Report to Congress on the

Depreciation of Business - Use Passenger Cars

Department of the Treasury
April 1991

DEPARTMENT OF THE TREASURY
WASHINGTON

ASSISTANT SECRETARY

April 1991

The Honorable Dan Rostenkowski
Chairman
Committee on Ways and Means
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Section 7612(f) of Public law 101-239, the Omnibus Budget Reconciliation Act of 1989, directs the Secretary of the Treasury or his delegate to conduct a study of the proper class life for cars and light trucks and submit a report to the Congress within one year of enactment. The Omnibus Budget Reconciliation Act of 1990 extended the date for submission of the report to April 15, 1991. Pursuant to those directives, I hereby submit the "Report to Congress on the Depreciation of Business Passenger Cars." A report on the depreciation of light trucks is expected to be submitted in July.

I am sending a similar letter to Representative Bill Archer.

Sincerely,

Kenneth W. Gideon

Kenneth W. Gideon
Assistant Secretary
(Tax Policy)

Enclosure

DEPARTMENT OF THE TREASURY
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ASSISTANT SECRETARY

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The Honorable Lloyd Bentsen
Chairman
Committee on Finance
United States Senate
Washington, D.C. 20510

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Table of Contents

Table of Figures

Table of Tables

Chapter I. Introduction and Principal Findings

A. Mandate for This Study

This study of the depreciation of business-use passenger cars has been prepared by the Office of Tax Analysis (OTA) in response to a Congressional mandate in the Omnibus Budget Reconciliation Act of 1989 (P.L 101-239). Section 7612(f) of the Act, which became effective December 19, 1989, directed Treasury to conduct a study on the proper class life for cars and light trucks and to report its findings to the Congress within one year. The Omnibus Budget Reconciliation Act of 1990 extended the due date for the report to April 15, 1991. A report on the depreciation of light trucks is expected to be submitted to Congress later this year.

OTA conducts studies of the depreciation of other assets, including assets not expressly requested for study by the Congress, as part of its general mandate under Section 168(i)(1)(B) of the Internal Revenue Code (IRC), as modified by the Tax Reform Act of 1986. (See Exhibit 1 of Appendix A.) This provision directed the Treasury to "monitor and analyze actual experience with respect to all depreciable assets", and granted Treasury the authority to change the classification and class lives of assets. The Technical and Miscellaneous Revenue Act of 1988 (TAMRA) repealed Treasury's authority to alter asset classes or class lives, but the revised Section 168(i) continued Treasury's responsibility to "monitor and analyze actual experience with respect to all depreciable assets" (see Exhibit 2 of Appendix A).

The *General Explanation of the Tax Reform Act of 1986* indicates that the determination of the class lives of depreciable assets should be based on their anticipated useful lives and the anticipated decline in their value over time, after adjustment for inflation (see Exhibit 3 of Appendix A). Under current law, the useful life of an asset is taken to be its entire economic lifespan over all users combined, and not just the period it is retained by a single owner. The *General Explanation* also indicates that, if the class life of an asset is derived from the decline with age of its market value, such life (which, to avoid confusion, is hereafter referred to as its equivalent economic life) should be set so that the present value of straight-line depreciation over the equivalent economic life equals the present value of the decline in value of the asset (both discounted at an appropriate rate of interest).

As described in Chapters III and IV, an unadjusted equivalent economic life was derived for a broad spectrum of business-use passenger cars. In its study of the depreciation of rental clothing (tuxedos), where it was assumed that separate accounts were not kept for each tuxedo,

OTA computed the equivalent economic life from the estimated decline in value with age of the tuxedos, without considering the potential gains or losses incurred upon the retirement of each tuxedo[1]. In this report, such calculated equivalent economic life is referred to as the *unadjusted* equivalent economic life.

Business-use passenger cars have unique characteristics. Unlike most other business equipment, passenger cars are typically sold before the end of their useful life as vehicles. Moreover, unlike a number of other business assets for which an established resale market exists, used business-use passenger cars are nearly always acquired for household (or non-business) use.[2] The analysis of the depreciation of business-use passenger cars in this report is thus somewhat different from the analysis used in prior OTA depreciation studies. In those studies the analysis took into account the decline in the asset's market value with age, the pattern of asset retirements, and the tax consequences of the retirements. Such analysis, however, ignores the economic implications of the relatively infrequent sales of used assets. By contrast, an *adjusted* equivalent economic life for business passenger cars was derived in this study that accounts not only for the decline in value of the cars with age, but also for their conversion from business to non-business use and the tax gains and losses that arise from their sale at different ages. However, because of the relatively short period passenger cars remain in business use, retirements are ignored in calculating their adjusted equivalent economic life.

Under current law, passenger cars used in a trade or business, including taxicabs, have a class life of three years, regardless of whether they are owned, leased, or rented by their business users. Under Section 168(e)(3)(B)(i) of the IRC, however, passenger cars are assigned to the five-year property recovery class, regardless of their class life. Likewise, under Section 168(g)(3)(D), the alternative depreciation system recovery period for passenger cars is five years.

B. Principal Findings

A distinction between fleet and non-fleet vehicles is generally recognized in the industry, which is briefly described in Chapter II. Fleet vehicles are defined by the industry as passenger

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1 Treasury submitted a report to Congress in August 1989 on the depreciation of rental clothing (*Report to Congress on the Depreciation of Clothing Held for Rental*). In March 1990, Treasury submitted separate reports to Congress on the depreciation of scientific instruments, fruit and nut trees, and horses (*Report to Congress on the Depreciation of Scientific Instruments; Report to Congress on the Depreciation of Fruit and Nut Trees; Report to Congress on the Depreciation of Horses*).

2 For this study, OTA accepts the industry assertion that nearly all sales of business-use passenger cars are made directly or indirectly to households.

cars held by their business owners in groups of 10 or more. All other business-use passenger cars are defined as non-fleet vehicles. Fleets mostly include vehicles owned by long-term leasing firms and daily rental firms, but also include vehicles owned directly by their business users (private fleets). Non-fleet vehicles include passenger cars owned by their business users as well as cars leased by their business users from non-fleet lessors and retail dealerships.

The principal findings of this study are that passenger cars used in business fleets have an adjusted equivalent economic life of 2.8 years, and that non-fleet business-use passenger cars have an adjusted equivalent economic life of 4.5 years.[3] Weighting the present values underlying the two lives by each sector's share of tax-depreciable investment in passenger cars yields an average adjusted equivalent economic life ranging from 3.5 years to 3.8 years, depending on the relative weight given to non-fleet leased vehicles. This weighting issue is discussed in more detail in Chapter V.

While the estimated equivalent economic lives are significantly different for fleet and non-fleet passenger cars, OTA does not recommend establishing separate asset classes for business-use passenger cars under the Modified Accelerated Cost Recovery System (MACRS). As discussed in Chapter V, the difference in economic lives for fleet and non-fleet vehicles is explained mostly by differences in miles travelled during the first two years of service. While mileage and other use-related characteristics are closely correlated with fleet/non-fleet status, such status does not by itself determine a vehicle's intensity of use. Moreover, any distinction based on ownership would pose difficult administrative problems of definition and enforcement.

As noted in Chapter VI, based on the above findings Treasury recommends that the class life for MACRS asset class 00.22 (Automobiles, Taxis) be changed from 3 years to 3.5 years.

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3 Passenger cars are defined as four-wheeled vehicles manufactured or sold primarily for use on public streets, roads, and highways, and rated at 6,000 pounds unloaded vehicle weight or less. Limousines and taxi cabs are included without regard to weight. Multipurpose vehicles, sport utility vehicles, and passenger vans are not included in this report.

Chapter II. Industry Background

While sales of passenger cars to households are an important part of the national economy, sales to businesses are also significant. According to the Bureau of Economic Analysis (BEA), business spent $50 billion in 1989 on new passenger cars, accounting for one-third of total domestic passenger car sales and about 12 percent of total business investment in new equipment.

As noted, for this study business-use passenger cars have been classified into two major categories: fleet cars and non-fleet cars. According to industry classification, fleets consist of cars owned by firms with 10 or more cars. All other business-use cars are defined for this study as non-fleet cars. The majority of fleet cars are owned by long-term (30 days or more) leasing firms and short-term (less than 30 days) rental firms, with a small portion owned directly by their business users (private fleets). Non-fleet cars are mostly owned by small and medium-sized business firms in a wide variety of industries, including small lessors. These distinctions by type of ownership are of interest due to the differences observed in resale prices and holding periods. Table 1 shows 1989 investment in passenger cars by each industry sector.

Table 1.--Investment in Business-Use Passenger Cars by Industry Sector, 1989 (Units in Thousands, Dollars in Billions)

Industry Sector	Number of Vehicles	Acquisition Cost	Percentage Distribution	
			Number	Cost
Fleet	1,953	25.0	56.3	49.9
Lease	894		25.8	
Rental	907		26.2	
Private	152		4.4	
Non-fleet	1,514	25.1	43.7	50.1
Total	3,467	50.1	100.0	100.0

Sources: Bureau of Economic Analysis, *Automotive Fleet Fact Book.* Acquisition cost by sector estimated by OTA.

The composition of passenger cars acquired for business purposes differs somewhat from those acquired for non-business purposes. Table 2 compares the distribution by size class of all passenger cars sold in model year 1989 with that for business fleets.[4] Business fleets are more heavily concentrated in compact and intermediate models, with lease and private fleets especially heavily concentrated in intermediate-sized models. The results presented in this study, though, are for the depreciation of business-use vehicles only. Because the depreciation pattern varies by size class, and because the distribution by size class differs between vehicles acquired for household use and business use, the results shown in this report for business-use cars cannot be generalized to all passenger cars.

Table 2.--Distribution of Passenger Car Sales, Model Year 1989 (Number of Cars in Thousands)

Size Class	All Passenger Cars		Business-Fleet Passenger Cars	
	Number	Percent	Number	Percent
Domestic plus selected imports	8,409.5	81.5	1,922.5	92.6
Subcompact	2,264.7	21.9	334.1	16.1
Compact	2,110.9	20.5	544.2	26.2
Intermediate	2,428.8	23.5	676.7	32.6
Standard	832.7	8.1	178.9	8.6
Luxury	772.4	7.5	188.6	9.1
Other imports	1,908.5	18.5	154.3	7.4
Total	10,318.0	100.0	2,076.8	100.0

Source: *Automotive Fleet Fact Book*, p. 22.

4 The classification of cars in this table differs from that used elsewhere in this report. *Automotive Fleet Fact Book* includes government fleet cars, and classifies only selected imports in the specific size class categories. While adjustments to fleet data were generally made in this report to exclude government cars and to include all imports in a single category ("foreign"), such adjustments were not made in Table 2 for comparability with the available data for "All Passenger Cars".

Chapter III. Data Collection and Methodology

A. Public meetings

Public meetings were held at the Treasury Department in January and March of 1990 to determine the scope of the study, discuss the study design and general methodology, and describe the kind of data needed for the study. The first public meeting was announced in the Federal Register on December 21, 1989, and invitations were extended to each of the major trade associations representing different sectors of the business-use car and light truck industry. Invitations were also sent to executives of the largest leasing and rental firms in the United States.

At these meetings, it was determined that the scope of the study should include all automobiles and light/medium duty trucks designed for use over-the-road and used in a trade or business. This coverage was generally understood by Treasury and industry participants to include both fleet and non-fleet vehicles, and vehicles that are leased or owned by their users. Although no attempt was made to define "light" or "medium-duty" trucks, data collection for trucks was limited to those with a gross vehicle weight of 33,000 lbs. or less. This decision effectively eliminated large tractor-trailer trucks from the scope of the study, and it preserved flexibility in ultimately defining light and medium duty trucks for classification purposes.

Unlike many of the previous depreciation studies conducted by OTA, no survey of the industry was conducted or proposed. Instead, data were solicited directly from a limited number of owners of business-use vehicles based on vehicle specifications that were proposed and developed at the public meetings. This data-collection procedure was adopted because of the relatively short time frame granted by the Congress for completion of this study, and because of the availability of machine-readable data from several of the firms that agreed to participate in the study.

B. Description of the Data

Firms participating in the study were asked to provide OTA with detailed data on characteristics of cars and light trucks either disposed of during the last few years or in their fleet inventory at the time the data were provided. Each observation in each data set was to include, at a minimum, the vehicle's Vehicle Identification Number, original acquisition cost,

the month and year of acquisition, the sale price (net of refurbishing costs), and the month and year of disposition. Some data sets also included the type of disposition and the mileage of the cars at disposition. All of the data were received by OTA from May through August of 1990.

Data for fleet passenger cars were received from four major national leasing firms and three large private fleet owners[5]. Data for non-fleet vehicle dispositions and mileage were obtained from a sample of business tax returns prepared by the Statistics of Income Division of the Internal Revenue Service. Despite repeated requests to the major rental car trade associations and other industry representatives, OTA was unable to obtain passenger car data from the daily rental sector of the industry.

Although the daily rental sector accounts for nearly one-half of fleet passenger car purchases, not all of this investment is capitalized and depreciated for tax purposes, since many of the vehicles are sold within the same tax year they are acquired. This holding period has declined in recent years, as both domestic and foreign auto manufacturers (some of whom hold large equity stakes in daily rental firms) have increased their sales to such firms by agreeing to re-purchase the cars at guaranteed prices after just several months of use. These cars are then typically sold by the manufacturers to their retail dealerships and are in turn sold by such establishments to households as "nearly new" used cars.

Passenger car data from three of the leasing firms and two of the private fleet firms were analyzed in detail.[6] Although OTA had requested data on dispositions for the period 1983 through 1989, only one of the leasing firms was able to provide a significant number of dispositions prior to 1985. Thus, the great majority of the dispositions represent sales, wrecks, and other dispositions during the years 1985 through 1989.

C. Structuring the Data

Since depreciation of passenger cars is likely to vary by model and class, and since the composition of passenger car fleets varies over time, passenger cars were classified by manufacturer's model whenever possible. A manufacturer's model is defined as a set of

5 The American Automotive Leasing Association (AALA) and the National Association of Fleet Administrators (NAFA) assisted in this study by coordinating the collection of data from their participating member firms.

6 Data provided by one of the leasing firms and one of the private fleet firms were not analyzed because the data were incomplete. However, due to the relatively large sample of complete data, these firms were not asked to resubmit their information. The five data sets that were analyzed provided in total useable observations for 773,000 passenger cars, with 469,000 dispositions and 304,000 cars in inventory. The vast majority of the observations (97 percent) were provided by the three leasing firms.

passenger cars with the same basic design features over a number of different model years, and includes all passenger car observations with those features from all relevant model years. By construction, it includes cars that may differ in characteristics such as body type, engine type, and optional equipment.[7]

For the fleet analysis, 35 specific domestic models and 11 foreign nameplates were identified that represent all major manufacturers (both domestic and foreign) and six different classes. Models were chosen for study only when there were a sufficiently large number of vehicle dispositions spread over several years. Consequently, little or no weight was given in the overall results to models discontinued early in the sample period or introduced late in the sample period.

Since many of the same models occurred in more than one data set, a total of 145 model-data sets were separately analyzed. (See Appendix B for a listing of the models studied and the number of dispositions observed for each class.) Lease fleets included a much wider variety of models than private fleets. The models and nameplates listed in Appendix B account for 392,121 passenger car dispositions, or about 84 percent of the total useable passenger car observations in the sample. Non-fleet vehicles could not be stratified by make, model, or size class due to the relatively small number of observations for this sector.

Both the unadjusted and adjusted equivalent economic lives were derived (as described below in Section D) for each model chosen for study in each data set. Data from model years 1985 and 1986 were analyzed separately in obtaining the adjusted equivalent economic lives for fleet vehicles.[8] Models were then grouped into one of six size classes, as defined by *Automotive Fleet Fact Book.* A weighted average equivalent economic life was derived for each class in each data set, with weights equal to the firm's model year 1989 investment in that model.[9] These results were than aggregated over firms (data sets) to obtain equivalent economic lives for each class.

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7 Models were identified consistently across data sets and over time using the standard 17 digit Vehicle Identification Number (VIN) assigned by the manufacturer. For example, the "Ford Taurus" model includes all observations with a VIN car line/series code indicating Ford Taurus for model years 1986 through 1990, including four-door sedans and station wagons. Due to smaller sample sizes, foreign cars were generally analyzed at the broader "nameplate" level, which refers to all of the models produced by one production division of a manufacturer.

8 A model year is defined as a manufacturer's annual production period that includes January 1 of the year referenced. A model year typically begins in September or October, but can start earlier.

9 In deriving the weighted average, the estimated equivalent economic lives for each model were converted to present values, and these were weighted by each model's share of investment. The weighted average present value was then converted into an average equivalent economic life. This weighting procedure was followed at each level of aggregation.

Finally, equivalent economic lives for each class were weighted by the observed fleet share of 1989 investment in the class to obtain a single equivalent economic life for fleets. The non-fleet sample was too small (121 new passenger car dispositions) to stratify by model, model year, or class. Consequently, a single equivalent economic life for non-fleet vehicles was estimated over all models and model years.

D. Methodology

As suggested in the *General Explanation of the Tax Reform Act of 1986*, the class life of an asset is to be determined from the decline in its value with age. This life (which for clarity has been referred to as the asset's equivalent economic life) can be either longer or shorter than its useful life (i.e., the period over which the asset provides service), depending upon whether the pattern of its decline in value with age (its "age-price profile") is more or less rapid than straight-line depreciation. An asset that declines in value less rapidly than straight-line depreciation has a longer economic life, and an asset that declines more rapidly in value than straight-line depreciation has a shorter economic life, than the asset's useful life. (For a more complete discussion see Hulten and Wykoff [1981].)

For each model chosen for study in each data set, both an unadjusted equivalent economic life and an economic life adjusted for sales were derived. The unadjusted equivalent economic life was obtained by equating the present value of economic depreciation (i.e., the decline in value of the asset) with the present value of straight line depreciation, both discounted at a four percent real rate. The straight line depreciation is calculated over a recovery period equal to the unadjusted economic life. In calculating the unadjusted equivalent economic life, the tax implications of the actual sales (from which the age-price profile is obtained) are ignored. In particular, both straight line depreciation and economic depreciation are considered over the entire useful life of the vehicles.[10] (See Appendix C for a more detailed description of the analysis.)

The decline in value is obtained from an estimated age-price profile, which represents the average inflation-adjusted value of the model (relative to its average initial acquisition cost) at each age. In contrast to the Box-Cox procedure used by Hulten and Wykoff (1981) and Wykoff (1989), in this study the age-price profile for each model was determined statistically by fitting

10 The unadjusted equivalent economic life is obtained numerically using a computer program that chooses a test solution for that life, uses this solution to calculate the present value of straight line depreciation, and then determines a new solution based on the resulting difference in present values. This process continues until the present value of depreciation over the straight line life equals the present value of economic depreciation with a very small tolerance.

a fifth-order polynomial of vehicle age (in months) to inflation-adjusted relative resale prices. All normal sales over the entire sample period for the model were used to determine the parameters of the regression equation.[11]

It was important to estimate the decline in value of a model from fairly complete data that include, at a minimum, the first two years of each model's life. In general, only model years 1985 and 1986 met these conditions. Since data for dispositions prior to 1985 were generally not provided by the industry, a large percentage of first-year and second-year sales for model years prior to 1985 were missing. Conversely, relatively few cars in model year fleets from 1987 through 1989 had been disposed of by late 1989 or early 1990.

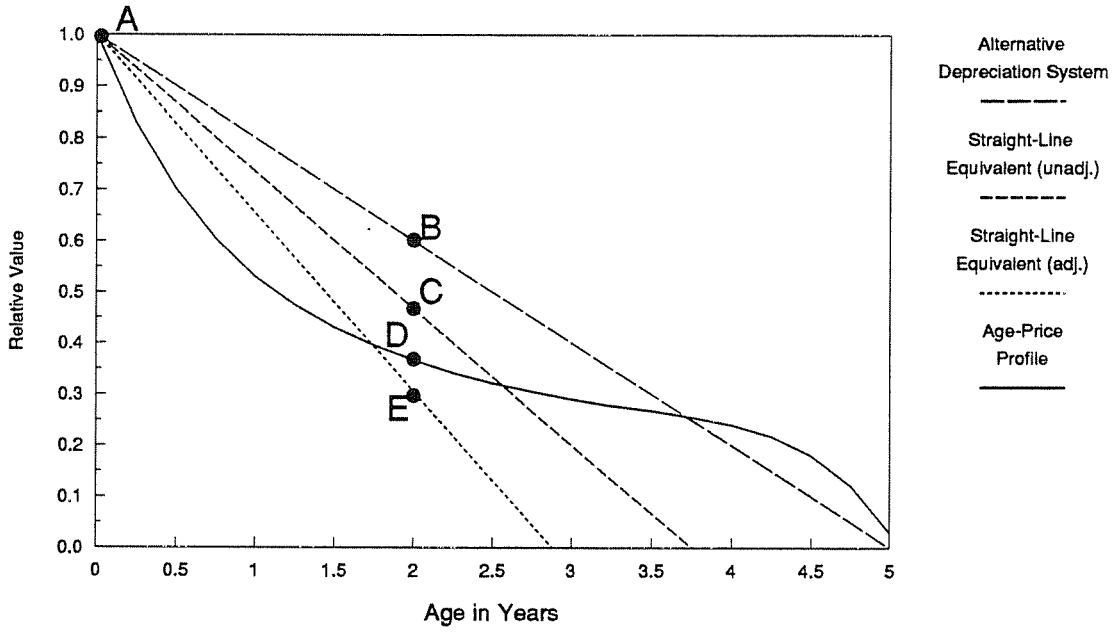
Whereas the unadjusted equivalent economic life is obtained by equating the present values of straight-line and economic depreciation over the entire useful life of the passenger cars, the adjusted equivalent economic life is obtained by equating the present values of straight-line and economic depreciation only over the period the passenger cars remain in business use. In addition, the adjusted equivalent economic life also takes into account the present value of the loss (or gain) incurred upon the transfer of the passenger cars from business to non-business use. Thus, in contrast to the unadjusted equivalent economic life, the tax implications of sales of vehicles (which result in their transfer to non-business use) are taken into account.

The straight line depreciation is calculated over a period equal to the adjusted equivalent economic life, and both straight-line and economic depreciation are considered only up to the date of sale. Gains and losses are computed as the difference between the straight-line adjusted basis and the actual value at the time of sale. Because most of the vehicles are sold well before the end of their useful life and experience a present value of economic depreciation over their retention period that exceeds the present value of the (hypothetical) straight-line depreciation (including the gain or loss on disposition), the adjusted equivalent economic life is less than the unadjusted equivalent economic life.

Figure 1 illustrates the relationship between the age-price profile and various straight-line depreciation schedules: the current law alternative depreciation system (ADS), the unadjusted straight-line equivalent economic life, and the adjusted straight-line equivalent economic life,

11 Ackerlof (1970) suggested that because buyers of used passenger cars have imperfect information regarding the quality of the car purchased, only "lemons" are sold. Although this point may have some relevance for household-use vehicles, it would appear to be less important for business-use cars, most of which are sold after a relatively short period of use.

Figure 1: Relationship Between Age-Price Profile and Various Straight-Line Depreciation Schedules



for a single representative domestic compact model. The age-price profile (solid line) drops rapidly over the model's first year of service, and then at successively slower rates over ages two, three, and four, before turning down sharply after age four.[12] The adjusted basis as calculated under ADS (long-dashed line in Figure 1) reaches zero after five years for all passenger cars. (For convenience, the applicable half-year convention is ignored.)

For this model, the adjusted basis using the unadjusted straight-line equivalent schedule (short-dashed line) reaches zero at 3.8 years. As discussed below, when this model's observed pattern of dispositions is taken into account (and the resulting gains and losses included in the analysis), the adjusted basis under the *adjusted* straight-line equivalent schedule (dotted line in Figure 1) reaches zero after 2.9 years.

Representatives of the lease sector of the industry have argued that the current law alternative depreciation system (which enters the adjusted current earnings component for corporate taxpayers subject to the alternative minimum tax) is too slow, especially when the

12 The estimated age-price profile is determined by fitting a fifth-order polynomial through the actual relative price observations. Although the polynomial crosses the x axis at an age of about 5 years, there are no observations for cars older than 4.5 years.

relatively short retention period of passenger cars characteristic of their industry is recognized.[13] Thus, if a car from the model shown in Figure 1 were sold at age two by a taxpayer using ADS, the taxpayer's adjusted basis in the car at that age would be about 60 percent of the car's original cost (point B in Figure 1), whereas its sales price, as reflected in the age-price profile, would be about 37 percent of its original cost.

While such taxpayers would be able to claim a tax loss, the present value of the depreciation deductions (represented by the path AB in Figure 1) plus the present value of the loss (represented by the distance BD), would be much less than the present value of economic depreciation (represented by the path AD). If the cars remained in business use after their disposition, this deficiency over the first two years would not be particularly relevant, since the present value of the depreciation deductions and disposition gains and losses would be considered over the entire useful life of the car, regardless of ownership changes. However, industry representatives claim that no more than five percent of the business-use cars sold are purchased by other business users. In accepting this statement describing a unique aspect of the resale market for business-use vehicles, OTA also accepts the corresponding implication that the present values should be equated only over the more limited period during which passenger cars are used for business purposes.

Even if taxpayers were allowed to depreciate the cars along the unadjusted straight-line equivalent schedule (short-dashed line), the present value of the depreciation deductions (represented by the path AC) plus the present value of the loss incurred at disposition (represented by the distance CD) would still be less than the present value of economic depreciation to the time of disposition. This is not surprising. By construction, the present values of depreciation under the unadjusted equivalent straight-line schedule and that of economic depreciation are equal only when the asset is held until the end of its useful life. A disparity will always arise if the asset is typically converted to non-business use prior to that age.

The adjusted equivalent straight-line schedule is designed to reflect both the disposition of the cars prior to the end of their useful life and the gains and losses incurred upon disposition. If taxpayers depreciated their cars along this schedule (represented by the path AE), then a gain (rather than a loss) would occur when the car is sold at age two (represented by the distance ED in Figure 1). The adjusted straight-line equivalent schedule reflects the entire observed pattern of dispositions, and not just those dispositions at age two. Thus, even if the taxpayer were to

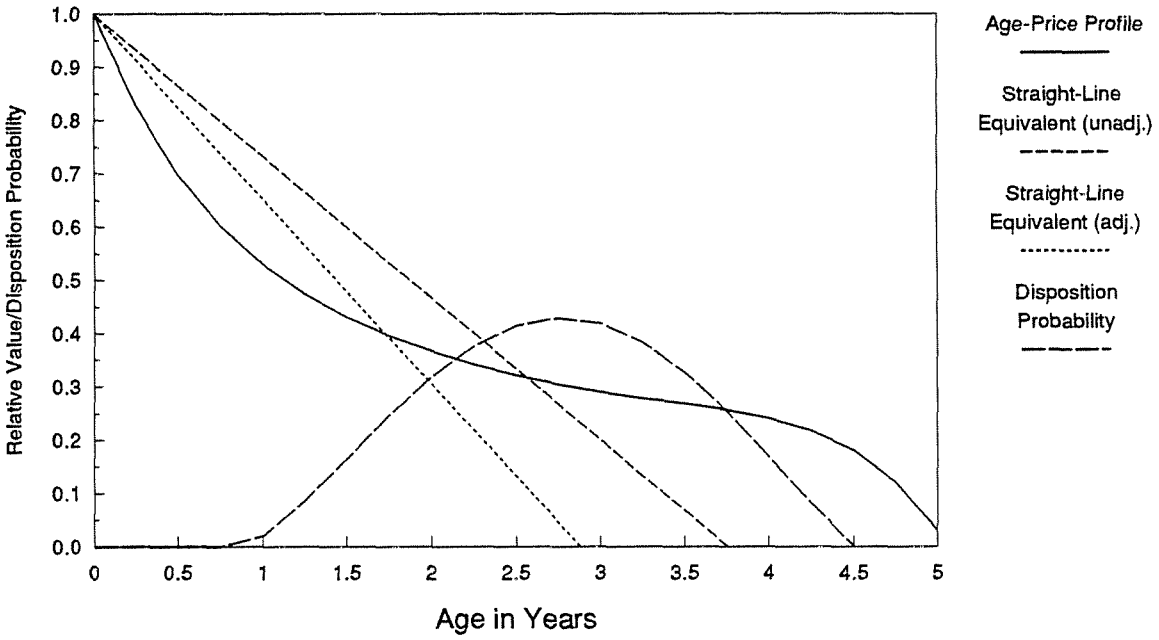
13 See, for example, Pies and Fischer (1990).

use this schedule, a disparity in present values would generally arise. The present values over the period of the cars' business use will be equal only on average for all taxpayers who own this particular model of passenger car.

Chapter IV. Results of the Analysis

This chapter presents the results of applying the methodology described above in Chapter III. For illustration, four specific models (representative compact, intermediate, standard, and foreign models) are discussed. The aggregate results for fleet and non-fleet passenger cars are then presented. In Figure 2, the age-price profile for the representative compact model (model year 1986) owned by lease firm A is again shown, together with the unadjusted and adjusted straight-line equivalent schedules. Also shown is the observed disposition probability curve (long-dashed line in Figure 2). Lease firm A on average holds this model 2.8 years, and no cars of this model are held by this firm beyond 4.5 years.

Figure 2: Representative Compact Model
Age-Price Profile, Straight-Line Equivalent Schedules, and the Disposition Probability

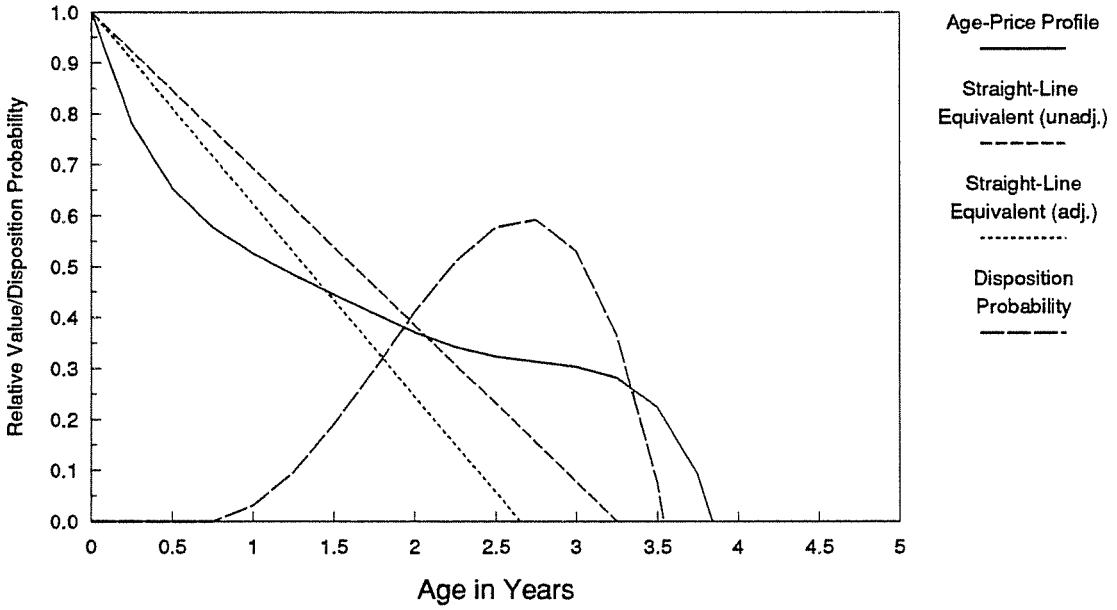


Figures 3 through 5 show the age-price profile, unadjusted and adjusted straight-line equivalent schedules, and disposition probability curve for representative intermediate, standard, and foreign models, respectively, that were among the 46 models studied for this report. The intermediate model (model year 1986) is owned by lease firm B, the standard model (model year 1986) is owned by lease firm C, and the foreign model (model year 1985) is also owned by lease firm B.

While the shapes of the age-price profiles for the representative compact model (Figure 2) and the representative intermediate model (Figure 3) are similar over the first three years, the curve for the intermediate model declines more rapidly after age three, resulting in a shorter unadjusted equivalent economic life for that model. While the adjusted equivalent economic life for the intermediate model is also shorter, the difference in adjusted equivalent economic lives between the two models is not very significant. This is the result of a somewhat wider range of holding periods for the compact model, which results in relatively more dispositions in later years at a gain than for the intermediate model.

Figure 3: Representative Intermediate Model

Age-Price Profile, Straight-Line Equivalent Schedules, and the Disposition Probability



For the representative standard model (Figure 4) and the representative foreign model (Figure 5), the age-price profiles decline less rapidly in the early years, resulting in longer unadjusted equivalent economic lives than for the compact and intermediate models.[14] The adjusted equivalent economic life for the representative foreign model (3.6 years) is longer than

14 The slight upturn in the age-price profile at 4.5 years for the representative foreign model in Figure 5 is a result of sparse data on dispositions after age 4. The fitted curve turns down after age 5 and reaches zero at 5.7 years of age.

for any of the representative domestic models. This is due not only to a higher unadjusted equivalent economic life (4.7 years), but also a longer average holding period (3.1 years) relative to the representative domestic models.

Figure 4: Representative Standard Model

Age-Price Profile, Straight-Line Equivalent Schedules, and the Disposition Probability

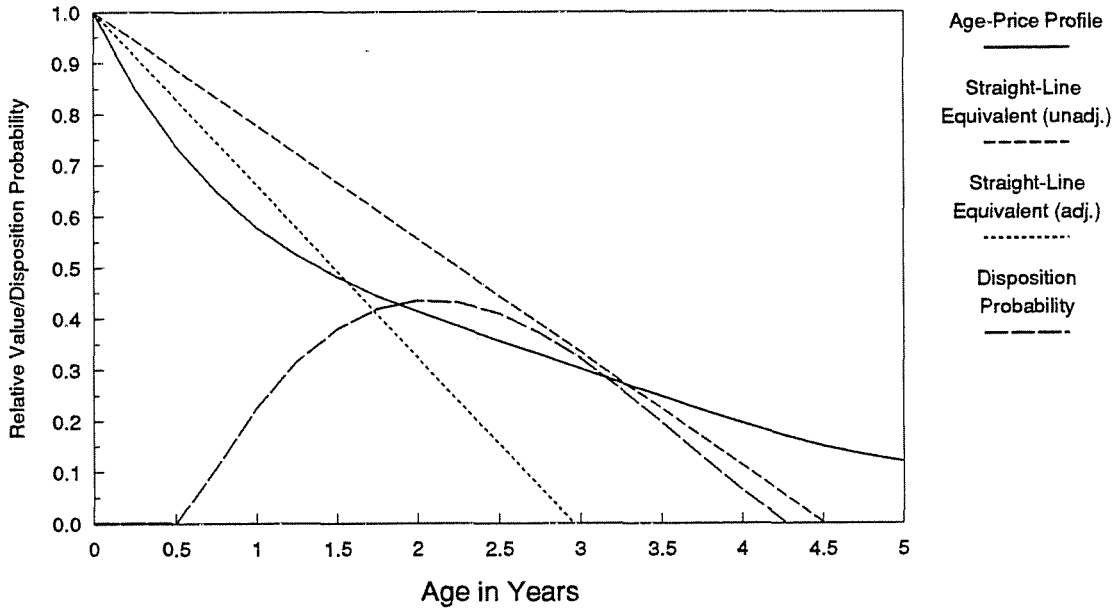
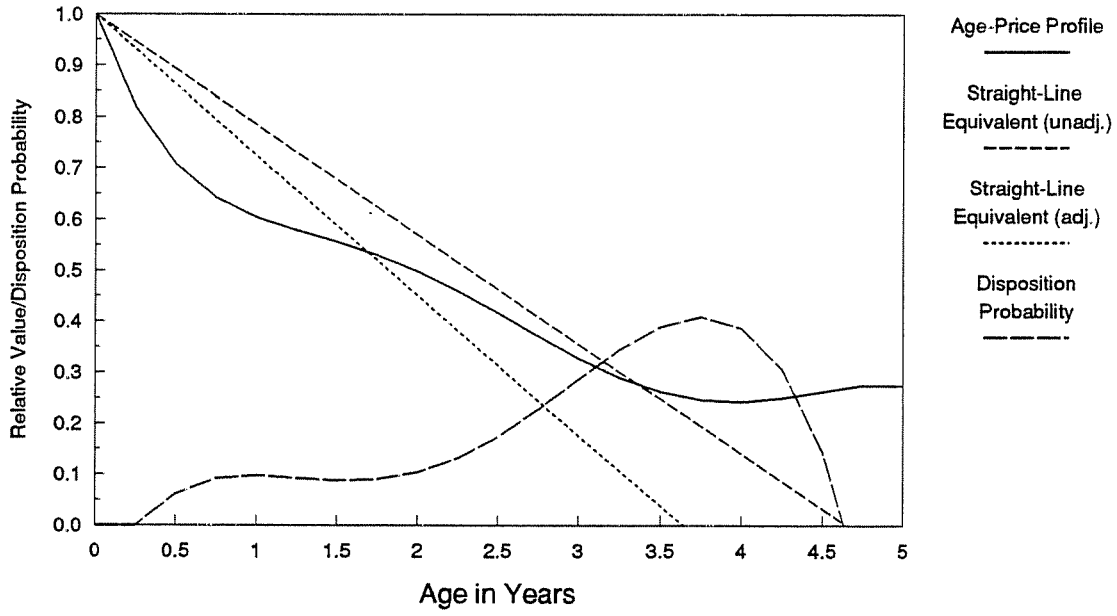


Table 3 summarizes the estimated adjusted and unadjusted equivalent economic lives by class for fleet passenger cars. As described above, the lives shown for each category represent the weighted average of the lives for each model studied, as noted in Appendix B. The overall life for private fleets (over all models) is nearly the same as that for lease fleets. The fleet estimates presented in Table 3 combine the results for both fleet types. This similarity in overall lives is not surprising, since industry representatives claim that private fleets are managed much the same way as lease fleets, and that private non-leasing firms will switch between leasing and

Figure 5: Representative Foreign Model

Age-Price Profile, Straight-Line Equivalent Schedules, and the Disposition Probability



buying from year to year depending on market and firm conditions. The overall unadjusted equivalent economic life of 3.7 years for fleet passenger cars found in this study is somewhat shorter than the results reported by Wykoff (1989) regarding business-leased passenger cars.[15]

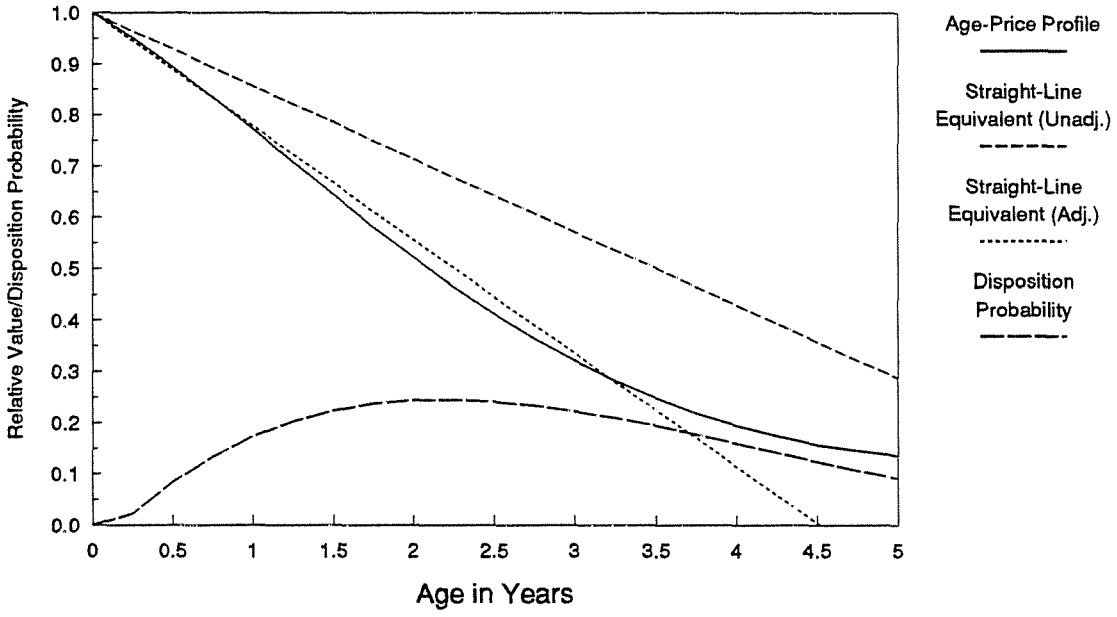
Figure 6 presents the age-price profile, unadjusted and adjusted straight-line schedules, and disposition probability curve for the entire sample of non-fleet passenger cars. It is clear that the age-price profile for the non-fleet vehicles drops less rapidly in the first two years of service than for any of the fleet categories shown in Figures 2 through 5. In addition, the pattern of dispositions is different than for fleet vehicles, with significant disposition probabilities at both relatively young and relatively old ages.

15 Wykoff reported annual economic depreciation rates for business-leased passenger cars that imply an unadjusted equivalent economic life of about 4.5 years. These depreciation rates were estimated for four specific passenger car models owned by a leasing firm. Although Wykoff's study differs somewhat from this one in scope and methodology, the difference in unadjusted equivalent economic lives appears to be largely due to a higher first-year rate of depreciation found in this study.

Table 3.--Unadjusted and Adjusted Equivalent Economic Lives of Fleet Cars by Size Class			
		Adjusted Life	
Size Class	Unadjusted Life	Model Year 1985	Model Year 1986
Subcompact	3.3	2.4	2.3
Compact	3.6	2.6	2.7
Intermediate	3.6	2.7	2.7
Standard	4.2	3.1	3.1
Luxury	4.5	3.5	3.5
Foreign	4.5	3.8	3.9
Total	3.7	2.8	2.8

Figure 6: Nonfleet Passenger Cars

Age-Price Profile, Straight-Line Equivalent Schedules, and the Disposition Probability



Although not evident in Figure 6, the age-price profile does not reach a minimum value until age 10, and the unadjusted straight-line equivalent schedule reaches zero at 7.0 years. The relatively large difference between the unadjusted equivalent economic life (7.0 years) and the adjusted equivalent economic life (4.5 years) for these cars can be attributed mostly to the slow decline in value that occurs after age five.

Chapter V. Issues in Setting Class Lives

A. Estimation Issues

Several estimation issues arose during the course of the study and their resolution affects the final results. The most important issue concerns the reliability of the estimated adjusted equivalent economic life for non-fleet vehicles, and the related matter of properly weighting that estimate in computing the overall adjusted equivalent economic life. Since the fleet estimates were based on nearly 400,000 dispositions and the non-fleet estimates were based on only 121, non-fleet estimates are far more uncertain than fleet estimates.

Nevertheless, the difference in the estimated adjusted equivalent economic lives (2.8 years for fleet vehicles vs. 4.5 years for non-fleet vehicles) appears reasonable in light of differences in intensity of use. Mileage data provided by fleet firms show that fleet vehicles are driven an average of 25,000 miles per year in each of the first two years of service. Data on mileage patterns for non-fleet vehicles obtained from a sample of business tax returns indicate that such vehicles are driven an average of 15,000 miles per year during the first two years. Moreover, the results for non-fleet vehicles are consistent with the findings of other studies that were based on non-fleet passenger cars.[16]

Given the large difference in estimated lives, properly weighting the estimates into a single class life becomes very important. Data from the Bureau of Economic Analysis and the *Automotive Fleet Fact Book* suggest that after excluding daily rental firms and adjusting for lower rates of business-use and tax capitalization among non-fleet vehicles, fleets of 10 or more vehicles account for 40 percent of the annual capitalized investment in business-use passenger cars while non-fleet vehicles account for 60 percent. A weighted average adjusted equivalent economic life of 3.8 years would be obtained using those shares as weights.

About one-third of the non-fleet vehicles, however, are acquired by independent leasing firms and retail dealers for lease to both business and non-business users. When used for business purposes, these cars are probably driven more like fleet cars than non-fleet cars, and would depreciate in a manner more similar to fleet vehicles. This would suggest weighting the *fleet* estimate at 60 percent, and the non-fleet estimate at 40 percent, resulting in a weighted average adjusted equivalent economic life of 3.5 years.

16 Wykoff (1989) reported that the unadjusted present values of economic depreciation estimated from five studies based mainly on household-use cars averaged .873 (pp. 280-282). This study found an unadjusted present value of economic depreciation for non-fleet passenger cars of .874.

Another important estimation issue concerns the weighting of the adjusted equivalent economic lives derived for the different fleet classes. As shown in table 3, these lives range from a low of 2.3 years for domestic subcompact vehicles to highs of 3.5 years for domestic luxury vehicles and 3.9 years for foreign vehicles. The overall fleet adjusted equivalent economic life of 2.8 years was derived by weighting the size class lives by the sample firms' model year 1989 investment in vehicles in each of those classes. An alternative is to weight the size class lives by industry-wide fleet investment in those classes. This would result in an aggregate fleet unadjusted equivalent economic life of 3.1 years. However, industry-wide investment data include rental firm investment, which is not separately identified. Industry sources indicate that rental fleets are more heavily concentrated in domestic luxury cars and imports than are lease and private fleets.

A final estimation issue concerns the use of the half-year convention for tax depreciation purposes and its impact on the calculated equivalent economic life. In its study of the depreciation of rental clothing, OTA found that consideration of the generally required use of the half-year convention for tax purposes reduced the calculated equivalent economic life by about one-half year. However, this result was largely due to the seasonal pattern of investment in rental clothing, which placed most investment in the first half of the fiscal year. Fleet passenger car investment is fairly smoothly distributed over firms' fiscal years, with about one-half of vehicles acquired by the middle of the fiscal year. Assuming that non-fleet investment follows a similar pattern, the neglect of the half-year convention for the analysis in this report is not likely to be significant.

B. Administrative Issues

The significant difference in estimated adjusted equivalent economic lives for fleet vehicles and non-fleet vehicles raises the issue of establishing separate MACRS classes for business-use passenger cars based on type of use, ownership, or some other related criterion. While the data clearly indicate that vehicles held in fleets depreciate more rapidly than non-fleet business cars, this difference appears to arise from difference in the intensity with which such vehicles are used, rather than their ownership or use. A classification of passenger cars based on anticipated mileage patterns or anticipated holding period at the time vehicles are placed in service would pose major definitional and enforcement problems.

A classification system that distinguishes vehicles based on the size of a firm's leasing activity would approximate a classification based on intensity of use, and would be simpler to administer (although still not without some difficult problems). Such a classification system,

however, would create an incentive for leasing as compared to owning passenger cars that is not necessarily desirable. Additional accounting and compliance complexity would be introduced for firms that both own and lease vehicles. Both the American Automotive Leasing Association, which represents large leasing firms, and the National Vehicle Leasing Association, which represents small and mid-sized leasing firms, have expressed reservations to Treasury concerning the establishment of separate MACRS classes for passenger cars based on ownership.

C. Conceptual Issues

The *General Explanation* of the Tax Reform Act of 1986 states that the class life for an asset class should be determined primarily by equating the present value of straight-line depreciation and the present value of economic depreciation. It did not indicate whether the fact that the owners of the assets may in some cases not be able to claim depreciation deductions over a portion of the assets' useful life should be considered. Treasury believes that in the case of business-use passenger cars, a very large fraction of which are transferred from business use to non-business use well before the end of the vehicle's useful life, this fact should be considered. More specifically, Treasury believes that in equating the present values of straight-line and economic depreciation for business-use passenger cars, only that part of the useful life over which the asset is used for business purposes is relevant. Treasury believes that the gains or losses incurred by taxpayers at the time the asset is converted from business use to non-business use should also be considered in determining the class life. For this reason, the recommendations in the following chapter are based on the estimated adjusted equivalent economic life of passenger cars, which takes these factors into account.

The unadjusted equivalent economic lives, which do not take these factors into account, have also been presented in this report. These estimated unadjusted equivalent economic lives are, however, longer than the economic lives OTA would have estimated had it focused on the entire useful life of passenger cars (and not just the period over which the cars are used in business). More specifically, the reported equivalent economic lives do not allow for the ultimate retirement (scrappage) of the vehicles. This is not a very significant omission when attention is focused only on the period the vehicles are held for business use, but it is important when vehicles are studied over their entire useful life. In such case, a more conceptually correct

economic life is derived from the retirement-adjusted age-price profile. The latter is obtained by multiplying the unadjusted age-price profile by the survivor function, which is the fraction of investment of a given vintage that remains in service at each age.[17]

This study estimated an unadjusted equivalent economic life for non-fleet passenger cars of 7.0 years. Based on a survivor function for all passenger cars derived from results reported by Hu (1983), the equivalent economic life adjusted for retirements is 6.3 years. This life is quite close to the 6.2 year retirement-adjusted equivalent life that corresponds to the economic depreciation for passenger cars observed by Hulten and Wykoff (1981). Thus, although the data obtained for this study cover only the period passenger cars are used in business, the data for non-fleet vehicles provide an estimate of a total equivalent economic life for passenger cars that is nearly the same as that suggested by the work of Hulten and Wykoff.

17 See, for example, page 22 of *Report to Congress on the Depreciation of Scientific Instruments.*

Chapter VI. Conclusion and Recommendations

This study has found that the adjusted equivalent economic life of fleet passenger cars, excluding daily rental fleets, is 2.8 years, while the adjusted equivalent economic life of non-fleet passenger cars is 4.5 years. These differences appear to be attributable to differences in miles driven during the first two years of service. While there is some merit to establishing separate asset classes for these two different classes of passenger cars, the benefits do not appear to exceed the considerable definitional and compliance problems that would arise.

When the estimated economic lives are weighted by business investment in fleet and non-fleet passenger cars, an average economic life ranging from 3.5 years to 3.8 years is obtained, depending on the relative weight given to non-fleet vehicles. Due to the relative uncertainty of the non-fleet estimate, and the exclusion of daily rental fleets from the study, a class life of 3.5 years seems appropriate. Thus, Treasury recommends that the class life for MACRS asset class 00.22 (Automobiles, Taxis) be changed from 3 years to 3.5 years.

Under current law, this recommendation, if adopted, would have no effect on the depreciation deductions claimed by taxpayers for passenger cars. Section 168(e)(3)(B)(i) assigns automobiles and light general purpose trucks to the five-year property recovery class, regardless of their class lives. If this provision were repealed, passenger cars would be assigned to the three-year property MACRS recovery class, whether or not the recommended change in the class life were enacted. (The three-year property recovery class generally includes property with a class life of four years or less.) Likewise, under Section 168(g)(3)(D), the alternative depreciation system recovery period for automobiles and light general purpose trucks is five years, regardless of their class lives. If this provision were repealed, taxpayers using the alternative depreciation system could depreciate their passenger cars over three years (based on the current law class life) or over 3.5 years (based on the recommended class life).

Appendix A. The Mandate for Depreciation Studies

Exhibit 1.

Section 168(i)(1)(B) of the Internal Revenue Code as Revised by the Tax Reform Act of 1986

(i) Definitions and Special Rules.

For purposes of this section--

(1) **Class Life.**

(B) Secretarial authority. The Secretary, through an office established in the Treasury--

(i) shall monitor and analyze actual experience with respect to all depreciable assets, and

(ii) except in the case of residential rental property or nonresidential real property--

(I) may prescribe a new class life for any property,

(II) in the case of assigned property, may modify any assigned item, or

(III) may prescribe a class life for any property which does not have a class life within the meaning of subparagraph (A).

Any class life or assigned item prescribed or modified under the preceding sentence shall reasonably reflect the anticipated useful life, and the anticipated decline in value over time, of the property to the industry or other group.

Exhibit 2.

Section 168(i)(1) of the Internal Revenue Code as Revised by the Technical and Miscellaneous Revenue Act of 1988

Definitions and Special Rules.

For purposes of this section--

(1) **Class Life.** Except as provided in this section, the term "class life" means the class life (if any) which would be applicable with respect to any property as of January 1, 1986, under subsection (m) of section 167 (determined without regard to paragraph (4) and as if the taxpayer had made an election under such subsection). The Secretary, through an office established in the Treasury, shall monitor and analyze actual experience with respect to all depreciable assets.

Exhibit 3.

Provisions for Changes in Classification from the General Explanation of the Tax Reform Act of 1986 (pp. 103-104)

The Secretary, through an office established in the Treasury Department is authorized to monitor and analyze actual experience with all tangible depreciable assets, to prescribe a new class life for any property or class of property (other than real property) when appropriate, and to prescribe a class life for any property that does not have a class life. If the Secretary prescribes a new class life for property, such life will be used in determining the classification of property. The prescription of a new class life for property will not change the ACRS class structure, but will affect the ACRS class in which the property falls. Any classification or reclassification would be prospective.

Any class life prescribed under the Secretary's authority must reflect the anticipated useful life, and the anticipated decline in value over time, of an asset to the industry or other group. Useful life means the economic life span of property over all users combined and not, as under prior law, the typical period over which a taxpayer holds the property. Evidence indicative of the useful life of property, which the Secretary is expected to take into account in prescribing a class life, includes the depreciation practices followed by taxpayers for book purposes with respect to the property, and useful lives experienced by taxpayers, according to their reports. It further includes independent evidence of minimal useful life -- the terms for which new property is leased, used under a service contract, or financed -- and independent evidence of the decline in value of an asset over time, such as is afforded by resale price data. If resale price data is used to prescribe class lives, such resale price data should be adjusted downward to remove the effects of historical inflation. This adjustment provides a larger measure of depreciation than in the absence of such an adjustment. Class lives using this data would be determined such that the present value of straight-line depreciation deductions over the class life, discounted at an appropriate real rate of interest, is equal to the present value of what the estimated decline in value of the asset would be in the absence of inflation.

Initial studies are expected to concentrate on property that now has no ADR midpoint. Additionally, clothing held for rental and scientific instruments (especially those used in connection with a computer) should be studied to determine whether a change in class life is appropriate.

Certain other assets specifically assigned a recovery period (including horses in the three-year class, qualified technological equipment, computer-based central office switching equipment, research and experimentation property, certain renewable energy and biomass properties, semiconductor manufacturing equipment, railroad track, single-purpose agricultural or horticultural structures, telephone distribution plant and comparable equipment, municipal waste-water treatment plants, and municipal sewers) may not be assigned a longer class life by the Treasury Department if placed in service before January 1, 1992. Additionally, automobiles and light trucks may not be reclassified by the Treasury Department during this five-year period. Such property placed in service after December 31, 1991, and before July 1, 1992, may be prescribed a different class life if the Secretary has notified the Committee on Ways and Means of the House of Representatives and the Committee on Finance of the Senate of the proposed change at least 6 months before the date on which such change is to take effect.

Appendix B. Models Studied and Sample Sizes [18]

Subcompact (16,636)

Chevy Cavalier (4)
Ford Escort (3)
Ford Mustang (2)

Compact (64,472)

Dodge Lancer (3)
Ford Tempo (4)
Pontiac Grand AM (2)
Mercury Topaz (3)
Plymouth Reliant (4)
Olds Cutlass Calais (1)
Dodge Aries (3)

Standard (34,501)

Ford Crown Victoria (3)
Chevy Caprice (5)
Mercury Grand Marquis (3)
Olds Delta 88 (4)
Buick LeSabre (3)

Intermediate (247,831)

Dodge 600 (3)
Chrysler New Yorker (3)
Chevy Celebrity (4)
Pontiac 6000 (5)
Pontiac Grand Prix (3)
Olds Cutlass Ciera (4)
Olds Cutlass Supreme (3)
Buick Century (4)
Ford Taurus (3)
Ford Thunderbird (3)
Chevy Citation (3)
Chrysler LeBaron GTS (3)
Mercury Sable (3)
Mercury Marquis (3)
Plymouth Caravelle (3)

Luxury (21,347)

Buick Electra (4)
Cadillac (3)
Ford LTD Brougham (4)
Lincoln (3)
Olds Delta 98 (1)

Foreign (7,334)

Mercedes-Benz (3)
Honda (3)
Jaguar (3)
Nissan (3)
Toyota (3)
Volvo (3)
BMW (3)
Mazda (3)
Volkswagen (3)
Porsche (3)
Audi (3)

18 The total number of dispositions for all models in the class is shown in parenthesis after the class name; the number of data sets in which a particular model appeared is shown in parenthesis after the model name.

Appendix C. Determination of Equivalent Economic Lives from the Age-Price Profile and Pattern of Sales

This appendix first describes the equations used to calculate the unadjusted equivalent economic life for each specific passenger car model. The computation of the adjusted equivalent economic life, which allows for the disposal of assets before the end of their useful life, is then discussed.

The first step involves obtaining the age-price profile for a particular model. The relative value of the cars as a function of age is obtained for each model by fitting the observed average sales prices (excluding wrecks) at each age by a fifth degree polynomial. Average disposition prices are calculated for each month in which dispositions take place. All sale price observations are adjusted for inflation and divided by the initial cost of cars to obtain relative values, V(t). The regression equation is:

$$V(t) - 1 = a_1 t + a_2 t^2 + a_3 t^3 + a_4 t^4 + a_5 t^5, \tag{1}$$

where the normalized value is unity at age zero, t represents age, and the a_i are the regression coefficients[19]. The negative of the derivative of the fitted function V(t) provides the asset's economic depreciation as a function of its age. The present value of this economic depreciation function (PVED) is the total discounted value of economic depreciation. It is found by integrating the discounted value of depreciation from age zero to the age at which the asset value is at a minimum (typically zero).

$$PVED = -\int_{t=0}^{M} (a_1 + 2a_2 t + 3a_3 t^2 + 4a_4 t^3 + 5a_5 t^4) e^{-rt} dt \tag{2}$$

where M is the age at which the minimum asset value is reached (its useful life), and r is the discount rate.

The present value of straight-line depreciation over a life L is given by:

$$PVSL(L) = \int_{t=0}^{L} \frac{e^{-rt}}{L} dt = \frac{1 - e^{-rL}}{rL}. \tag{3}$$

The straight-line life with the same present value as PVED can be determined from Equation 3 by numerical methods. This life is the unadjusted equivalent economic life.

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19 Average sale price observations are weighted in the regression by the initial cost of the cars represented.

The fact that the assets are not all held until the end of their useful life is now considered. Current law requires the taxpayer to treat as a gain (or claim a loss) an amount equal to the difference between the adjusted basis of the asset and its sales value. Equation 4 corrects Equation 3 to include the fact that assets are converted (via sale) to non-business use prior to the end of their useful life, and to take account of the tax gain or loss claimed when the assets are sold.

$$PV(E) = \int_y^E D(t)\left(\frac{1-e^{-rt}}{rE} + \left(1 - \frac{t}{E} - V(t)\right)e^{-rt}\right)dt + \int_E^z D(t)\left(\frac{1-e^{-rE}}{rE} - V(t)e^{-rt}\right)dt \qquad (4)$$

where y is the shortest and z is the longest holding period in the disposition probability distribution characterized by the function D(t), and where E is the adjusted equivalent economic life. In this study, the value of D(t) is obtained from the observed pattern of dispositions[20].

The first integral provides the present value of straight-line depreciation, plus any gains or losses for passenger cars retired before the adjusted economic life weighted by the disposition probability, D(t). The first term in the outer bracket of the integrand reflects the aggregate present value of straight-line depreciation up to the time of sale. The terms in the inner bracket express the present value of the gain or loss at the time of sale. The gain or loss is the difference between the remaining basis, 1 - t/E, and the relative value, V(t), of the asset at the time of disposition. Similarly, the second integral provides the present value of economic depreciation for the portion of assets disposed of after the adjusted equivalent economic life. The first term in the bracket in the integrand reflects the present value of straight-line depreciation, while the second term likewise adjusts for the present value of the gain on sale (the adjusted basis for cars of age greater than E is zero).

Equation 5 corrects Equation 2 to allow for the fact that not all the cars are held until the end of their useful life:

$$PVED' = -\int_y^z D(T)\left(\int_0^T (a_1 t + 2a_2 t + 3a_3 t^2 + 4a_4 t^3 + 5a_5 t^4)e^{-rt}dt\right)dT. \qquad (5)$$

Equation 4 is solved for that life, E, that provides the same present value as determined from Equation 5 using a combination of analytical and numerical techniques. This is the adjusted equivalent economic life reported for each model type. For fleet vehicles, separate adjusted equivalent economic lives were calculated for 1985 and 1986 model years for each of the models and data sets. A single estimate was obtained for the non-fleet vehicles.

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20 The disposition probability distribution is calculated by first fitting the cumulative disposition function, which measures the fraction of the initial cost that has been sold by age t, by a fifth degree polynomial function. This function is then differentiated to obtain the disposition probability distribution D(t). Where appropriate, the function is truncated so that only the bell shaped portion of this function is used to represent the disposition probability distribution.

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