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6 The United States

6.1 Introduction

In early United States history, tariffs and excise taxes were the major sources of government revenue. Because of constitutional constraints on direct taxation at the federal level, an income tax could not be enacted until the Sixteenth Amendment was passed in 1913. Since that time the personal income tax has become the single most important tax, growing to more than 35 percent of total revenue and to more than 45 percent of federal revenue (see the annual *Economic Report of the President*).

The importance of the corporate income tax also grew in the first part of this century, but the past thirty years have seen a decline in its share of federal revenue, from about 25 percent to 15 percent. Major policy shifts have reduced the corporate tax by introducing investment tax credits and by speeding up allowances for depreciation. Under the Economic Recovery Tax Act of 1981, as amended by the Tax Equity and Fiscal Responsibility Act of 1982, corporate revenues are expected to fall still further. The decline in corporate revenues has, however, been more than offset by the increase in social insurance taxes. From 18 percent of federal revenues in 1960, payroll taxes increased by one percentage point per year before leveling off at 33 percent in 1975. Finally, the proportions above leave only about seven percentage points for the recent share of other federal sources, including excise taxes. Thus revenue sources have experienced a major reversal in the seventy years since 1913.

Trends in revenue between 1960 and 1979 are shown in table 6.1 (which may be compared with the corresponding tables in the other country chapters). The rising shares of personal and payroll taxes are evident in this table, as are the falling shares of corporate and excise taxes. As a proportion of GDP, taxes grew from about 7 percent to 24 percent over the first half of this century. The bottom of table 6.1 shows that this

Table 6.1 Sources of Tax Revenue, United States, 1960–79

Revenue Source	Share of Total Receipts (%)			Total Receipts ($ billion)
	1960	1970	1979	1979
Taxes on personal incomes	32.7	35.2	36.5	254.772
Federal income tax		29.4	30.0	209.541
State and local income tax		3.5	5.1	35.524
Capital gains (federal, state, and local)		2.3	1.4	9.707
Taxes on corporate incomes	17.2	12.7	11.1	77.874
Social security contributions[a]	14.4	19.3	25.4	177.441
By employers		10.5	15.0	105.099
By employees		8.1	9.6	67.309
By self-employed		0.7	0.7	5.033
Property taxes	12.4	12.1	9.3	64.943
By households		7.5	5.8	40.265
By others		4.6	3.5	24.678
Estate, inheritance, gift, and transfer taxes	1.9	1.8	1.2	8.267
Value-added tax	—	—	—	—
Taxes on goods and services	21.5	18.9	16.5	115.501
General sales tax		5.6	6.7	46.558
Alcohol (federal, state, and local)		2.1	1.2	8.079
Tobacco (federal, state, and local)		1.6	0.9	6.265
Motor fuels (state and local)		2.2	1.4	10.080
Other (federal, state, and local)		7.4	6.4	44.519
Total receipts	100.0	100.0	100.0	698.798
Gross domestic product ($ billion)	502.9	985.4	2,370.1	
Share of taxes in GDP (%)	26.6	29.2	29.5	

Source: Revenue Statistics of OECD Member Countries, 1965–1980 (Paris, 1981).

[a]Employee shares exactly match employer shares for Old-Age, Survivors, Disability, and Health Insurance (OASDHI), but only employers pay for unemployment insurance and workmen's compensation.

growth has continued since 1950, although at a slower rate, to about 30 percent of GDP in 1979.

One trend not evident in table 6.1 is the growth of state and local tax revenues in the 1960s. These revenues were 8.6 percent of GDP in 1960 and just over 11 percent in both 1970 and 1980 (see *Economic Report of the President*). When this revenue is coupled with grants from the federal government, it is clear that the funds available to subfederal governments have increased dramatically. Federal grants to the state and local governments were 1.3 percent of GDP in 1960, 2.5 percent in 1970, and 3.3 percent in 1980. The revenues retained at the federal level have thus declined as a percentage of GDP.

Within the United States, different levels of government use a variety of separate instruments for the taxation of income from capital. Income

in the corporate sector is subject to the federal corporate income tax, state corporate income or franchise taxes, local property taxes, and the personal income tax of the ultimate recipients. Federal corporate and personal income taxes are not integrated, though there is a small dividend deduction of up to $100 at the personal level ($200 for joint returns). Though there has been considerable discussion of integration in academic circles,[1] actual policy proposals that would affect taxation of capital income tend to involve changes in accelerated depreciation, investment tax credit rates, interest exemptions, or the various forms of savings deductions for individual retirement accounts.

Aside from being a major source of revenue in the United States, the corporate tax system has been used for stabilization and as an incentive. The rate of tax, the rate of investment tax credit, and the allowances for depreciation have all been changed in response to macroeconomic conditions. Depreciation for tax purposes, known as "capital consumption allowance" in the United States, is accelerated to a different degree for each asset. Accelerated allowances have been used to provide incentives for investment in particular kinds of assets such as pollution-control equipment and low-cost housing.

Another concern has been the effect of inflation on the taxation of income from capital. Because depreciation is based on historical cost, inflation reduces the real value of nominal depreciation deductions in later years. This problem was not important in the 1950s and 1960s when inflation was running at about 2 percent per year, but from 1970 to 1980 the deflator for gross private domestic product increased at an average annual rate of 6.77 percent. This inflation rate averages consumption and investment goods, and it is the measure used for expected inflation in this chapter. Because of inflation, there have been frequent proposals to shorten asset lives for tax purposes. The recently enacted Accelerated Cost Recovery System (ACRS) not only shortens lives but simplifies administration by aggregating diverse assets into only a few categories of service lives. Other discussion has centered on reestimation of economic service lives (e.g., Hulten and Wykoff 1981) and indexing depreciation for inflation (e.g., Auerbach and Jorgenson 1980).

The fifty states have different systems for taxing income in the corporate sector. Thousands of local jurisdictions impose further taxes on commercial and industrial property, each with its own statutory rate and its own ratio of assessed value to market value. Capital income taxation is further complicated at the individual level, where taxes depend on considerations such as the proportion of dividend recipients with less than $100 of dividends, the dividend/retention policies of firms, the determi-

1. Charles McLure (1979) provides a comprehensive discussion of integration proposals in the United States, and Fullerton et al. (1981) provide some estimates of welfare effects attributable to several such proposals.

nants of tax-exempt status, the ceilings on individual retirement accounts, and the interaction of inflation with the nominal brackets of a graduated personal tax system.

Because of the variations of personal tax rates among income recipients, property tax rates among state and local jurisdictions, depreciation lives among different assets, and means of finance among different industries, an overall evaluation of United States effective marginal tax rates is a particularly useful but difficult exercise.

The outline for this chapter is the same as that of the other country chapters in this study: section 6.2.1 describes salient features of the personal income tax in the United States, including both federal and state tax provisions. While the 1980 law is used for comparison with other countries, the two new tax laws of 1981 and 1982 are also described and evaluated. Section 6.2.2 describes federal and state income tax provisions, but it defers discussion of depreciation allowances to section 6.2.3 and discussion of investment tax credits to section 6.2.5. Economic depreciation appears in section 6.2.4, and property taxes are described in section 6.2.6. Effective personal tax rates for our three ownership categories are provided in sections 6.2.8, 6.2.9, and 6.2.10. The various parts of section 6.3 provide information on the amount of investment flowing from each owner to each location, and the parts of section 6.4 provide final estimates of the total effective marginal tax rates in the United States.

6.2 The Tax System

6.2.1 The Personal Income Tax

Because personal taxes started primarily as taxes on income, and because departures from comprehensive income taxation have tended to involve various types of income from capital, many individuals view these departures as loopholes for wealthy taxpayers that significantly reduce the progressivity of the overall tax system. For example, capital gains taxation has been a more prominent feature in the United States than in the other three countries in this study, yet many view as a loophole the fact that the tax base includes only 40 percent of long-term capital gains (those resulting from assets held more than twelve months). Some recent proposals would increase this partial exclusion, while others would tax all capital gains. Still other proposals would broaden the tax base in other ways and replace the graduated rate structure with a flat rate of tax that is relatively low. On the other hand, the 40 percent inclusion refers to *nominal realized* long-term capital gains, an amount that might be greater than or less than real accrued capital gains, depending on the rate of inflation and on the asset.

Other departures from comprehensive income taxation include the nontaxation of state and local bond interest, the imputed rents from owner-occupied homes, and the income from saving through pension funds and life insurance. As the untaxed proportion of investment income has increased, and as discussion about the switch to a consumption-based tax has continued, fewer of these features have come to be viewed as loopholes. Yet, as pointed out by Bradford (1980) and others, having half of all assets on a consumption-tax basis is not like being halfway between an income tax and a consumption tax. Because of the dispersion of tax rates on different investments, this hybrid system has many disadvantages not associated with either pure extreme.

Table 6.2 documents some of the changes in the personal income tax base since 1950. The National Income and Product Accounts' definition of personal income is the starting point in the first row of table 6.2. This definition is equivalent to an economic definition of income minus unrealized capital gains and minus the imputed rents of owner-occupied homes. The basic income concept for personal tax purposes in the United States is called adjusted gross income (AGI). It can be obtained from personal income by subtracting 60 percent of realized long-term capital gains, all of interest from state and local bonds, transfer receipts, pension contributions of employers, moving expenses, alimony, and the income from saving through life insurance. The second row of table 6.2 reveals that these exclusions have increased steadily as a fraction of personal income since 1950.

Table 6.2 also reveals that the illegally unreported fraction of income diminished from 1950 to 1970, before turning back up again. The fraction of personal income on taxable returns increased from 70 percent in 1950 to 76 percent in 1970, and it fell back to 72 percent by 1978.

"Taxable income" in the United States refers to reported AGI after personal deductions and exemptions. Personal deductions can include charitable contributions, interest paid, state and local taxes, medical

Table 6.2 **Taxable Income as a Percentage of Personal Income**

	1950	1960	1970	1978
Total personal income	100.0	100.0	100.0	100.0
Adjusted gross income (AGI)	89.4	86.4	84.1	81.6
Reported AGI	79.2	78.9	78.8	75.6
Reported AGI on taxable returns	70.1	74.4	76.2	72.1
Taxable income on taxable returns	37.3	42.9	50.0	59.7

Source: Own calculations from data in the *Survey of Current Business* (Commerce Department) and *Statistics of Income, Individual Income Tax Returns* (Treasury Department). See Pechman (1977) or Steurle and Hartzmark (1981) for further tables.

Note: Adjusted gross income is the basic accounting measure for tax purposes in the United States and is further described in the text.

expenses above 3 percent of AGI, and some casualty losses. Each taxpayer can elect to "itemize" these deductions—that is, to list all deductions, add them up, and subtract the total from AGI before paying tax. As an alternative, taxpayers can take the "standard deduction" of $2,300 (or $3,400 for joint returns), also called the zero-bracket amount. The personal exemption is $1,000 per taxpayer, spouse, and each dependent. As shown in table 6.2, these deductions and exemptions made up over 30 percent of personal income in 1950, fell gradually to 26 percent in 1970, but then fell dramatically to only 12.4 percent in 1978. Inflation has eroded the real value of these nominal amounts in spite of occasional legislative increases, and as a result the taxable portion of personal income has risen from 37 to 60 percent since 1950.

The taxable portion of income in the United States is subject to the federal rate schedules of table 6.3 for joint returns. To show the zero-bracket amount, "income" in this table is defined as AGI less exemptions and less any itemized deductions over $3,400. The schedules for single and married taxpayers differ in such a way that a couple with sufficiently unequal incomes can reduce their total taxes by being married, while a couple with similar incomes would suffer a tax penalty by being married. Although marginal rates ranged from 14 percent to 70 percent in 1980,

Table 6,3 Federal Tax Rates for Joint Returns

Income	Percentage of All 1979 Returns Taxed at or Below Marginal Rate	Marginal Tax Rate	
		1980 Law	New Law after Phase-in (1984)
$ 0–3,400	21.3	.00	.00
3,400–5,500	29.2	.14	.11
5,500–7,600	35.8	.16	.12
7,600–11,900	48.6	.18	.14
11,900–16,000	63.5	.21	.16
16,000–20,200	75.2	.24	.18
20,200–24,600	83.8	.28	.22
24,600–29,900	90.7	.32	.25
29,900–35,200	95.3	.37	.28
35,200–45,800	97.9	.43	.33
45,800–60,000	99.1	.49	.38
60,000–85,600	99.7	.54	.42
85,600–109,400	99.8	.59	.45
109,400–162,400	99.9	.64	.49
162,400–215,400	100.0	.68	.50
Over 215,400	100.0	.70	.50

Source: Revenue Act of 1978, Economic Recovery Tax Act of 1981, and Steurle and Hartzmark (1981).

table 6.3 shows that three-fourths of all returns were taxed at a 24 percent marginal rate or less.

Tax rates under the Economic Recovery Tax Act are also shown in table 6.3. This 1981 law specifies a phased reduction of personal tax rates over three years starting with 1981. The top bracket is reduced from 70 percent to 50 percent, and if there were no inflation other rates would be reduced by 23 percent. Much of this reduction just offsets the effects of inflation since the last adjustment in 1978, however, and further inflation is expected to erode the value of these tax cuts by the time they take full effect in 1984. This law specifies automatic inflation adjustments to the income brackets and exemptions, starting in 1985.

Low-income taxpayers with dependents can qualify for the "earned income credit." This credit is equal to 10 percent of earned income up to $5,000, and it is reduced thereafter to the point where no credit is received with $10,000 of earned income. However, this credit is unusual in that it is refundable, which means that the government will send a check to the household if the credit exceeds their normal tax liability. A joint return with two dependents receives a credit in excess of tax liability up to an AGI of $8,483. Thus, the United States system includes a type of negative income tax. At the other end of the spectrum, earned income in 1980 was ostensibly subject to a maximum tax of 50 percent.[2]

For all qualified private retirement plans, both employee and employer contributions are deductible, while all benefits are taxable. If the individual's marginal tax rate does not change upon retirement, then this treatment is equivalent to that of a consumption tax.[3] Employees not covered by a pension plan in 1980 could deduct savings of 15 percent of earned income up to a $1,500 maximum ($1,750 for joint returns) through an individual retirement account (IRA). The 1981 Tax Act removed the percentage limitation and increased the maximum to $2,000 ($2,250 for joint returns). It also made IRAs available to those already covered by pension plans of their employers. Self-employed persons could deduct savings of 15 percent of earned income up to $7,500 under a Keogh retirement plan, increased to $15,000 by the new law.

Social security taxes and subsequent benefits could be viewed as another savings vehicle, an alternative to the various retirement savings vehicles just described. Because these social security payments are man-

2. For an exposition of how earned income could be effectively taxed at more than 50 percent at the margin, see Lindsey (1981). The Economic Recovery Tax Act of 1981 reduced all marginal rates to a maximum of 50 percent.

3. See chapter 2. *Blueprints for Basic Tax Reform* (U.S. Department of the Treasury 1977) describes a consumption tax that operates like a comprehensive income tax but allows deductions for savings through "qualified accounts." Since income minus savings leaves only consumption in the tax base, a normal graduated schedule can be applied to it. Qualified retirement plans operate in this manner, except that they have contribution ceilings and withdrawal constraints.

datory, however, they are not included in our calculations of the effective tax on a marginal increase of savings. To the degree that social security is an actuarially fair way to save, this vehicle would receive favored status relative to an income tax or even a consumption tax. While employee contributions are taxable, the employer contributions and all social security benefits go tax free.

Business income of unincorporated enterprises is taxed under the personal tax system. Depreciation allowances are the same as those described in section 6.2.3 for corporations, and investment tax credits are the same as those described in section 6.2.5 for corporations.

Because of the various exclusions and deductions, tax revenue from high-income individuals can sometimes be small. Income from capital is more readily sheltered than income from labor, particularly through exclusion of imputed rents and 60 percent of long-term capital gains. To take another example, a combination of debt finance and accelerated depreciation means that an investor can often claim first-year allowances greater than the initial capital investment. These considerations have led to two kinds of provisions. First, Congress has passed rules that prevent the investor from taking depreciation allowances beyond the amount of the investment for which he is at risk. That is, the investor cannot use nonrecourse debt and still qualify for fully accelerated allowances. Second, Congress passed "minimum tax" provisions in 1969, strengthened them in 1976, and weakened them again in 1978. These provisions operate as a floor to tax liability, designed to ensure that at least some tax is paid at high income levels. A 15 percent rate is applied to "preference income," defined as the excluded 60 percent of long-term gains, itemized deductions that are over 60 percent of AGI, and parts of depletion deductions, intangible drilling costs, and accelerated depreciation. State and local interest is not included here as a preference income item.

Finally, at the federal level, we should mention the averaging provisions that are designed to help avoid the payment of extra tax that is due solely to the interaction of a volatile income stream and a graduated tax system. However, income must exceed the average of the previous four years by at least one-third, this excess must be more than $3,000, and no allowance is made for falling incomes.

Of the forty-one states with personal income taxes, thirty-two make use of the AGI concept from the federal tax calculations. States differ with respect to exemptions and deductions and with respect to the applicable rate structure. Most state systems have graduated rates, and several have top marginal rates as high as 11 percent. Only Alaska, Delaware, Iowa, and New York have top marginal rates above 11 percent. Also, state taxes paid are deductible at the federal level if the taxpayer itemizes deductions.

Several local governments collect personal income taxes. New York City and Washington, D.C., obtain more than 20 percent of their revenues from this source, while Philadelphia gets a full half. In total, however, local income taxes collected only $3.75 billion in 1977. When compared with $25.5 billion at the state level and $156.7 billion at the federal level, this $3.75 billion of local tax can be ignored for present purposes.

Effective marginal tax rates at the household level are estimated using the tax simulation (TAXSIM) model of the National Bureau of Economic Research (NBER). This model is described in Feldstein and Frisch (1977) and in Feenberg and Rosen (1983). The data base for this model includes 25,000 tax return records from the Internal Revenue Service (IRS) for each year. TAXSIM has information not only on adjusted gross income, but also on wages, dividends, interest, capital gains, other types of income, and on various tax deductions taken for each return in the sample. The state of residence is also available for each return. The federal tax law and each of the fifty states' tax laws are specifically programmed into the model. To calculate the effective marginal tax rate on a given type of income, such as interest income, the TAXSIM model raises all individuals' receipts of that income type by 1 percent, recalculates their tax liabilities, and sums the additional tax to be paid. It is thus a weighted-average marginal tax rate, where the weights are the shares for the type of income under consideration.

To obtain federal rates, the TAXSIM model need not account for the deductibility of any additional state taxes. For combined state and federal tax rates, however, there is a simultaneous deductibility in states that allow a deduction for federal taxes. These deductions are simulated for the same tax year, though actual federal (state) practice allows a deduction for one year's state (federal) taxes in the following tax year. Deductions are allowed only for those who itemize.

Because tax law does not require the separate specification of corporate bond interest and bank deposit interest, the tax-return data show only total interest receipts. Thus we can calculate an overall marginal tax rate on interest income but not a separate weighted-average marginal tax rate on corporate interest alone. The most recent data available are for 1977, a problem that is discussed further below.

If a marginal dollar of wage income were distributed in proportion to all wage income, the simulated extra tax would be about 27 cents at the federal level, 5 cents on average at the state level, and about 32 cents overall. Similar overall weighted-average marginal tax rates for dividend and interest incomes are 47.5 percent and 32.5 percent, respectively. These estimates reflect the fact that dividends are more highly concentrated in high income brackets than are taxable interest receipts.

Finally, data in TAXSIM can be used to estimate the elasticity of personal income taxes to changes in the tax base. This "liability" measure of progressivity is equal to one for proportional taxes and is larger than one for progressive taxes. For the United States personal income tax, the estimated elasticity is 1.66, including state and federal taxes.[4] This estimate is similar to the 1.76 estimate found by Ott and Dittrich (1981).

6.2.2 The Corporate Tax System

The federal corporate income tax started in 1913 at a rate of 1 percent. The marginal rate varied around 12 percent from 1918 to 1935. The United States instituted a surcharge on retained earnings in 1936 and 1937 and thus experimented briefly with a form of corporate integration. It reverted to a classical system, however, and the top rate varied around 40 percent until 1945. The top marginal rate after 1946 has varied around 50 percent, as shown in table 6.4.

In 1980 the federal corporate tax had a graduated rate structure, with percentage rates of 17, 20, 30, and 40 applied to four brackets of $25,000 each. The 1981 law reduces the first two brackets' rates to 15 and 18 percent, respectively. Above $100,000 of taxable income under both laws, corporations pay a flat 46 percent marginal tax rate.

For the federal part of τ, the statutory corporate rate, the relevant concept is the additional tax on profits resulting from a dollar of marginal investment allocated in proportion to existing capital. While most corporations do not reach the top marginal rate of 0.46, the great bulk of corporate capital is held by firms that do.[5] Thus we can safely ignore investment in firms with less than $100,000 of profits and take 0.46 as the federal part of τ.

The corporate income tax applies to all corporate profits net of depreciation, interest payments, and other expenses, whether those profits are retained or distributed. The payment of dividends does not affect the corporate tax as it does in Germany or the United Kingdom. Thus, since 1938, the United States corporate tax is a classical system. If the corporation retains another dollar, it gives up a dollar of dividends that are gross of the personal income tax. Thus 1.0 is the value for θ, the opportunity cost of retained earnings in terms of gross dividends.

The corporation may deduct all dividends it receives from subsidiaries and 85 percent of dividends from other corporations. Long-term capital gains are fully taxed under both the old law and the new law, but at a reduced rate of 0.28 instead of 0.46. Capital losses may be used only to offset capital gains within the previous three or following five years. On the other hand, net operating losses may be carried back for three years or forward for seven. The 1981 Tax Act extends this carryover to fifteen years.

4. I am grateful to Daniel Feenberg, who performed all TAXSIM calculations.
5. See Musgrave and Musgrave (1980).

Table 6.4 Top Marginal United States Corporate Income Tax Rates

Tax Years	Top Rate (%)	Tax Years	Top Rate (%)
1946–49	38	1965–67	48
1950	42	1968	52.8[a]
1951	50.75	1969	49.2[a]
1952–63	52	1970–78	48
1964	50	1979–82	46

Source: Facts and Figures on Government Finance, Tax Foundation, 1981.

[a]In 1968 and 1969 the basic rate was 48 percent, but there were surcharges of 10 percent and 2.5 percent, respectively, applied to tax liabilities.

Before 1969, oil and gas producers could deduct 27.5 percent of gross receipts as an allowance for the depletion of reserves. Total depletion was not limited to the cost of the asset. Since exploration and drilling costs were immediately expensed, however, these depletion allowances were generally recognized as a preferential treatment. In 1969 these allowances were reduced to 22 percent, and in 1975 they were cut to 15 percent for small producers and eliminated for large producers.

Several other features of the federal tax code are worth mentioning at this point. First, immediate expensing is allowed for intangible investments such as advertising and R&D. Since neither corporate "goodwill" nor research and development capital is considered an asset in this study, this tax break is ignored. Second, certain tax credits are allowed for the hiring of new employees. Third, earnings of foreign subsidiaries are taxed only upon repatriation to the United States parent corporation. A credit on United States taxes is allowed for any foreign taxes already paid on those earnings. Finally, a domestic international sales corporation (DISC) can be organized to handle export business of a United States corporation. Part of the DISC earnings are also untaxed until returned to the parent corporation.

With respect to subfederal corporate income taxes, forty-five states and the District of Columbia levy rates varying from 2 percent to 12 percent. Most systems define corporate income in a manner similar to the federal system, but adjustments vary from state to state. Most also have a graduated structure. A significant problem arises, however, in determining what portion of the corporation's total profits were generated in the state. Most corporate income is apportioned among states through the use of a formula based on the proportion of the corporation's total property located in the state, the proportion of total wages paid in the state, and the proportion of the corporation's sales in the state. Each state can choose its own formula. An interesting result of this procedure is that the sum of a corporation's tax base across the taxing states can exceed its total profits, if each state chooses a formula that is advantageous to its

own base. Many states use the "Massachusetts formula," giving equal weight to each of the three factors mentioned above.[6]

For our marginal statutory tax rate τ, we would like to include a weighted average of state marginal tax rates and account for deductibility at the federal level. The top marginal rate in each state is available in *Facts and Figures on Government Finance* (Tax Foundation 1981), but the choice of weights is more difficult. A 1 percent increase in all corporate capital holdings would be distributed among the states in proportion to existing capital holdings, but state taxes on the income would also depend on where those corporations paid wages and made sales. Since states adopt different apportionment formulas, a "correct" set of weights is virtually impossible. We use personal income in each state to weight statutory marginal tax rates, since this is highly correlated with payroll and with sales. Since it is based on residence, however, personal income may be less well correlated with corporate property. These data are available for the first quarter of 1980 in the July 1980 *Survey of Current Business*. The personal-income-weighted average of state marginal corporate tax rates, including a zero rate for states without a corporate tax, is 6.55 percent. If we multiply this rate by $(1 - 0.46)$ to account for deductibility at the federal level, we get a net rate of 3.54 percent. Adding 0.46 for the federal tax itself, we have 0.495 for the value of τ.[7]

6.2.3 Tax Allowances for Depreciation and Inventories

Because provisions related to depreciation are relatively less straightforward, we first discuss provisions related to inventories. United States corporations are allowed to use any of a number of consistent accounting methods, including last in, first out (LIFO) and first in, first out (FIFO).[8] Unlike other countries in this study, however, the United States requires firms to use the same method for profits reported to shareholders as they use for profits reported to taxing authorities.

With recent increases in the rate of inflation, many firms have been switching from FIFO to LIFO accounting. Because first-bought inventory items have a lower nominal cost than the last-bought items, FIFO profits are larger than LIFO profits for a given sales price. Firm managers might like to report FIFO profits to shareholders, especially if executive

6. McLure (1980) argues that these apportionment formulas change the effect of a particular state's corporate income tax from a tax on income to an excise tax on sales, payrolls, or property. We have a national perspective, however. Our marginal investment is made in proportion to existing capital with its existing allocation among assets, industries, and states. The earnings from such an investment would incour additional state corporate income tax liability at the weighted-average rate.

7. This calculation ignores the deductibility of federal corporate taxes in some state tax systems.

8. Other allowable methods include an "average cost" method, a "standard cost" method, and an "actual cost" method. See Shoven and Bulow (1975) for further discussion of these accounting choices.

salaries or bonuses are based on reported profits. On the other hand, taxes can be reduced by reporting relatively smaller LIFO profits to the IRS. It is thus surprising that only 30 percent of manufacturing inventories and only 22 percent of retail trade inventories were on a LIFO basis in 1979.[9] Most large corporations are on LIFO accounting, so perhaps small businesses find it easier to remain on FIFO.

Two possibilities exist for our parameter v, the proportion of inventories on FIFO accounting. In our standard case, we set v to zero and assume that firms act so as to minimize taxes in this regard. (This assumption is consistent with the use of minimum lifetimes and maximum acceleration in the depreciation of assets discussed below.) As an alternative, we report results for the case where v is set to 0.7, the actual proportion of manufacturing inventories on FIFO in 1979.

We turn now to look at depreciation allowances for tax purposes. Tax law, government data, and United States studies typically divide assets into "equipment" and "structures," but these categories correspond to our "machinery" and "buildings" categories. All assets received straight-line allowances with the beginning of the personal and corporate income taxes in 1913, but considerable choice was available on tax lifetimes. The Treasury Department first published a set of suggested lifetimes in its *Bulletin F* of 1931, and depreciation allowances were still based on those estimates in 1980. Tightening and controversy followed with the lengthening of suggested lifetimes in the 1942 edition of *Bulletin F*.

Reversing this trend in 1954, Congress decided to allow accelerated methods of depreciation. In particular, both equipment and structures were allowed double declining balance (DDB) or sum-of-the-years'-digits (SYD) methods of depreciation.[10] The actual adoption of acceler-

9. Data are from the United States Commerce Department publication *Current Industrial Reports* (Manufacturers' Shipments, Inventories and Orders) and from *Current Business Reports* (1979 Retail Trade).

10. This footnote describes each depreciation scheme in more detail. For straight-line depreciation, the law specifies a lifetime for tax purposes L, and it allows the taxpayer to deduct $1/L$ of the purchase price of the asset each year for L years. The asset is fully depreciated after L years. For sum-of-the-years'-digits (SYD), the taxpayer starts by calculating a SUM, equal to $\sum_{i=1}^{L} i$. The purchase price is multiplied by L/SUM for depreciation in the first year, $(L-1)$/SUM for depreciation in the second year, down to 1/SUM for depreciation in the last year. If $L = 3$, for example, the purchase price is allocated as 3/6, 2/6, and 1/6 across the three years, and again the asset is fully depreciated. With double declining balance (DDB), the taxpayer can take twice the straight-line rate, but on a declining balance basis. That is, first-year depreciation is $2/L$ of the purchase price, but second-year depreciation is $2/L$ of the remaining basis $(1 - 2/L)$. As described in the text, some assets receive less than twice the straight-line rate. With "150 percent of declining-balance," for example, taxpayers can deduct $1.5/L$ of the purchase price in the first year and $1.5/L$ of remaining basis in later years. We refer to the numerator of this ratio as B in our equations below. Under declining balance methods, however, the asset is never fully depreciated. The United States law allows taxpayers to switch from the declining balance method to one of the other methods to complete depreciation deductions. The optimal times to make such switches are described in the text below.

ated methods has, however, been gradual. Jorgenson and Sullivan (1981) estimate that the proportion of assets using these methods jumped from 0.30 to 0.52 between 1954 and 1955, but then grew more slowly to 0.85 in 1978. Adjustment costs and traditional accounting practices are the major available explanations for the continued use of less accelerated methods.

At least partly in response to taxpayer practices of using shorter asset lives for tax purposes, in 1962 the Treasury issued "Guidelines" with a 30 to 40 percent shortening of suggested *Bulletin F* lives. These changes were accompanied by the 1962 introduction of the investment tax credit (ITC) discussed in the next section. Although the "Long Amendment" specified that the basis for depreciation was to be net of the ITC, this amendment was repealed in 1964, and investors were allowed to increase the basis of assets bought in 1962 and 1963.

Later changes included the 1969 elimination of double declining balance for structures other than public utility structures. New nonresidential structures were reduced from 200 percent to 150 percent of declining balance, while used nonresidential structures were reduced from 150 percent to straight-line.

In 1971 the Asset Depreciation Range (ADR) system further liberalized depreciation allowances for equipment and public utility structures by permitting lifetimes that were 20 percent above or below the Guideline lifetimes (which were themselves 30–40 percent lower than those of *Bulletin F*). Taxpayers did not always adopt the shortest lifetimes available, because longer lifetimes made some assets eligible for higher rates of investment tax credit. In particular, the asset's life must be at least seven years to qualify for the full 10 percent credit, at least five years to qualify for two-thirds of that credit, and at least three years to qualify for one-third of the credit.

The law also includes a requirement that assets not be depreciated below their ultimate scrap values. However, the assumed scrap value as a proportion of asset value has been considerably reduced in recent years. The reduction in allowances comes at the end of the depreciation stream for the declining balance methods, and the present value effect of the scrap value provisions must be very small. As a result, this complication can be ignored.

We now turn to a detailed examination of depreciation allowances as they stood in 1980 (the "old law"), to be followed by an examination of the Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act of 1982. We assume that the hypothetical project under study is one undertaken by a corporation using the most favorable depreciation method, and we assume that the investment under consideration is a new asset, not a used one.

For the old law, Guideline lifetimes are specified for hundreds of different assets. To reduce this number to more manageable proportions, several studies have provided information on an aggregation to the thirty-four asset types listed in table 6.5. For example, Hulten and Wykoff (1981) have estimated economic depreciation rates based on this aggregation. These estimates, shown in column 1 of table 6.5, are discussed in the next section. The first twenty assets are types of equipment and will ultimately be aggregated into a single asset for the purposes of this study. The following fourteen assets are types of structures, also to be aggregated for this study. Inventories are treated elsewhere.

These thirty-four assets are used in different proportions by each of our three industries (manufacturing, other industry, and commerce). To obtain the relevant thirty-four by three matrix, we aggregated more detailed capital stock data provided by Dale Jorgenson.[11] As described below, these 1977 capital stocks are used in weighting depreciation rates of column 1 and investment tax credit rates of column 2 to obtain industry-specific values for δ and g.

We also use these capital stocks to obtain industry-specific values for tax depreciation allowances, but this procedure is considerably more complicated for two reasons. First, United States tax law does not specify any exponential depreciation rate suitable for use as the parameter a, defined in chapter 2. Instead, tax lifetimes and depreciation formulas are used directly to calculate A_z, defined as the present value of depreciation allowances for a dollar of investment, in each of the thirty-four assets under each law. Multiplication by τ provides A_d, defined in chapter 2 as the tax saving from these depreciation deductions. Second, the law differs for each of the thirty-four assets. In particular, the "buildings" asset in this study includes public utility structures, which are allowed double declining balance like equipment, plus other structures, which receive only 150 percent of declining balance under the old law (175 percent under the 1981 and 1982 laws). We use the capital stock matrix to calculate a weighted average of the present value of depreciation allowances in each industry, first over the twenty types of equipment and then over the fourteen types of structures. In this case, however, capital stocks do not provide the correct weights by themselves. After we describe depreciations allowances below, we refer to Appendix D for a procedure to average allowances over the twenty types of equipment or fourteen types of structures in each industry.

To proceed, for the old law Jorgenson and Sullivan (1981) have aggregated the Guideline lifetimes for hundreds of assets into thirty-four

11. See Jorgenson and Sullivan (1981), Fraumeni and Jorgenson (1980), and section 6.3.2 for more detail.

Table 6.5 **Depreciation, Investment Tax Credit (ITC) Rates, and Tax Lifetimes by Asset Class**

Asset Class	Hulten/Wykoff Depreciation Rates (1)	1980 Law		1981 and 1982 Laws	
		ITC Rate (2)	Lifetime (3)	ITC Rate (4)	Lifetime (5)
1. Furniture and fixtures	0.1100	0.100	8.00	0.10	5.0
2. Fabricated metal products	0.0917	0.100	10.00	0.10	5.0
3. Engines and turbines	0.0786	0.100	12.48	0.10	5.0
4. Tractors	0.1633	0.067	5.00	0.10	5.0
5. Agricultural machinery	0.0971	0.100	8.00	0.10	5.0
6. Construction machinery	0.1722	0.100	7.92	0.10	5.0
7. Mining and oilfield machinery	0.1650	0.100	7.68	0.10	5.0
8. Metalworking machinery	0.1225	0.100	10.16	0.10	5.0
9. Special industry machinery	0.1031	0.100	10.16	0.10	5.0
10. General industrial machinery	0.1225	0.100	9.84	0.10	5.0
11. Office and computing machinery	0.2729	0.100	8.00	0.10	5.0
12. Service industry machinery	0.1650	0.100	8.24	0.10	5.0
13. Electrical equipment	0.1179	0.100	9.92	0.10	5.0
14. Trucks, buses, and trailers	0.2537	0.067	5.00	0.10	5.0
15. Autos	0.3333	0.033	3.00	0.06	3.0
16. Aircraft	0.1833	0.100	7.00	0.10	5.0
17. Ships and boats	0.0750	0.100	14.40	0.10	5.0
18. Railroad equipment	0.0660	0.100	12.00	0.10	5.0
19. Instruments	0.1473	0.100	8.48	0.10	5.0
20. Other equipment	0.1473	0.100	8.16	0.10	5.0
21. Industrial buildings	0.0361	0.0	28.80	0.0	15.0
22. Commercial buildings	0.0247	0.0	47.60	0.0	15.0
23. Religious buildings	0.0188	0.0	48.00	0.0	15.0
24. Educational buildings	0.0188	0.0	48.00	0.0	15.0
25. Hospitals	0.0233	0.0	48.00	0.0	15.0
26. Other nonfarm buildings	0.0454	0.0	30.90	0.0	15.0
27. Railroads	0.0176	0.100	24.00	0.10	15.0
28. Telephone and telegraph	0.0333	0.100	21.60	0.10	15.0
29. Electric light and power	0.0300	0.100	21.60	0.10	15.0
30. Gas	0.0300	0.100	19.20	0.10	10.0
31. Other public utilities	0.0450	0.100	17.60	0.10	10.0
32. Farm structures	0.0237	0.0	25.00	0.0	15.0
33. Mining, shafts, and wells	0.0563	0.0	6.80	0.0	5.0
34. Other nonresidential structures	0.0290	0.0	28.20	0.0	15.0

Source: Depreciation rates are from Hulten and Wykoff (1981). For public utility structures (assets 27–31), Jorgenson and Sullivan (1981) provide estimates based on the Hulten/Wykoff methodology. Investment tax credit rates and lifetimes are from Fullerton and Henderson (1981) and are described in the text.

lifetimes, based on the aggregations of table 6.5. These lifetimes provide estimates of the midpoints of the Asset Depreciation Range (ADR) system. Most structures are assigned these lives directly, but the ADR system allows 20 percent longer or shorter lives for equipment (assets 1–20) and public utility structures (assets 27–31). Because of our optimizing tax practice assumption, these assets are assigned lives that are 80 percent of ADR midpoints, except where the use of a longer life would reduce effective taxes through eligibility for a higher investment tax credit. In order to concentrate on tax law rather than on actual practices, we ignore the possibility of shorter lives substantiated by facts and circumstances. The resulting vector of lives, shown in column 3 of table 6.5, is consistent with the ITC vector in that three- and five-year assets get one-third and two-thirds of the full investment tax credit, respectively.[12] This vector of lives also appears in Fullerton and Henderson (1981).

For equipment (assets 1–20) and public utility structures (assets 27–31), the old law allows double declining balance (DDB), with a switch to sum-of-the-years'-digits (SYD). See footnote 10 for description of these schemes. This combination is used here as tax-minimizing practice because it can be shown to provide the earliest possible depreciation deductions.[13] Define L as the asset's lifetime for tax purposes, an integer number of years. Define L_s as the time of the optimal switch, and B as the "declining balance rate." The B parameter refers to the multiplier for the straight-line rate when depreciation is allowed on a declining basis. That is $B = 2.0$ for double declining balance, and $B = 1.5$ for 150 percent of declining balance. We can then define $a' \equiv B/L$ as the exponential rate for the first part of the asset's life. The prime distinguishes this parameter from the exponential rate that would apply to the asset's whole life. Since DDB starts out with higher depreciation allowances, and since SYD on the remaining basis must eventually exceed DDB, the optimal switching point can be found by equating depreciation under the two methods:

12. Lifetimes for many of the thirty-four assets are actually averaged over more diverse asset categories. As a result, only some of the assets in one of our categories may need their lifetimes adjusted to receive higher credits. Since the aggregation to thirty-four assets provides considerable detail, however, it seems appropriate to treat each asset as individually homogeneous. One example where this treatment may be less appropriate is in mining, shafts, and wells. The 6.8 year life here reflects an average of intangible drilling with a zero life and other structures with a longer life.

13. See Shoven and Bulow (1975). If a firm expects a steady stream of positive taxable profits, as assumed, it would always take depreciation allowances as early as possible. In other circumstances, however, the firm may prefer later deductions. Under the old law, the firm could delay its depreciation by delaying the switch or by using straight-line. The 1981 and 1982 laws are less flexible, however, because they mandate the switchover time that would be optimal for the firm wanting the earliest deductions. All laws allow the flexibility to combine just straight-line depreciation with longer tax lives, but this decision can be made only at the time of acquisition.

$$\frac{L - L_s}{F(L - L_s)} = \frac{B}{L}, \tag{6.1}$$

where the F function is defined by

$$F(x) = \sum_{j=0}^{x} (x - j) \tag{6.2}$$

if x is an integer. As seen below for cases where x is not an integer, the summation goes from zero to the integer part of x.

For such equipment, the firm would use DDB in the first year, would be indifferent in the second year, and would switch to SYD by the third year of the asset's life. However, tax laws make use of the half-year convention, assuming that all assets were bought on 1 July. The firm thus uses DDB for $L_s = 1.5$ years, and SYD afterward. Take, for example, a one-dollar asset with $L = 5$, $B = 2$, and $a' = 0.40$. Then the firm would deduct 0.2 (half of a') in the year of purchase and 0.32 (a' times 0.8) in the first full taxable year. Switching to SYD for the 0.48 remaining basis over 3.5 years, the firm would use numerators of 3.5, 2.5, 1.5, and 0.5 respectively. The sum of those figures for the denominator is 8.0, as defined by $F(L - L_s)$ in equation (6.2), where $L - L_s$ is not an integer. Because allowances are on a historical cost basis, these nominal future depreciation deductions are discounted at the nominal (after-tax) discount rate ρ. Since A_z was defined as the present value of depreciation allowances on a current dollar of investment, the general expression under 1980 law for equipment and public utility structures is:[14]

$$\begin{aligned} A_z = {} & a \int_0^{.5} e^{-\rho u}\, du + a'\left(1 - \frac{a'}{2}\right) \int_{.5}^{1.5} e^{-\rho u}\, du \\ & + \left(1 - \frac{a'}{2}\right)(1 - a') \cdot \sum_{J=2}^{L} \frac{L - (J - .5)}{F(L - L_s)} \\ & \cdot \int_{J-.5}^{J+.5} e^{-\rho u}\, du. \end{aligned} \tag{6.3}$$

To save space, the integration is not performed here.

For structures (assets 21–26 and 32–34), the old law specifies a 150 percent declining balance rate ($B = 1.5$) with a switch to straight-line.

14. This expression avoids assuming a continuously declining basis, which would inaccurately leave $e^{-a'L_s}$ remaining at the time of the switch. Instead, we follow the law by specifying yearly adjustments to basis. Also, because we discount continuously, depreciation deductions at the beginning of the year are worth more than those at the end of the year. This procedure explicitly recognizes that depreciation deductions are "coincident" with the associated earnings and tax liability.

The switch time L_s is again found where the two methods provide the same deductions. Since continued exponential deductions would allow a rate B/L on remaining basis, and since straight-line would allow $1/(L - L_s)$ on the same remaining basis, we can set these two expressions equal to each other and solve for L_s as:

$$L_s = \left(\frac{B-1}{B}\right)L. \tag{6.4}$$

Thus the firm would switch after one-third of the asset's life, but it must begin straight-line at the start of a tax year. For a twenty-five year asset, for example, L_s would be 8.33 years. If we assume midyear purchase dates on average, the firm actually switches after 8.5 years. The general present value expression for structures is then:

$$\begin{aligned} A_z = a' \int_0^{.5} e^{-\rho u}\,du + a'\left(1 - \frac{a'}{2}\right) \\ \cdot \sum_{J=0}^{L_s - 1.5} (1-a')^J \cdot \int_{J+.5}^{J+1.5} e^{-\rho u}\,du \\ + \left(1 - \frac{a'}{2}\right)(1-a')^{(L_s - .5)} \cdot \frac{1}{L - L_s} \cdot \int_{L_s}^{L} e^{-\rho u}\,du. \end{aligned} \tag{6.5}$$

The Economic Recovery Tax Act of 1981 changed both the investment tax credit, as described in the next section, and depreciation allowances. It introduced the Accelerated Cost Recovery System (ACRS), under which any depreciable asset falls into one of four classes and is given a tax life of three, five, ten, or fifteen years. The ACRS lifetimes for our thirty-four assets are shown in column 5 of table 6.5. The law assigns a three-year life to autos, light trucks, R&D equipment, certain race-horses, and personal property with an ADR midpoint of four years or less. Our level of aggregation shows autos with a three-year life, but none of the other assets has an (average) ADR midpoint of four years or less. All other equipment gets a five-year life.

A ten-year life is granted to any public utility structure with an ADR midpoint between eighteen and twenty-five years. Since the "gas" and "other public utility" categories have ADR midpoints of less than twenty-five years, we assign a ten-year life to these two assets under ACRS. Finally, a fifteen-year life is assigned to public utility structures with an ADR midpoint of more than twenty-five years, and to all other structures except mining, shafts, and wells, which we reduce from 6.8 years to a five-year life. Thus, all thirty-four assets receive lifetimes that are shorter than the minimum allowable under the old law, and tax lives are no longer based on estimates of expected useful lives.

Although these shorter lives were effective immediately, the 1981 law specifies a depreciation schedule that is less accelerated during a five-year phase-in period. In 1981, purchases of equipment and public utility structures were allowed only 150 percent of declining balance, switching to straight-line, and from 1982 to 1985 they were scheduled to receive 175 percent, switching to SYD. They were scheduled to receive double declining balance again starting in 1986. We will investigate only the posttransition allowances that were scheduled to start in 1986.

Under the ultimate 1981 law, equipment and public utility structures receive DDB switching to SYD as before, so we could almost get away with substituting the new lifetimes into equation (6.3) from the old law to obtain A_z, the present value of allowances. However, the 1981 law moves up depreciation from the last half-year. As a result, the three-year class is depreciated in only 2.5 years, the five-year class in 4.5 years, and the ten-year class in 9.5 years. For the five-year asset example, depreciation deductions are 0.2 in the first half-year (half of B/L) and 0.32 in the first full year (B/L times 0.8), but the remaining 0.48 basis is given SYD treatment over only three remaining years. Also, the taxpayer is not given the choice of when to switch. If the firm selects a five-year life for equipment, the law actually provides a table requiring deductions of 0.2, 0.32, 0.24, 0.16, and 0.08, starting in the year of purchase. We thus have a general expression for A_z under the 1981 Economic Recovery Tax Act for equipment and public utility structures in 1986:

$$A_z = a' \int_0^{.5} e^{-\rho u}\,du + a'\left(1 - \frac{a'}{2}\right) \int_{.5}^{1.5} e^{-\rho u}\,du$$

$$+ \left(1 - \frac{a'}{2}\right)(1 - a') \cdot \sum_{J=2}^{L} \frac{L - J}{F(L_s - G - .5)} \int_{J-.5}^{J+.5} e^{-\rho u}\,du. \tag{6.6}$$

This formula is essentially that used to calculate the depreciation amounts specified in the tables of the law.

Other structures have no transition but immediately increase from 150 to 175 percent of declining balance. They still switch to straight-line, however, and the last half-year is not moved up. As a result, we can set B to 1.75 and use formulas from the old law for structures. Equation (6.4) implies that the switch point is 3/7 of L. For a fifteen-year asset purchased 1 July, L_s is set to 6.5 years, and equation (6.5) provides the present value of depreciation allowances, A_z.

The 1981 act represented a dramatic tax change, but not only because of the business provisions described here. Personal tax cuts and many other features of the act are described in section 6.4.2. While the Reagan administration may have planned commensurate cuts in government expenditures, the 1981–82 recession served both to reduce revenue and to

increase required expenditures relative to planned amounts. In light of high deficit projections, growing concern over deficits, and claims that the 1981 tax cuts were tilted in favor of business, Congress passed the Tax Equity and Fiscal Responsibility Act of 1982. This act retains the personal tax cuts, the ACRS lifetimes, and the ITC rates of the 1981 act, but it repeals the last two phases of the transition for equipment and public utility structures. These assets are left with 150 percent of declining balance (switching to straight-line) rather than progressing to 175 and 200 percent of declining balance (switching to SYD). Further, the 1982 act reduces the depreciation basis by half of the investment tax credit.

Operationally, for equipment (assets 1–20) and public utility structures (assets 27–31), we set B equal to 1.5 and use equations (6.4) and (6.5) to calculate A_z. We then multiply by $(1 - g/2)$ to get the present value of allowances per dollar of investment.[15] Other structures are unchanged from the 1981 law, using $B = 1.75$ and the same equations.

For any law, we now have A_z for each of the thirty-four assets. This A_z was defined as the present value of depreciation allowances for a dollar of current investment, but we want the present value of allowances for a dollar of maintained capital stock. A distinction arises because reinvestment in later years also receives accelerated allowances (at historical cost). For this reason, each A_z is weighted not by capital stocks alone, but by existing capital plus the present value of reinvestment required to replace capital in each asset and industry. A short-lived asset receives relatively more weight because it requires more reinvestment qualifying for depreciation deductions A_z. This procedure is fully described in Appendix D.

The correctly averaged A_z for equipment or structures in each industry, called $\overline{A_z}$ in Appendix D, is multiplied by τ to obtain A_d, the present value of tax savings from these future depreciation deductions. These tax savings thus depend in a very nonlinear manner on ρ, and they cannot be calculated until this nominal after-tax discount rate is available. In the fixed-r case this requirement presents no obstacle. In the fixed-p case, however, equation (2.23) of chapter 2 shows that A_d is required before the discount rate can be calculated. This simultaneity cannot be resolved by an analytical solution for ρ. Instead, we iterate to find an interest rate ρ that is consistent with both sets of equations.

Finally, for the United States data set, the f_2 parameter is set to zero, indicating no immediate free depreciation of investment. The f_1 param-

15. Tables in the 1981 and 1982 laws specify actual percentages of purchase price to be depreciated each year for each asset. These percentages can all be derived from our formulas, with one exception. For five-year equipment in 1981, B is 1.5, and the optimal switch to straight-line would occur after one-third the life of the asset. With the half-year convention L_s would be 2.5. Because of early-year revenue constraints, however, the 1981 tables require a switch to straight-line after only the first half-year. These amounts were multiplied by $(1 - g/2)$ to provide tables for the 1982 law. We capture this effect by specifying $L_s = 0.5$ for five-year assets under the 1982 law.

eter is set to one, indicating that all equipment and structures depreciate for tax purposes according to the formulas above. Inventories receive no depreciation allowances.

6.2.4 Estimates of Economic Depreciation

The most recent and most comprehensive estimates of economic depreciation in the United States are found in Hulten and Wykoff (1981). They use prices observed from secondhand asset markets to infer the declines in asset values that occur with age, taking inflation into account. To avoid "censored sample bias," a problem associated with the fact that prices would not be available for retired assets, they use separate data on retirements to obtain survival probabilities. The "average" price for an asset of a particular vintage is then its observed price times its survival probability (plus zero times its retirement probability). A potential difficulty is that assets appearing in the secondhand markets may be systematically inferior to those retained by original owners. If buyers cannot distinguish between normal assets and these inferior assets, called "lemons" by Akerlof (1970), then market prices would understate the average value of a particular vintage. Hulten and Wykoff argue that this problem is not serious for business resale markets. Since buyers are sophisticated specialists, sellers cannot expect to gain from offering only their inferior assets. Furthermore, assets such as construction machinery are often bought for particular jobs and sold afterward.

Hulten and Wykoff use "blue book" and other business asset price data directly for eight asset categories. They test alternative assumptions about the time profile of depreciation, and they conclude that exponential decay is much more data-compatible than straight-line or one-horseshay depreciation. The weakest link in their procedure is the derivation of thirty-two depreciation rates from the eight directly estimated rates. For each of these thirty-two assets, the Commerce Department provides an estimate of actual economic life, assuming that depreciation is straight line. Call this economic life L (but note that this concept differs from the tax lifetime discussed in the previous section).

If each asset does decay exponentially, and if each has an associated lifetime L, then each depreciation rate can be described by

$$\delta = \frac{B}{L}, \tag{6.7}$$

where B is the "declining balance rate" for economic depreciation. Again, this concept differs from the legal B of the previous section, but $B = 2$ would imply that actual depreciation was on a declining basis at twice the straight-line rate defined by L. Since they have δ and L for their six directly estimated equipment types, Hulten and Wykoff use (6.7) to find an average B of 1.65 for equipment. They use this B with other lifetimes

Table 6.6 **Economic Depreciation Rates by Asset and Industry**

Industry	Machinery (Equipment)	Buildings (Structures)	Inventories
Manufacturing	.1331	.0343	.0
Other industry	.1302	.0304	.0
Commerce	.1710	.0247	.0

Source: Own calculations from Hulten and Wykoff (1981) depreciation rates and Jorgenson's unpublished capital stock matrix, as described in the text.

in equation (6.7) to get a δ for each type of equipment. Similarly, they find an average B of 0.91 for their two directly estimated structure types, and they use this B with other lifetimes in equation (6.7) to get a δ for each type of structure. These rates are shown in column 1 of table 6.5. They range from a low of 0.0176 for railroad structures to a high of 0.3333 for automobiles.

Since each industry's capital stock in each asset is available from the unpublished Jorgenson data, we can calculate separate weighted averages for each of our three industry groups. These rates are shown in table 6.6, based on the Hulten-Wykoff depreciation rates. They do not depend on the discount rate.[16]

Equipment (or machinery in the terminology of this study) depreciates at about 13 percent per year except in the commercial industry, with its high weight on autos and trucks. Structures (or buildings) depreciate at rates between 2.5 and 3.4 percent per year, as shown in the table.

6.2.5 Investment Grants and Incentives

The investment tax credit (ITC) was introduced in 1962 at a 7 percent rate on equipment and a 3 percent rate on public utility property. It was repealed in 1969 but was reintroduced in 1971 at a 7 percent rate on equipment and a 4 percent rate on public utility property. A 1975 act temporarily increased the credit to 10 percent for both types of assets and eliminated the 50 percent limit on the amount of tax liability that could be offset. In 1978 the 10 percent credit was made permanent, and taxpayers were allowed to offset all of the first $25,000 of tax liability and 90 percent of any remaining liability.

The 1980 statutory rate of credit is 10 percent for all qualifying equipment and special-purpose structures, but the latter definition has been

16. To see that the capital stocks are the correct weights for economic depreciation rates, we could perform an exercise similar to that performed for tax depreciation in Appendix D. Take the present value of actual depreciation on a dollar of current investment in each of the disaggregate assets, and add the present value of depreciation on the reinvestment necessary to maintain a dollar of real capital. Take a capital-weighted average of those present values, then ask what depreciation rate δ on an aggregate maintained asset would yield the same value of depreciation. The answer for $\bar{\delta}$ reduces to a K-weighted average of δ_j.

broadened to include more than half of our total structures category.[17] As mentioned, the credit was only two-thirds effective for assets with lives less than seven years, one-third effective for assets with lives less than five years, and not effective for assets with lives less than three years. Furthermore, owing to inadequate taxable profits, some credits had to be carried forward and some were never able to be used. As a result of all these considerations, Jorgenson and Sullivan (1981) estimate that the effective 1980 tax credit rates for equipment and structures were 0.078 and 0.045, respectively.

In this study, however, we focus on a company with sufficient profits to enable it to use the statutory rates of credit. The 1980 statutory ITC rates for each of our thirty-four assets are shown in column 2 of table 6.5 above. These rates are the same as those in Fullerton and Henderson (1981).

We use Jorgenson's capital stocks separately for each industry in weighting the investment tax credits over the twenty types of equipment and the fourteen types of structures. Here again, however, capital stocks by themselves do not provide correct weights. If an asset depreciates faster than average, it will have more than the average amount of reinvestment associated with maintaining it. Because replacement investment also qualifies for the ITC, the weight on such an asset should be larger than its current stock.

Appendix D describes our procedures for calculating $\bar{g}$, the average of investment grant rates g, for each asset and industry. Weights are equal to capital plus the present value of replacement investment. As a result, $\bar{g}$ cannot be expressed as raw data but must be calculated for each ρ and π combination. One set of $\bar{g}$ for 1980 is shown in table 6.7. The 0.07833 discount rate for this example corresponds to debt finance in the fixed-r case with the actual United States inflation experience. Rates for equipment are close to 0.10, as would be expected by looking at the rates in column 2 of table 6.5. Only tractors, trucks, and autos have statutory rates less than 0.10. These assets have large weights in commerce and in other industry, so their $\bar{g}$ values are 0.0852 and 0.0897, respectively. Manufacturing gets a 0.0957 effective rate. Structures receive no investment credit, except for the 0.0978 rate in other industry, which includes public utility structures.

Table 6.8 shows ITC rates under the Economic Recovery Tax Act of 1981. These are very similar to those for 1980, except that the statutory credit for autos has been increased from 0.033 to 0.06, and that for trucks and trailers has been increased from 0.067 to 0.10, as shown in column 4 of table 6.5.

The value of $\bar{g}$ for inventories is always zero. Finally, the f_3 parameters

17. Special-purpose structures are those that "are replaced contemporaneously with the equipment that they . . . house, support, or serve" (U.S. Department of the Treasury, 1962 Guidelines).

Table 6.7 **Investment Tax Credit Rates in 1980, by Asset and Industry**

Industry	Machinery (Equipment)	Buildings (Structures)	Inventories
Manufacturing	.0957	.0	.0
Other industry	.0897	.0978	.0
Commerce	.0852	.0	.0

Source: Own calculations from data in Fullerton and Henderson (1981) and Jorgenson's unpublished capital stock matrix. The values in this table are based on a 0.07833 nominal discount rate, as obtains for debt finance in the case where r is fixed at 0.05, $\bar{m}$ is 0.3559, and inflation is at the 0.0677 actual United States rate.

Table 6.8 **Investment Tax Credit Rates under the Economic Recovery Tax Act of 1981, by Asset and Industry**

Industry	Machinery (Equipment)	Buildings (Structures)	Inventories
Manufacturing	.0984	.0	.0
Other industry	.0988	.0978	.0
Commerce	.0941	.0	.0

Source: Own calculations from data in Fullerton and Henderson (1981) and Jorgenson's unpublished capital stock matrix. The values in this table are based on a 0.07833 nominal discount rate, as obtains for debt finance in the case where r is fixed at 0.05, $\bar{m}$ is 0.3559, and inflation is at the 0.0677 actual United States rate.

are all set to one, indicating that all investments qualify for effective credit rates $\bar{g}$.

6.2.6 Local Taxes

Personal and corporate income taxes at the local level were discussed in sections 6.2.1 and 6.2.2. Local governments also collect considerable revenue from sales taxes, business and occupation taxes, license fees, and gross receipt taxes on public utilities. These taxes are not relevant for this study, since we are concerned with taxes for which the base is capital or capital income. Some states do collect a "corporate franchise" or "net worth" tax, however, with capital assets as the tax base. These were incorporated into the statutory state corporate income tax rates, discussed above.

The major remaining tax on capital is the property tax, providing at least a quarter of total state and local revenues. Thousands of local jurisdictions each set their own statutory rate, and they each have their own assessment practices. A given asset may be subject to interjurisdictional differences in statutory rates or interjurisdictional differences in average assessed-value/market-value ratios. In addition, assets can be treated differently within a jurisdiction if some assets have not been

reassessed recently and have assessment ratios different from the average. Generally, the statutory rates differ for real property (buildings and land) and for personal property (machinery, inventory, livestock, motor vehicles, furniture, etc.).

We would like to estimate the average effective rate of property tax on each asset in each industry. Because Jorgenson's 1977 capital stock matrix is available, we could divide 1977 property taxes in each category by the corresponding stock of capital. Unfortunately, however, property tax payments are not generally broken down by both asset and industry. Because there are substantial rate differentials between equipment and structures, we will disaggregate by asset, not by industry.

Table 6.9 summarizes the calculation of effective property tax rates. The first row presents data from the Advisory Commission on Intergovernmental Relations (ACIR), available only for 1972. This row shows that 28.6 percent of property taxes were paid on business realty (land and structures) and that 11.8 percent were paid on business personalty (equipment and inventories). No further disaggregation is available. These figures include both the corporate and the noncorporate sectors but exclude public utility taxes, which were not divided between realty and personalty. Data from the Commerce Department's Bureau of Economic Analysis show that a total of $62.535 billion of state and local property taxes was paid in 1977. If we assume that the allocation of these

Table 6.9 Derivation of Property Tax Rates by Asset

	Nonbusiness (Household) Sector		Business Sector	
	Realty	Personalty	Realty (land and structures)	Personalty (equipment and inventories)
1. Proportion of total 1972 property tax	0.501	0.019	0.286	0.118
2. Estimated 1977 tax (multiply (1) by $62.535 billion)	31.330	1.188	17.885	7.379
3. Jorgenson's 1977 capital stocks in $ billion			1,588.516	960.382
4. Estimated rate of tax (divide (2) by (3))			0.01126	0.00768

Source: Proportions in row 1 are from the Advisory Commission on Intergovernmental Relations (ACIR), as found in Harriss (1974). They exclude the 0.075 proportion of 1972 property taxes paid by public utilities. The 1977 property tax figure in row 2 is from the Commerce Department's Bureau of Economic Analysis. Capital stocks in row 3 are from Dale Jorgenson's unpublished data. We have excluded public utility capital in order to match the available tax data.

taxes was the same as in 1972, then $17.885 billion was paid on business realty and $7.379 billion on equipment and inventories, as shown in row 2.

The appropriate denominator for realty is the aggregate of Jorgenson's corporate and noncorporate capital stocks over land and all types of structures in all industries except public utilities ($1,588.5 billion, as shown in row 3 of table 6.9). For personalty, the appropriate denominator is the aggregate of Jorgenson's corporate and noncorporate capital stocks over inventories and all types of equipment in all industries except public utilities ($960.4 billion, also shown in the table). Division, in row 4 of the table, provides 0.01126 as the effective property tax rate on realty, applied to buildings in this study, and 0.00768 as the effective rate on personalty, applied to machinery and inventories in this study.

Though our study does not include residential capital explicitly, it is nevertheless interesting to compare the 0.01126 business realty rate to a household realty rate. Table 6.9 shows $31.33 billion of 1977 property taxes on household realty, including rented and owner-occupied housing. The February 1981 *Survey of Current Business* shows $1,705.7 billion as the appropriate denominator, providing 0.01837 as the effective property tax rate on housing. Thus the United States, in contrast to the United Kingdom, for example, imposes higher effective property tax rates on households than on business. Houses are sold more often than business realty, so there are longer lags in the reassessment of business property. In addition, jurisdictions often compete for incoming businesses by offering temporary tax abatements.

In fact, because a firm can bargain with a number of cities before deciding where to locate, a city might provide a ten-year tax holiday for the buildings of that firm alone. These property tax abatements lower the payments of only new entrants, implying that the marginal property tax rate could be less than the average tax rate calculated here.

Finally, because of the mobility among the many taxing jurisdictions, followers of Tiebout (1956) might argue that the local property tax payments must be exactly offset by the value of local public goods in each jurisdiction. As with other tax calculations in this study, however, our property tax calculation ignores the possibility of offsetting benefits on the expenditure side.[18]

18. The property tax in each jurisdiction is used to finance local public expenditure benefits that can offset any disincentive effects of the tax. Fischel (1975) and White (1975) argue, for example, that communities compete to obtain commercial and industrial property, implying that a community would be indifferent to the entry of a marginal firm in equilibrium. If we sought net budget incentive effects, and if this argument were correct, then the effective property tax rate should be set to zero. The use of nonzero rates can be taken as a rejection of this argument, or as an attempt to measure purely tax effects rather than net effects of government activity. See Fullerton and Gordon (1983) for further discussion and alternative simulations with and without distorting property taxes.

6.2.7 Wealth Taxes

Various forms of state and local net wealth taxes and property taxes have already been reviewed. At the federal level, article I, section 9 of the United States Constitution prohibits direct taxation. Since the Sixteenth Amendment specifically introduced a federal income tax, the constitutionality of a federal wealth tax is left in doubt. There is a federal estate tax, and this section describes some of its features. As specified in chapter 2, however, the estate tax does not enter our calculations.

In 1980 the federal estate tax had a graduated structure with the equivalent of a $175,000 initial exemption. The marginal tax rate reached 70 percent for estates over $5 million. Half of an estate was not taxable if left to a spouse. Estate tax returns were filed for only about 9 percent of deaths, and only 40 percent of those filing returns had to pay any tax. These taxes amounted to less than 2 percent of federal revenue.

The Economic Recovery Tax Act of 1981 specifies a transition period during which the exemption equivalent is increased and the top marginal tax rate is decreased. After 1987 there will be no tax on estates up to $600,000, and the top marginal rate will be 50 percent. Also, unlimited property can be left to a spouse without tax. These provisions will essentially eliminate estate taxes as a source of revenue.

For purposes of this study, the personal wealth tax rates of all three ownership categories are set to zero. The vectors of wealth tax rates for each asset are given by the effective property tax rates of the preceding section. These parameters are summarized in table 6.10.

6.2.8 Household Tax Rates

To estimate weighted-average personal tax rates on marginal increases in various types of income, we use the tax simulation (TAXSIM) model of the National Bureau of Economic Research (NBER). The model and our estimation procedures are described in section 6.2.1, and the estimates based on these procedures are shown in table 6.11. These marginal rates apply to 1977, the most recent year for which TAXSIM calculations are available. Inflation would have pushed many households into higher marginal rate brackets by 1980, but the Revenue Act of 1978 readjusted the nominal boundaries of the brackets. While explicit recalculation of

Table 6.10 Wealth Tax Rates

		Tax-Exempt	Insurance
Personal Wealth Tax	Households	Institutions	Companies
w_p	0	0	0
Corporate Wealth Tax	Equipment	Structures	Inventories
w_c	.00768	.01126	.00768

Source: Own calculations as described in the text.

Table 6.11 Personal Marginal Tax Rates for 1977

	Federal Only	State and Federal
1. Wages	.270	.324
2. Dividends	.410	.475
3. Interest	.271	.325
4. Statutory capital gains	.260	.280
5. Realized capital gains	.130	.140
6. Accrued capital gains	.065	.070

Source: Calculations from NBER's tax simulation (TAXSIM) model. As described in the text, the statutory capital gains rates of row 4 are halved (because of the increase of basis at death) to obtain row 5. These rates are approximately halved again (because of deferred realizations) to obtain row 6.

1980 rates is desirable, we have no procedure that rivals the quality of the TAXSIM procedures for 1977. Thus, the table 6.11 rates are employed for our 1980 calculations.

For wage income, the federal marginal tax rate from this model is 27 percent, while the combined state and federal rate is about 32 percent. For interest income, these rates are also 27 percent and 32 percent, respectively.[19] For dividend income, the federal and combined rates are 41 percent and 47.5 percent. To account for the dividend deduction, these calculations assign a zero tax rate to the dividends received by those with less than $100 of dividends ($200 for joint returns). These estimates correspond closely to the dividend rates estimated by Brinner and Brooks (1981). Their combined state and federal tax was 43.2 percent for 1953–79 and 49 percent for 1979 alone.

Retained earnings are taxed by the personal income tax only to the extent that they induce share appreciation over historical cost, and then only when realized. This deferral advantage clearly depends on the average length of the holding period or the proportion of gains to be realized each year. Furthermore, about half of gains are never realized because of the increase of basis at death. (No capital gains taxes are paid out of the estate, but the basis for calculating capital gains of the new owner is set equal to market value at the time of inheritance.) These considerations reduce the present value of expected taxes on current accrued capital gains.

With only 40 percent of realized gains taxable in 1979–80, and with a top marginal rate of 70 percent, the highest nominal rate of tax on capital

19. Feldstein and Summers (1979) report a 25 percent federal rate on interest income from the TAXSIM model but use a 35 percent rate on corporate bond interest to account for its greater concentration in high-income brackets. Without a breakdown of interest receipts in each bracket, it is appropriate to take the 32 percent combined state and federal tax rate for use in this study.

gains would be 28 percent. NBER's TAXSIM model places the federal capital gains rate at 26 percent, reflecting a very high concentration of capital gains in the high-income brackets. To account for state taxes, we use 28 percent as the combined nominal statutory rate.[20]

In other studies of taxes in the United States, a common assumption is that this nominal rate is halved owing to the deferral advantage and halved again owing to the increase of basis at death. It is sometimes argued that the resulting 0.07 effective tax rate on accrued capital gains is still too high, because investors can selectively realize their losses and hold onto their gains.

To account for deferral in this study, we multiply the capital gains rate by the effective accrued tax (EAT) ratio found in chapter 2:

$$\text{EAT ratio} = \frac{\lambda}{\lambda + \rho_p}, \tag{6.8}$$

where λ is the proportion of accrued gains realized each year and ρ_p is the investor's rate of discount. Suppose that λ is set to 0.1, reflecting an average lag of ten years between accrual and realization. The proper discount rate is the investor's nominal after-tax interest rate, a rate that depends on the combination under consideration. As an illustration, consider the fixed-r case. For the particular calculation where inflation adds $\pi/(1-\bar{m})$ to nominal interest rates, r is 0.05, and π is 0.0677, the nominal interest rate is 0.155 before tax. If the investors are households with the 0.325 marginal tax rate on interest income, their interest rate is 0.105 after tax. With this discount rate, the EAT ratio is 0.539, and the capital gains rate is still approximately halved owing to deferral. In our calculations the ratio is endogenous because it depends on ρ_p, the personal discount rate, which depends on inflation and the ownership category.

In this study we further halve the capital gains rate to account for the increase of basis at death and the selective realization of losses. This adjustment cannot be justified on solid empirical grounds, but it does make our procedures comparable to those of other United States tax studies that have adopted the same assumption.[21]

We turn now to the treatment of banks. In general, we assume that banks are financial intermediaries through which households hold part of their ownership of corporate capital. Since bank holdings of corporate equities are small enough to be safely ignored, we use the personal tax rates described above for all household dividend income and capital gains.

20. Because the TAXSIM model has complete tax return information with complete tax law specifications, the estimated nominal rate would reflect the alternative tax limitations and the inclusion of untaxed gains in the minimum tax calculations.

21. See, for example, Feldstein and Summers (1979), Fullerton et al. (1981), and Feldstein, Poterba, and Dicks-Mireaux (1983).

Households' purchases of bonds, however, account for only part of their ultimate ownership of debt-financed corporate investment. They also make deposits at banks, which, in turn, use those funds for loans to corporations in the forms of mortgages, commercial paper, acceptances, and bond purchases. If all of these corporate interest payments flowed through the intermediaries to households in a taxable form, then we could just add bank holdings of corporate debt to the household sector and tax it all at the 0.325 combined household rate on interest receipts. Since individuals in 1980 received no interest on demand deposits (checking accounts) and sometimes received low interest rates on time deposits, we could imagine three alternative treatments of the taxation of interest payments made by companies to banks. The first alternative represents a strict adherence to the general procedures of chapter 2, intended for use by all four countries. The second alternative follows the spirit of those procedures but accounts for interest ceilings on time deposits, found primarily in the United States. The third alternative follows a different view taken by Feldstein and Summers (1979).

Bank assets such as corporate debt are not tied to particular liabilities such as time deposits or demand deposits. As a result, all three alternatives employ information on total time and demand deposits for a breakdown of bank holdings of corporate debt. In the first alternative, time deposits are a conduit through which all corporate returns are paid out in the form of interest that is fully taxable at the household level. This procedure ignores the differential between the rate earned on corporate loans and the rate paid to depositors. Demand deposits, on the other hand, are a conduit through which all corporate returns are used by the bank not to pay interest, but to provide services to depositors. Households receive liquidity in the form of check writing and other banking services, but they are not taxed on this form of return to their investment. We thus assign a zero tax rate to the return on the share of households' corporate debt held through demand deposits, and a 0.325 rate to all other holdings of corporate debt.

For specific estimates, we use statistics on the ownership of corporate debt from table 6.18 of the next section. Of the $528.7 billion held by households in 1980, $285.6 billion was in commercial banks and $83.6 billion in savings institutions. Essentially all of the last category represents time deposits, taxed at the household rate. For commercial banks, *Flow of Funds* data reveal that their $1,306.2 billion total liabilities included $306.4 billion (or 23.5 percent) in demand deposits, $462.0 billion (or 35.4 percent) in small savings and time deposits, and the rest (or 41.1 percent) in other large accounts with no ceilings. We apply these percentages to the bank holdings of corporate debt. Following the first alternative, the overall household rate is calculated as 0.325, the tax rate on interest, times the proportion of debt not in demand deposits:

$$(6.9) \qquad m = .325\left[\frac{528.7 - (.235)(285.6)}{528.7}\right] = .284.$$

The second alternative recognizes that regulatory ceilings affect the interest paid by both commercial banks and savings institutions. Each maturity has a separately assigned ceiling, but the average rate paid on savings and small-denomination time deposits was 7.88 percent in 1980.[22] Since the unconstrained money market rates were about 12 percent in 1980, there existed a considerable interest differential that was ignored by the first alternative. In the spirit of the first alternative, however, we can treat these small savings deposits as generating nontaxable services for depositors. They might not receive check-writing services, but there are few withdrawal constraints, and the banks provide other liquidity services. In this view the interest differential does not generate pure profits for the bank, because competition for customers would encourage banks to extend their hours, open more branches, or provide gifts for new depositors. Since demand deposits and the interest differential on savings deposits represent nontaxable returns to households, the figures above can be used to calculate the overall household rate.

$$(6.10) \qquad m = \frac{.325\left[\left(\frac{7.88}{12}\right)(184.6) + 277.2\right]}{528.7} = .245,$$

22. In 1980, the maximum interest rates payable on time and savings deposits at federally insured institutions were:

Type of Deposit	*Savings Institutions*	*Commercial Banks*	*$ Billion at Commercial Banks*
Savings	5.50	5.25	196.1
90 days to 1 year	6.00	5.75	17.2
1 to 2.5 years	6.50	6.00	11.1
2.5 to 4 years	6.75	6.50	7.6
4 to 6 years	7.50	7.25	27.9
6 to 8 years	7.75	7.50	17.8
8 years or more	8.00	7.75	2.5
6 month money market certificates			152.8
2.5 year variable ceiling deposits under $100,000			28.5

The ceiling on six-month money market time deposits was the auction average from most recently issued six-month United States Treasury bills. This rate varied throughout the year but reached 15 percent in December 1980. The ceiling for 2.5 year deposits was fifty basis points below the 2.5 year Treasury rate. This long-term rate varied around 11 percent during the year, substantially less than the short-term rate just mentioned. These regulations were in a state of transition, owing to the March enactment of the Depository Institution Deregulation and Monetary Control Act of 1980. This new law imposes more consistent reserve requirements, broadens the powers of savings institutions to invest in corporate securities and to offer checking services, and orders a phaseout and ultimate elimination of interest rate ceilings. The authorities to impose ceilings on deposits by any of the federal financial institutions regulatory agencies are repealed as of 31 March 1986.

where 184.6 = 83.6 + (.354)(285.6) is the part of households' corporate debt held in savings accounts, and 277.2 = 528.7 − [184.6 + (.235)(285.6)] is the part not in savings or checking accounts.

The third alternative corresponds to the procedures used in Feldstein and Summers (1979). They argue that corporate interest receipts of the bank, when not paid out to depositors, are taxed as equity income to the bank's shareholders. In other words, banks earn monopoly profits that are not competed away either in the form of interest or in the form of additional services. The assumption of monopoly profits is left unexplained. For the combined rate of tax on banking income, Feldstein and Summers used an estimate of 0.561, reflecting the statutory corporate tax rate plus additional personal taxes on dividends paid to bank shareholders. With this estimate, the total tax on household and bank receipts of corporate bond interest is another weighted average:

$$m = \frac{.325\left[\left(\frac{7.88}{12}\right)(184.6) + 277.2\right] + .561\left[\left(\frac{12 - 7.88}{12}\right)(184.6) + (.235)(285.6)\right]}{528.7} = .383. \tag{6.11}$$

In this equation the household rate is applied to the interest actually paid on time deposits, and to direct ownership, while the bank's shareholders' rate is applied to the retained interest differential on time deposits plus all interest earned on funds in demand deposits.

The different approaches may be further explained as follows. A marginal tax rate measures the increased tax associated with a marginal dollar of income. However, interest income iK can increase either because of an increase in the interest rate i or because of increased investment in assets K. In this study we are concerned with a marginal increase in corporate capital K, financed in the same proportions as existing net capital. With this assumption, a proportion of additional savings is deposited in banks that use the funds for loans to corporations. Some of the ensuing interest must be used to pay interest on the additional time deposits (with a 0.325 tax rate on household interest receipts), some must be used to service the additional time and demand deposits (with a zero tax rate), and some might be retained as monopoly profits to the owners of the banks (with a 0.561 corporate tax rate).

Feldstein and Summers, however, were concerned with a different margin. They measured the additional tax associated with increases in inflation and resulting increases in the nominal interest rate. Without any additional dollar deposited, there is no need for the bank to incur costs through services on the extra deposit. Furthermore, interest-rate ceilings prevented banks from paying higher interest themselves. As a result of

the monopoly power assumption, all of the extra interest represents additional income to the banks and is taxed at the banks' corporate rate.[23]

Finally, this study is concerned with the total tax wedge on a *nonfinancial* corporate investment. While monopoly profits of the bank might be part of the wedge between the gross return on the nonfinancial investment and the net return of the ultimate saver, it is not clear that any of this monopoly wedge should be counted in our tax wedge. Any tax on these profits could be described as a tax on the financial activity rather than on the nonfinancial corporate investment.

Still, all three views have something to recommend them. We will take the central estimate of 0.284 as our household tax rate on interest income in the standard case. The lower rate of 0.245 will be used with an alternative "low tax" set of parameters, and the 0.383 rate will be used with an alternative "high tax" set of parameters.

6.2.9 Tax-Exempt Institutions

A deduction from personal tax is allowed for all employer and employee contributions to "qualified" retirement accounts, including Keogh and IRA accounts. A qualified pension must be nondiscriminatory and must meet certain other legal requirements for tax-exempt status. Not more than 20 percent of an employee's gross earnings may be placed in such an account and deducted from taxable income. The earnings of these pension reserves are also untaxed, but all retirement income is taxed when paid out. If the individual's marginal tax rate is unchanged after retirement, then this treatment is equivalent to that of a consumption tax. Thus the appropriate personal rate on this form of saving is zero.

Contributions to nonqualified pension plans, on the other hand, are not deductible in determining taxable income. The earnings on these nonqualified pension funds are untaxed until retirement benefits are paid, however, so these earnings have the advantage of tax deferral. One could think of the deferred personal income tax as an element in the taxation of nonqualified pension reserves. This treatment would require a

23. The two margins for effective marginal tax rates have different implications for behavior. To determine desired investment, individuals presumably want to know the extra tax associated with the marginal investment. Corporations receive investment tax credits and accelerated depreciation at historical cost on this marginal investment, and banks must pay the going rate of interest on the marginal deposit. By contrast, the extra tax associated with a marginal change in the interest rate does not involve any new credits or depreciation, or any new deposits. Bank interest might not increase, because of the ceilings. However, it is not clear that individuals can do anything about the extra tax associated with a marginal change in the inflation rate and the interest rate. Rather, if the inflation rate changes, individuals want to know the *new* extra tax associated with the marginal investment, including the ITC, accelerated depreciation at historical cost, and taxes on the interest of the new deposit.

present value calculation for retirement taxes, including a figure for the average time between pension earnings and pension benefits. A long postponement of tax and a high discount rate would imply a low effective tax on these pension earnings. Furthermore, the relative size of these nonqualified pensions is extremely small. Feldstein and Summers (1979) use zero for the effective personal rate on all pension income, and we make the same assumption here.

Nonprofit institutions also pay no tax on interest or dividend receipts. The m and z parameters for these groups are zero. Unfortunately, the *Flow of Funds* data include nonprofit institutions in the household sector. Sections 6.3.4 and 6.3.5 discuss ways of moving nonprofit institutions from the household category to the tax-exempt category.

6.2.10 Insurance Companies

Households receive investment income indirectly through insurance companies, and this income is taxed through a complicated set of provisions. In order to make sense of these provisions, this section breaks them down into corporate taxes on life insurance companies, corporate taxes on nonlife insurance companies, and personal taxes on amounts paid out by insurance companies. The particularly complicated, and seemingly arbitrary, taxation of life insurance companies is explained below by describing it in historical context.

First consider only the personal taxes on individual saving through life insurance. Individuals use after-tax income to pay insurance premiums, but no personal tax is due on accruals of interest to the reserves or on benefits paid on the death of the insured. If there were no corporate tax, then this treatment would correspond to the prepayment plan of a consumption tax.[24] If benefits are taken before the death of the insured, there is the possibility of a personal tax liability on earnings of the account—that is, benefits in excess of paid-in premiums. In this case insurance savings get the same deferral advantage as the nonqualified pension discussed in section 6.2.9. As mentioned there, a long postponement of tax, high discount rate, and/or a low personal rate after retirement can justify ignoring this personal tax as well.

For these reasons, we set the personal tax on insurance saving at zero. Insurance companies do, however, pay a corporate income tax. Consider the taxation of dividends and capital gains, followed by the taxation of interest income.

Since 85 percent of intercorporate dividends are excludable, the effective tax on insurance company dividend receipts is 0.15×0.46, or 6.9

24. See *Blueprints for Basic Tax Reform* (U.S. Department of the Treasury 1977) for thorough descriptions of prepayment plans and qualified accounts.

percent.[25] On realized capital gains, insurance companies pay the corporate statutory rate of 28 percent. We assume that insurance companies expect to realize 10 percent of their gains each year, and we use equation (6.8) above to calculate the effective rate on accrued capital gains. This rate depends on the discount rate and thus on the insurance company's marginal tax rate. However, when the EAT ratio of equation (6.8) is about one-half, the effective rate on accrued capital gains is about 14 percent.[26]

For interest income, insurance companies other than life insurance companies basically are taxed like other corporations. Feldstein and Summers (1979) take this to mean that these companies pay the 0.46 corporate rate on all interest income, and that their stockholders pay dividend taxes if the income is distributed or capital gains taxes if it is retained. Feldstein and Summers use 0.561 as the combined corporate and personal tax on insurance company income. Again, however, this procedure assumes that the extra capital income is generated by an unanticipated increase in the nominal interest rate. The relevant margin for our purposes is an increase in capital assets. The extra tax then depends on how the (nonlife) insurance company obtained the additional assets.

In our international comparison of marginal tax rates, we take a 1 percent increase in the existing capital stock, used wherever capital is currently used and owned wherever capital is currently owned. In general, individuals proportionately increase their holdings through all conduits, including direct ownership, banks, pensions, and insurance companies. Since insurance companies are a category of ownership, we posit an increase in their capital assets. If they make such investments out of their net earnings, without any additional reserves or expenses to deduct, then a tax of 0.561 might well be paid on the resulting income. However, the personal tax (associated with the difference between 0.561 and 0.46) would have to be paid on those earnings in any case. The only extra tax associated with this additional investment is the 0.46 corporate rate. If, instead, we explain the additional assets by suggesting an overall increase in the insurance business, then insurance companies would finance investments out of premiums but would incur additional reserves and expenses. They might pay no additional tax if there are no excess profits on their new operations. In light of all these considerations, the simplest

25. Note that here we use the 0.46 federal corporate tax rate rather than the 0.495 combined corporate tax rate. State and local governments typically impose premium taxes (on the consumer's purchase of life insurance services) rather than income taxes (on the investment income of the life insurance corporation).

26. For individuals, we cut the statutory capital gains rate of 0.28 in half to account for the increase of basis at death. We used the resulting 0.14 rate in (6.8) to get effective rates of about 7 percent. Since insurance companies do not have that advantage, their 0.28 statutory rate is used directly in (6.8) to get effective rates of about 14 percent.

and probably most appropriate marginal tax rate for nonlife insurance interest income is the 0.46 corporate rate. This rate is used with our standard parameters for the small portion of corporate debt held by nonlife insurance companies. The lower rate of zero will be used with our alternative "low tax" set of parameters, and the 0.561 rate will be used with our "high tax" set of parameters.

The taxation of life insurance companies is more complicated because of two special factors that exist only for life insurance companies or that become particularly acute only for them.[27] First, annual accounting would provide a particularly bad measure of life insurance income. While the income and expenses of most businesses are fairly close to concurrent, the life insurance transaction earns premiums many years before it is terminated. At the same time, long-run profitability of the insurance transaction can be accurately predicted by using mortality tables, and reserves can be set aside for those future death benefits. For these reasons, reserves are counted as a liability, income on the reserves is counted as a required expense for those future benefits, and annual tax calculations can use income on required reserves as a current deduction. Without legally specified allowances for reserves, however, life insurance companies could greatly affect their own taxable income through their choice of mortality and interest assumptions.

Second, the taxation of life insurance companies is complicated by the perceived need for maintaining the competitive balance between stock and mutual companies. The measured income of a stock company might be taxed at corporate rates before distribution of net earnings to shareholders, but the mutual company has no owners other than the policyholders who mutually insure each others' lives. Mutual companies would receive an unfair advantage if they were allowed to describe distributions as premium reductions and thus avoid corporate taxes.

The history of life insurance taxation reflects various attempts to embrace these special factors. From the beginning of the corporate tax until 1920, life insurance companies were subject to ordinary principles of taxation. That is, they included premiums and investment income, and they deducted operating expenses, sums paid out on insurance contracts, and net additions to policy reserves. Reserves were self-determined, and dividends were deductible if applied to current premiums. Capital gains were made nontaxable in 1921, and reserve interest requirements were limited to a uniform 4 percent rate. The company's actual interest requirements were not considered, but the 4 percent allowance changed several times since 1921. Mutual and stock companies were made comparable by eliminating the deduction for policyholder dividends.

27. The following discussion derives largely from the thorough treatment of the taxation of life insurance companies provided by McGill (1967). For more recent discussion, see Aaron (1982, 1983).

After 1942 the Treasury determined the excludable portion of investment income for each company, the "secretary's ratio," based on a weighted average of the company's actual interest requirements and an assumed interest rate of 3.25 percent. At various times when actual interest rates fell, the secretary's ratio exceeded one, and no taxes were paid by life insurance companies. The fixed 3.25 percent rate was dropped in 1949 so that reserve allowances could reflect the low actual rates then in effect. Reserve allowances were dropped altogether in 1951, but the statutory rate was reduced such that taxes would be the same as if the previous rates had applied with a secretary's ratio of 87.5 percent for all companies.

The Life Insurance Company Income Tax Act, passed in 1959, reverted to a modified version of the total income approach used before 1921. The major features of this act are still in effect. Premiums, investment income, and capital gains are all includable, while expenses, dividends to policyholders, and special reserve allowances are all deductible. Dividends to shareholders are not deductible. The company's tax is calculated in four "phases," but we assume that the firm is taxed under phase I. (Phase II taxes part of the underwriting gains, phase III taxes distributions not already taxed under phase II, and phase IV separates capital gains so that their tax is not offset by operating losses.)

Phase I calculates the investment yield as the difference between gross investment income and deductions for expenses, state and local taxes, depreciation, and depletion. Call this investment yield iK, the product of an interest rate and assets owned by the life insurance company. Reserve interest requirements are determined for each company in a formula with several steps. First, the "adjusted reserve rate" (arr) is found as the lesser of the company's current rate of return (i) and the average rate of return for the past five years. Next, the "average reserve interest rate" for all companies is derived from various assumptions. This average rate assumption has remained close to 0.03 and has not changed in response to inflation. Finally, the "adjusted life insurance reserves" are calculated by assuming that each percentage point by which the company's adjusted reserve rate (arr) exceeds the average interest rate (0.03) implies a 10 percent reduction in required reserves. If actual reserves are denoted R, then adjusted reserves are $R[1 - 10(arr - .03)]$. This formula is often called the "ten-to-one rule," or the "Menge formula" after its instigator. The company can deduct the adjusted reserve rate on these adjusted reserves.

$$\text{Taxable income} = iK - (arr)R[1 - 10(arr - .03)]. \tag{6.12}$$

Thus, if our margin is an increase in K with no change in actual reserves, the interest rate i, or the adjusted rate arr, then the additional capital income is taxed at the 0.46 corporate rate, and that is the end of it. As in

the case of nonlife insurance, we could use 0.46 as the extra tax, assuming that the additional assets were financed out of net earnings (and that any additional personal tax would have had to be paid on those earnings in any case). Or again, as in the case of nonlife insurance, we can explain the additional assets by suggesting an overall increase in the life insurance business. The life insurance company finances investments out of premiums but incurs additional expenses in obtaining and servicing the additional policies. It must hire more salesmen, clerks, and investment analysts, and it might pay no additional tax if there are no excess profits on its new operations. Thus a tax rate of zero will again be used with our "low tax" set of parameters.

Suppose instead that all assets are held only for reserves, including the marginal increase in K. Suppose also that the adjusted reserve rate equals the actual interest rate. Since $R = K$ and $arr = i$, equation (6.12) can be multiplied by 0.46 and simplified.

$$\text{Tax} = 4.6(i - .03)iK. \tag{6.13}$$

This simpler formula is used by Feldstein and Summers (1979) and others to compute life insurance taxes. When those authors calculate the extra tax for a change in i, they differentiate (6.13) with respect to i and obtain $4.6(2i - .03)$ as the extra tax on K. They use $i = 0.07$ to get a tax rate of 50.6 percent, but at the 1980 interest rates of approximately 0.12, this tax rate would be 96.6 percent.[28]

The problem, of course, is that regulatory authorities have not changed the 0.03 average reserve rate in response to inflation and higher interest rates. The increase in i serves to increase both the taxable income iK and the effective tax rate $4.6(i - .03)$.

Our margin, however, concerns not an increase in the interest rate i, but an increase in the capital stock K. From (6.13), the tax rate on interest income iK is equal to $4.6(i - .03)$. With $i = 0.07$ this rate is 18.4 percent, and with $i = 0.12$ this rate is still only 41.4 percent. For 1980 interest rates and actual inflation rates, we could just use this tax of 41.4 percent. Another problem arises, however, when we calculate effective tax rates under assumptions of different inflation rates: How would inflation affect the nominal yield?

Suppose first that $i = r + \pi/(1 - \bar{m})$ such that real after-tax returns are constant by assumption. Where r is fixed at 0.05, our model assumes that nominal interest rises by the increase in inflation rate divided by unity minus the average personal tax rate over debt and equity (0.3559). In this case, the $4.6(i - .03)$ tax rate becomes $(.092 + 7.14\pi)$, equal to 0.092 with no inflation, 0.5755 with the actual United States inflation, and

28. This description of Feldstein and Summers (1979) is only slightly different from their actual procedures, because they used the then-current corporate rate of 0.48, and took the difference between the tax at $i = .07$ and the tax at $i = .08$, rather than differentiating.

0.8062 with 10 percent inflation. The tax rate skyrockets because inflation adds more than point-for-point to the nominal interest rate within the effective tax rate formula. These rates will be used with our "high tax" set of parameters.

On the other hand, we might not believe that counterfactual scenario. In particular, the fixed 3 percent allowance is not consistent with a ceteris paribus change in π. With 10 percent inflation and 20 percent nominal interest rates, insurance companies would successfully lobby for a change in the law or at least a change in the fixed 3 percent allowance. Furthermore, Summers (1982) finds that actual interest rates hardly rise with inflation, if they rise at all. Our assumption of constant after-tax returns requires that inflation adds more than point for point to interest rates, but Summers finds evidence that a point-for-point relation is a high upper bound. Indeed, $r = 0.05$, $\pi = 0.0677$, and $i = r + \pi$ provides a 0.1177 nominal interest rate, very close to the 12 percent figure mentioned above for 1980. In this case, the $4.6(i - .03)$ tax rate becomes $(.092 + 4.6\pi)$, equal to 0.092 with no inflation, 0.403 with actual inflation, and 0.552 with 10 percent inflation. These rates will be used with our "standard" set of parameters.[29]

Insurance companies have recognized that their taxes rise with inflation. Partly in response to this effect, insurance companies have discovered and increased their use of tax loopholes such as "modified coinsurance." Under this arrangement, the life insurance company can reinsure its policies with another company while retaining the assets associated with those policies. Money changes hands in complicated ways, but the funds left with the original insurer are not called investment income. As a result, they are taxed at a lower rate. Table 6.12 shows recent revenues from life insurance companies in the last column. These revenues are generally increasing through the early 1970s but increase faster in the late 1970s with inflation. After 1979, when modified coinsurance was discovered, revenues suddenly fall.

Finally, the pension fund business of life insurance companies is not

29. We do not use the 0.46 rate that results from the assumption that life insurance companies invest out of net earnings with no change in actual reserves. Instead, the authors of all four country chapters agreed to assume that the additional investment comes from individuals saving through new life insurance policies. This assumption implies that the tax is zero if expenses exhaust the income from the new policies, or that it is from equation (6.13) if we ignore expenses other than the allowance for adjusted reserves. Still, however, the 0.46 rate might be justified from the $4.6(i - .03)$ formula if all assets are held for reserves and if the interest rate is a fixed 13 percent at any inflation rate. The use of a 0.46 tax rate on interest income would also be more compatible with the rates on dividends and capital gains discussed above. All forms of investment income enter the "yield," and the Menge formula determines the assumed split between the company and the policyholders. The fraction attributable to the company is multiplied by total dividends, and the company can exclude only 85 percent of its resulting share of total dividends. Thus the tax on dividends should really be 15 percent of whatever rate comes out of the Menge formula.

Table 6.12 **Selected Data on Pensions and Life Insurance**
($ billion in current prices)

Year	Private Pension Reserves	Life Insurance Companies: Pension Reserves	Life Insurance Companies: Life Insurance Reserves	Life Insurance Companies: Federal Income Taxes
1965	59.2	27.3	98.9	0.741
1966	66.2	29.4	103.5	0.883
1967	74.2	32.0	108.2	1.040
1968	83.1	35.0	112.9	1.174
1969	90.6	37.9	117.8	1.237
1970	97.0	41.2	123.1	1.232
1971	106.4	46.4	129.4	1.451
1972	117.5	52.3	136.1	1.544
1973	126.5	56.1	143.5	1.803
1974	133.7	60.8	150.1	1.915
1975	145.2	72.2	158.6	1.910
1976	160.4	89.0	166.8	2.209
1977	181.5	101.5	178.1	2.526
1978	202.2	119.1	189.8	2.994
1979	223.5	139.2	202.0	3.269
1980	256.9	165.8	213.5	2.551

Source: Flow of Funds and *Life Insurance Fact Book*.

taxable. Table 6.12 shows not only the very rapid growth of private pension reserves in the first column, but also the rising pension reserves of life insurance companies in the second column. These pension reserves made up 22 percent of total life insurance reserves in 1965, 25 percent in 1970, 31 percent in 1975, and 44 percent in 1980. These assets of pension funds administered by life insurance companies are included in the tax-exempt category when we look at holdings of each group in section 6.3.5.

The final step is the averaging of the tax rate for life insurance with the tax rate for other insurance. As shown in section 6.3.5, all insurance companies hold $133.1 billion of corporate debt that is not attributable to pensions. Life insurance companies hold 84.4 percent of this total, and other insurance companies hold the remaining 15.6 percent. Table 6.13 summarizes our tax rate findings for all our ownership categories. For insurance companies, we use a weighted average of life insurance and other insurance companies found in the two preceding rows. The "low tax" parameter for both types of insurance is a zero rate, so the average is a zero rate. The "standard" tax rate for life insurance is $(.092 + 4.6\pi)$ and for other insurance is 0.46, so the weighted average is $(.149 + 3.88\pi)$. The "high tax" rate for life insurance is $(.092 + .714\pi)$ and for other insurance is 0.561, so the weighted average is $(.165 + 6.03\pi)$.

Table 6.13 Summary of Tax Rates by Ownership Category

Owner	Interest Income			Rate on Dividends	Rate on Realized Capital Gain
	Low-Rate Alternative	Standard Parameters	High-Rate Alternative		
Households	.245	.284	.383	.475	.14
Tax-exempt institutions	0	0	0	0	0
Insurance					
Life	0	$.092 + 4.6\pi$	$.092 + 7.14\pi$	.069	.28
Other	0	.46	.561	.069	.28
Total	0	$.149 + 3.88\pi$	$.165 + 6.03\pi$	.069	.28

Source: Derived and described in the text.

Finally, note that the tax rate for exempt institutions is always zero and that the tax rate for households has standard, low, and high alternatives given by equations (6.9), (6.10), and (6.11), respectively. All of these tax rates are listed in table 6.13.

6.3 The Structure of the Capital Stock and Its Ownership

6.3.1 Data Limitations

With the statutory tax parameters of section 6.2, we can calculate effective tax rates for each of the eighty-one combinations involving three assets, three industries, three sources of finance, and three ownership categories. Then, with the proportion of capital stock attributable to each of the eighty-one combinations, we can calculate various types of weighted averages. This section derives the weights for averaging these effective marginal rates. Section 6.3.2 describes a three-by-three matrix for the amount of each asset used in each industry. These nine numbers derive from Jorgenson's more detailed capital stock data that were used in sections 6.2.3, 6.2.4, and 6.2.5 to average depreciation and investment grants over thirty-four assets for each of our three industries. Section 6.3.3 describes another three-by-three matrix for the sources of finance used in each industry. While *Flow of Funds* data do not provide an industry breakdown of retained earnings, new equity, and new debt issues, we use data on the market value of debt and equity in each industry to derive these nine separate numbers.

Section 6.3.4 describes the ownership of corporate equity, and section 6.3.5 describes the ownership of corporate debt. A number of studies discuss the corporate shares, dividends, capital gains, and interest income

of institutions and households in different income brackets, but none traces that ownership through to the industry or asset of origin.[30] Indeed, such a study for the United States would face enormous difficulties dealing with the ownership of conglomerate corporations and with intercorporate shareholdings. (The chapter for Germany describes a study of the ownership of financial claims by industry, made possible by the lesser degree of conglomeration.) In any case, when we take the three ownership proportions for debt in the United States and apply the three equity ownership proportions to both retained earnings and new equity issues, we have another three-by-three matrix of ownership for each source of finance. Finally, the three matrixes can be appropriately multiplied together to produce eighty-one proportions. In doing so, we assume that all assets in a particular industry are financed in the same way, that all owners hold debt from the different industries in the same proportions, and that all owners hold equity from the different industries in the same proportions.

6.3.2 Capital Stock Weights

The most thorough and detailed capital stock data available for the United States are those described in Jorgenson and Sullivan (1981) and Fraumeni and Jorgenson (1980).[31] Their basic procedure starts with gross investment in the 1963 and 1967 "capital flows tables" from the *Survey of Current Business*. Though these matrixes are not available on an annual basis, the Commerce Department does provide enough information to construct a vector of investment by industry and a vector of investment by asset for each year. These vectors can be taken as row sums and column sums of underlying annual capital flow tables. For every year back to 1929, they take the 1963 gross investment matrix and scale each row so that its total equals the investment for that industry in that year. They then scale each column so that its total equals the investment for that asset in that year, and they iterate between row and column scaling until they have an investment matrix for that year that is consistent with the

30. See, for example, the 1962 *Survey of Consumer Finances*, done for the Federal Reserve Board by Projector and Weiss, and the 1974 *Survey of Current Business* study of stockownership trends, done by Blume, Crockett, and Friend.

31. Alternative published capital stock data are available in Kendrick (1976). He includes much detail on industry, government, and personal wealth, but corporate capital is not segregated, and 1973 is the most recent year. Since machinery, buildings, and inventories make up the only three assets considered in this study, we effectively ignore investments in land, investments in R&D, and investments in goodwill through advertising. Since manufacturing, other industry, and commerce make up the only three industries considered in this study as described in chapter 2, we effectively ignore all investments in agriculture, mining, crude petroleum, financial business, real estate, and government enterprises. Trade and services fall into the commercial category, while construction, transportation, communications, and utilities are aggregated into other industry.

two investment vectors. This procedure of iterative row and column scaling is described in Bacharach (1971).

From this procedure they obtain gross investment for each asset in each industry back to 1929. They then use Hulten-Wykoff depreciation rates for each of the thirty-four assets, found in table 6.5, to calculate a capital stock matrix by the perpetual inventory method. For each asset-industry cell, they add gross investment from each year and subtract depreciation in each year up through 1977 to get net capital stock in that year. These capital stock data are particularly well suited for our purposes not only because of the great asset and industry detail, but also because they are designed to be consistent with Hulten-Wykoff depreciation rates used elsewhere in this study.[32]

The 1977 capital stock matrix, aggregated to our assets and industries, is shown in table 6.14. The total corporate capital in these categories (excluding land) is $1,702 billion, as shown in the fourth row of the table. Of this total, $746 billion or 44 percent is in manufacturing, $530 billion or 31 percent is in other industry, and $426 billion or 25 percent is in commerce. Of the capital in manufacturing, most is in buildings, but a surprisingly high proportion is held in the form of inventories. Since other industry includes utilities, the predominant share of capital is in buildings, followed by machinery. Our commercial category includes retail and wholesale trade, so the predominant share of capital is in buildings, followed by inventories. The proportion of capital in each of these nine cells is shown in parentheses in the table, and we assume that these proportions were the same in 1980 as in 1977.

6.3.3 Sources of Financial Capital

Data from the *Flow of Funds* are used in table 6.15 to estimate the proportions of corporate investment financed through retained earnings, new equity, and debt. The sector is defined as "nonfinancial corporate business," which would include not only manufacturing, but other industry and commerce as well. This data source does not disaggregate by industry. The first column gives gross internal funds on a national income accounting basis for 1970 to 1979. This definition corresponds to a measure of cash flow in the corporate sector, not a measure of economic profits.

The second column of table 6.15 provides net new equity issues for 1970–79. The third column shows the net increase in liabilities from debt instruments, including corporate bonds, mortgages, acceptances, commercial paper, finance company loans, United States government loans, bank loans not elsewhere classified, and tax-exempt bonds. The proportions at the bottom of table 6.15 are remarkably similar to those for the

32. The land and inventory figures were obtained somewhat differently by Dale Jorgenson and his colleagues but are still based ultimately on Commerce Department data.

Table 6.14 **Corporate Capital Stock by Asset and Industry**
($ billion in 1977; proportions in parentheses)

Asset	Sector			
	Manufacturing	Other Industry	Commerce	Total
Machinery	147.65	164.32	70.60	382.57
	(.0867)	(.0965)	(.0415)	(.2247)
Buildings	368.92	335.39	212.44	916.75
	(.2167)	(.1970)	(.1248)	(.5385)
Inventories	229.79	29.94	143.33	403.06
	(.1350)	(.0176)	(.0842)	(.2368)
Subtotal	746.36	529.65	426.38	1,702.39
	(.4384)	(.3111)	(.2502)	(1.000)
Land	52.83	23.44	33.65	109.91
Total	799.19	553.09	460.02	1,812.30

Source: Aggregation from unpublished data described in Jorgenson and Sullivan (1981) and in Fraumeni and Jorgenson (1980).

Table 6.15 **Sources of Finance for Nonfinancial Corporate Business, 1970–79**
($ billion in current prices; proportions in parentheses)

Year	Gross Internal Funds	Net New Equity Issues	Debt Instruments	Total
1970	58.9	5.7	35.0	99.6
	(.59)	(.06)	(.35)	
1971	68.6	11.4	33.8	113.8
	(.60)	(.10)	(.30)	
1972	80.8	10.9	47.2	138.9
	(.58)	(.08)	(.34)	
1973	83.8	7.9	65.2	156.9
	(.53)	(.05)	(.42)	
1974	75.7	4.1	78.0	157.8
	(.48)	(.03)	(.49)	
1975	106.8	9.9	28.0	144.7
	(.74)	(.07)	(.19)	
1976	125.3	10.5	50.2	186.0
	(.67)	(.06)	(.27)	
1977	139.9	2.7	77.2	219.8
	(.64)	(.01)	(.35)	
1978	148.8	2.6	92.2	243.6
	(.61)	(.01)	(.38)	
1979	158.3	3.5	110.1	271.9
	(.58)	(.01)	(.40)	
Average	(.602)	(.048)	(.349)	

Source: Flow of Funds Accounts, Board of Governors of the Federal Reserve System, Sector Statements of Savings and Investment.

other countries in this study. In the United States, 60 percent of corporate investments are financed by internal funds, 35 percent by debt, and only 4.8 percent by new share issues.

Because "internal funds" in this table is just a measure of cash flow, it takes no account of the fact that inflation reduces the real value of outstanding debt. In table 6.15, the sum of "internal funds" and "new equity issues" understates equity finance by the amount of this inflation-induced gain to equity holders. However, while inflation affects the validity of the debt–equity breakdown in table 6.15, it does not affect the validity of the relation between retained earnings and new share issues. Thus we use table 6.15 for the equity breakdown, but we obtain debt/equity ratios elsewhere.

An industry breakdown for debt and equity is available with data from the COMPUSTAT tape of the Standard and Poor's Corporation. This data tape contains balance sheet information on 2,484 publicly traded corporations, including firms with securities traded on the New York Stock Exchange, the American Stock Exchange, and over the counter. This tape was used by Gordon and Malkiel (1981) to estimate the economywide ratio of the market value of debt to the market value of debt plus equity. Since the information on each corporation also includes its primary industry of operation, we can reproduce the Gordon and Malkiel procedures to get a similar ratio for each of our three sectors. For each corporation on the tape, we first determine the industry with which it is associated. Most of these disaggregated industries fall into one of our three sectors, while firms in agriculture, mining, finance, or real estate are excluded. We are left with 1,201 firms in manufacturing, 298 in our "other industry" category, and 395 in commercial enterprises. Only the book value of debt is reported on the COMPUSTAT tape. For each firm on the tape, we construct a figure for the market value of debt by using its disaggregated industry's average ratio of market value of debt to book value of debt, available in von Furstenberg, Malkiel, and Watson (1980). When the ratio of the market value of debt to the book value of debt was not available for a specific industry, we applied the economywide ratio to the firms in that industry.

The resulting debt/capital ratios are 0.1981 for manufacturing, 0.4847 for other industry, and 0.3995 for commercial enterprises. The high proportion for debt in other industry reflects the high proportion of public utilities in that sector. The remaining fractions in each industry, attributable to equity, can now be divided into new shares and retained earnings by using the average division found in table 6.15. For all industries combined, the ratio of new shares to total equity is 0.0738. Applying this fraction to the remaining equity/capital ratio for each of our three industrial sectors, we obtain the three-by-three matrix in table 6.16 for source of finance by industry.

Table 6.16 Source of Finance Proportions for Each Industry

Industry	Debt	New Share Issues	Retained Earnings	Total
Manufacturing	.1981	.0592	.7427	1.000
Other industry	.4847	.0381	.4772	1.000
Commerce	.3995	.0443	.5562	1.000

Source: Derived and described in the text.

6.3.4 The Ownership of Equity

Proportions for equity ownership are obtained from *Flow of Funds* data. Neither this source nor any other source can be used to determine the industrial mix of each owner's debt or of each owner's equity.

The household sector in the *Flow of Funds* includes both individuals and nonprofit institutions such as hospitals and universities. Since we want these institutions to be grouped with the tax-exempt category, we must impute a division to the data. For this purpose we follow Feldstein and Summers (1979) and Feldstein, Poterba, and Dicks-Mireaux (1983) in assuming that 7 percent of household equity is held by nonprofit institutions. This percentage, applied to all years, is the figure estimated for 1975 by the Securities and Exchange Commission (1977). The resulting individual holdings are shown in the first line under households in table 6.17, and the resulting nonprofit holdings are shown in the last row under tax exempt. Tax-exempt ownership also includes private pensions and state and local government retirement funds that are fully funded pensions.

Insurance company equity must also be divided into the part attributable to the companies' insurance business and the part attributable to their pension business. The latter holdings must also be moved into tax exempt. Table 6.12 showed that pension reserves made up 22 percent of total life insurance reserves in 1965, 25 percent in 1970, and 44 percent in 1980. These proportions are applied to 1960, 1970, and 1980 life insurance holdings of equity to obtain their pension holdings, shown in the second row under tax-exempt holdings.

Table 6.17 shows that the proportion of equity held by our household category has declined from 86.8 percent in 1960, to 81.5 percent in 1970, and to 74.3 percent in 1980. It is still higher than the corresponding 43.5 percent figure for Britain or the 60.4 percent figure for Sweden, but it is comparable to the several industry-specific figures for Germany.

Inspection of annual data in the *Flow of Funds* reveals that the decline across time in the United States was nearly monotonic, but that most of it took place in the first half of the past decade. The household proportion was already down to 74 percent by 1975. Bank and insurance company

Table 6.17 **Ownership of Corporate Equity in 1960, 1970, and 1980**
($ billion in current prices; proportions in parentheses)

	1960	1970	1980
1. Households	368.1	676.8	1,117.9
	(.868)	(.815)	(.743)
Individuals	351.9	634.1	1,071.1
Commercial banks	0.0	0.1	0.1
Savings institutions	1.3	2.8	4.2
Mutual funds	14.8	39.7	42.4
2. Tax-exempt institutions	44.7	128.8	324.0
	(.105)	(.155)	(.215)
Private pensions	16.5	67.1	175.8
Life insurance pensions	1.1	3.9	23.3
S&L government retirement	0.6	10.1	44.3
Nonprofit	26.5	47.7	80.6
3. Insurance companies	11.3	24.7	61.9
	(.027)	(.030)	(.041)
Life	3.9	11.5	29.6
Other	7.5	13.2	32.3
Total	424.1	830.2	1,503.9
	(1.000)	(1.000)	(1.000)
4. Addenda			
Rest of the world	9.3	27.2	64.5
Brokers and dealers	0.5	2.0	3.9

Source: Flow of Funds Accounts: Assets and Liabilities Outstanding, Board of Governors of the Federal Reserve System, various issues.

holdings have increased slightly over the two decades, but they remain inconsequential. The big increase since 1960 is to be found in various pension plans, including private plans, those operated through insurance companies, and the funded pension plans of state and local governments. These and other ownership trends are further discussed in Blume, Crockett, and Friend (1974). The final equity ownership proportions, those from 1980, are 0.743 for households, 0.215 for tax-exempt institutions, and 0.041 for insurance companies.

6.3.5 The Ownership of Debt

Nonfinancial corporate borrowing can also be obtained from the *Flow of Funds* data, but the lenders in each case cannot be traced directly. We will trace these owners of corporate debt indirectly by first looking at all the forms of corporate net liabilities and then looking at financial assets in the portfolios of each ownership category. This procedure essentially replicates for 1960, 1970, and 1980 the procedures used by Feldstein and Summers (1979) for 1976 alone.

For each year, we have data on the financial assets and liabilities of nonfinancial corporate business. Debt instrument assets include demand

deposits, time deposits, security repurchase agreements (RPs), government securities, commercial paper, consumer credit, net trade credit, and miscellaneous assets. Debt instrument liabilities include bonds, mortgages, bank loans, more commercial paper, bankers' acceptances, finance company loans, United States government loans, and miscellaneous liabilities. If all these amounts were listed vertically with assets included negatively, the column would sum to net corporate indebtedness. In this study, however, we exclude government securities, government loans, and net trade credits. Then, for each item in this column, we construct a row that determines its distribution among creditors or debtors. For example, each ownership category has a table in the *Flow of Funds* that shows its holdings of corporate and foreign bonds but does not show its holdings of United States nonfinancial corporate bonds separately. We assume that the latter are distributed among owners in the same proportions as the former.

Similarly, we assume that United States nonfinancial corporate mortgage liabilities are distributed among owners in the same proportions as total holdings of mortgages shown in the tables. Bonds and mortgages are the only two forms in which pensions and life insurance companies hold any corporate debt. Next, nonfinancial corporate liabilities in the form of bank loans or bankers' acceptances are allocated entirely to commercial banks, and those in the form of finance company loans are allocated entirely to finance companies.

Similar assumptions are made about corporate assets. Demand deposits and security RPs are allocated to commercial banks, while time deposits are split between commercial banks and savings institutions in proportion to their total liabilities in that form. Net assets in the form of commercial paper are allocated entirely to finance companies because these are the largest single issuers of open-market paper. Consumer credit is allocated entirely to households. The result is a matrix for the distributional ownership of each corporate asset (listed negatively) or liability. The sum of each column gives the net corporate liabilities in the hands of each owner. As in the case of equity, however, the part of life insurance holdings that are attributable to pension business are moved to the tax-exempt category.

The resulting ownership of corporate debt is shown in table 6.18 for 1960, for 1970, and for 1980. Unlike equity, the trend seems to be an increasing proportion of debt held in the household sector. Most of this debt is attributable to banks and finance companies. Holdings of tax-exempt institutions are diminishing slightly over time, but most of the decline is found in the proportional holdings of insurance companies. The proportion of total corporate debt held for the pension business of life insurance companies is actually increasing.

A comparison of debt and equity and in tables 6.17 and 6.18 demon-

Table 6.18 **Ownership of Nonfinancial Corporate Net Debt in 1960, 1970, and 1980**
($ billion in current prices; proportions in parentheses)

	1960	1970	1980
1. Households	40.4	150.6	528.7
	(.365)	(.505)	(.609)
Individuals and nonprofit institutions	8.6	23.8	70.1
Commercial banks	15.0	81.4	285.6
Savings institutions	8.6	28.4	83.6
Mutual funds	1.0	2.9	6.2
Finance companies	5.7	12.4	78.4
Real estate investment trusts	—	1.8	2.3
Mortgage pools	—	0.0	2.4
2. Tax-exempt institutions	30.6	77.0	205.7
	(.277)	(.258)	(.237)
Private pensions	13.5	25.6	44.0
Life insurance pensions	10.8	21.2	88.3
S&L government retirement	6.3	30.3	73.4
3. Insurance companies	39.7	70.9	133.1
	(.359)	(.237)	(.153)
Life	38.2	63.6	112.4
Other	1.5	7.3	20.7
Total	110.6	298.7	867.6
	(1.000)	(1.000)	(1.000)
4. Addendum			
Miscellaneous (largely rest of the world)	1.5	6.1	29.8

Source: *Flow of Funds Accounts: Assets and Liabilities Outstanding*, Board of Governors of the Federal Reserve System, various issues.

Note: Net debt equals (bonds + mortgages + bank loans + commercial paper issued + bankers' acceptances + finance company loans) minus (demand deposits + time deposits + security repurchase agreements + consumer credit + commercial paper owned).

strates the portfolio effects of differential tax treatments. Individuals in 1980 own the smallest part of debt (8.1 percent) and the largest part of equity (71.2 percent). However, banks and other household intermediaries hold 52.8 percent of debt and 3.1 percent of equity. Finally, insurance companies own a larger share of debt (15.3 percent) than of equity (4.1 percent). These patterns are not surprising in light of comparative tax advantages.

Also, as in the case of equity, *Flow of Funds* data do not separate the debt held by nonprofit institutions from the debt held by taxable individuals. This aggregation causes less of a problem here in that individual plus nonprofit debt holdings are miniscule compared with their equity holdings. But it causes more of a problem in that no estimates are available for the breakdown of this debt. As in the case of equity, we could assume that 7 percent of this debt is held by nonprofit institutions, but portfolio responses to taxation suggest that much more of the equity

would be held by individuals and much more of the debt would be held by nonprofits. Since the numbers in the case of debt are small, we proceed by using two sets of parameters. The standard set of parameters come directly from table 6.18 and are shown in the top half of table 6.19. We use the 1980 proportions of 0.609 for households, 0.237 for tax-exempt institutions, and 0.153 for insurance company holdings of corporate debt in all industries.

The "low tax" set of parameters are obtained from table 6.18 by assuming that all of the debt holdings of individuals and nonprofit institutions are actually in the hands of the nonprofit institutions. These parameters, as shown in the bottom half of table 6.19, are 0.529 for households, 0.318 for tax-exempt institutions, and 0.153 for insurance companies.

6.4 Estimates of Effective Marginal Tax Rates

6.4.1 Principal Results

With the fixed-p calculations described in the methodology chapter, our standard assumptions about tax parameters, and the actual inflation rate of 6.77 percent, the overall weighted average of the marginal effective tax rate on capital income in the United States is 37 percent. The interpretation is that if all assets started with a gross return of 10 percent, and if all capital of all owners were increased by one dollar, then the present value of the expected tax would be 37 percent of the additional return. It is noteworthy that this effective rate is less than the 46 percent statutory corporate tax rate, but the effective rate incorporates many factors that tend to offset or increase overall taxes. Some of these factors are discussed as we look at the breakdown of this effective tax rate in table 6.20.

The numbers in this table are calculated such that the overall rate of 37 percent is obtained by taking a weighted average of rates over the three

Table 6.19 **Ownership Proportions for Corporate Net Debt**

	1960	1970	1980
Standard parameters			
Households	.365	.505	.609
Tax-exempt institutions	.277	.258	.237
Insurance companies	.359	.237	.153
"Low tax" parameters			
Households	.288	.425	.529
Tax-exempt institutions	.354	.337	.318
Insurance companies	.359	.237	.153

Source: Derived and described in the text.

Table 6.20 Effective Marginal Tax Rates, United States, 1980, Fixed-*p* Case (%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	3.9	22.8	17.6
Buildings	35.4	41.8	41.1
Inventories	50.9	45.5	47.0
Industry			
Manufacturing	44.2	55.0	52.7
Other industry	10.0	15.8	14.6
Commerce	37.9	37.5	38.2
Source of finance			
Debt	−2.0	−22.2	−16.3
New share issues	61.0	104.6	91.2
Retained earnings	48.4	66.5	62.4
Owner			
Households	44.1	61.9	57.5
Tax-exempt institutions	4.0	−37.2	−21.5
Insurance companies	4.0	44.3	23.4
Overall	32.0	38.4	37.2

assets, or over the three industries, or over the three sources of finance, or over the three owners. A glance down any column of this table reveals considerable dispersion among these combinations, however, and this dispersion increases with the rate of inflation. This first column shows rates for zero inflation that vary from −2 to +61 percent, while the second column shows rates for 10 percent inflation that vary from −37 to +105 percent. (Because we use the same capital stock weights for different inflation rates, we abstract from the possibility that patterns of investment might shift in response to a change in the rate of inflation.) The distribution of 1980 tax rates is further discussed in chapter 7.

The bottom row of this table shows that overall taxes increase somewhat with inflation, from 32 percent at zero inflation, to 37 percent with 6.77 percent inflation, and to just over 38 percent with 10 percent inflation. This very moderate rise with inflation may be surprising to those who are accustomed to thinking about depreciation at historical cost, FIFO inventory accounting, and the taxation of purely nominal capital gains. Feldstein and Summers (1979) found that these factors combined to increase taxes significantly with inflation. They found no offsetting effect through the deductibility of nominal interest payments, because the tax rate at which individuals included interest receipts (42%) was as

high on average as the rate at which corporations deducted interest payments (40.4%).

Here, by contrast, we find that the combined federal and state corporate rate for nominal interest deductions is 49.5 percent. For nominal interest receipts, when we use weights for debt in table 6.18 to average the owners' marginal tax rates in table 6.13, we obtain an overall rate of 23.6 percent. Our procedures improve on earlier ones by using more recent data, by treating some of the return from banks as tax-free services, by moving the pension business of insurance companies into the tax-exempt category, and by looking at a marginal increase in capital rather than in the interest rate. (These differences are further explored in Fullerton 1983.) Thus corporations can deduct nominal interest at a 49.5 percent rate, significantly higher than the 23.6 rate at which recipients must include it, and the row for debt in table 6.20 shows a subsidy that increases with inflation. This effect offsets some of the other effects of inflation. In table 6.20, we also assume that all firms use the tax-minimizing practice of LIFO accounting, so no extra inflation tax exists for that reason.[33]

We do, however, include the effect of inflation on the nominal allowances for depreciation. This effect is pronounced for machinery, where the effective rate changes from 4 percent at no inflation to 18 percent at 6.77 percent inflation and 23 percent at 10 percent inflation. The tax on buildings increases slightly with inflation, as shown in the table, but the tax on inventories falls from 51 percent with no inflation to 45.5 percent with 10 percent inflation. This asset receives no depreciation allowances, so the disadvantage of historical cost depreciation does not offset the advantages of nominal interest deductions.

The effective tax rate includes the taxation of purely nominal capital gains, but at the reduced statutory rate applicable to capital gains. The row for retained earnings in table 6.20 shows a rate that increases from 48

33. As an alternative, we recalculate effective tax rates with the assumption that the proportion of inventories on FIFO is $\nu = 0.7$, the actual fraction for manufacturing inventories in 1979 as discussed in section 6.2.3. Fixed-p results are summarized in the accompanying table.

	Inflation Rate		
Overall Effective Tax Rate	Zero	10%	Actual (6.77%)
No FIFO (standard case)	32.0	38.4	37.2
70% FIFO	32.0	47.2	43.2

Clearly, with no inflation, the choice for inventory accounting is irrelevant. Also, as can be seen from the detailed results, the choice has no effect on machinery or buildings. It has a large influence on inventories, however, producing the overall effect shown here. FIFO accounting adds six percentage points to the effective tax rate at 6.77 percent inflation, and almost nine percentage points at 10 percent inflation.

to 67 percent with inflation. More important, we include the effect of inflation on the taxation of insurance companies. As described in section 6.2.10, we find that their interest income is taxed at a rate equal to $(.149 + 3.88\pi)$, where π is the rate of inflation. Because the allowance for reserves is based on a fixed nominal interest rate, inflation tends to increase insurance companies' effective rate of tax as well as their nominal taxable income. The effect is dramatically demonstrated in the row for insurance companies in table 6.20, where the overall tax increases from 4 percent to 44 percent as inflation changes from zero to 10 percent.

The rates in table 6.20 include state corporate income taxes, state and local property taxes, complicated nonlinear depreciation schedules, and an asset-specific investment tax credit. As described in section 6.2.6, state and local property tax rates are lower on machinery and inventories than on buildings. Furthermore, as described in section 6.2.5, the investment tax credit is available only for machinery and for public utility structures. Table 6.20 shows effective tax rates that are substantially lower for machinery than for other assets, and substantially lower for "other industry" (including public utilities) than for manufacturing or commerce.

Table 6.21 shows results for the fixed-r calculations described in the methodology chapter. If the real interest rate with no inflation were 5 percent, if inflation at rate π added $\pi/(1 - \bar{m})$ to the nominal interest

Table 6.21 **Effective Marginal Tax Rates, United States, 1980, Fixed-r Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	−33.0	37.3	26.4
Buildings	43.2	56.0	54.1
Inventories	55.2	54.0	54.5
Industry			
Manufacturing	48.9	64.2	61.2
Other industry	9.2	27.3	24.4
Commerce	44.6	49.0	48.8
Source of finance			
Debt	−1.2	−166.5	−72.5
New share issues	62.2	85.9	81.8
Retained earnings	50.3	70.2	66.5
Owner			
Households	50.3	80.7	73.4
Tax-exempt institutions	11.9	−42.7	−21.3
Insurance companies	10.2	49.3	22.4
Overall	39.1	52.3	49.9

rate, if the expected rate of inflation were 6.77 percent, and if all capital of all owners were increased by one dollar, then the present value of the expected tax would be 50 percent of the additional return. As explained in chapter 2, averaged effective tax rates are higher than in the fixed-p case, but the same essential patterns exist. Overall rates are still slightly increasing with inflation, debt is still subsidized at rates that grow with inflation, insurance company taxes still increase dramatically with inflation, machinery is still taxed at rates lower than buildings, and other industry is still taxed at rates lower than our manufacturing or commercial sectors.

At several points in the derivation of parameter values, we described alternative arguments in favor of different procedures. Rather than claim that any single treatment is the only appropriate one, we often decided to select "standard" parameters as best estimates and to present high and low alternatives to that treatment. In the taxation of banks in section 6.2.8, for example, we reviewed one argument that depositors receive tax-free services in lieu of interest and another argument that bank owners pay a corporate rate of tax on the interest differential. The various arguments gave us 0.245 for the "low" tax rate on the household sector's interest income, 0.284 as the standard rate, and 0.383 as an alternative high rate.

For insurance companies, the "low" tax rate is zero, the standard rate is $(.149 + 3.88\pi)$, and the "high" rate is $(.165 + 6.03\pi)$. These alternatives are reviewed in table 6.13 above. Finally, the standard parameters use 0.609 and 0.237 for the proportions of debt held by households and tax-exempt institutions, respectively, allocating all of the individuals plus nonprofit category to households. As an alternative, the "low" tax parameters allocate all of these holdings to nonprofit institutions and use 0.529 and 0.318 for the same parameters.

Table 6.22 shows our fixed-p results with the "low tax" assumptions. Relative to the standard parameters, for the actual inflation rate, the overall fixed-p tax rate falls from 37 percent to 32 percent. Thus the net result is fairly robust to these assumptions. (In the fixed-r case, not shown, the overall tax falls from 50 percent to 47 percent with the use of low tax parameters.) Some interesting differences exist, however, as the overall rate is no longer monotonically increasing with inflation. Since the proportion of debt held by tax-exempt institutions has increased, and since individuals are taxed on nominal interest at a lower rate, inflation provides more of a subsidy through the deductibility of nominal interest payments at the corporate level. Because the effects of historical cost depreciation diminish as inflation increases, and since the effects of nominal interest deductions do not diminish, the latter eventually overtake the former, and the effective tax rate turns down at some inflation rate. That point is reached earlier with the low tax parameters than with

Table 6.22 **Effective Marginal Tax Rates, United States, 1980, with "Low Tax" Parameters, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	1.0	13.2	10.6
Buildings	33.4	33.3	35.2
Inventories	49.8	39.7	43.1
Industry			
Manufacturing	43.7	53.3	51.4
Other industry	6.1	0.5	3.9
Commerce	35.8	27.1	31.1
Source of finance			
Debt	−10.4	−59.8	−42.0
New share issues	61.0	104.6	91.2
Retained earnings	49.8	74.0	67.3
Owner			
Households	45.0	66.0	60.3
Tax-exempt institutions	1.8	−37.8	−23.1
Insurance companies	−7.7	−57.2	−39.3
Overall	30.0	30.3	31.6

the standard parameters, but the effective tax rate still turns down if inflation becomes high enough.[34]

Table 6.23 shows our results with the "high tax" assumptions. In this case, the overall fixed-*p* tax rate is 41 percent. In light of these results, we can be fairly sure that the correct tax rate (given the methodology and our whole approach to the problem) is between 32 percent and 41 percent, with a best estimate of 37 percent. (In the fixed-*r* case, not shown, this rate falls between 47 and 52 percent, with a best estimate of 50 percent.) Household nominal interest is taxed at a 0.383 rate in the high tax case, much closer to the corporate rate at which nominal interest is deducted. Thus, table 6.23 shows that the average debt financed asset is no longer subsidized. More important, insurance companies are assumed to get reserve allowances at only a 3 percent nominal rate even as their actual nominal interest rate increases by more than the rate of inflation. Table 6.23 shows an effective rate for this ownership category that increases

34. Figure 7.1 of the next chapter shows tax rates for inflation rates up to 15 percent. The curve for the United States rises before leveling off. The curve for Germany, which has similar depreciation allowances and interest deductibility, rises and then falls.

Table 6.23 **Effective Marginal Tax Rates, United States, 1980, with "High Tax" Parameters, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	6.4	29.7	22.8
Buildings	37.2	47.9	45.5
Inventories	51.8	49.5	49.9
Industry			
Manufacturing	44.5	55.9	53.4
Other industry	13.6	27.0	22.9
Commerce	39.8	45.0	43.5
Source of finance			
Debt	6.0	6.4	4.2
New share issues	61.0	104.6	91.2
Retained earnings	46.8	60.2	57.9
Owner			
Households	47.0	67.2	62.2
Tax-exempt institutions	2.6	−43.1	−25.6
Insurance companies	4.6	86.6	46.9
Overall	33.7	44.2	41.4

from 5 percent to more than 86 percent as inflation changes from zero to 10 percent.[35]

Returning to the standard parameter tax rates, we next attempt to determine the relative contributions of different tax instruments. That is, we decompose the effective tax rates of table 6.20 by calculating alternative tax rates that would exist were it not for property taxes, or corporate taxes, or personal taxes. To see how much of the 37 percent effective rate is due to the state and local property tax, table 6.24 reports fixed-*p* results for a simulation with no such tax. The overall tax rate falls from 37 percent to 31 percent, so the property tax contributes an average of six points to the overall effective rate. The property tax is deductible from the corporate income tax, however, so a calculation with a property tax and no other taxes would show an effective tax rate of more than 6 percent. By comparing table 6.24 with table 6.20, we can see that the

35. The reader might also notice that effective tax rates in some categories are raised by the use of "low tax" parameters or reduced by the use of "high tax" parameters. In particular, the effective tax rate on retained earnings is 67 percent with the low-tax assumptions, 62 percent with the standard assumptions, and only 58 percent with the high-tax assumptions. Because this phenomenon is general to all four countries, it is fully explained in chapter 7 (pp. 289–90).

Table 6.24 **Effective Marginal Tax Rates, United States, with No Property Tax, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	−2.0	17.0	11.7
Buildings	28.2	34.5	33.8
Inventories	46.8	41.3	42.9
Industry			
Manufacturing	39.0	49.7	47.4
Other industry	2.1	8.1	6.8
Commerce	32.1	31.6	32.3
Source of finance			
Debt	−11.0	−30.8	−25.1
New share issues	57.5	101.0	87.6
Retained earnings	43.6	61.4	57.3
Owner			
Households	39.0	56.6	52.2
Tax-exempt institutions	−4.7	−46.4	−30.6
Insurance companies	−4.6	38.3	16.5
Overall	25.8	32.2	31.0

deductible property tax adds 7.3 percent to the tax on buildings, 5.9 percent to the tax on machinery, and 4.1 percent to the tax on inventories.

Table 6.25 reports fixed-*p* results of a simulation with no corporate tax. Depreciation allowances are irrelevant, and for consistency we have also set the investment tax credit rates to zero. This case is different from full integration of the corporate and personal tax systems in that it does not attempt to measure corporate income for personal tax purposes. Rather, personal tax applies just to interest paid, dividends paid, and realized capital gains. Under these assumptions, t falls from 37 percent to 35 percent. Again, this difference is affected by the deductibility of the property tax: a calculation with corporate taxes and no other taxes would show an effective rate larger than 2 percent. Still, however, it is clear that the investment tax credit, accelerated depreciation allowances, and the deductibility of interest payments and property taxes have all served to greatly diminish the incremental impact of the corporate tax system. Although t falls for buildings and inventories with the elimination of the corporate tax, the combination of credits and accelerated depreciation implies that the effective tax on machinery would rise were it not for the corporate tax. Similarly, as shown in the table, debt would no longer be subsidized.

Finally, table 6.26 portrays a world with corporate taxes and property taxes, but with no personal tax on any of our ownership categories.[36] Both m and z are set to zero so that no owners are taxed on interest receipts, dividend receipts, or capital gains. Now the effective tax rate is 7.7 percent as shown in table 6.26, almost thirty points lower than before. While interrelations (such as the deductibility of property taxes at the corporate level) destroy the additivity of our decomposition, it is clear that the personal tax system contributes the bulk of effective taxes in the United States. Without the personal tax, machinery would be subsidized, other industry would be subsidized, the subsidy for debt would increase from 16 to 73 percent, and the average rate on households would fall from 58 to 13 percent.[37]

6.4.2 Recent Changes in Tax Legislation

The Economy Recovery Tax Act of 1981 (ERTA) represented a major departure from recent tax history. It specified a 23 percent reduction in personal tax rates, phased in over a period of three years, and it introduced the first indexation of marginal rate brackets in the graduated personal income tax system, scheduled to start in 1985. It introduced tax-free "all savers' certificates" for individuals, charitable deductions for those who do not otherwise itemize their deductions, and a reduction in the marriage penalty mentioned in section 6.2.1.[38] For businesses, ERTA entirely removed the complex set of depreciable lifetimes for various assets and replaced them with only four categories of lives. It expanded the investment tax credit, extended the period for carryover of losses, introduced tax credits for new research and development, changed the tax rates in low corporate brackets, and created a "safe harbor" for a

36. Since insurance company taxes are actually part of the corporate tax system, we might have eliminated them along with the corporate tax rather than with the personal tax. However, these simulations are intended to provide intuition rather than evaluation of real policy proposals.

37. This decomposition was performed for both the fixed-p and the fixed-r methods, with the following summary results:

	Fixed-p Case		Fixed-r Case	
	Overall Effective Tax Rate	Decrease	Overall Effective Tax Rate	Decrease
With all tax instruments	37.2		49.9	
With no property taxes	31.0	6.2	41.7	8.2
With no corporate tax or ITC	35.3	1.9	48.1	1.8
With no personal taxes	7.7	29.5	25.7	24.2

38. Starting in 1983, joint filers are able to deduct 10 percent of the earnings of the lower-earning spouse, up to a maximum of $3,000. With a top marginal rate of 50 percent, the maximum tax saving is $1,500. If two individuals with similar incomes were to marry, however, they would still pay a higher total tax than they did under the single schedules.

Table 6.25 **Effective Marginal Tax Rates, United States, with No Corporate Tax, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	23.2	39.2	34.0
Buildings	26.2	42.0	36.9
Inventories	23.0	37.4	32.8
Industry			
Manufacturing	24.1	36.4	32.7
Other industry	25.6	44.6	38.2
Commerce	24.9	41.8	36.3
Source of finance			
Debt	27.4	58.3	47.0
New share issues	41.8	77.4	65.9
Retained earnings	22.0	27.4	26.4
Owner			
Households	36.9	62.7	54.8
Tax-exempt institutions	−8.6	−36.4	−26.7
Insurance companies	11.5	58.1	37.8
Overall	24.8	40.3	35.3

leasing arrangement designed primarily to extend the benefits of credits and accelerated depreciation deductions to firms without enough tax liability to take advantage of them otherwise. Here we look at the ultimate version of the 1981 law, scheduled to start in 1986, where machinery receives five-year services lives and is depreciated at the double declining balance rate. Detailed provisions of the 1981 law are described in sections 6.2.3 and 6.2.5.

Several of these business tax provisions will not be evaluated here. First, changes to the tax rates in low corporate brackets do not affect the use of 0.46 as the top marginal rate. Second, the extension of the period for loss carryovers and the introduction of safe-harbor leasing pertain only to companies with insufficient tax liability to use all their deductions. In this study we abstract from actual practices and concentrate on a hypothetical project undertaken by a taxable firm that exhibits tax-minimizing behavior in this regard. Finally, business tax changes such as the new R&D credit do not relate primarily to income from capital.

A personal tax change that does relate to the taxation of income from capital is the phased reduction of personal marginal rates. While the top marginal rate falls from 70 percent to 50 percent immediately, all other rates are reduced by 23 percent over three years. The important issue for

our purposes is to estimate the weighted-average personal marginal tax rate on interest income at the end of this transition. This rate was 0.325 for individuals in 1980, and it would fall to $0.325(1 - 0.23) = 0.250$ by 1985 if there were no inflation. Because indexation does not start until 1985, however, inflation will push many individuals into higher nominal brackets with higher marginal rates. What rate of inflation from 1980 to 1985 would be enough to completely negate the effects of the 23 percent cut? A lengthy footnote finds that the required inflation rate would be very close to our actual inflation rate, and so we use the 1980 personal tax rates for 1985.[39]

Other personal tax provisions of the Economic Recovery Tax Act are ignored. The new all savers' certificates provide tax-free interest, but at rates 30 percent below the corresponding taxable government bond rate. Finally, changes to the marriage penalty and to charitable deductions do not relate primarily to income from capital.

Effective tax rates under the ultimate 1981 law, presented in table 6.27, can be compared with rates under the old law in table 6.20. With these legal developments, the overall rate in the fixed-p case falls from 37 percent to 26 percent, with actual inflation. The rate is still only moderately related to inflation, while debt is still highly subsidized. Under the 1981 law every category of industry, owner, or source of finance has a tax rate that is lower than under the 1980 law, at any inflation rate. Every category of asset has a tax rate no higher than before, but inventories are taxed exactly the same way, since they receive no investment tax credit and no depreciation allowances.

39. If nominal incomes were unchanged when all marginal rates were cut by 23 percent, then revenue and average rates would also fall by 23 percent. The same holds for a tax schedule of the form

$$T = .CY^{\alpha},$$

where T is total tax collected, Y is nominal taxable income, α is the elasticity of T with respect to Y, and C is an arbitrary constant. The TAXSIM model of NBER has been used to estimate that α is 1.66 in the United States. Because $\partial T/\partial Y$ is equal to $\alpha T/Y$, the marginal rate is always 166 percent of the average rate. Thus when ERTA first cuts the marginal rate from 0.325 to 0.250, the average rate falls from 0.196 to 0.151. Revenues initially fall from CY_0^{α} to $(1 - .23)CY_0^{\alpha}$. Suppose, however, that inflation at rate π for five years increases nominal incomes and prices by the factor $e^{5\pi}$. Nominal tax revenue after five years would then be $.77C(Y_0e^{5\pi})^{\alpha}$. Dividing by the price index $e^{5\pi}$, we find that real revenue after five years is $.77CY_0^{\alpha}e^{5\pi(\alpha-1)}$. We want to find the value π such that the increase in real revenues is equal to 23 percent of the prechange revenue:

$$.77CY_0^{\alpha}e^{5\pi(\alpha-1)} - .77CY_0^{\alpha} = .23CY_0^{\alpha}.$$

Dividing both sides by $.77CY_0^{\alpha}$ and substituting for α, we have

$$e^{5\pi(.66)} - 1 = .23/.77,$$

and π is equal to 7.92 percent. If the time period were six years, π would only have to be 6.60 percent. Finally, because the marginal rate equals $\alpha T/Y$ and real income is unchanged by assumption, the restoration of real revenue also restores the marginal rate.

Table 6.26 **Effective Marginal Tax Rates, United States, with No Personal Taxes, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	−16.7	−18.6	−16.5
Buildings	21.1	4.6	12.0
Inventories	40.1	11.6	20.8
Industry			
Manufacturing	32.4	26.7	29.8
Other industry	−10.1	−32.4	−23.4
Commerce	24.1	−2.3	7.5
Source of finance			
Debt	−26.8	−98.5	−73.2
New share issues	39.5	51.8	48.9
Retained earnings	39.5	51.8	48.9
Owner			
Households	19.9	7.5	12.9
Tax-exempt institutions	15.7	−2.2	5.0
Insurance companies	−3.9	−46.6	−31.1
Overall	17.1	1.0	7.7

If the phased increases in depreciation were continued to 1986, machinery would become subsidized on an overall average basis. This 5.5 percent subsidy results from the combination of investment tax credits, very short depreciable lives, and the use of double declining balance. Autos, for example, receive a 6 percent credit and a three-year life. With double declining balance and the half-year convention, as described in section 6.2.3, the investor could write off 33 percent of the asset in the year of purchase, and an additional 45 percent in the first full year of ownership. The net result is a subsidy at the corporate level alone, a subsidy that is augmented if the ultimate owner is a tax-exempt institution or if debt is used to finance the investment. The overall 5.5 percent subsidy for machinery in table 6.27 includes the average amount of personal taxes on interest or dividend receipts.

Buildings are taxed at an overall 30 percent rate, while inventories have not changed from their 47 percent rate under the 1980 law. As pointed out by Fullerton and Henderson (1981), the Economic Recovery Tax Act implies significantly disparate tax treatments of depreciable assets on the one hand, and of land and inventories on the other. For actual inflation in the fixed-*p* case, effective tax rates change from a dispersion of −21 to +91 percent in 1980 to a dispersion of −38 to +85 percent under ERTA.

Table 6.27 **Effective Marginal Tax Rates, United States, with the Economic Recovery Tax Act of 1981, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	−16.1	−0.9	−5.5
Buildings	24.1	31.8	30.2
Inventories	50.9	45.5	47.0
Industry			
Manufacturing	35.7	46.0	43.5
Other industry	−2.9	2.0	0.7
Commerce	26.7	27.5	27.5
Source of finance			
Debt	−17.6	−37.1	−31.9
New share issues	55.1	98.4	84.9
Retained earnings	40.2	57.7	53.4
Owner			
Households	35.4	52.7	48.2
Tax-exempt institutions	−11.0	−53.0	−37.6
Insurance companies	−10.8	33.9	11.2
Overall	21.4	27.7	26.2

The fixed-*r* case is not shown, but the overall tax falls from 50 percent to 41 percent under the 1981 law, when expected inflation is equal to the actual rate of 6.77 percent. As in the fixed-*p* case, the taxation of inventories is unchanged, while other rates are all lower than before. Debt and tax-exempt institutions would be subsidized more than before, and machinery would become subsidized at a 17 percent rate. Variations among the rates are again greater under ERTA than they were in 1980.

These calculations pertain to the ultimate version of the 1981 law, not scheduled to start until 1986. Equipment actually received the new five-year lives and 150 percent of declining balance in 1981, but Congress never allowed the phased changes to 175 and 200 percent of declining balance. In the Tax Equity and Fiscal Responsibility Act of 1982, the 150 percent declining balance rate was made permanent for equipment, and the depreciation basis was reduced by half the investment tax credit. Section 6.2.3 described these provisions in more detail. The 1982 law also changed safe-harbor leasing and excise taxes, but these provisions do not affect our calculations.

The resulting overall fixed-*p* effective tax rate, which fell from 37 percent to 26 percent with the ultimate 1981 law, now rises back to 31.5 percent. Table 6.28 shows the breakdown of fixed-*p* effective tax rates by asset and other combinations. For machinery, the tax rate fell from 17.6

Table 6.28 **Effective Marginal Tax Rates, United States, with the Tax Equity and Fiscal Responsibility Act of 1982, Fixed-*p* Case**
(%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	−0.3	15.7	11.0
Buildings	27.4	34.7	33.2
Inventories	50.9	45.5	47.0
Industry			
Manufacturing	38.4	49.0	46.4
Other industry	7.9	12.4	11.4
Commerce	29.6	30.5	30.5
Source of finance			
Debt	−8.9	−29.1	−23.5
New share issues	57.8	101.2	87.7
Retained earnings	43.9	61.7	57.3
Owner			
Households	39.7	57.2	52.7
Tax-exempt institutions	−3.5	−45.3	−29.8
Insurance companies	−3.0	39.2	17.3
Overall	26.7	33.0	31.5

to −5.5 percent under the ultimate 1981 law but rises back to 11 percent under the 1982 law. Inventories are unchanged at 47 percent. Most buildings are unaffected by the 1982 law, but public utility structures were grouped with equipment for phased changes that were cut off by the 1982 law. Thus table 6.28 also shows a rate for buildings that rises from 30 to 33 percent, and a rate for "other industry" (including utilities) that rises from 0.7 to 11.4 percent. Sources of finance and owners show somewhat higher tax rates as a result of these changes for equipment and public utility structures.

In the fixed-*r* case, not shown, the overall effective tax rate fell from 50 to 41 percent but now rises back to 45 percent. The rate for machinery fell from 26 to −17 percent but now rises back to 19 percent. Although the weighted-average fixed-*r* tax rates are higher than the fixed-*p* tax rates, patterns among combinations are very similar. In either case the 1982 changes for equipment reverse about half of the overall tax cut associated with the 1981 law.

Finally, we note a surprising and dramatic result of these changes in corporate taxation. With personal and property tax rates unchanged, the overall fixed-*p* effective tax rate falls from 37 percent in 1980 to 31.5

percent in 1982. Yet table 6.25 shows that these personal and property taxes alone yield an overall effective rate of 35 percent. Thus, while elimination of the corporate tax under 1980 law would subtract two percentage points, repeal of the corporate tax after 1982 would *raise* the overall effective tax rate from 31.5 percent to 35 percent. Taxes will still be collected on the income from old investments, but the combination of new grants, accelerated depreciation, and interest deductions more than offsets any corporate tax on the marginal investment. If firms can make use of these tax benefits, then the corporate system amounts to a net subsidy to marginal investments after 1982.

6.4.3 Comparison with 1960 and 1970

Although histories of the personal and corporate income taxes were provided in sections 6.2.1 and 6.2.2, particular parameter values for use in calculating 1960 and 1970 effective tax rates were not specified. By referring back to those sections, and particularly to a few tables, we can now specify the tax parameters that were different in those years. In order to compare only the tax systems in the three periods, however, we do not recalculate capital stock weights or inflation rates in earlier years. Rather, we try to determine the effect of 1960 law were it to exist in 1980.

Since 1938, the United States corporate income tax system has been a classical (nonintegrated) system in the terminology of chapter 2, so the θ parameter is unity in all years. Table 6.4 shows some historical variation in the federal statutory tax rate on all corporate profits, however, including a 0.52 rate for 1960 and a 0.48 rate for 1970. In addition we need to adjust for state corporate taxes, as in section 6.2.2, where the 1980 federal rate of 0.46 was augmented by $(1 - .46)(.0655)$ to account for the weighted-average state marginal rate of 0.0655 and the deductibility of state corporate taxes at the federal level. We cannot calculate the weighted-average state corporate tax rates for 1960 and 1970 the same way we did for 1980, but we adjust the 1980 rate by factors that reflect the growth of state corporate taxes. In particular, data in Feldstein, Poterba, and Dicks-Mireaux (1983) show that the 1979 ratio of the marginal federal corporate rate to the average federal corporate rate (.46/.317) was 1.22 times the ratio of the marginal state corporate rate to the average state corporate rate (.0655/.055). If the same relationship existed in earlier years, then the 1960 and 1970 state marginal rates would have been 0.0245 and 0.0460, respectively. The total 1960 statutory rate is then $[.52 + (1 - .52)(.0245)] = 0.532$, and the total 1970 rate is $[.48 + (1 - .48)(.046)] = 0.504$. Thus the total rate fell from 53.2 to 49.5 percent from 1960 to 1980, even though the state rate rose from 2.45 to 6.55 percent.

Starting in 1954, all assets were depreciated by the double declining balance method with a switch to sum-of-the-years' digits, but since 1969

buildings have been depreciated by the 150 percent of declining balance method with a switch to straight-line. These methods and the tax-minimizing choices of firms are described in section 6.2.3. While Jorgenson and Sullivan (1981) found that firms have moved only gradually toward the more accelerated methods, we wish to look at changes in tax law rather than changes in actual practice. For this reason we assume that firms choose the most advantageous depreciation schedules in all years, and these are given by equations (6.1) through (6.6) above.

Tax law has been amended to allow shorter lifetimes, however. Table 6.29 is similar to table 6.5 in that it lists the same twenty types of

Table 6.29 Tax Lifetimes by Asset Class in 1960 and 1970

Asset Class	*Bulletin F* Lifetimes (1960)	Guideline Lifetimes (1970)
1. Furniture and fixtures	17.6	10.0
2. Fabricated metal products	21.2	12.5
3. Engines and turbines	24.7	15.6
4. Tractors	9.4	4.3
5. Agricultural machinery	20.0	10.0
6. Construction machinery	10.6	9.9
7. Mining and oilfield machinery	11.8	9.6
8. Metalworking machinery	18.8	12.7
9. Special industry machinery	18.8	12.7
10. General industrial equipment	16.5	12.3
11. Office and computing machinery	9.4	10.0
12. Service industry machinery	11.8	10.3
13. Electrical equipment	16.5	12.4
14. Trucks, buses, and trailers	10.6	5.6
15. Autos	11.8	3.0
16. Aircraft	10.6	6.3
17. Ships and boats	25.9	18.0
18. Railroad equipment	29.4	15.0
19. Instruments	12.9	10.6
20. Other equipment	12.9	10.2
21. Industrial buildings	31.8	28.8
22. Commercial buildings	42.3	47.6
23. Religious buildings	56.5	48.0
24. Educational buildings	56.5	48.0
25. Hospitals	56.5	48.0
26. Other nonfarm buildings	36.5	30.9
27. Railroads	60.0	30.0
28. Telephone and telegraph	31.8	27.0
29. Electric light and power	35.3	27.0
30. Gas	35.3	24.0
31. Other public utilities	30.6	22.0
32. Farm structures	44.7	25.0
33. Mining shafts, and wells	18.8	6.8
34. Other nonresidential structures	36.5	28.2

Source: Jorgenson and Sullivan (1981).

equipment and the same fourteen types of structures. *Bulletin F* lifetimes, in the first column, were in effect for these assets from 1942 until 1962, when the "Guideline" lifetimes of the second column were introduced. The Guideline lifetimes (for 1970) are all 30 to 40 percent less than the *Bulletin F* lifetimes (for 1960). Then, in 1971, the Asset Depreciation Range (ADR) system established Guideline lives as the midpoints for an allowed 20 percent increase or decrease in depreciation periods for equipment (assets 1–20) and public utility structures (assets 27–31). For 1980, we therefore use 80 percent of ADR midpoints as the shortest allowable lives for those assets, as shown in column 3 of table 6.5.

As mentioned in section 6.2.5, the investment tax credit was first introduced in 1962 and was repealed from 1969 to 1971. Thus the rate of grant was zero for all assets in both 1960 and 1970. The corporate rates, grant rates, and other parameter changes are summarized in table 6.30.

In section 6.2.6, the effective property tax rates for buildings and for other assets are found to be 0.01126 and 0.00768, respectively. These rates are estimated for 1977 and applied to 1980. We cannot, however, calculate separate property tax rates for 1960 and 1970 in the same manner as for 1977. As with the state corporate tax rates, we adjust the 1977 property tax rates by factors that reflect changes in state and local

Table 6.30 **United States Tax Parameters for 1960, 1970, and 1980**

Parameter	1960	1970	1980
θ	1.0	1.0	1.0
Federal corporate rate	0.52	0.48	0.46
State corporate rate	0.0245	0.0460	0.0655
τ	0.532	0.504	0.495
Investment tax credit rates, g	0.0	0.0	(table 6.5, col. 2)
Asset lifetimes, L	*Bulletin F* (table 6.29, col. 1)	Guidelines (table 6.29, col. 2)	ADR (table 6.5, col. 3)
Property tax rates, w_c			
Buildings	0.01126	0.01408	0.01126
Machinery and inventories	0.00768	0.00960	0.00768
Tax rate on dividends			
Households	0.431	0.413	0.475
Tax-exempt institutions	0.0	0.0	0.0
Insurance companies	0.078	0.072	0.069
Tax rate on capital gains, z_s			
Households	0.14	0.14	0.14
Tax-exempt institutions	0.0	0.0	0.0
Insurance companies	0.30	0.30	0.28
Tax rate on interest income			
Households	0.284	0.284	0.284
Tax-exempt institutions	0.0	0.0	0.0
Insurance companies	$(0.149 + 3.88\pi)$	$(0.149 + 3.88\pi)$	$(0.149 + 3.88\pi)$

Source: Derivations described in the text.

property taxation. Data in Feldstein, Poterba, and Dicks-Mireaux (1983) show that the overall property tax rate in 1960 was very close to the overall rate in 1977, and that the overall rate in 1970 was 1.25 times the rate in 1977. We therefore use 1980 rates for 1960 and scale them by 1.25 to obtain rates for 1970. Final property tax rates are shown in table 6.30.

For the weighted-average marginal tax rate on dividends in 1980, we use 0.475 as found by the TAXSIM model of NBER. Since that source is not available for earlier years, we turn to rates estimated by Brinner and Brooks (1981). The total federal and state tax rates on personal dividend receipts in 1960 and 1970 were 0.431 and 0.413, respectively. Tax-exempt institutions pay no tax on dividend receipts, while insurance companies, like other corporations, can deduct 85 percent of dividend receipts. Since the federal corporate tax rates were 0.52 in 1960, 0.48 in 1970, and 0.46 in 1980, their effective tax rates on dividends in those years were 0.078, 0.072, and 0.069, respectively.

We use 0.28 for the weighted-average statutory personal marginal tax rate on realized capital gains in 1980, a number found by the TAXSIM model. This time, however, we have no viable alternative source for earlier years. Although the Revenue Act of 1978 reduced the taxable proportion of long-term gains from 50 to 40 percent (and thereby set the top federal rate at 28 percent), prior law specified a maximum 25 percent rate on the first $50,000 of gains and an additional 10 percent tax on the excluded gains in some circumstances. Since we halve the 0.28 rate to account for the increase of basis at death, and since the resulting 0.14 rate is approximately halved again to account for deferral, the resulting rate is small, and variations over time would be small. For these reasons we use the TAXSIM personal rates in all years. Exempt institutions pay no tax on capital gains, while insurance companies paid the statutory corporate rate of 30 percent in 1960 and 1970, reduced by the Revenue Act of 1978 to 28 percent for 1980.

Finally, we turn to the tax on interest income. The TAXSIM model provides an estimate of 0.325 for the combined federal and state marginal personal rate in 1980, and again we have no viable alternative source for earlier years. There have been many adjustments to personal rates and brackets over the years, including a 1964 reduction in the top marginal rate from 90 to 70 percent, but most of these adjustments have only approximately offset the fact that inflation pushes individuals with unchanged real income into higher nominal brackets with higher marginal rates. Wright (1969) found that the average personal marginal tax rate on interest income in 1958 was 33.3 percent, very close to our number for 1980. As a result, we use the same personal rate for all years. When adjusted for interest receipts of banks, this figure is 0.284, as shown in table 6.30. Since the Life Insurance Company Income Tax Act of 1959 is still in effect, the tax rates for our third ownership category are also unchanged.

Table 6.31 **Effective Marginal Tax Rates, United States, 1960, Fixed-*p* Case** (%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	44.7	63.7	59.3
Buildings	41.7	44.3	45.0
Inventories	52.5	42.7	45.6
Industry			
Manufacturing	51.1	60.5	58.8
Other industry	37.3	37.1	38.4
Commerce	43.6	40.7	42.4
Source of finance			
Debt	16.9	−13.2	−3.6
New share issues	67.5	109.0	96.5
Retained earnings	58.6	77.3	73.1
Owner			
Households	54.0	68.1	65.3
Tax-exempt institutions	24.2	−17.0	−0.9
Insurance companies	23.2	56.5	37.6
Overall	44.9	48.3	48.4

When all of these 1960 parameters are substituted into the basic United States data to calculate effective tax rates using our standard methodology, the results are as shown in table 6.31. The overall fixed-*p* rate is 44.9 percent with no inflation, and 48.4 percent with 6.77 percent inflation. While the relation between inflation and the tax rate is not linear, it is clear that the tax rate in 1960 would be about 46 or 47 percent if very low rates of inflation were expected at that time. This rate falls in 1980 to 37 percent with 7 percent inflation, or 38 percent with 10 percent inflation. Many have suggested that accelerated depreciation and shorter lifetimes have been introduced in response to higher expectations of inflation, but these results indicate that legal changes have much more than offset any increases in inflationary expectations.[40]

Moreover, the bottom row of table 6.31 shows that the overall rate in 1960 is fairly insensitive to expected inflation and even falls as inflation increases from 7 to 10 percent. This result can be explained by the much

40. Since the pattern of investment responds to tax differentials, the weights would adjust over time. The rate on machinery fell the most, so investment would increase the most. Because we use the relatively high 1980 weight for machinery in all years, the high average rates from earlier years are somewhat overstated. Also, these calculations assume that firms minimize taxes by using LIFO inventory accounting. Footnote 33 summarizes some results with 70 percent FIFO accounting, and the tax rates in that case rise faster with inflation.

longer asset lifetimes in 1960, since depreciation deductions are less important. The fact that depreciation is on a historical cost basis when there is inflation cannot make real depreciation deductions much lower, while the fact that nominal interest is deducted against the corporate tax rate still substantially reduces the cost of debt finance. Indeed, the row for debt finance still shows a subsidy with 7 or 10 percent inflation, even though nominal interest receipts of individuals are included at the personal rate, and even though there are no investment tax credits or short lifetimes allowed on the assets that are financed by that debt.

Machinery, since it receives no credits, relatively long lives, and only historical cost depreciation, is taxed at a 59 percent effective rate in 1960. When compared with the 18 percent rate for machinery in 1980, this figure is striking. Table 6.29 shows that the lifetimes for some types of equipment were as long as twenty-five to thirty years, whereas the longest life in 1980 was fourteen years. Autos were depreciated over 11.8 years in 1960, compared with three years in 1970 and 1980. When we note that the economic depreciation rate for autos is measured to be 33.3 percent per year, it is clear that some assets were not receiving even economic depreciation write-offs in 1960. Since autos and machinery made up a relatively high proportion of total assets in commerce and manufacturing, those industries are taxed at rates of 42 and 59 percent respectively.

The overall tax rate in the fixed-r case is 59 percent for 1960, compared with 50 percent for 1980. As pointed out in chapter 2, the fixed-r tax rates are always higher than the fixed-p rates when there is a dispersion among the rates of individual combinations. Patterns between years and among assets in the fixed-r case are not shown, but they are similar to those in the fixed-p case.

The fixed-p results for 1970 are shown in table 6.32 with an overall rate of 47 percent. Thus, in the fixed-p case overall effective tax rates in 1960, 1970, 1980, under the ultimate 1981 law, and under the 1982 law, are equal to 48, 47, 37, 26, and 32 percent, respectively. In the fixed-r case the corresponding tax rates are 59, 57, 50, 41, and 45 percent. In either case the total taxation of income from capital falls substantially from 1960 to 1981, but some of this decline is reversed with the 1982 law. Since the fixed-p rate on machinery falls from 59 to 49 percent from 1960 to 1970, it is clear that the 1962 introduction of Guidelines did more to reduce equipment lives than building lives (see table 6.29 lifetimes). Since the rate on buildings rises from 45 percent to 47 percent, the elimination of double declining balance in 1969 had more effect than the shortening of lives in 1962. Most 1970 rates in table 6.32 are lower than the 1960 rates of table 6.31, but inventories reflect the higher property tax rate used in the later year.

Table 6.32 **Effective Marginal Tax Rates, United States, 1970, Fixed-*p* Case** (%)

	Inflation Rate		
	Zero	10%	Actual (6.77%)
Asset			
Machinery	36.7	52.6	48.5
Buildings	43.3	46.7	47.1
Inventories	51.8	44.0	46.3
Industry			
Manufacturing	51.1	59.9	58.3
Other industry	32.5	33.9	34.4
Commerce	45.1	42.3	43.8
Source of finance			
Debt	17.2	−7.8	−0.2
New share issues	65.6	104.8	92.9
Retained earnings	56.7	73.2	69.7
Owner			
Households	52.7	66.4	63.5
Tax-exempt institutions	23.4	−15.9	−0.7
Insurance companies	22.8	57.6	38.3
Overall	43.8	47.4	47.2

6.4.4 Comparison with Average Tax Rates

How do the 37 percent (fixed-*p*) and the 50 percent (fixed-*r*) marginal tax rates compare with other estimates of average tax rates? To maintain comparability in such a calculation, we look at only domestic nonfinancial corporate business, and we include all forms of capital taxation as a fraction of all forms of capital income. We also want the income measure to reflect economic rather than tax depreciation.

Table 6.33 summarizes the appropriation of corporate profits from 1978 to 1980. We average these years together because the series are fairly volatile. Since losses induce delayed rather than immediate tax offsets, the denominator of the average tax rate could be unusually low in a single year without a corresponding reduction in the numerator. Thus the average of several years could be expected to provide not just a more stable but a more accurate reflection of the normal tax on existing investments. Profits in table 6.33 are defined to include the "capital consumption adjustment," which corrects for economic rather than tax depreciation, and the "inventory valuation adjustment," which puts all inventories on a LIFO accounting basis. We also include interest pay-

Table 6.33 **Corporate Profits and Their Appropriation, United States, 1978–80**
($ billion in current prices)

	1978–80 Average
Real operating profits	196.78
Federal and state corporate profits tax	73.10
State and local property tax	18.45
Interest payments	36.40
Dividend payments	36.90
Real retained earnings	31.93

Source: Various issues of the *Survey of Current Business*, plus calculations described in the text.

ments and property tax payments in the total gross profits figure. For domestic source income of only nonfinancial corporations, these profits were $196.78 billion.[41]

Corporate profits taxes at all levels of government totaled $73.10 billion for these corporations, as shown in the *Survey of Current Business*. This source also reports interest payments of $36.40 billion and dividend payments of $36.90 billion. Real retained earnings of $31.93 billion are obtained from their corrected profits figure less taxes, interest, and dividends.

The property tax payments are not shown separately for these corporations, however. To obtain an estimate for these taxes, we turn back to the effective rates estimated in section 6.2.6. The 0.01126 rate for buildings and the 0.00768 rate for machinery and inventories were estimated from total property taxes and total capital. When they are applied to Jorgenson's 1977 figures for only nonfinancial corporate structures, equipment, and inventories, $14.54 billion results. To approximate 1979 property taxes, we scale the 1977 amount by the ratio of the 1979 to the 1977 total nonfinancial corporate property tax base, as shown in Feldstein, Poterba, and Dicks-Mireaux (1983). The resulting estimate for 1979 is $18.45 billion, very close to the amount those authors find with their "equal rate" hypothesis.

These profit taxes and property taxes are included in the taxation of capital income, shown in table 6.34. Also in the table, we include estimates of personal taxes on interest, dividends, and real retained earnings. Interest payments from the previous table are multiplied by 0.236, the weighted average of debt holders' personal marginal rates on interest income. That is, the household rate of 0.284 (from table 6.13) is weighted by their 0.609 share of debt (from table 6.19), and the insurance company rate of $(.149 + 3.88\pi) = 0.412$ is weighted by their 0.153 share of debt.

41. We were unable to exclude agriculture, mining, and crude petroleum from these calculations of the average tax rate, since the *Survey of Current Business* does not show corporate interest payments or capital consumption adjustments separately by industry.

Table 6.34 **Average Tax Rate on Real Corporate Profits**
($ billion in current prices)

	1978–80 Average	Percentage of Profits
Total taxes	115.11	58.50
Corporate taxes	73.10	37.15
Property taxes	18.45	9.38
Taxes on		
Interest payments	8.59	4.37
Dividend payments	13.13	6.67
Real retained earnings	1.84	0.94
Personal wealth	0.00	
Real operating profits	196.78	
Average tax rate (%)	58.50	
Average profit rate (%)		
Gross of tax	9.41	
Net of tax	3.91	

Source: Own calculations as described in the text.

Similarly, dividend payments are multiplied by 0.356, the weighted average of equity holders' personal marginal rates on dividends. Finally, each dollar of real retained earnings from table 6.33 is assumed to generate one dollar of real capital gains for shareholders. The household capital gains rate of 0.14 and the insurance company rate of 0.28 (from table 6.13) are first halved to account for deferral, then weighted by the 0.743 and 0.041 shares to obtain 0.058 as the effective rate on accrued capital gains. This rate is applied to the real retained earnings of table 6.33 to obtain $1.84 billion of tax, shown in table 6.34.

Total taxes are $115.11 billion, or 58.5 percent of gross corporate profits. The gross and net rates of return are 9.4 and 3.9 percent, respectively, derived by dividing gross or net profits by $2,091.0 billion, the total 1979 nonfinancial corporate stock from the Federal Reserve Board Balance Sheet data. Similar information, on average tax rates and profit rates, is available for a time series of thirty years in Feldstein, Poterba, and Dicks-Mireaux (1983).

Two questions arise. First, why is the 58.5 percent average tax rate lower than the 69.4 percent rate estimated for 1979 by Feldstein, Poterba, and Dicks-Mireaux (1983)? Second, why is the 58.5 percent average tax rate so much higher than the 37 to 50 percent marginal tax rate?

A number of differences exist between the two average tax rate estimation procedures. First, Feldstein, Poterba, and Dicks-Mireaux (1983) use 0.35 for the personal rate on interest. We found from the TAXSIM model that the total federal and state marginal rate on interest was 0.325, and we reduced that rate to 0.284 to account for the fact that some corporate

interest reaches the hands of bank depositors in the form of tax-free services. Second, our calculations use weights from 1980 rather than 1976, and more recent data show more debt in the hands of tax-exempt institutions. Third, unlike those authors, we moved part of insurance company debt holdings into the tax-exempt group to account for their nontaxable pension business. For these reasons, our weighted tax rate on interest is 0.236 while theirs was 0.317. However, our 0.356 dividend rate is similar to their 0.349 rate, and our 0.058 capital gains rate is similar to their 0.044 rate for 1979. A final difference is that those authors include a capital gains tax on nominal gains, the product of an inflation rate and the capital stock. Chapter 2 describes our reasons for excluding this component.

The differences between average tax rates and marginal tax rates primarily involve distinctions between ex post taxes paid and ex ante expectations of taxes using current legislation. Several such distinctions can be suggested. First, unanticipated inflation reduces the real value of depreciation allowances on past investments without necessarily affecting the expected real value of depreciation allowances on the current marginal investment. Jorgenson and Sullivan (1981) argued that recent inflation rates have been higher than expected in the United States and have acted as a lump-sum tax on investments already in place. Second, the average tax rate mixes investments with different tax treatments. The rates from 1978 to 1980, for example, include taxes paid on some investments that were made before the 1971 liberalization of depreciation allowances, while the marginal rate in 1980 should reflect only the law then current. Third, transitory or windfall profits on past investments are subject to the statutory corporate tax rate, while the expected normal return to the marginal investment is also affected by investment tax credits and accelerated depreciation allowances. Fourth, monopoly profits receive the statutory rate. Fifth, initial corporate investments pay initial low-bracket corporate rates, while marginal investments were assumed to pay the 0.46 top bracket rate. Finally, firms may have reasons unrelated to the marginal investment for using charitable deductions, FIFO accounting, longer than minimum asset lives, and other features affecting the average tax rate without necessarily affecting the marginal tax rate.

It is thus not too surprising that when Fullerton and Henderson (1981) took different formulations for the marginal tax rates in eighteen United States industries, and different formulations for the average tax rates in the same eighteen industries, they obtained correlation coefficients that varied around zero and never exceeded 0.3. Furthermore, most of the reasons given above point to a marginal rate that is less than the average rate, as we found in this study. Fullerton (1983) includes much more discussion about the difference between average and marginal effective tax rates.

Table 6.35 **Ratios of Total Capital Taxes to Total Capital Income from Two Different Studies**

Industry	1953–59	1972–74
Included		
Manufacturing	.58	.58
Other industry	.58	.63
Commerce	.46	.57
Excluded		
Agriculture	.30	.35
Mining (including crude petroleum)	.35	.50
Real estate	.32	.39
Overall total	.47	.49

Source: The 1953–59 capital income, corporate taxes, and property taxes are from Rosenberg (1969). The imputation of personal taxes is based on assumptions of Harberger (1966), as corrected and disaggregated by Shoven (1976). The 1972–74 ratios are from the Fullerton/Shoven/Whalley model, using different personal tax imputations. See Fullerton et al. (1978, 1981).

Several other studies have estimated average tax rates by industry, including Rosenberg (1969) for 1953–59 and Fullerton et al. (1978, 1981) for 1972–74. Their results are summarized in table 6.35. In both of these studies, capital income is defined to include corporate profits, net interest paid, net rents paid, and corrections for economic depreciation. Several years are averaged in order to avoid problems with loss carry-forwards. Capital taxes are defined to include corporate income taxes, property taxes, and an imputation for the personal taxes paid on capital earned in each industry. In spite of these similarities, enough procedural differences remain so that we cannot attribute tax ratio differences to changes over time. However, it is fair to presume that the higher rate for mining and crude petroleum in the 1972–74 study reflects the phasing-out of oil depletion deductions. The higher rate for the commercial industry probably reflects increased incorporation.

Because personal and property taxes are included, we can also compare our corporate industries with three excluded noncorporate industries. These noncorporate industries clearly have lower average effective tax rates. In fact, the average tax rates in both of these studies have been used to estimate the capital misallocation and welfare effects from differential capital taxation.[42] Part of the point of this book is that our marginal effective tax rates might be better suited for measuring these investment incentive effects.

42. See Harberger (1966), Shoven (1976), and Fullerton et al. (1978, 1981).