3

*Comparison of Effective Tax Rates[a] Using Straight-Line and
Accelerated Depreciation Methods*

Service Life (years)	Straight-Line, Pretax Rate of Return (per cent)			Sum-of-the-Years-Digits, Pretax Rate of Return (per cent)			Double-Declining-Balance,[b] Pretax Rate of Return (per cent)		
	10	20	30	10	20	30	10	20	30
5	55.3	54.2	53.6	49.3	48.8	48.4	46.8	48.5	47.8
10	55.6	54.1	53.0	48.5	47.7	47.0	50.2	49.0	48.2
20	54.7	52.6	51.5	47.6	46.8	46.7	49.8	48.3	47.7
30	53.6	51.6	50.8	46.9	46.5	46.8	49.2	47.9	47.7
50	52.0	50.6	50.3	46.5	47.0	47.5	48.2	47.8	48.0

Note: I am indebted to George Terborgh for the computations in this table.

[a]Per cent reduction in net rate of return, assuming a marginal tax rate of 50 per cent, no salvage value, and full equity financing.

[b]Switch to straight-line, as indicated above.

bilities of substituting such facilities for other inputs in the production process. The greater the elasticity of substitution, the greater the increase in the desired capital stock.

The use of an accelerated depreciation method instead of the straight-line method also results in a greater flow of internal funds generated with respect to any given amount of depreciable facilities. For any one asset (or assets acquired in any one year), of course, the increase in cash flow (i.e., profits after tax plus depreciation) in the asset's early years over that resulting from the use of straight-line depreciation will be exactly offset by the reduction in cash flow in the later years of the asset's life. Where assets are acquired in more than one year, however, the use of accelerated in lieu of straight-line depreciation will result in an increase in cumulated cash flow, until the taxpayer completely liquidates his depreciable assets accounts. For a taxpayer whose purchases of depreciable assets are growing, the use of an accelerated depreciation method will continue to yield a larger cash flow than straight-line; only when the asset account is stabilized, i.e., when annual acquisitions and

retirements leave the gross value of the account unchanged, will the annual cash flow become the same under both methods of depreciation, but annual cash flow under the accelerated method will never fall below that under the straight-line method so long as the total stock of facilities remains stabilized. For the taxpayer who adopts an accelerated method of depreciation for newly acquired assets and who maintains a fixed amount of depreciable assets, annual cash flow will exceed that which would have resulted from use of straight-line depreciation throughout a full replacement cycle and will become just equal to that under straight-line depreciation when all facilities are being written off under the accelerated method. The excess of accelerated over straight-line depreciation realized when the stock was growing will never be fully offset until the last asset has been retired. Where irregular growth in purchases occurs, the accelerated allowance may fall below the straight-line allowance in some years, even after the holdings of depreciable assets have been stabilized, but as before, total allowances under the accelerated methods will continue to exceed those under the straight-line method until all facilities have been retired.[20]

The more rapid the growth in the stock of depreciable facilities, the greater will be the excess of the cash flow under an accelerated as compared with the straight-line method, as shown in the following table. The impetus for rapidly growing, cash-hungry companies to adopt the use of accelerated depreciation techniques should be particularly strong.

	Percentage Excess of Accumulated Declining-Balance Over Accumulated Straight-Line Allowances,[b] *at the End of*		
Growth Rate[a] *(per cent)*	*10 years*	*20 years*	*30 years*
0	16.9	3.5	2.0
5	20.5	7.7	5.7
10	23.6	11.0	9.3

[a] Annual percentage increase in purchases.
[b] Assumes facilities with ten-year service lives and no dispersion of retirements.

As a corollary to the greater cash flow, the use of accelerated depreciation also serves to reduce the risk of investment in depreciable

[20] This discussion assumes, in the case of declining-balance depreciation, that each year's acquisitions of facilities are maintained in a separate account and that each such account is switched to straight-line at the appropriate time, as indicated earlier in this chapter.

facilities. For example, the SYD method on a ten-year asset results in a tax saving about $1\frac{2}{3}$ as great as that from straight-line depreciation at the end of the first three years. At a 50 per cent tax rate, SYD allowances generate a cash flow of about 25 per cent of the asset's cost in the first three years, compared with 15 per cent under straight-line depreciation. For the business taxpayer relying on a short payoff period approach to allow for the riskiness of investment in depreciable assets, the greater cash flow resulting from the use of accelerated depreciation methods means a greater proportion of the asset's cost will be recovered within the payoff period. For a taxpayer who assigns successively higher rates of discount to receipts of successively later years, the use of accelerated depreciation, which in effect transfers cash flow from later years when it would be subject to relatively heavy discounting to earlier years when the applicable discount is relatively slight, serves to reduce the average effective discount for risk. Under these circumstances, the increase in the present value of total depreciation allowances resulting from a switch to accelerated from straight-line depreciation is augmented by the very nature of the discount function.

A change in depreciation methods may also affect the theoretically optimum replacement cycle for depreciable facilities. In the case of a going concern, i.e., one in which there is no finite limit on the time horizon, an existing piece of equipment will be retired when its after-tax quasi-rent (the excess of its gross revenues over all variable costs attributable to it) falls below the interest on the capitalized value of the excess of after-tax quasi-rents over the costs of acquisition of an infinite succession of replacements (ignoring disposal value). Acceleration of depreciation allowances both increases the present value of this excess of quasi-rents over acquisition costs of the replacement facilities and accelerates the rate of decline in the quasi-rents of the existing facility. The condition for replacement, accordingly, will be realized at an earlier point in time than under nonaccelerated depreciation.[21]

[21] With respect to any given facility, acceleration of depreciation involves no change in the total amount of allowances, hence of quasi-rents, merely their redistribution through time. When the accelerated method allowance falls below the straight-line allowance, the quasi-rent on the facility declines below what it would be under straight-line. For a discussion of optimum economic service life, cf. Friedrich and Vera Lutz, *The Theory of Investment of the Firm*, Princeton, 1951, pp. 101 ff., and Edgar O. Edwards, "Depreciation and the Maintenance of Real Capital," in J. L. Meij (ed.), *Depreciation and Replacement Policy*, Amsterdam, 1961, pp. 46–54.

As a practical matter, a taxpayer comparing the cash flow from existing facilities with that which he might expect from replacements is likely to find that the more rapid reduction in an existing facility's cash flow under accelerated depreciation will make replacement worth while at an earlier date. Some taxpayers may view acceleration as reducing the average length of time their funds are "tied up" in a facility or as writing a facility off their books at an earlier date, thereby justifying earlier replacement.

While the replacement cycle for the firm will be shortened, it does not follow that it will be shortened for the economy as a whole. Since the change in depreciation method for tax purposes does not reflect a change in the real productivity of depreciable facilities, there is little reason to believe that such facilities will be *scrapped,* as opposed to *sold,* earlier than before depreciation acceleration. This conclusion would need to be altered if there is no market for secondhand facilities (or only a weak one), i.e., if facilities are typically scrapped upon retirement. The earlier sale for reuse of depreciable facilities, incidentally, should contribute to expanding or improving the market for used capital goods.

On the other hand, a shift to accelerated depreciation methods tends to reduce outlays on maintenance and repairs relative to those for new facilities. It should also reduce outlays for modification of existing facilities compared with those for new ones. Since the accelerated provisions of the 1954 Code were restricted to new, as opposed to secondhand facilities, an obvious bias towards the former was introduced. Both by reducing the impetus for maintaining the quality of existing facilities and by biasing firms against the purchase of used facilities, the acceleration of depreciation allowances might weaken the used capital goods market and reduce the over-all average period of use of depreciable assets.

In all of the respects indicated above, the acceleration of depreciation allowances should increase a firm's demand for depreciable facilities and expand its financial capabilities for acquiring them. While the direction of these effects seems clear a priori, the magnitude of the effect cannot be readily inferred. If short payoff periods and increasing discount functions are ignored, the effect of the accelerated depreciation provisions of the 1954 Code on the rate of return on investment, as indicated in Tables 1 and 2 above, is of a relatively small order of magni-

tude. For companies in which the demand for depreciable facilities is highly elastic with respect to anticipated profitability, of course, these changes may be adequate to induce a relatively large expansion of planned investment. That is to say, there may be a relatively large volume of capital projects which become attractive and feasible to the company by virtue of a slight increase in the rate of return realizable upon them and/or an increase in the amount of internally available funds. On the other hand, for other companies the increase in rate of return may be deemed to be too small to affect capital programs. The elasticity of demand for depreciable facilities, in turn, depends on the nature of the firm's production function and upon the elasticity of demand for its output. The elasticity of supply of the capital goods used by the firm in its production function will determine the extent to which increases in demand for depreciable facilities result in increases in the real capital stock or increases in the prices of capital goods. For production activities in which factor combinations are relatively fixed in the short run, the adoption of accelerated depreciation will certainly increase the firm's liquidity and may in the near term affect its inventory and dividend policies and its degree of reliance on external sources of funds; accelerated depreciation may very well have little influence on the ratio of the firm's capital to labor inputs until such time as it becomes technically feasible to introduce a new production arrangement or until alternative lines of production activity involving a higher capital-labor ratio become feasible. On the other hand, even with a technically fixed input combination, the effects of accelerating depreciation may induce the firm to attempt to enlarge the scale of its operations beyond that it would deem desirable using the straight-line method.

It is even more difficult to generalize about the impact of depreciation liberalization on aggregate investment in depreciable facilities. The outcome depends on the effect of this tax change on both investment demand and total saving. An increase in the former without an increase in the latter will result in a rise in the price of capital goods but no change in the short run in the rate of real capital formation. Depreciation liberalization will not necessarily augment total saving. If this tax change occurs under circumstances of full employment, there can be no increase in the rate of expansion of real output to generate an increase in the rate of real saving. Under this condition, the rate of real saving could be increased only if the inflationary expansion of aggregate demand in current prices—but not in real terms—resulted in the trans-

fer of income from persons or companies with low to those with high saving propensities. Alternatively, the short-run revenue loss from depreciation liberalization might be offset by tax increases on other components of national income, in order to forestall inflation. Whether there will be an increase in aggregate saving will depend on the relative saving inclinations of the taxpayers who realize tax reduction through depreciation liberalization and those who incur greater tax liabilities. On the other hand, depreciation liberalization might also be used as a vehicle for net tax reduction under conditions of less than full employment. If investment demand responds to this tax reduction, the consequent increase in aggregate demand and in real output will, with unchanged savings predilections, afford an increase in real saving.

In any event, it is clear that the extent to which accelerated depreciation tax provisions can have any of the effects attributed to them depends on the extent of use of these provisions.

A number of constraints may militate against the firm's shifting from straight-line to other depreciation methods. Depreciation accounting under either the declining-balance or SYD method is more complex than under straight-line and involves greater compliance costs. For small companies or those with relatively small amounts of depreciable facilities, the increase in these costs might outweigh the anticipated benefits. Accounting conventions of the firm, moreover, may make it difficult to report income and costs to shareholders on a different basis from that used for tax purposes; in such a case, the reported increase in depreciation and consequent reduction in profits before tax, resulting from the use of an accelerated instead of the straight-line method, might reflect adversely—albeit inaccurately—on the firm's management. Management may initially misunderstand the consequences of using accelerated instead of straight-line depreciation; it may require a number of years before the financial advantages of acceleration become sufficiently understood to induce a change in depreciation practice.

The lower the applicable marginal rate of tax, the less the benefit in using accelerated compared with straight-line depreciation. The inducement to adopt accelerated methods, presumably, would be relatively weak for many unincorporated businesses and small corporations for this reason. In addition, accelerating depreciation deductions might prove disadvantageous if marginal tax rates are expected to rise, since these higher rates (because of the decreasing depreciation deductions) will apply when taxable income generated by a facility is rising. Un-

incorporated businesses and very small corporations anticipating growth in income, hence in marginal rates, might therefore wish to defer adoption of accelerated methods.

A frequently heard contention is that many small companies, depreciating their facilities under the straight-line method on the basis of service lives and salvage values significantly less than might be justified by their replacement practices, were reluctant to change to an accelerated method lest the resulting increase in the ratio of their depreciation allowances to their new gross facilities alert revenue agents to these practices. If the revenue agent were consequently to insist on the use of longer service lives or greater salvage values, the net effect might be to reduce rather than to increase depreciation allowances and cash flow.

These, and quite possibly other, factors may have limited the extent to which taxpayers availed themselves of the accelerated depreciation methods. In time, however, these constraints may have become less consequential; as we shall see below, some of our measures show a rapid increase in taxpayer response between the taxable years 1954 and 1960, the period covered by our data. The use of these methods very likely has continued to increase thereafter.[22]

[22] On the other hand, a shift toward greater use of the straight-line method occurred in the taxable years 1962–64, as a result of a feature of the Treasury's Revenue Procedure 62-21 (July 11, 1962), which set forth new guidelines for tax depreciation. For purposes of the reserve ratio test provided by the procedure, the taxpayer must include in his guideline accounts all of the depreciable property on hand and all of the depreciation accumulated thereupon. In group or composite accounting under the straight-line method, the depreciation rate is applied to the gross asset account, no matter what the net balance of the account (i.e., gross assets less accumulated depreciation) might be. The addition of overage, fully depreciated assets to the group account, therefore, expands the depreciable basis, hence the annual depreciation deduction. Subsequent retirement of such assets substantially reduces the reserve ratio and facilitates the taxpayer's meeting the "transition" rules in the reserve ratio test. Accordingly, the procedure created a strong impetus for taxpayers to set up guideline accounts under the straight-line method. The same sort of impetus, but to a lesser degree, is afforded by group or composite SYD accounts, since in such cases, too, the depreciation rate is applied to the gross amount of assets. No similar impetus was afforded under declining-balance, in which the annual allowance, as noted above, is computed by applying the depreciation rate to the remaining balance of the account. For a more detailed discussion, cf. Frederick W. Stevenson, "Tax Depreciation and Business Resources," *National Industrial Conference Board Record*, Vol. II, Nos. 7 and 9, and Vol. III, No. 3; and George E. Lent, "Should the Reserve Ratio Test Be Retained," *National Tax Journal*, December 1964, pp. 365–393, especially, pp. 380–381.