Federal Reserve Bank of Minneapolis
Research Department Staff Report 309

June 2004

DATA APPENDIX:
Taxes, Regulations, and the Value of U.S. and U.K. Corporations*

Ellen R. McGrattan
Federal Reserve Bank of Minneapolis
and University of Minnesota

Edward C. Prescott
Federal Reserve Bank of Minneapolis
and Arizona State University

* The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

Table of Contents

1. Introduction

This appendix describes the data we use in the paper, "Taxes, Regulations, and the Value of U.S. and U.K. Corporations" (McGrattan and Prescott (2003)). It has two main sections. The first section describes the U.S. data, and the second describes the U.K. data. For both countries, we provide details of our measures of corporate values, capital stocks, and tax rates.[1]

2. United States

2.1. Corporate Value

To compute the market value of U.S. corporations plotted in Figure 1, we need the value of corporate equities and the value of net debt (debt liabilities less debt assets). The main source for these data is the Federal Reserve's *Flow of Funds Accounts of the United States*. In this section, we provide the details on our measures.

2.1.1. Equity

The market value of U.S. corporate equities is taken from the *Flow of Funds Accounts* (Table L.213, line marked "Market value of domestic corporations"). The value excludes intercorporate holdings of both nonfinancial and financial corporations.

2.1.2. Net Debt

Net debt is computed from *Flow of Funds Accounts* level tables for all domestic sectors issuing corporate equities:[2]

- nonfinancial corporate business (Table L.102);
- commercial banking (Table L.109);
- life insurance companies (Table L.117);

[1] The data and codes that generate the tables and figures in the paper are available at our Web site: www.minneapolisfed.org/research/sr/sr309.html.

[2] The list of sectors issuing corporate equity is given in flow Table F.213.

- other insurance companies (Table L.118);
- closed-end and exchange traded funds (Table L.123);
- real estate investment trusts (Table L.129);
- security brokers and dealers (Table L.130).

Corporate net debt is defined to be debt liabilities less debt assets of corporations, where 'debt' includes all financial claims except corporate equities, mutual fund holdings that are equity, life insurance reserves, pension fund reserves, and the part of miscellaneous claims that is equity.

As an estimate of the fraction of mutual fund holdings that are equity, we use the ratio of net assets in equity mutual funds to total industry net assets from the Investment Company Institute (1961-2002). We split assets in hybrid funds equally between debt and equity. In 1960, more than 90 percent of mutual fund assets were in equity funds. In 2000, approximately 60 percent were in equity funds.

Next, we correct for life insurance and pension fund reserves. We include life insurance reserves and pension reserves with the household sector and, therefore, subtract it from life insurance company financial liabilities. To keep the accounts in balance, we also subtract an equal sum from life insurance financial assets. We do so in a prorated way between equity assets and debt assets.

Finally, we subdivide "miscellaneous assets" and "miscellaneous liabilities" into equity claims and debt claims. Using *Flow of Funds Accounts* Tables L.230, L.231, and L.232, we can assign part of miscellaneous assets to debt assets and part to equity assets. Similarly, we can assign part of miscellaneous liabilities to debt liabilities and part to equity liabilities. We do this based on the description of the assets in the Federal Reserve's *Guide to the Flow of Funds Accounts*. Miscellaneous assets listed in Tables L.230 through L.232 that we include with debt assets are

- 1/10 of corporate direct investment abroad;
- 1/2 of bank holding companies' investment in subsidiaries;
- nonfinancial corporation investment in finance company subsidiaries;

- nonfinancial corporation policy payables;
- brokers' and dealers' securities borrowed;
- deferred and unpaid life insurance premiums;
- unidentified corporate assets,

where the last category is the residual after subtracting *Flow of Funds Accounts* estimates in "identified" categories from the U.S. Treasury's *Statistics of Income, Corporate Tax Return* totals. Miscellaneous liabilities listed in Tables L.230 through L.232 that we include with debt liabilities are

- 1/4 of corporate foreign direct investment in the United States;
- 1/2 of bank holding companies' investment in subsidiaries;
- liabilities of subsidiary foreign banks in the United States and brokers and dealers;
- other insurance company policy payables;
- nonfinancial corporation pension fund contributions payable;
- unidentified corporate liabilities.

Note that for two categories under miscellaneous, we have assumed that only part is debt: direct investment and bank holding companies' investment in subsidiaries. The weights 1/10 for U.S. direct investment abroad and 1/4 for foreign direct investment in the United States are based on average equity and debt flows reported in the *Flow of Funds Accounts* Table F.230. In Figure A1, we show the ratio of direct investment in the United States relative to GDP. That part which is 'equity' is the sum of equity and reinvested earnings. That part which is 'debt' is intercompany accounts. About 1/4 of the total is debt.[3] Figure A2 has the same data except for direct investment abroad, which is a U.S. asset. Only about 1/10 of the total is debt in this case.[4]

We divided bank holding companies' investment in subsidiaries equally between equity and debt because the *Guide to the Flow of Funds* notes that the miscellaneous category includes both equity and nonequity investments. The *Flow of Funds Accounts* does not

[3] Components are not available prior to 1982.

[4] We will show later that these data are consistent with U.K. direct investment.

Figure A1. Foreign Direct Investment in the U.S. (Flows)

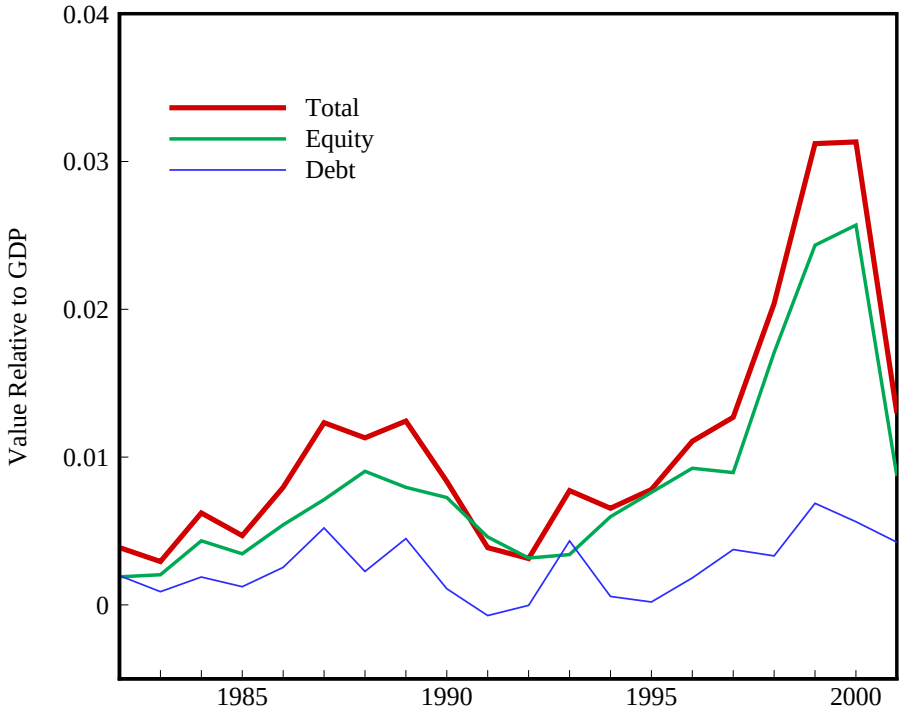
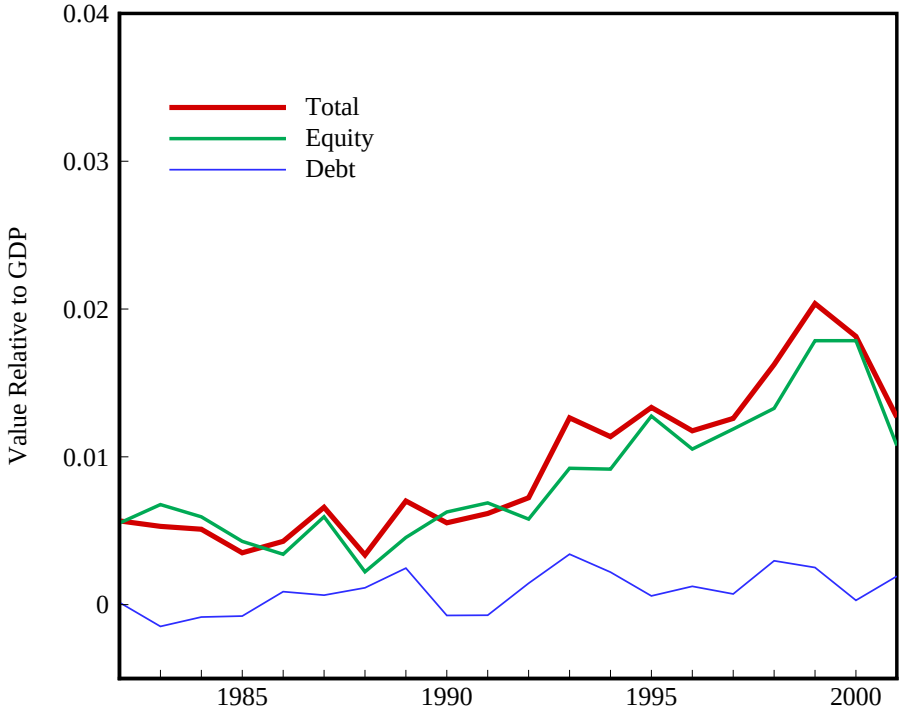


Figure A2. U.S. Direct Investment Abroad (Flows)



provide values for the subdivision, but the choice on how to split it has a negligible effect on our estimates.

One problem with the net debt measure based on *Flow of Funds Accounts* (and shown in Figure 1 of the paper) is that it is based on book values rather than market values. In the case of nonfinancial nonfarm corporations, which is by far the largest sector within the corporate sector, Hall (2001) adjusts his net debt figure for the difference between market and book values for debt securities. In Figure A3, we plot his series 'market value of securities with corporate bonds at market value' relative to GDP and his series 'value of securities with corporate bonds at book value.' As the figure shows, the difference between the two series is small, but we do make the same adjustments to our average net debt estimates when comparing predicted and actual corporate values.[5]

2.2. Corporate Capital Stocks

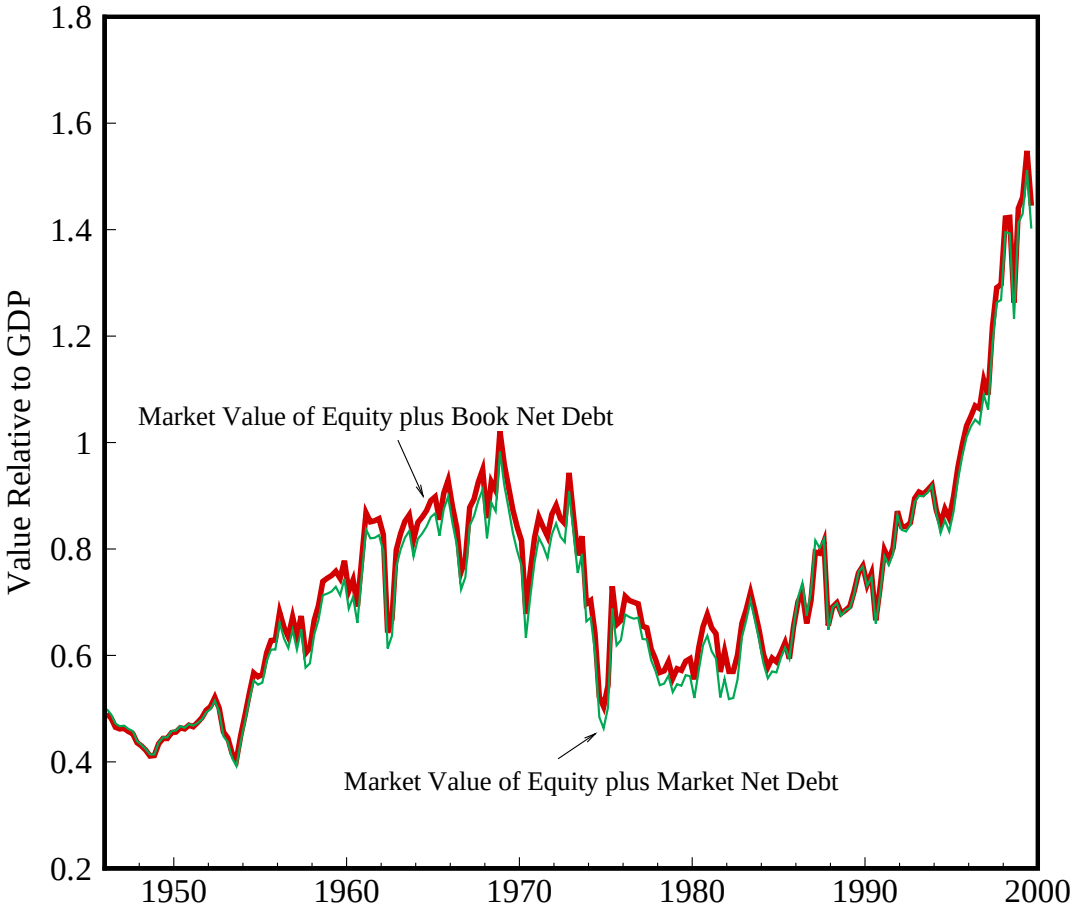
Next, we describe our measures of U.S. corporate productive capital that underly the estimates of Table 3 in the paper (and appear again in Table 4 when we compare the United States and the United Kingdom). In the first subsection, we provide specific sources for tangible reproducible capital plus land. In the second subsection, we describe the data underlying our measure of intangible capital. In the third subsection, we describe the data underlying our measure of capital in foreign subsidiaries.

2.2.1. Tangible capital

The Bureau of Economic Analysis (BEA) at the U.S. Department of Commerce provides estimates of inventories and the reproducible cost of equipment (including software) and structures. Data on the stock of inventories are available in the National Income and Product Account Tables (NIPA) of the *Survey of Current Business* (Table 5.12). Data on equipment and structures in the corporate sector are available in the Fixed Asset tables of the *Survey of Current Business* (Tables 4.1 and 5.1). We use total private nonfarm inventories plus 10 percent of farm inventories. The latter is an estimate of the inventories

[5] We also make an adjustment for taxes on distributions since companies can adjust capital and debt one for one before making distributions. Below, we discuss how we compute the tax rate on distributions.

Figure A3. Total Value of U.S. Nonfinancial Corporations with Hall's Adjustment



owned by corporate farms.

The BEA structures do not include land values. For estimates of corporate land value, we use data from balance sheets reported in the *Statistics of Income, Corporate Tax Returns*.

In Table A1, we compare decade averages of these stocks. In both the 1960s and the 1990s, the reproducible cost of corporate tangible assets was about 1 times GDP. In the two intermediate decades, the stocks were slightly higher due to the capital subsidies we discuss in the paper. These subsidies were more generous for equipment purchases, and therefore we see a greater increase in equipment starting in the 1970s. These subsidies were eliminated in the 1980s, and by the 1990s stocks were back to their 1960s level –

Table A1. U.S. Tangible Reproducible Costs Relative to GDP

	1960-69	1970-79	1980-89	1990-99
Structures	.489	.528	.546	.476
Land	.042	.040	.034	.033
Equipment†	.278	.345	.393	.367
Inventories	.179	.194	.187	.151
TOTAL	.988	1.107	1.161	1.027

† Including software.

although equipment was a larger fraction of the total.

2.2.2. Intangible capital

The value of the stock of intangible capital is not measured by the BEA and must be estimated. We take an indirect approach, using observations on corporate profits and returns to tangible assets to estimate a return to intangible assets. An assumption of equal after-tax returns to tangible and intangible assets allows us to infer the stock of intangible capital. This is described in the context of the growth model in Section 3B of the paper, with the main results reported in Table 2.

Our calculations in Table 2 of the paper require data for corporate investment and domestic pretax corporate profits. Corporate investment is reported in the *Flow of Funds Accounts*, Table F.6. We sum across all corporate categories and again assume that 10 percent of farm business is corporate. Data on domestic pretax corporate profits, with inventory valuation and capital consumption adjustments, are from NIPA, Table 1.16.

2.2.3. Foreign capital

The BEA estimates tangible capital located in the United States. To get an estimate of the value of capital in foreign subsidiaries, both tangible and intangible, we assume that the ratio of domestic stocks to foreign subsidiary stocks is equal to the ratio of after-tax

domestic corporate profits to after-tax foreign subsidiary corporate profits.

After-tax foreign subsidiary corporate profits are reported in NIPA Table 6.16. We take receipts from the rest of the world and subtract payments to the rest of the world. We then divide by corporate profits in GDP after subtracting the corporate profits tax liability, which are both in NIPA Table 1.16.

2.3. Tax Rates

This section describes how we estimate the tax rates reported in Table 1 of the paper. There are three rates: the tax rate on corporate income, the tax rate on corporate distributions, and the subsidy rate on investment.

2.3.1. Tax Rate on Corporate Income

The tax on corporate income is set equal to the ratio of corporate tax liabilities to corporate before tax profits. Because profits of the Federal Reserve Banks are taxed at 100 percent, we eliminated Federal Reserve profits from tax liabilities and from before-tax profits. Thus, our estimate of the corporate tax rate is the ratio of the NIPA profit tax liability (Table 1.16) less Federal Reserve Bank profits (Table 6.16) to the NIPA corporate before-tax profits (Table 1.16) less Federal Reserve Bank profits.

2.3.2. Tax Rate on Corporate Distributions

The tax rate reported in Table 1 of the paper is the tax rate on corporate dividends. We describe how we compute this rate and then explain why this rate is relevant for the calculations reported in the paper.

The tax rate on corporate dividends is constructed as follows. We start with dollar-weighted average marginal income tax rates for U.S. individual income taxes calculated by the National Bureau of Economic Research (NBER) TAXSIM model with micro data from the Statistics of Income Division of the Internal Revenue Service.[6] The rate is found by first calculating the tax liability of each 1040 tax return in the sample, then increasing

[6] Depending on the year, the sample size ranges from 80,000 to 200,000 actual 1040 tax returns.

dividend income by 1 percent and recalculating the tax liability under the assumption that other incomes and expenses are constant. The difference in aggregate tax divided by the difference in aggregate income is the marginal tax rate on the average dollar of dividend income. (See Feenberg and Coutts (1993) for further details.)

Estimates from TAXSIM are not available for all years in the 1960s. Thus, we independently calculate tax rates using aggregate figures from the *Statistics of Income, Individual Income Tax Returns* for the two periods covered in Table 1. Personal taxes on dividend income are paid by individuals who file the 1040 form with the U.S. Internal Revenue Service (IRS) and by fiduciaries who file the 1041 form. The IRS compiles information from these tax forms in its *Statistics of Income* (SOI). It reports sources of income and taxable income from the filed returns for many income categories. For individual returns (1040), the IRS also reports information by marital status: married filing jointly, married filing separately, single, surviving spouse, or head of household.

From the SOI data, we construct the marginal tax rate paid by a typical filer in each income and marital category. For each group, we take reported taxable income for a typical filer, and we use the IRS tax schedule relevant to this group.[7] To compute an average marginal rate in a given year, we weight the rate for each income and marital group by the fraction of dividend income earned by this group.[8] For nontaxable returns, we use a marginal tax rate of zero and the dividend income these filers report.

For fiduciary returns, we have much less data available. We have statistics for even years in the early period and for 1997 only in the later period. For the tax rates in the early odd years, we use the tax rates in the subsequent year. For example, for the tax rate in 1961, we use our estimate from 1962. In the later period, we use the 1997 tax rate in all years.

To construct a single rate for both types of returns, we use the fraction of dividend

[7] In the 1960s period, many high income filers used the alternative tax computation. We also do this when computing marginal tax rates of high income filers using information on net long-term capital gains in excess of short-term capital losses provided by the SOI.

[8] In 1987–2000, the IRS reports dividend income by adjusted income class only for all returns. We compute a marginal rate for each marital class by using taxable income from all returns along with that marital class's tax schedule. We weight the results using total dividend income earned by that marital group.

income reported on the 1040s and the 1041s to weight the respective tax rates. We have to estimate the taxable dividend income on the 1041s because part of the income is distributed to individuals (who then report it on their 1040). We know the total amount of income distributed. We assume that all types of income (dividends, interest, etc.) are distributed proportionally. Taxable dividend income for a particular 1041 filer is therefore assumed to be total dividend income multiplied by the fraction of income not distributed.

Income taxes are also paid to state and local governments. To adjust for state and local taxes in a particular year, we multiply our estimate of the marginal tax rate on the 1040/1041 in that year by the ratio of total personal income tax receipts to federal personal income tax receipts. Data on receipts are taken from the *Survey of Current Business* NIPA Tables 3.2 and 3.3. This is a reasonable procedure for adjusting the rates if federal, state, and local tax schedules have similar slopes.

To get our final estimates, we make one final adjustment. We multiply the marginal rates by the fraction of equity held outside of nontaxed accounts. Nontaxed entities include pension funds, individual retirement accounts (IRAs), and tax-exempt nonprofit organizations.

Data on non-IRA pension funds are taken from the Fed's *Flow of Funds Accounts*. To estimate the equity holdings in these funds, we add corporate equities of private pension funds, state and local government employee retirement funds, and tax-exempt life insurance reserves. These holdings are reported in Table B.100e.

Some corporate equity in the pension funds is held in the form of mutual funds. We estimate the equity fraction of mutual fund holding by taking the ratio of all mutual fund equity to total mutual fund assets (FOF Tables B.100 and B.100e).

To estimate equity holdings of IRAs, we use data reported by Copeland (2001), the Investment Company Institute (ICI) (2003), and Yakoboski (2000). From these sources we can get a time series of IRA asset holdings back to 1981. We use data on IRA assets by type from the ICI (2003) to estimate the share of equity holdings in IRAs. The third category of nontaxed equity is equity held by nonprofit organizations. The *Flow of Funds Accounts* Table L.100.a provides estimates for nonprofits. Adding the retirement equity

and the nonprofit equity, we get our estimate of the fraction of equity that is in nontaxed accounts. We use this estimate to adjust our marginal tax rate.

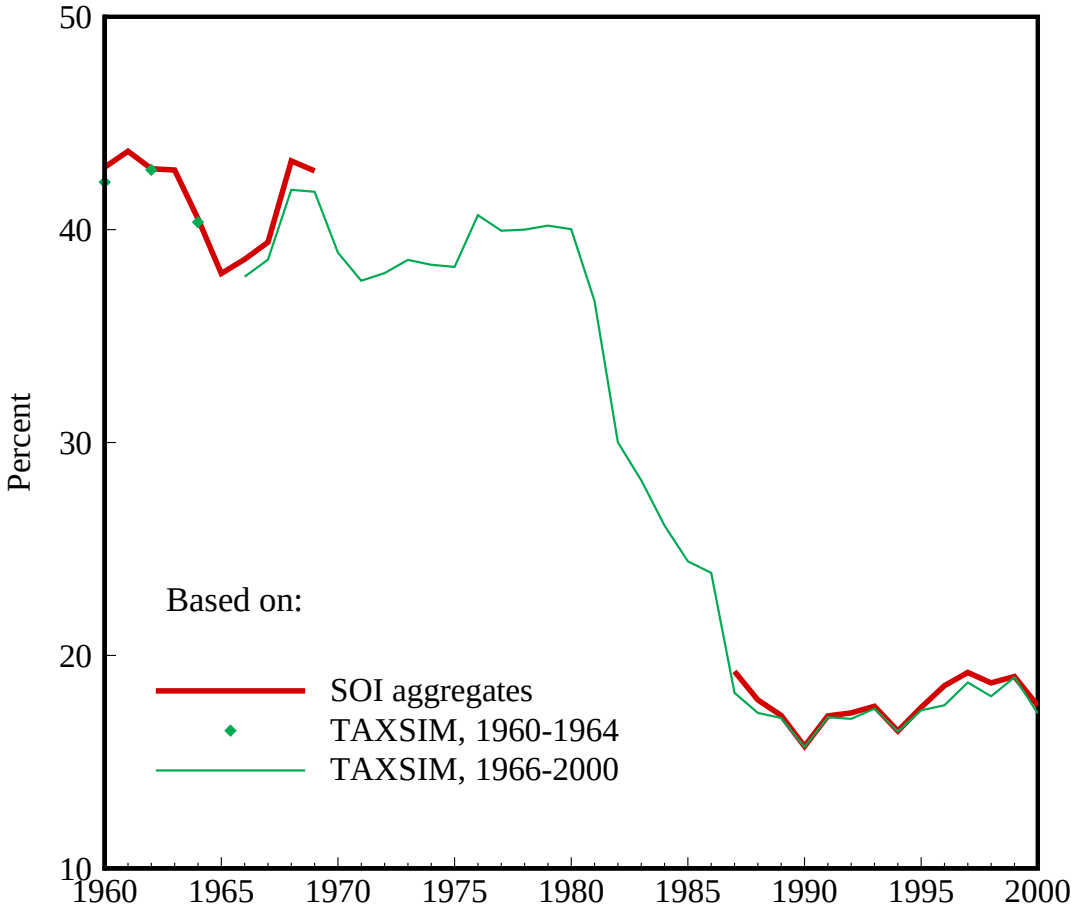
In Figure A4, we plot estimates for the average marginal tax rates. The series marked 'TAXSIM' uses the 1040 estimates from the NBER TAXSIM model. The series marked 'SOI aggregates' is based on our estimates of 1040 and 1041 rates from the aggregate data reported in *Statistics of Income.* The latter is plotted for the periods 1960–69 and and 1987–2000. Adjustments for state and local taxation and nontaxed equity holdings have been made to both. As the figure shows, when there is overlap, the two series are close. The time series for the effective marginal tax rate on dividends that we use when computing statistics in the paper is that marked 'SOI aggregates' for the period 1960–65 and that marked 'TAXSIM' for the period 1966–2000. The year 2000 is the last one for which any tax data are available.

Next, we estimate how the recent numbers change if we take into account share repurchases. Grullon and Michaely (2002) report data that show a large increase in repurchases after 1997 when the capital gains rate fell to 20 percent (and 10 percent for filers in the 15 percent ordinary income bracket). In 2000, a little more than 1/2 of all distributions was share buybacks. For the year 2000, the TAXSIM estimate for the federal tax rate on dividends is 28.83 percent. The estimate for long-term gains is 18.53 percent.

A tax rate of 18.53 percent is a lower bound for income from share repurchases. It is a lower bound because some gains are short-term. Also, this is the rate on nominal gains, not real gains. Even if there are no real capital gains, a shareholder pays income taxes on any nominal gains. In an inflationary economy, the effective tax rate on real capital gains will be higher than that on nominal capital gains.

If we use the TAXSIM estimates for dividend income and long-term gains weighted equally (to reflect the fact that repurchases and dividends are currently about equal), then our average marginal tax rate on distributions for 2000—after making adjustments for state and local taxes and nontaxed accounts—is 14.2 percent. Compare this to the estimate of 17.3 percent for the tax rate on dividends. (See Figure A4.) If we use a rate of 17.3 percent, our prediction for the total fundamental value is 1.567 GDP. If we use

Figure A4. U.S. Average Marginal Tax Rate on Dividends

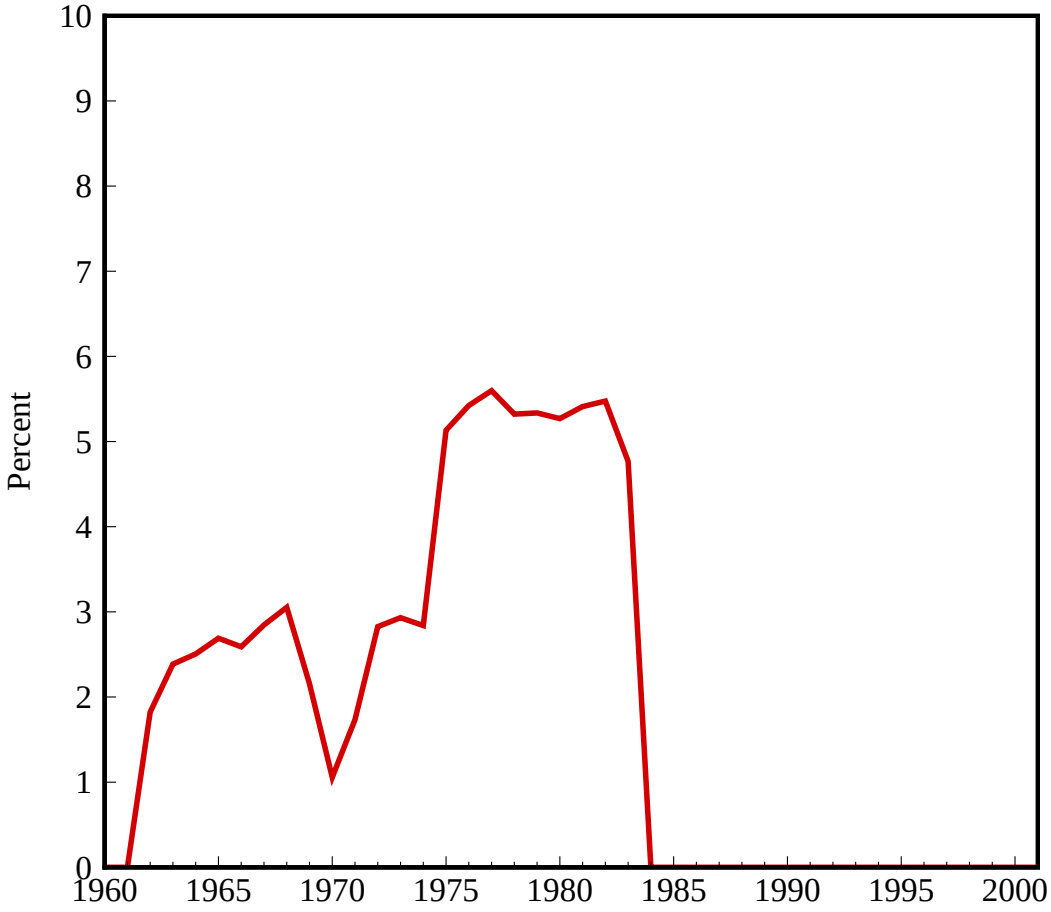


a rate of 14.2 percent, our prediction for the total fundamental value is 1.626 GDP. The best prediction is between these, and the actual market value, which is 1.609 GDP, is also. In other words, given that 14.2 is a lower bound for τ_d, we may find that making a more precise adjustment for share repurchases could actually imply closer agreement between the predicted and actual values.

2.3.3. Investment Subsidies

Statistics for the investment subsidy in Table 1 of the paper are derived from data on investment tax credits reported in NIPA Table 8.25. To compute a subsidy rate, we take the credits and divide by corporate investment. As noted above, corporate investment is

Figure A5. Rate of ITC Subsidy



reported in the *Flow of Funds Accounts*, Table F.6. We sum across all corporate categories and assume that 10 percent of farm business is corporate.

Figure A5 shows the subsidy rate for the period 1960–2001. As the figure shows, the investment tax credits were largest between 1975 and 1983, nearly 6 percent of total corporate investment.

The two main sources for information on depreciation allowances are King and Fullerton (1984) and Fullerton and Karayannis (1993). Both have details on changes in IRS rules. See, in particular, Section 6.2.3 and Tables 6-5 and 6-29 of King and Fullerton (1984) and Table 10-7 of Fullerton and Karayannis (1993).

3. United Kingdom

An advantage of our study of the United States is access to long time series. For the United Kingdom, the data coverage is less complete. However, there are good studies of the economy and the stock market conducted in the period 1957–70 by members of the Department of Applied Economics at the University of Cambridge, and there are complete and comparable data provided by U.K. government agencies in the period 1987–2001. Work done at the University of Cambridge was continued by government agencies after 1970, but not consistently. In this section, we describe the data that we use and provide details on all of the statistics reported in the paper.

3.1. Corporate Value

In this section, we provide sources for the components of the market value of U.K. corporations, namely, the value of corporate equities plus the value of net debt.

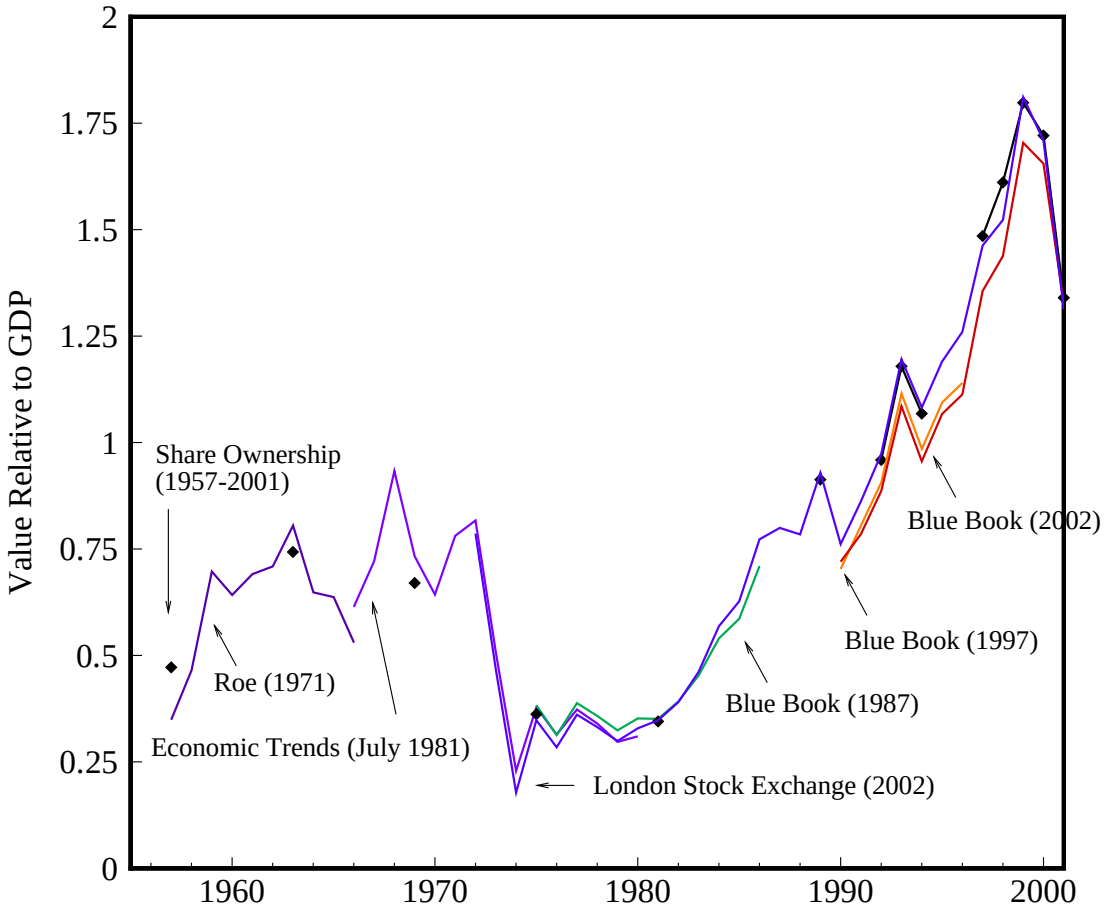
3.1.1. Equity

Figure 2 of the paper displays the value of corporate equities of U.K. domestic corporations. In this section, we describe how we construct this series.

There are two components: quoted shares and unquoted shares. The main sources of data on the value and ownership of quoted shares are historical statistics from the London Stock Exchange (2002) and surveys of share ownership carried out by the Department of Applied Economics at Cambridge University in 1957, 1963, and 1969 (Stone et al. (1966), Revell (1967), and Moyle (1971)), by the U.K. Central Statistical Office (CSO) (1979) in 1975, by the Stock Exchange (1982) in 1981, and by the U.K. Office for National Statistics (ONS) (1994, 1997–2002) in the years 1989–94 and then again 1997–2002. The main source of data for unquoted shares is Roe (1971), the ONS *Blue Book 2002*, and the ONS *Pink Book 2002*.

The value of quoted U.K. shares is available from the London Stock Exchange Web site since 1963 and for all share ownership survey years. There are only a few years since 1960 with missing data. In those years, we interpolate values. To get the market value of

Figure A6. Value of Quoted U.K. Shares Net of Intercorporate Holdings



U.K. quoted shares net of intercorporate holdings (as is done in the U.S. *Flow of Funds Accounts*), we use information from the share ownership surveys on corporate holdings.

As a check on our estimates of the value of quoted U.K. shares, we also use other sources and plot the values in Figure A6. These figures show that there is consistency in the estimates across sources. The series for the period 1957–66 is taken from Table 62 in Roe (1971).[9] The series for 1966–80, published in *Economic Trends* (July 1981) was part of a project of the CSO to fill in gaps on U.K. national wealth statistics. The published data cover the nonbank sector and all U.K. shares. We use estimates for 1966 in

[9] We include all sectors issuing quoted U.K. ordinary shares. These include all private nonfinancial companies except co-operative societies and marketing boards; deposit banks; U.K. banks overseas; discount houses; other U.K. banks in the United Kingdom; U.K.-owned insurance companies; quoted investment trusts; hire-purchase finance companies; and other financial institutions.

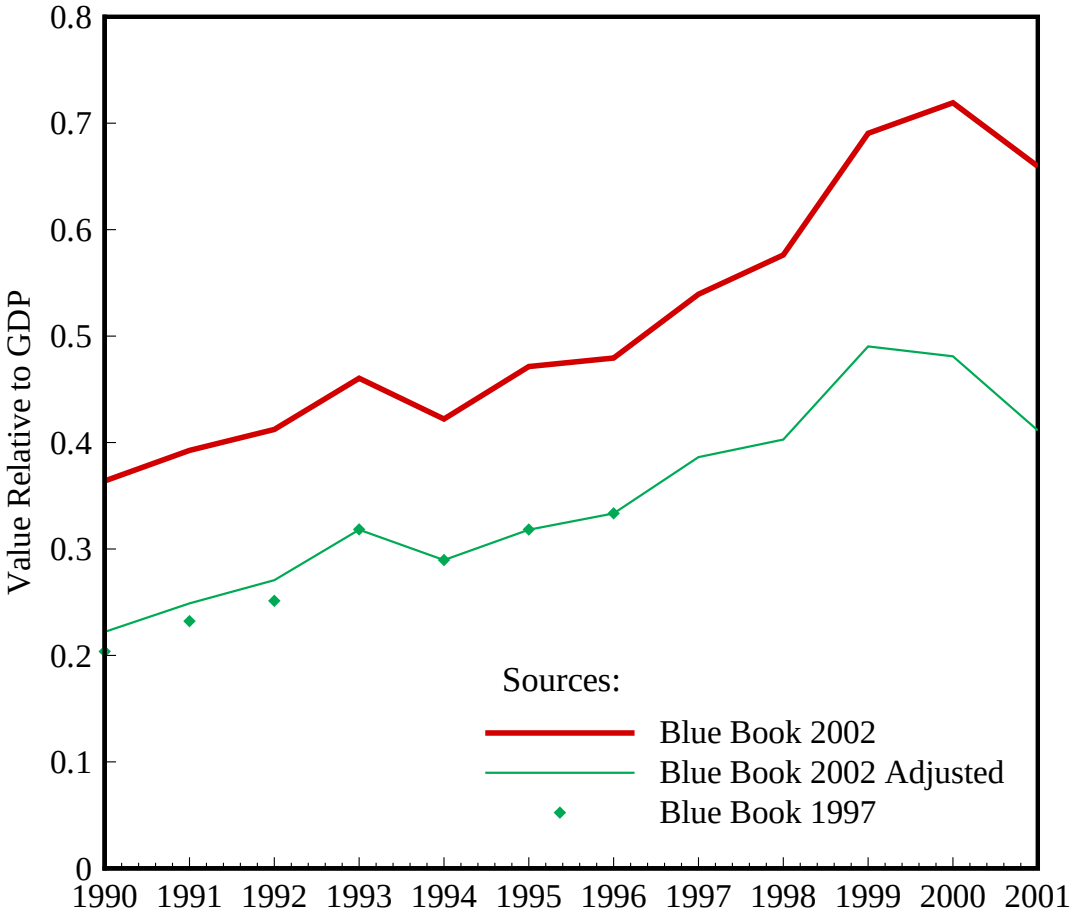
Roe (1971) to approximate the ratio of quoted ordinary shares to all shares (quoted and unquoted, ordinary and preference). We use data from the ONS *Blue Book 1987* to fill in estimates for banks. The *Blue Book 1987* is the first issue with balance sheets included on a regular basis. This issue had no breakdown of ordinary and preference shares or quoted and unquoted. Here again, we use Roe's 1966 figures. The share ownership survey provides data for quoted ordinary shares in survey years, which have been published annually in recent years. Finally, we include data for two recent *Blue Books*: *Blue Book 1997* because it published detailed data on company securities (Table 12.13) and *Blue Book 2002*, which is the most recent data from national balance sheets. The recent data in the national balance sheets are based on *Share Ownership* surveys. There are some minor differences in our estimates from these two sources because of our adjustments for intercorporate holdings. There is a finer breakdown of ownership by sector in the *Share Ownership* survey than in the *Blue Book*.

Data on unquoted shares are available for the period 1957–66 from Roe (1971), Table 63, and for 1990–2001 from ONS.[10] Starting with the *Blue Book 1998*, there was a change in ONS's definition of unquoted share liabilities on corporate balance sheets. It now includes investment in the share capital of U.K. subsidiaries by rest of the world parent corporations. Because we want only U.K. company equities, we use data from the *Pink Book 2002* to adjust the *Blue Book* series for unquoted share liabilities. The *Pink Book* Table 8.3 reports that part of unquoted shares that is direct investment by rest of world parent corporations. We subtract this from the *Blue Book* series.

In Figure A7, we plot U.K. unquoted shares included with corporate liabilities from three different sources. The first is from the *Blue Book 1997*, before rest of world direct investment was included. The second is from the *Blue Book 2002*, which includes the direct investment. The third subtracts the direct investment using data from the *Pink Book 2002*. Note that the adjusted series and the series from *Blue Book 1997* are close. In fact, in the period 1993–96 they are identical.

[10] We include all sectors issuing unquoted U.K. ordinary shares. These include all private nonfinancial companies except co-operative societies and marketing boards; deposit banks; U.K. banks overseas; discount houses; other U.K. banks in the United Kingdom; U.K.-owned insurance companies; quoted investment trusts; hire-purchase finance companies; and special investment agencies.

Figure A7. U.K. Corporate Liabilities of Unquoted Shares



3.1.2. Net Debt

Table 4 of the paper reports average net debt for the United Kingdom for the periods 1960–66 and 1990–2001. The estimate for the earlier period is computed using data in Roe (1971). The estimate in the later period is computed using data in the recent ONS *Blue Book 2002*. In the text, we also report an estimate for net debt in the period 1975–79 using the *Blue Book 1987*.

As before, corporate net debt is defined to be debt liabilities less debt assets of corporations, where 'debt' includes all financial claims except corporate equities, life insurance reserves, pension fund reserves, and the part of direct investment that is equity.

Using data from Roe (1971), we make the same adjustments to the balance sheets of

life insurance corporations that we do for their U.S. counterparts. That is, we subtract life insurance reserves from liabilities and subtract the same amount from assets. As before, we do this in a prorated way for equity and debt assets.

For the data in the ONS *Blue Book 2002*, balance sheets are reported for life insurance companies and pension funds together. Thus, it is not possible to get an estimate for net debt of life insurance companies. We do know that for the United States and for the United Kingdom in the 1960s, net debt for life insurance companies is very small relative to GDP.

Next, we estimate the part of direct investment that is debt. We only need to do this for the 1960s since it is separately reported in the ONS *Blue Book 2002* for the more recent period. We use recent figures to approximate levels in the 1960s. In Figure A8 and A9 we plot estimates of foreign direct investment and direct investment abroad in the recent period taken from Table 8.3 of the ONS *Pink Book 2002*. The part that is 'equity' is the sum of equity capital and reinvested earnings. The part that is 'debt' is the sum of debt securities, branch indebtedness, and intercompany balances. About 1/4 of foreign direct investment in the United Kingdom is debt. About 1/20 of direct investment abroad is debt.[11]

For the data in the ONS *Blue Book 1987*, balance sheets are reported for industrial and commercial companies, the monetary sector (which includes banks), and other financial institutions (which includes pension funds). We estimate net debt for the late 1970s using the same procedure as above, except here we exclude the balance sheets of all other financial institutions. We do this because pension funds are a large part of this group.

3.2. Corporate Capital Stocks

Table 4 of the paper has estimates of U.K. corporate tangible capital, corporate intangible capital, and an estimate of the ratio of foreign to domestic capital. In this section, we describe our data sources and measurement.

[11] For the United States, we find similar quantities: debt is 1/4 of foreign direct investment and 1/10 of direct investment abroad.

Figure A8. Level of Foreign Direct Investment in the U.K.

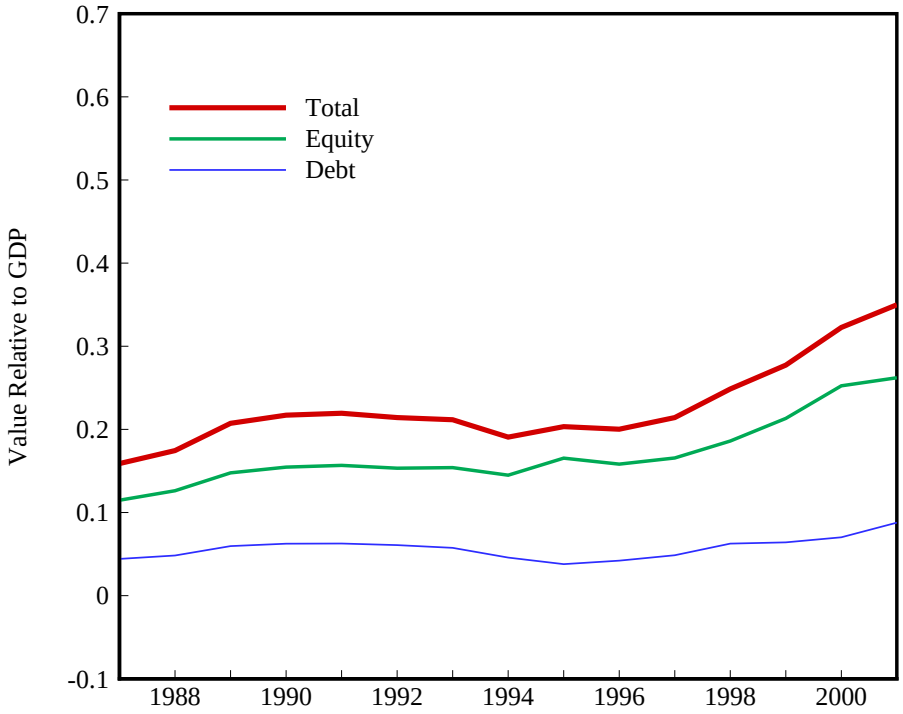


Figure A9. Level of U.K. Direct Investment Abroad

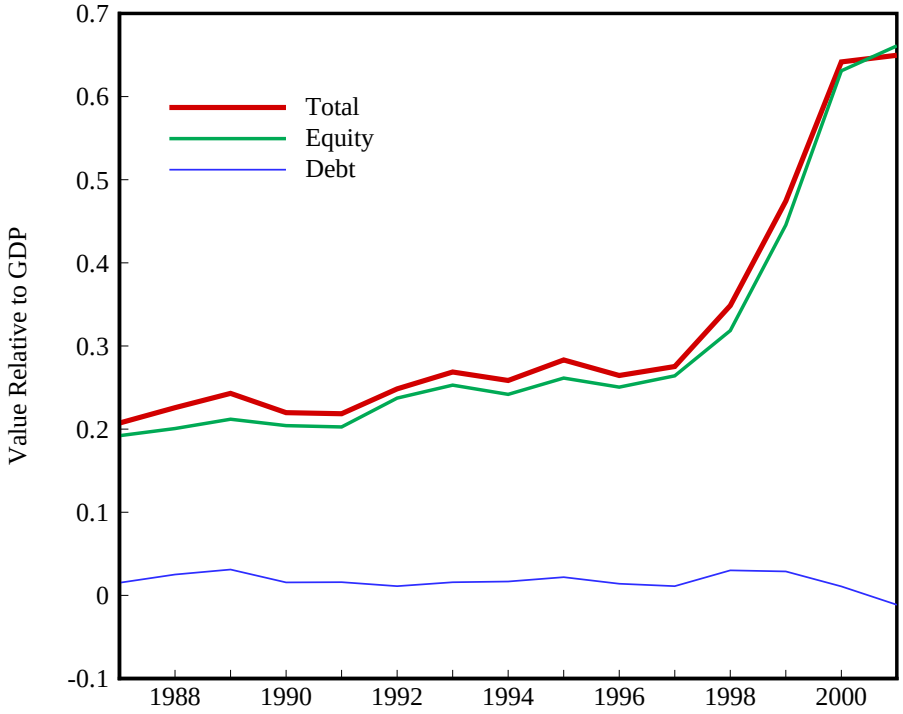


Table A2. A Comparison of U.S. and U.K. Tangible Reproducible Costs Relative to GDP, Averaged 1990-2001

	U.S.	U.K.	Difference
Structures and land	.509	.794	.285
Equipment	.368	.495	.127
Inventories	.149	.162	.013
TOTAL	1.026	1.451	.425

3.2.1. Tangible capital

Data on corporate tangible capital are available from Roe (1971) for the period 1957–66. Roe has estimates of dwellings, other land and buildings, plant and equipment, and stocks and work in progress for all sectors. For corporate tangible capital, we include capital stocks of all sectors issuing U.K. company quoted or unquoted ordinary shares.

Recent estimates of tangible capital are available in the ONS *Blue Book 2002* since 1987. They provide values for the following: residential buildings; agricultural assets; commercial, industrial and other buildings; civil engineering works; plant and machinery; vehicles; and stocks and work in progress. The value of land is included with values on structures.

Unlike the United States, the United Kingdom has seen an increase in the value of tangible assets between the 1960s and 1990s. The increase is certainly not sufficient to account for the very large rise in stock values but deserves a closer examination. In the 1960s, Roe (1971) estimates that U.K. tangible capital is 1.23 times GDP. In the period 1990–2001, ONS estimates that it is 1.45 times GDP. One reason for the difference across periods is coverage: ONS includes unincorporated enterprises while Roe (1971) does not.

A comparison of the U.S. stocks and U.K. stocks gives some indication of other possible reasons for the rise in U.K. corporate tangible stocks over time. In Table A2, we show the breakdown of the reproducible costs for structures and land, equipment, and inventories.[12]

[12] For the United Kingdom, we include residential buildings, commercial, industrial, and other buildings, and civil engineering works in the category 'Structures and Land'. We include plant and machinery

Capital subsidies for U.K. companies were significantly higher in the 1970s and 1980s than those for U.S. companies, which would result in higher U.K. stocks. Furthermore, U.K. corporate income tax rates fell more in the postwar period than U.S. rates. Finally, the United Kingdom is more congested, which would imply that the value of corporate land is greater than in the United States. Unfortunately, we do not have a breakdown of structures and land, but structures plus land is the category with the largest difference.

3.2.2. Intangible capital

For the United States, we computed intangibles in the 1960s and the 1990s using comparable observations on after-tax corporate profits, tangible capital, growth rates, and depreciation rates. For the United Kingdom, we do not have long time series for the national accounts that allows precise estimation of intangibles in the 1960s and 1990s. The current national accounts published in *The Blue Book 2002* date back only to 1987 and, with changes in the accounting system and sectoral assignments, are not comparable to earlier issues of *The Blue Book*.

We know, however, from direct measures that a large component of U.S. intangible investment is R&D investment. We use data from the U.S. National Science Foundation *National Patterns of R&D Resources* (1953–2002) to estimate total U.K. intangible investment by scaling up their expenditures on nondefense R&D. That is, we assume that the ratio of U.K. to U.S. intangible investment is equal to the ratio of U.K. to U.S. R&D investment. Assuming the same rates of accumulation in the United Kingdom and the United States, we set the ratio of investments equal to the ratio of the capital stocks.

We have estimates of nondefense R&D expenditures as a percentage of national GDP for the United States since 1953 and the United Kingdom since 1972. To estimate the ratio of spending in the 1960s, we use the earliest date available: 1972. For the 1990-2000 period, we have complete data. In 1972, nondefense R&D was 1.5 percent of GDP in the United Kingdom and 1.62 percent of GDP in the United States. Our estimate of

---

and vehicles in the category 'Equipment.' We include stocks and work in progress in the category 'Inventories.' Agricultural assets are included in all three, using the same proportional weights as nonagricultural assets. Software is not included with equipment as it is in the United States.

U.S. intangible capital is 0.71 × GDP. Our estimate of U.K. intangible capital is therefore equal to (1.5 × U.K. GDP)/ (1.62 × U.S. GDP) × (.71 × U.S. GDP), or .66 × U.K. GDP. For 1990-2000, nondefense R&D averaged 1.64 percent of GDP in the United Kingdom and 2.12 percent of GDP in the United States. With U.S. intangible capital estimated to be 0.65 times GDP, our procedure yields an estimate of (1.64/2.12)×.65, or 0.51 times GDP for the United Kingdom in the 1990s.

Here, we have used nondefense spending. Part of defense R&D spending should also be included, especially that which leads ultimately to nonmilitary applications and future profits for private corporations. If we include *all* spending on R&D, the ratio of U.K. to U.S. spending changes little. For the period 1990–2000, for example, total R&D spending in the United Kingdom averaged 1.95 percent of GDP. The United States spent 2.59 percent. The ratio of U.K. to U.S. total R&D spending, then, is 76.1 percent, which is very close to 78.6 percent in the case of nondefense spending. This difference is too small to affect our estimates quantitatively.

3.2.3. Foreign capital

Like the U.S. BEA, the U.K. ONS estimates tangible capital located domestically. We follow the same procedure as for the United States to get an estimate of the value of U.K. capital in foreign subsidiaries, both tangible and intangible. In particular, we assume that the ratio of domestic stocks to foreign subsidiary stocks is equal to the ratio of after-tax domestic corporate profits to after-tax foreign subsidiary corporate profits.

These ratios, along with the U.S. analogues, are reported in Table 4 of the paper for two periods: 1960–69 and 1990-2001. For the first period, we take data from the U.K. Central Statistical Office (1971) on intra-company receipts less payments listed for the overseas sector (Table 78) and divide it by company gross trading profits net of taxes and depreciation (Tables 27 and 58).[13]

For the 1990s, we use the ONS *Blue Book 1997*, which has the data we need to

[13] We use direct investment measures for the profit flows because the appropriation account for companies does not break out income from abroad into trading profits and net interest from abroad.

compute foreign after-tax profits relative to domestic after-tax profits. There has been a major revision in accounting methods since 1997, which makes it difficult to get measures of the subcomponents of operating surplus. In *Blue Book 1997*, the ONS reports detailed data for industrial and commercial companies (Table 5.2). We use this subgroup for computing our ratio because it is large and income from abroad is almost all trading profits. To compute the ratio in Table 4 of the paper, we take income from abroad less profits due abroad — both net of tax — and we divide by gross trading profits less depreciation and taxes.

3.3. Tax Rates

In this section, we describe the sources and estimates for the U.K. tax rates reported in Table 4 of the paper and used in our calculation of the fundamental value of U.K. corporations reported in Table 5. There are three rates: the tax rate on corporate income, the tax rate on corporate distributions, and the subsidy rate on investment.

3.3.1. Tax Rate on Corporate Income

The sources of data for the U.K. corporate tax rate are King and Fullerton (1984) before 1980 and the *Inland Revenue Statistics* afterward. Specifically, the tax rate used for the 1960s is that estimated by King and Fullerton (1984, Table 3.4). The tax rate used for the post-1990 period is the ratio of charges to corporation tax less the small company relief to the profits chargeable to corporation tax. (See *Inland Revenue Statistics, Table 11.2.*) After 1973, small companies faced a lower tax rate on their income. In 2000, for example, the full rate on corporations was 30 percent while the small company rate was 20 percent. (See the appendix in the *Inland Revenue Statistics* for a summary of historical rates.)

3.3.2. Tax Rate on Corporate Distributions

As in the United States, our estimate of the tax rate on corporate distributions is the tax rate on corporate dividends. According to Shirley (1997) and Hill and Taylor (2001), share buybacks are not quantitatively important in the period 1960–2001.

Estimates for the marginal tax rate on U.K. corporate dividends prior to 1970 are available from Orhnial and Foldes (1975) and Poterba and Summers (1984). Both calculate the tax generated from a distribution of £1 of additional dividend income in each year given proportionally to shareholders. Since the shareholders may be in different marginal tax brackets, the result is a weighted average of marginal rates. Orhnial and Foldes estimate rates for the period 1919–70, and Poterba and Summers estimate rates for the period 1955–81.

The period Poterba and Summers (1984) study includes a dramatic change in law that occurred in 1973. Prior to 1973, the U.K. system was very similar to the current U.S. tax system: profits are taxed once through the corporate income tax and again, if distributed to shareholders, through the personal income tax. After 1973, the United Kingdom had a partial imputation system. Under an imputation system, the taxes paid by the corporations are taken into account when calculating the personal income tax owed on a dividend distribution.[14]

Under the U.K. imputation system, a company paying a dividend first computed the *gross dividend*, which is the sum of the distribution plus a tax credit to be used by shareholders as credit toward their tax liability. For most years, if the shareholder was a basic-rate taxpayer (i.e., had a marginal tax rate in the basic rate range), then the credit was sufficient to cover the tax liability on dividend income. If the shareholder was a higher-rate taxpayer, then the credit covered only part of the tax liability. Until 1997, tax-exempt institutions such as pension funds received the credit despite the fact that there was no tax liability. If there are a lot of tax-exempt shareholders, then the effective tax rate can be negative.

We follow the same procedure as Orhnial and Foldes (1975), Poterba and Summers (1984), and King and Robson (1993) to construct average marginal tax rates on dividends for the period 1984–2000.[15] We split shareholders into three groups: taxpaying individuals,

[14] For a clear and detailed explanation of the U.K. system, see Bond et al. (1996).

[15] Prior to 1984, insurance companies had certain tax reliefs for dividends paid on policyholders' investments. It was not clear to us how to compute the overall effective rate for this group of shareholders during this period.

tax-exempt pension funds and charities, and insurance companies.

To compute marginal tax rates for taxpaying individuals, we use data from the *Survey of Personal Incomes*, which is included in the *Inland Revenue Statistics* after 1988.[16] In each year and for each income group, we compute the tax, before credits, from an additional £1 of dividend income. To obtain a weighted average marginal rate, call it τ, we use weights proportional to the group's dividend income.[17]

To compute an effective rate for taxpaying individuals, we need to take into account the tax credit they receive. If the pre-credit rate is τ, then the post-credit (or effective) tax rate is $\tau^{eff} = 1 - (1-\tau)/(1-c)$, where c is the credit. Thus, if the shareholder's tax rate is equal to the tax credit (as was the case for basic-rate taxpayers in most years), then the effective tax on dividends is 0. If $\tau > c$, as was the case in all years for higher-rate taxpayers, then the effective rate is positive, but necessarily less than τ.

To compute the effective tax rates for shareholders that pay no tax or pay reduced rates, we use the same effective tax formula. For example, a tax-exempt pension fund has an effective tax of $\tau^{eff} = 1 - 1/(1-c)$, which is negative. In the case of insurance companies, we assume that the credit offsets the tax liability, as assumed by King and Robson (1993). This implies an effective rate of zero.

The weighted average marginal rate that we compute is a weighted average rate for three groups of shareholders: taxpaying individuals, tax-exempt institutions, and insurance companies. To construct weights proportional to equity holding, we use data on beneficial ownership of U.K. quoted shares from *Share Ownership*. To net out intercorporate holdings, we subtract holdings of corporations. To compute domestic weights, we subtract the rest of world holdings. We also subtract public sector holdings, although they are very small.

We assign the remaining categories of owners listed in *Share Ownership* to our three

[16] We do not have an estimate for the tax year 1999-2000 because data based on the 1999-2000 Survey of Personal Incomes were temporarily withdrawn. Information for that survey from the Self Assessment business system was incomplete, leading to some components of income being missed. Revised estimates will be issued after October 2003.

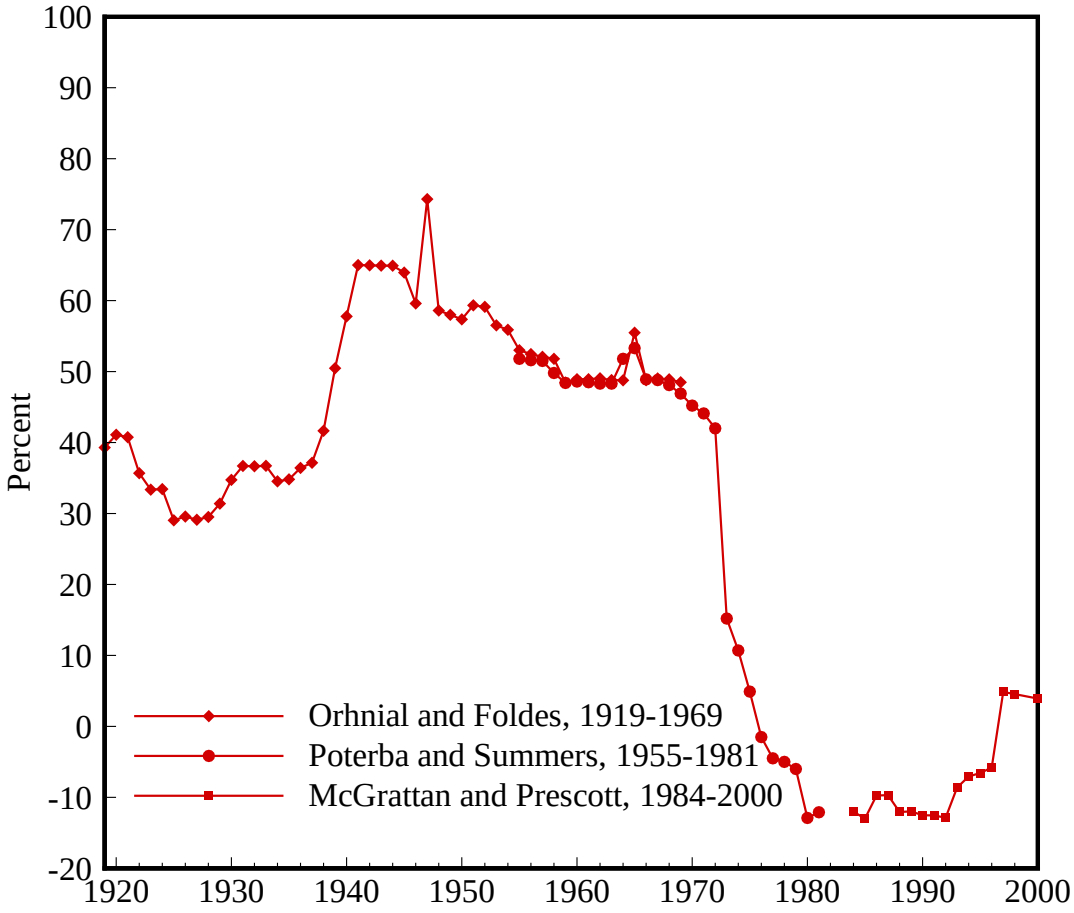
[17] As a check on the computation, we compare our estimates for taxpayers for 1985 and 1990 to those reported by King and Robson (1993). In 1985, their estimate is 0.412, while ours is 0.419. In 1990, their estimate is 0.333, while ours is 0.331.

groups. Those listed are individuals, unit trusts, pension funds, charities, and insurance companies. The category 'individuals' in *Share Ownership* includes taxable holdings and tax-exempt personal equity plans (PEPs) and investment savings accounts (ISAs). We split the holdings of this group into taxable and nontaxable holdings using data on the values of shares held in PEPs and ISAs (available at the Inland Revenue Web site www.inlandrevenue.gov.uk/stats). The values of shares in PEPs and ISAs are currently about 10 percent of individual holdings. We treat unit trusts like taxpaying individuals. We treat pension funds, charities, and the pension business of insurance companies as tax-exempt institutions. King and Fullerton (1984), using unpublished data of the Bank of England, estimate that 9/38 of insurance company holdings is attributable to the pension business. The remaining 29/38 is counted as life insurance holdings.

In Figure A10, we plot the time series using the estimates reported in Orhnial and Foldes (1975) for the period 1919–69, the estimates in Poterba and Summers (1984) for the period 1955–81, and those we compute for the most recent period. The figure shows a distinct break at 1973 when the imputation system started. During the 1980s and early 1990s, the effective rate is actually negative, since the fraction of tax-exempt shareholders receiving credits is large. In 1993, the rates start to head up somewhat. Prior to 1993-94, the credit was equal to the basic rate of tax. After that, the credit was equal to the lower rate of tax. Credits were given to all dividend recipients, even those that were tax-exempt until the law was changed in 1997. Under the Finance Act of 1997, the U.K. government no longer allowed certain tax-exempt shareholders, such as pension funds, to reclaim the value of their dividend tax credit. The figure shows a positive rate after that point.

These estimates of the effective tax rate on dividends do not take into account the fact that in some years many U.K. companies faced a lower rate of imputation because they had "surplus ACT." Between 1973 and 1999, the U.K. government required companies to pay gross dividends which were the sum of the distribution to shareholders plus an additional amount to cover shareholders' tax liabilities. The latter was called *advance corporation tax* or ACT, and was paid in advance of the date when corporation tax was due. The ACT paid by companies on distributed profits is imputed to shareholders and offsets all or

Figure A10. U.K. Average Marginal Tax Rate on Dividends



some of their personal tax liability on dividend income. When corporate taxes came due, companies could subtract what had already been paid in ACT from their total tax bill. If companies had taxable profits that were too low to recover all of their ACT, they were in a *surplus ACT* position.

Surplus ACT is relevant to the calculation of effective dividend tax rates because companies in a surplus ACT position face a lower effective rate of imputation. For example, suppose a company has £100 of income and wants to distribute all of it. Suppose also that taxable income for this company will be zero (say, because of generous investment subsidies). The company cannot distribute all £100 in a cash dividend. The cash dividend is £100 less c, where c is the ACT. The gross dividend is £100, and the shareholders pay

personal tax on this amount. The effective tax rate on dividends, then, is the marginal rate of the shareholder.

In Figure A11, we show estimates from Bond et al. (1996) of the proportion of companies in a surplus ACT position and the proportion that wrote off some ACT as irrecoverable. (This is Bond et al.'s Figure 2.) In Figure A12, we show the dividend payout ratio for the same period. (This is Bond et al.'s Figure 1, which is based on data from *Economic Trends Annual Supplement* (1994).) Notice that despite the very favorable tax treatment toward dividends after 1973, the payout ratio stayed low. According to Bond et al. (1996), part of the explanation was dividend controls in place between 1972 and 1979. But after 1979, surplus ACT was an important factor.

By 1990, the percentage of companies with surplus ACT fell below 10 percent and dividend payments recovered to pre-1973 levels. Thus, the figures reported in Table 4 of the paper are not going to be affected much if we take into account the surplus ACT.

3.3.3. Investment Subsidies

Investment grants were paid to corporations starting in 1967. According to King and Fullerton (1984), until 1970, all investment in manufacturing, construction, and extractive industries qualified for grants. For the period 1960–69, we estimate the rate of subsidy as the ratio of total investment grants to total corporate investment using data from the U.K. Central Statistical Office (1971). Table 29 has receipts of investment grants and investment expenditures for industrial and commercial companies. The ratio of investment grants to investment expenditures for these companies is 7.9 in 1967; 12.9 in 1968; and 14.3 in 1969. Table 30 has the same information for finance companies. The ratio of investment grants to investment expenditures is much smaller: 0.9 in 1967; 1.3 in 1968; and 1.4 in 1969. If we compute the ratio for all companies (shown in Table 28), we find an average rate of 3.1 percent for the period 1960-69 and a rate 12.7 percent in 1969.

The Industry Act of 1972 introduced a system of regional incentives, with grants for regional development and regional selective assistance. The regional development grants gave automatic assistance while regional selective assistance was discretionary. In 1988,

Figure A11. Percentage of U.K. Companies in Surplus ACT Position

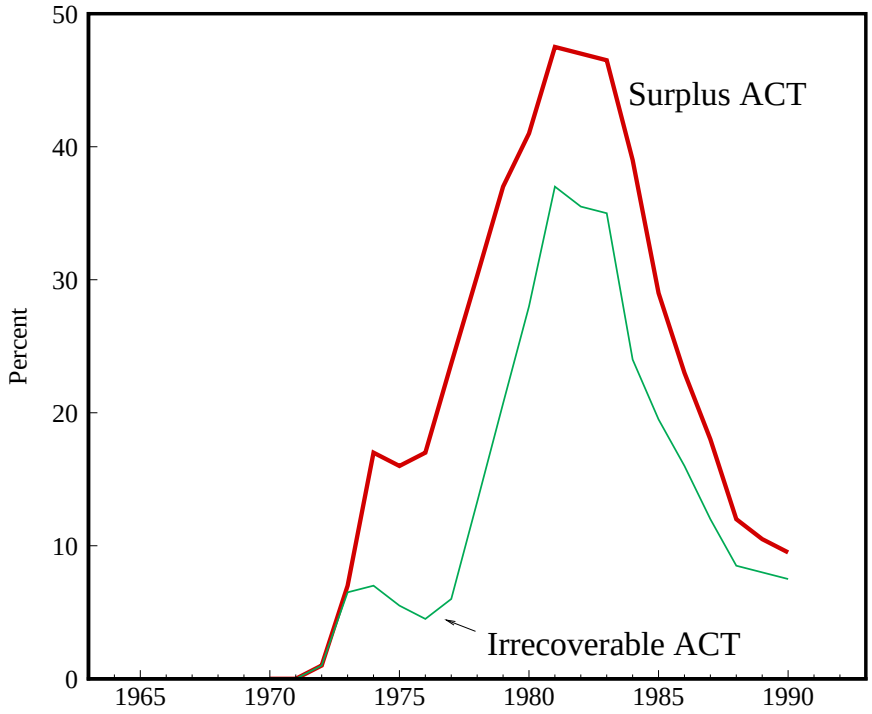
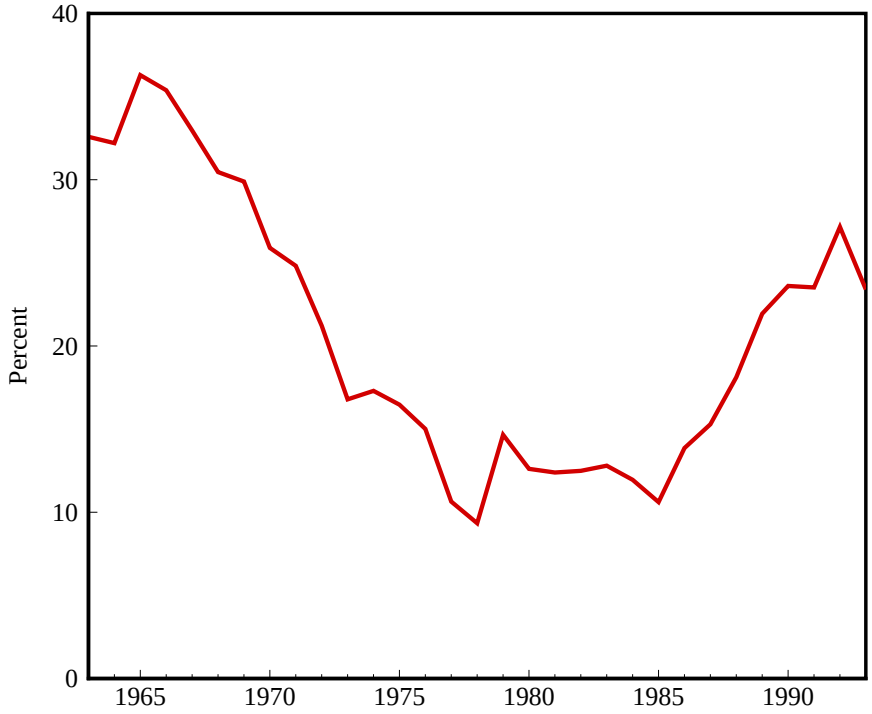


Figure A12. U.K. Dividend Payout Ratio



there was a shift away from automatic grants, which were closed to new applications at that time, to discretionary grants. (See King and Robson (1993) for more details.)

By the 1990s, we estimate that investment grants were significantly smaller than in earlier decades. Following the same procedure as above, we estimate the rate of subsidy as the ratio of total investment grants to total corporate investment. In this period, we use data from the *The United Kingdom Blue Book 2002*. Tables 3.3.7, 4.2.7, and 4.3.7 report investment grants and total gross capital formation for private nonfinancial corporations, monetary financial institutions, and other financial intermediaries and financial auxiliaries, respectively. There were no investment grants for the financial corporations during this time. The investment grants for private nonfinancial firms averaged only 0.85 percent of total corporate investment.

The three main sources for information on U.K. depreciation allowances are King and Fullerton (1984), and King and Robson (1993), and the appendix of *Inland Revenue Statistics*. The chapters by King and Fullerton (1984) and King and Robson (1993) provide historical background on the changes in rules. The *Inland Revenue Statistics* has a detailed timeline and the rates of allowances by asset type.

4. References

BOND, S., CHENNELLS, L. and DEVEREUX, M. (1996), "Company Dividends and Taxes in the UK", *Fiscal Studies*, **16**, 1–18.

COPELAND, C. (2001), "IRA Assets Continue to Grow", *Employee Benefit Research Institute Notes*, **22**, 5–8.

FEDERAL RESERVE BOARD OF GOVERNORS (1945–2002), *Flow of Funds Accounts of the United States* (Washington, D.C.: Federal Reserve Board).

FEDERAL RESERVE BOARD OF GOVERNORS (1945–2002), *Guide to the Flow of Funds Accounts of the United States* (Washington, D.C.: Federal Reserve Board).

FEENBERG, D. and COUTTS, E. (1993), "An Introduction to the TAXSIM Model", *Journal of Policy Analysis and Management*, **12**, 189–194.

FULLERTON, D. and KARAYANNIS, M. (1993), "United States", in D. W. Jorgenson and R. Landau (eds.) *Tax Reform and the Cost of Capital*, Chapter 10 (Washington, D.C.: Brookings Institution), 333–367.

GRULLON, G. and MICHAELY, R. (2002), "Dividends, Share Repurchases, and the Substitution Hypothesis", *Journal of Finance*, **57**, 1649–1684.

HALL, R. E. (2001), "The Stock Market and Capital Accumulation", *American Economic Review*, **91**, 1185–1202.

HILL, I. and TAYLOR, R. (2001), "Recent Trends in Dividends Payments and Share Buy-Backs", *Economic Trends*, February (London: The Stationery Office), **567**, 42–44.

KING, M. A. and FULLERTON, D., eds. (1984), *The Taxation of Income from Capital: A Comparative Study of the United States, the United Kingdom, Sweden, and West Germany* (Chicago: University of Chicago Press).

KING, M. A. and ROBSON, M. H. (1993), "United Kingdom", in D. W. Jorgenson and R. Landau (eds.) *Tax Reform and the Cost of Capital*, Chapter 9 (Washington, D.C.: Brookings Institution) 300–332.

INVESTMENT COMPANY INSTITUTE (1961-2002), *Mutual Fund Fact Book* (Washington, D.C.: Investment Company Institute).

INVESTMENT COMPANY INSTITUTE (2003), "Mutual Funds and the US Retirement Market in 2002", *Fundamentals*, **12**, 1–15.

LONDON STOCK EXCHANGE (2002), *Historical Statistics*, http://www.londonstockexchange.com/market/historic.asp.

MCGRATTAN, E. R. and PRESCOTT, E. C. (2003), "Taxes, Regulations, and the Value of U.S. and U.K. Corporations" (Staff Report 309, Federal Reserve Bank of Minneapolis).

MOYLE, J. (1971), "The Pattern of Ordinary Share Ownership", Department of Applied Economics, Occasional Paper 31 (Cambridge, U.K.: Cambridge University Press).

NATIONAL SCIENCE FOUNDATION (1953–2002), *National Patterns of R&D Resources* (Washington, D.C.: National Science Foundation).

ORHNIAL, A. J. H. and FOLDES, L. P. (1975), "Estimates of Marginal Tax Rates for Dividends and Bond Interest in the United Kingdom 1919–1970", *Economica*, **42**, 79–91.

POTERBA, J. M. and SUMMERS, L. H. (1984), "New Evidence that Taxes Affect the Valuation of Dividends", *Journal of Finance*, **39**, 1297-1415.

REVELL, J. (1967), *The Wealth of the Nation: The National Balance Sheet of the United Kingdom, 1957–1961*, Department of Applied Economics, Monograph 14 (Cambridge, U.K.: Cambridge University Press).

ROE, A. (1971), *The Financial Interdependence of the Economy* (London: Chapman and Hall).

SHIRLEY, P. (1997), "Share Repurchases", *Fiscal Studies*, **18**, 211-221.

STOCK EXCHANGE (1982), *The Stock Exchange Survey of Share Ownership* (London: Stock Exchange Publications).

STONE, R., REVELL, J. and MOYLE, J. (1966), *The Owners of Quoted Ordinary Shares: A Survey for 1963* (London: Chapman and Hall).

U.K. CENTRAL STATISTICAL OFFICE (1971) *National Income and Expenditure* (London: Her Majesty's Stationery Office).

U.K. CENTRAL STATISTICAL OFFICE (1979) *The Owners of Quoted Ordinary Shares: A Survey for 1975* (London: Her Majesty's Stationery Office).

U.K. CENTRAL STATISTICAL OFFICE (1981) "Financial Wealth of the Non-bank Private Sector", *Economic Trends*, July (London: Her Majesty's Stationery Office), 105–118.

U.K. CENTRAL STATISTICAL OFFICE (1994) *Economic Trends Annual Supplement* (London: Her Majesty's Stationery Office).

U.K. INLAND REVENUE STATISTICS AND ECONOMICS OFFICE (1984-1988), *The Survey of Personal Incomes* (London: Her Majesty's Stationery Office).

U.K. INLAND REVENUE STATISTICS AND ECONOMICS OFFICE (1970-2002), *Inland Revenue Statistics* (London: Her Majesty's Stationery Office).

U.K. OFFICE FOR NATIONAL STATISTICS (1987, 1997, 1998, 2002) *United Kingdom National Accounts, The Blue Book* (London: The Stationery Office).

U.K. OFFICE FOR NATIONAL STATISTICS (2002) *United Kingdom Balance of Pay-*

ments, The Pink Book (London: The Stationery Office).

U.K. OFFICE FOR NATIONAL STATISTICS (1994, 1997–2002) *Share Ownership: A Report on the Ownership of Shares at 31st of December* (London: The Stationery Office).

U.S. DEPARTMENT OF COMMERCE, Bureau of Economic Analysis (1929–2002), *Survey of Current Business* (Washington, D.C.: U.S. Government Printing Office).

U.S. DEPARTMENT OF TREASURY, Internal Revenue Service (1955–2000), *Statistics of Income* (Washington, D.C.: U.S. Government Printing Office).

YAKOBOSKI, P. (2000), "IRA Assets Total More than 2 Trillion", *Employee Benefit Research Institute Notes*, **21**, 1-3.