

# Explaining International Differences in the Cost of Capital

The chronic weakness of the U.S. trade position has raised concerns about what factors may lie behind this country's reduced competitiveness. One factor often cited in this regard is consistently lagging investment relative to other countries (Chart 1). Many elements can affect investment efforts. Certainly, the expected growth of markets for output is important, as is the pace at which technological change can be embodied in capital equipment. But differences in the cost of capital between nations are often viewed as contributing significantly to divergent investment performance.

This article estimates the cost of capital for corporations in the United States, Japan, Germany, and Britain in the period 1977-88 and finds that the United States and Britain labor under a decided disadvantage in relation to the other two economies. The second half of this article examines potential explanations for this finding.<sup>1</sup> We reject income tax structures as an important determinant of the cost of capital gap. Rather, we contend that higher household savings in Japan and

Germany and more successful policies for maintaining stable growth in Japan and stable prices in Germany have opened up the gap. In addition, we stress the importance of international differences in the relation of banks to industry and in the policy response to corporate distress. Industrial organization and policy enable firms in Japan and Germany to cheapen their capital through greater use of debt at lower risk premia.

Forces now at work to close the gap between the United States and United Kingdom, on the one hand, and Japan and Germany, on the other, may well prove slow acting and weak. There are signs that U.S. corporations, and perhaps also British corporations, are consciously leveraging up, spurred on by the cost advantages enjoyed by more leveraged international competitors. But leveraging may not be very effective in narrowing the gap. U.S. public policy toward financial distress puts the official sector at arm's length from corporate debtors and their creditors and tends to resist government bailouts or approved cartelization in troubled sectors. This policy of nonintervention, which touches values transcending the cost of capital, increases the degree of economic competition but raises the level of risk as well. That risk limits the extent to which U.S. and British corporations can cheapen their cost of capital through leverage.

Trends in the underlying determinants of the cost of capital suggest only limited prospects for improvement of the U.S. relative cost disadvantage without policy changes. Demographics will favor some rise in household savings in the United States; households abroad are likely to continue to gain more access to credit and

<sup>1</sup>Earlier, less systematic inquiries into the causes of the gap include Albert Ando and Alan J. Auerbach, "The Cost of Capital in the U.S. and Japan: A Comparison," *Journal of the Japanese and International Economies*, vol. 2 (1988), pp. 134-58; Albert Ando and Alan Auerbach, "The Corporate Cost of Capital in Japan and the United States: A Comparison," in John B. Shoven, ed., *Government Policy Towards Industry in the United States and Japan* (Cambridge: Cambridge University Press, 1988), chap. 2, pp. 21-49; George N. Hatsopoulos and Stephen H. Brooks, "The Gap in the Cost of Capital: Causes, Effects, and Remedies," in R. Landau and Dale Jorgensen, eds., *Technology and Economic Policy* (Cambridge: Ballinger, 1986), chap. 12, pp. 221-80. See our "Explaining International Differences in the Cost of Capital: the United States and United Kingdom versus Japan and Germany," Federal Reserve Bank of New York Research Paper no. 8913, for a more technical version of this article and more complete references.

thereby to lower their savings rate. Forces are operating to loosen the ties between Japanese and German corporations and their banks and to render government assistance to distressed sectors in Japan more difficult. These prospects alone, however, do not suggest a substantial closing of the cost of capital gap. More fundamentally, a monetary policy yielding stable prices and a fiscal policy consolidation offer the most potent means for the United States to redress its cost of capital disadvantage.

### Measuring the cost of capital

The cost of capital is the minimum before-tax real rate of return that an investment project must generate in order to pay its financing costs after tax liabilities. The cost of capital will be determined by the required payments to a firm's debt and equity holders, which we call the cost of funds, as well as by the economic depreciation of the investment, the tax treatment of that depreciation, the taxation of corporate earnings, and any fiscal incentives for investment.

Professional usage, as well as ordinary language, often equates the cost of funds with the cost of capital. Beyond the difference in terminology, however, lie two important economic distinctions. First, while a higher corporate income tax rate lowers the after-tax cost of funds by increasing deductions for interest payments, businessmen do not clamor for higher tax rates. Their behavior is understandable in light of the effect of higher taxes on the cost of capital for a given cost of

funds, a higher corporate income tax rate raises the cost of capital, since it increases the pre-tax rate of return that a project must generate. The net effect of an increase in the corporate tax rate is usually a rise in the cost of capital.

Second, while the cost of funds that a borrower faces is the same for all projects, the cost of capital is subject to influences that vary with the type of investment in different ways across countries. The most important influences are the tax treatment of depreciation and investment tax credits.

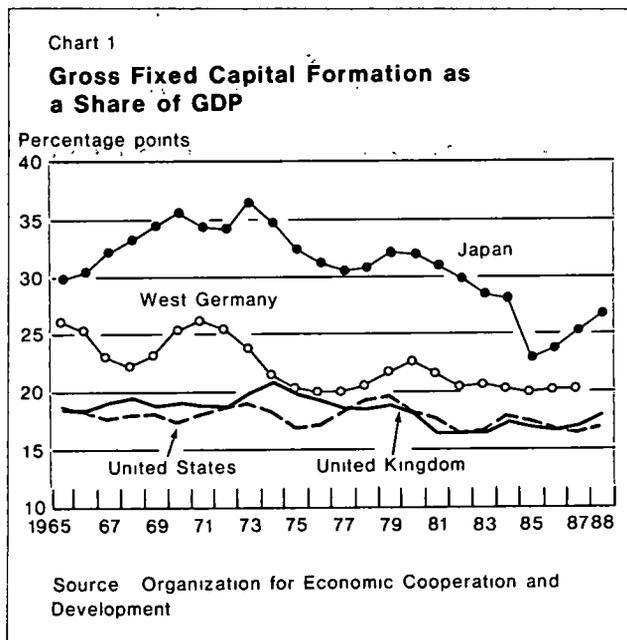
Judging whether corporations in one economy enjoy an advantage over their counterparts in financing a given project, therefore, requires more than analysis of financial market prices. One must demonstrate that any international disparity in the cost of funds survives differences in general corporate tax rates, investment tax rates, and depreciation allowed by national tax systems, taking account of the interaction of these factors with inflation.

### The cost of debt and equity

Investment can be financed by two basic kinds of claims on the stream of returns from the investment project: debt or equity. The cost of funds is defined as a weighted average of a firm's debt and equity costs. We measure first the cost of debt, then the cost of equity, and then combine the two according to the shares of debt and equity in the capital structure of the representative firm. Our measurements aim to capture the cost to the aggregate of nonfinancial firms in the four economies.

### The cost of debt

The cost of debt is defined as the real after-tax rate of interest faced by nonfinancial corporate borrowers. Estimating this measure begins with the nominal rate of interest paid by firms in each country on their mix of debt.<sup>2</sup> For reasons discussed below, this rate is then adjusted to account for the effects on borrowing costs across countries of different levels of liquid assets held by corporations. Inflation, measured by the GNP deflator, is subtracted from the nominal interest rate to give a more comparable measure of real rates of interest. Finally, the allowable deductions from corporate income taxes for nominal interest payments in all four countries are netted to put these real rates on an after-



<sup>2</sup>We assume that corporations finance themselves in their home currencies. Both survey results and anecdotal evidence strongly suggest that domestic firms borrow in foreign currency either to finance investment by subsidiaries abroad or to swap the proceeds into domestic currency. In the former case, the borrowing does not affect the cost of funds for domestic investment. In the latter case, the swap market is typically efficiently arbitrated so the all-in borrowing cost is the same in the domestic currency.

tax basis (Chart 2).

Corporate indebtedness comprises liabilities to banks, to bondholders, and to other creditors such as insurance companies and pension funds. Data from corporate balance sheets indicate that bank and bond debt typically amounts to 80 percent of total debt in each of the four countries considered. Owing to data limitations, miscellaneous debt has to be treated as an appropriately weighted mixture of bank and bond debt. Shares of bond debt and bank debt are then used to weight the interest rates payable on each in order to construct the nominal average cost of debt.

Bond yields are easy to observe, while the true cost of bank debt is more difficult. Bond rates are taken to be the yield on new issues of medium-term bonds of AA-rated corporate issuers. Measuring the cost of bank borrowing is not straightforward because a bank loan often represents just one item in a package of services that a corporation obtains from a bank.

Adjustment must be made for the differing propensities of corporations across nations to hold liquid balances. Liquid balances yielding less than market rates may be required by banks, especially in the presence of regulation of bank loan rates, to raise the effective cost of bank loans (see Appendix, equation 1).

Finally, accounting for differences in inflation and taxes permits a comparison of real after-tax effective rates of interest in the four countries (see Appendix, equation 2). Just as increased international capital flows in the 1980s have not equalized real interest rates,<sup>3</sup> so too they have not eliminated differences in real corporate borrowing costs (Chart 2). While the distortions of inflation are evident in the first half of the period, in the second half, real after-tax debt costs are similar for the United States (1.85 percent), Japan (1.82 percent), and Britain (1.82 percent). Low real rates after tax for German firms (-0.05 percent) reflect their heavy reliance on bank loans that have carried consistently low real rates of interest in this decade.

Differences in the pre-tax real cost of debt narrow when costs are put on a post-tax basis. Higher inflation economies improve their relative position because the entire nominal interest payment is deductible, even the portion that simply compensates lenders for the erosion of principal owing to inflation.

### *The cost of equity*

Measuring the cost of equity poses far greater difficulty than measuring the cost of debt. The preferred conceptual measure of the cost of equity is the sustainable post-tax profit rate. To give empirical content to that

concept requires a basic choice between two competing approaches. One method measures the pre-tax holding period return, both capital gains and dividends, as a proportion of market value. This ratio recommends itself because it captures the return realizable by shareholders. In the long run this method accurately measures the cost of equity, but in the short run it can mislead owing to its volatility. Worse yet, when market pricing shifts to incorporate a new discount rate for future cash flows, realized gains send the wrong signal. As the real long-term interest rate falls, for example, a corresponding decline in the required rate of return on equity is expected. For the ongoing return to equity to decline, stock prices must first rise to a new, higher level. The realized-gain measure, however, shows a short-term rise in the cost of equity. For such reasons, this study takes a second approach, accepting the market valuation of corporate earnings as the basic measure of the cost of equity. Adjustments are then necessary to produce comparable costs of equity because of international differences in inflation, depreciation rules, inventory behavior, ownership patterns, and accounting conventions.

Estimation of the cost of equity starts with the inverse of the value multiple that the equity market assigns to a given stream of earnings, the price-earnings ratio. Various potential adjustments can then be made to earnings to produce a true cost of equity.<sup>4</sup> Some adjustments apply to all countries — adjustments for the effects of inflation on depreciation allowances, on inventory profits, and on nominal interest payments and for the differential prospects of corporate earnings growth. Other adjustments are country-specific — in Japan, a novel adjustment for the underreporting of earnings on shares held by other corporations; and in Japan and Germany, adjustments stemming from additions to reserves for employees' retirement payments. Although each adjustment deserves examination, we do not deem it necessary or appropriate to implement every one.

(1) *Depreciation:* Earnings must be adjusted downward to reflect inflation's erosion of the historical values used for depreciation and upward to reflect acceleration of tax depreciation schedules. Economic earnings are overstated in an inflationary environment because historical costs used in tax and accounting allowances fall short of replacement values for plant and equipment. Partly in response to this distortion, tax laws at times speed up permitted depreciation rates beyond

<sup>3</sup>See Bruce Kasman and Charles Pigott, "Interest Rate Divergence among the Major Industrial Nations," this *Quarterly Review*, Autumn 1988, pp 28-44

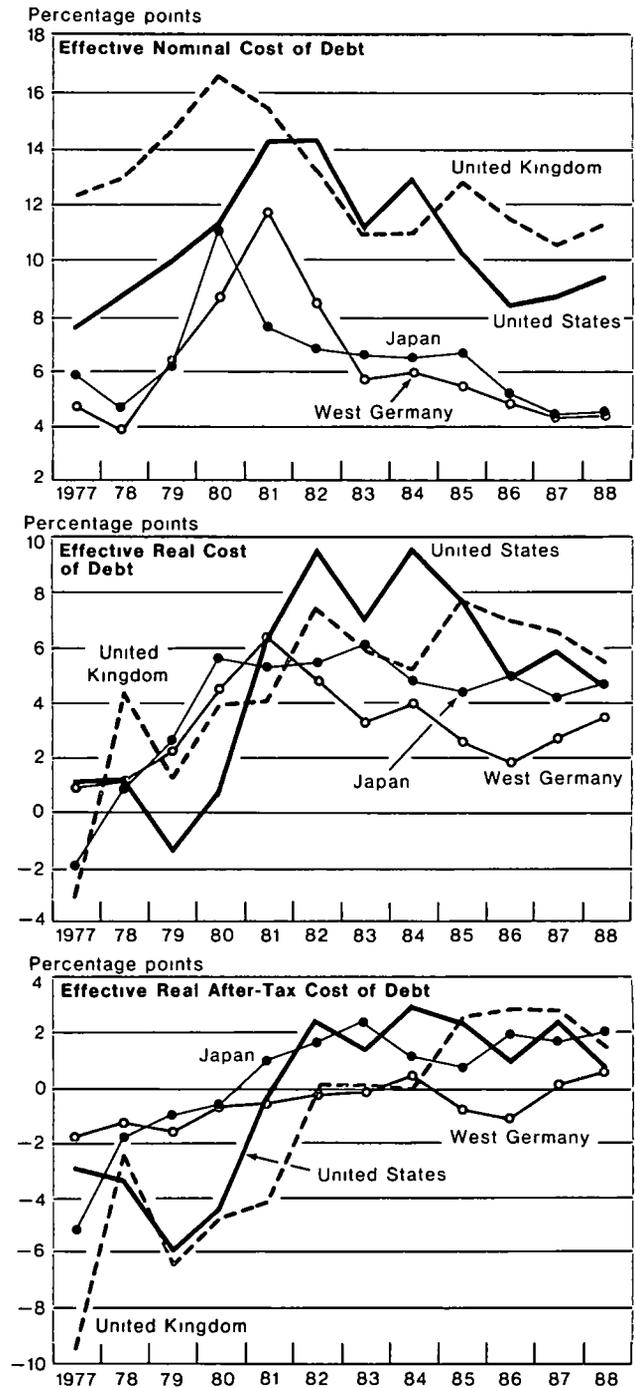
<sup>4</sup>Most of these adjustments are discussed in Ando and Auerbach, "Cost of Capital" and "Corporate Cost of Capital", and Hatsopoulos and Brooks, "The Gap." Paul H. Aron, "Japanese Price Earnings Multiples," Daiwa Securities America, 1981-87 reports, provides background on the interlocked shareholding pattern of Japan

Chart 2

The cost of debt is defined as the real after-tax interest rate faced by corporate borrowers. This measure is built up by starting with a weighted average of rates on bank and bond debt adjusted for differing propensities of firms to hold liquid assets, . . .

. . . then subtracting the actual inflation rate to produce a standard real rate of interest measure, . . .

. . . and, finally, correcting for allowable tax deductions on corporate interest payments to place costs on a real after-tax basis.



Note Chart 2 incorporates data from the following sources -- Federal Reserve Board, U.K. Central Statistical Office, Deutsche Bundesbank, Bank of Japan, Japan Ministry of Finance, International Monetary Fund, Organization for Economic Cooperation and Development, Yamachi Research Institute, Price Waterhouse, Statistical Office of the European Communities

economic rates. Earnings for all countries must be adjusted, but the procedures vary across the four countries, as outlined in the Appendix.

Only for Germany, where the tax code does not permit accelerated depreciation, does the adjustment consistently reduce earnings and the cost of equity (Table 1). The 1981 tax act lifted U.S. tax depreciation above economic depreciation from 1983 on. British companies experienced the opposite shift when they lost the ability to deduct much investment as an expense in the early 1980s. Accelerated depreciation in Japan has more than offset the effect of inflation in the latter half of the 1980s.

(2) *Inventory profits*: This adjustment reduces earnings to remove purely inflationary gains on goods in inventory. If a corporation uses first-in, first-out (FIFO) accounting, the real cost of goods sold will be understated by the extent of inflation over the inventory holding period. If the corporation uses last-in, first-out (LIFO) accounting, the real cost of goods sold will be understated when the firm reduces its inventory, with the size of the understatement dependent on the extent

of the inventory rundown and on the age distribution of the inventory. The appropriate inventory cost adjustment is straightforward for U.S. and U.K. corporations but more problematic in Japan and Germany (see Appendix)

(3) *Inflation's effect on nominal interest payments*: The overstatement of borrowing costs in an inflationary environment has a counterpart in the understatement of earnings. With no inflation, only real interest payments are subtracted from cash flow to arrive at earnings; with inflation, nominal interest costs represent not only the real interest rate but also a payment that compensates for inflation. In effect, this extra payment is a capital loss, not a current cost, and should not be accounted as a reduction in the firm's earnings.

For example, consider a firm with \$100 million of floating-rate debt and \$100 million of book equity financing nondepreciating fixed capital in an environment of 10 percent inflation and 12 percent nominal interest rates. Over a year, the firm contracts no net debt and reports no earnings. By usual accounting, its debt and equity remain unchanged, its capital structure remains half debt and half equity. It is true that in the previous year's prices, its debt has actually declined by 10 percent. But the debtholder is compensated by the inflation premium in the nominal interest rate. Most of the nominal interest payments serve as a realized capital loss, a liability equivalent of the inventory profits discussed in the preceding section, and should be removed from the income statement.

(4) *Differential growth rates*: Differing growth prospects for the corporate sectors of the four economies under consideration suggest another adjustment of the cost of equity measure. Theoretically, the cost of equity should be equal to the current profit rate, after appropriate adjustments, plus the rate of growth of profits. Making an allowance for different perceived growth prospects across nations is the analog of ascribing a fast-growing company's high price-earnings to rapid anticipated earnings growth rather than a low cost of equity. Ignoring the growth of profits tends to bias upward the cost of equity for low-growth countries relative to that of high-growth countries.

While the effect of expected differences in profit growth on cost of capital comparisons must be kept in mind, making precise quantitative adjustments is problematic. Japan, for example, is generally thought to have a higher potential growth rate than the other three countries, but the difference has narrowed in the last 10 years.<sup>5</sup> Whether the gap will continue to narrow or remain stable is necessarily difficult to say. Our approach to this problem is to recompute the cost of

Table 1

**Summary of Adjustments to Cost of Equity**

(Percentage Points Addition)

		1977-88	1977-82	1983-88
Depreciation	United States	0 70	-1 04	2 44
	Japan	-0 28	-0 94	0 38
	Germany	-2 42	-3 16	-1 68
	United Kingdom	-0 33	1 19	-1 85
Inventory	United States	-1 33	-2 21	-0 45
	Japan	-0 69	-1 22	-0 16
	Germany	-0 58	-0 87	-0 30
	United Kingdom	-2 67	-4 24	-1 10
Net nominal liabilities/inflation	United States	1 20	1 50	0 89
	Japan	2 27	4 02	0 51
	Germany	2 64	3 91	1 37
	United Kingdom	2 63	4 00	1 27
Growth	United States	2 3	2 3	2 3
	Japan	3 0	3 2	2 7
	Germany	1 8	1 9	1 7
	United Kingdom	1 4	1 2	1 7
Crossholding	Japan	1 17	1 19	1 14
Total	United States	2 86	0 54	5 18
	Japan	5 43	6 28	4 57
	Germany	1 43	1 77	1 08
	United Kingdom	1 06	2 09	0 02
Total without growth	United States	0 57	-1 74	2 88
	Japan	2 47	3 06	1 87
	Germany	-0 37	-0 11	-0 62
	United Kingdom	-0 37	0 94	-1 68

<sup>5</sup>Bruce Kasman, "Japan's Growth Performance over the Last Decade," this *Quarterly Review*, Summer 1987, pp 45-53

equity, adding to our current profit rate measures of the potential growth of the corporate sectors of the four economies as estimated by researchers at the International Monetary Fund<sup>6</sup> Building expected growth rates into the cost of equity lifts the U.S. average from just below to just above the U.K. average, Japan's advantage is preserved but narrowed by one percentage point (Charts 3 and 4) Because this adjustment is rough and does not significantly affect the ranking of the countries, we retain the original cost of equity measure without the growth rate adjustment.

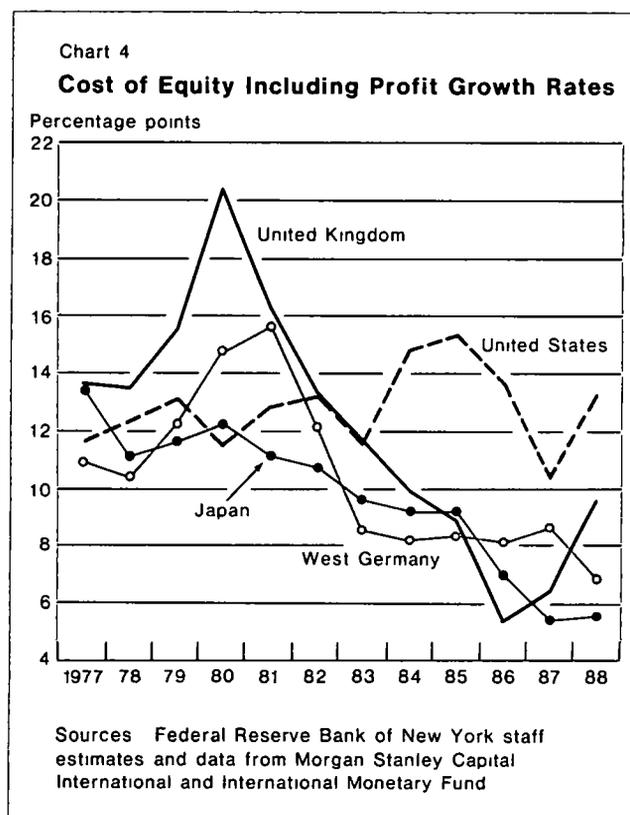
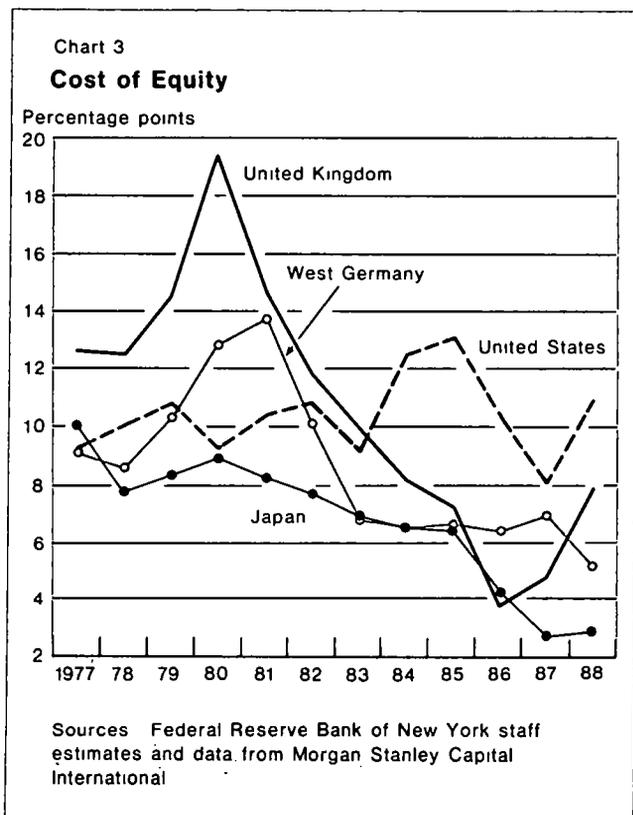
(5) *Crossholding of Japanese shares.* This adjustment, made solely to the Japanese costs of equity, accounts for the understatement of corporate earnings stemming from extensive ownership by affiliated firms of each other's shares. The need for this adjustment arises because a Japanese firm that holds less than a 20 percent share of a second corporation does not include the retained earnings of the latter corporation in its own reported earnings. At the same time, the crossheld shares are not excluded from the value of

the outstanding shares of the second company. As a consequence, the outstanding value of shares overcounts the net value held outside the corporate sector when compared to reported earnings. Since listed firms own a large and rising portion of all shares, crossholding results in a serious understatement of profits in Japan.

(6) *Employee retirement payments.* A final matter that merits discussion is how to treat reserves for employees' retirements. Some analysts have adjusted Japanese corporate earnings upward by treating these reserves as retained earnings. We consider this inappropriate and have made no such adjustment.

Japanese firms accumulate internal reserves against their promise to make a lump-sum payment of three or four years' wages to retiring workers. German firms accumulate reserves to pay retirement annuities, as do U.S. firms, but carry the funds as an on-balance-sheet liability and can use the funds for general corporate purposes, as in Japan. An important difference in fiduciary responsibility emerges. General Motors' pension management subsidiary by law cannot invest all its funds in its parent, but Daimler Benz may use employees' savings to finance plant and equipment or

<sup>6</sup>Charles Adams, Paul R. Fenton, and Flemming Larsen, "Potential Output in Major Industrial Countries," in *Staff Studies for the World Economic Outlook*, August 1987, p. 24.



acquisition of shares in suppliers or new businesses

For our purposes, however, it is irrelevant whether contributions are made to a retirement reserve that appears on the balance sheet, as in Japan and Germany, or to a "firewalled" pension fund set apart from the company, as in the United States or United Kingdom. While these differences may have significant implications for corporate control and market constraints on management, they do not drive a wedge between true profits and reported profits

Retirement funds affect the proper statement of profits only insofar as their value does not grow in line with the corporate obligation. To the extent that contributions to a retirement fund exceed the increase in the present value of retirement obligations, reported profits understate true profits. To the extent that contributions to a retirement fund fall short of the increase in the present value of retirement obligations, reported profits overstate true profits

Taking all these adjustments into account, we obtain the measures of the cost of equity in the four countries shown in Chart 3. Japanese corporations have generally enjoyed lower equity costs than the other three countries, and U.S. firms have generally faced the steepest equity costs. The effect of bull stock markets in the 1980s is evident in the generally declining trend of equity costs

A comparison of debt and equity costs shows that debt is generally cheaper than equity. Only for Japan in the last couple of years are the two costs close, that is, within 1 percent

### Cost of funds

The costs of debt and equity combine to produce a cost of funds. Weighting the two presents conceptual and measurement problems. This article adopts a weighting based on the market value of equity and the book value of debt. By this measure, German and Japanese corporations are more leveraged than U.S. and U.K. firms, and U.S. firms are leveraging up while Japanese firms are deleveraging at a more rapid pace (Chart 5)

The costs of debt and equity, weighted by book debt and market equity, yield an after-tax cost of funds (Chart 6). Japan and Germany claim the advantage of cheaper corporate funding. Japan's advantage derives from debt and equity that are both relatively cheap while Germany's advantage resides in cheap debt.

The argument for this choice of weighting scheme is grounded in both managerial practice and theoretical considerations. U.S. corporations actually use such a measure, and corporate funding in the four countries largely tracks it. While the measure is a simplification built on directly observable data, its deviation from the

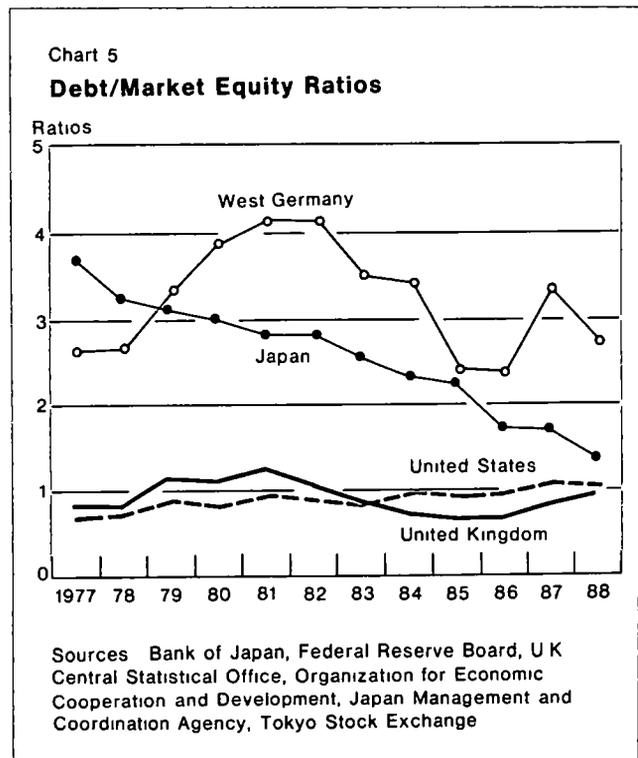
theoretically correct measure is limited.

### Changing capital structure

A problem arises in using observed capital structure to weight debt and equity costs if corporations are making their investment decisions on the basis of a planned change in the mix of debt and equity. Indeed, survey evidence on large firms' assessment of capital costs points to the importance of target capital structure.<sup>7</sup> If this structure differs from current capital structure, new financing patterns must be used to make the transition. Examination of the flow of actual financing can indicate the relation of target to actual structures. If the flow of financing for marginal assets matches the existing capital structure, then target leverage may be taken as equal to actual leverage in the aggregate. If the flow of financing does not match the stock, then further consideration of the appropriate weights for debt and equity is in order.

Changes in the relation of book debt to market equity arise from various sources. One source, the market

<sup>7</sup>Lawrence J. Gitman and Vincent A. Mercurio, "Cost of Capital Techniques Used by Major U.S. Firms: Survey and Analysis of Fortune's 1000," *Financial Management*, vol. 11 (Winter 1982), p. 23. For a comparison across countries, see James E. Hodder, "Evaluation of Manufacturing Investments: A Comparison of U.S. and Japanese Practices," *Financial Management*, vol. 15 (Spring 1986), pp. 17-24.



price of equity, is largely outside the control of management, while three others are under its more immediate direction net debt issuance, net equity issuance, and payment of dividends or, equivalently, retention of earnings. We consider a measure of the flow of financing decisions based on the three sources of change under management's control and then compare it to the ratio of book debt to market equity in the preceding period.

Management adds to real debt by net nominal debt issuance in excess of the rate of inflation. Many discussions of the sources of corporate financing fail to take explicit account of inflation in this manner, with the result that they overstate reliance on debt in cases of higher inflation. Management adds to equity through net equity issuance and through retained earnings, which may be thought of as sustainable profits less dividends paid out.

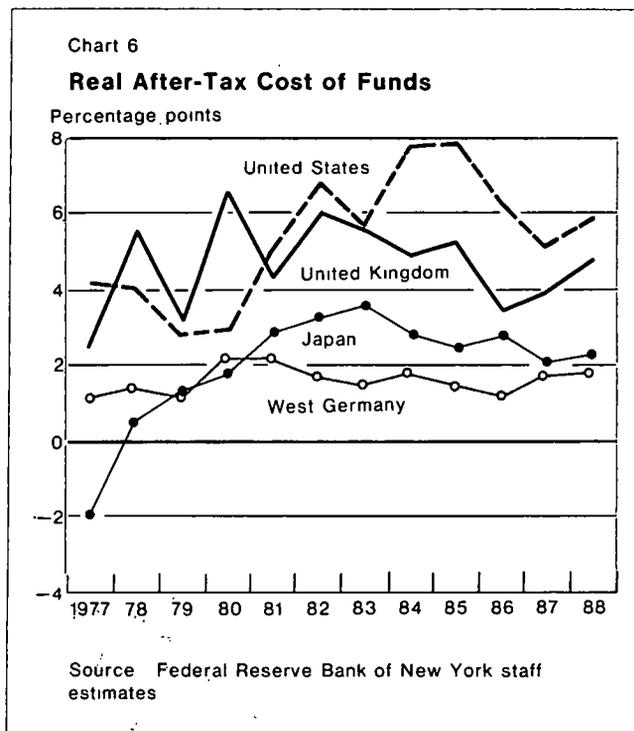
### Managed leveraging

We call the change in leverage over time produced by real net borrowing, retained earnings, and net equity issuance, "managed leveraging"<sup>8</sup>. This flow of financ-

$$\Delta DE_t = \prod_{i=0}^t \left\{ \left[ \frac{1 + Nd_i}{1 + \pi_i} \right] \cdot \left[ \frac{(1 + Ne_i) \cdot (1 + ev_i)}{(1 + dv_i)} \right]^{-1} \right\}$$

where

$\Delta DE_t$  = index of intentional change in debt/equity ratio  
 $dv_t$  = dividend rate at time  $t$

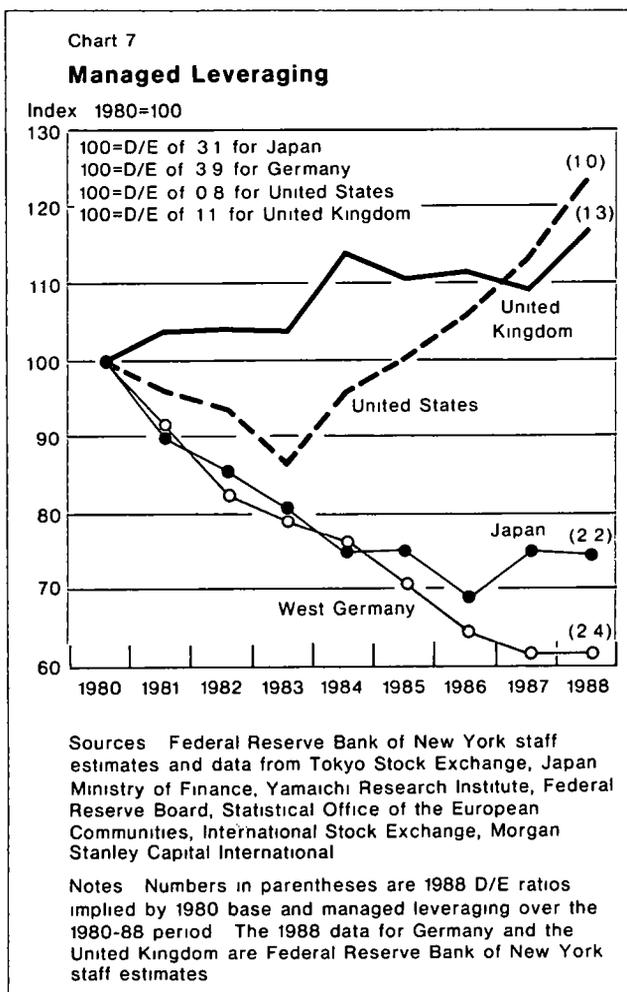


ing is displayed as an index in Chart 7 a rising index indicates that debt is rising faster than equity, a falling index shows that equity is growing faster than debt. The partial convergence of leverage across countries that showed up in measures based on the outstanding values of debt and equity (Chart 5) emerges in the financing flows indicator as well. This can be seen by comparing debt-equity ratios in 1988 with those for the base year.

U.S. firms have been actively leveraging up since 1983, British firms geared up in 1984 and again in 1988, while German firms are actively deleveraging. By contrast, Japanese firms do not appear to be managing a change in their leverage in the most recent years.

Footnote 8 (continued)

- $Ne_t$  = net equity issuance / market value of equity
- $Nd_t$  = net debt issuance / book value of debt
- $ev_t$  = adjusted profit rate
- $\pi_t$  = inflation rate for period  $t$



suggesting little aggregate difference between target and actual capital structure. We conjecture that German firms, under no pressure to disgorge equity through dividends and unable to repurchase shares, are letting the flow of retirement reserves replace debt.

The problem of a target capital structure that differs from actual structure remains for U.S. firms and, to a lesser extent, U.K. firms. Even if U.S. managers are relying heavily on debt to fund their marginal assets, however, their cost of funds does not in general reduce to the cost of debt. If an investment project is long-lived in relation to the transition period needed to reach the target capital structure, the target debt-equity ratio offers appropriate weights. Only if the project were to be exhausted during the transition period would the cost of debt alone be the appropriate cost of funds. In general, the weight of debt in the cost of funds is directly related to the portion (in present value terms) of a project's life falling in the transition period<sup>9</sup>

It is fair to presume that the transition period is short in relation to the life of the average investment project in U.S. corporate finance. Recapitalization through leveraged buy-outs, special dividends, and stock repurchases can take mere months and could hardly average more than two years. The average investment project, by contrast, stretches over seven years. Any error introduced by using actual debt in the weighting rather than target debt is limited since there is a strong presumption that a firm cannot plan to fund exclusively with debt.

### The cost of capital

The cost of funds does not measure investment costs but rather represents an intermediate step in figuring the cost of capital. The cost of funds does not account for all effects of inflation and taxation on corporate profits and neglects differences in depreciation schedules and investment tax incentives. No statement about relative costs of capital can safely be based on the relative cost of funds

<sup>9</sup>The appropriate weight of debt is given by the following  
 $dt = (\gamma t * d\tau_t) + ((1 - \gamma t) * dss_t)$ ,  
 where

$d\tau_t$  = debt as share of total financing flows during transition period

$dss_t$  = debt as share of total firm value in steady state

$$\gamma_t = \frac{\sum_{i=0}^m \left[ \prod_{k=t}^{t+i} (1 + R_k)^{-1} \right]}{\sum_{j=0}^n \left[ \prod_{h=t}^{t+j} (1 + R_h)^{-1} \right]} \quad \text{if } m \leq n$$

$\gamma_t = 1$  if  $m > n$

where  $m$  = length of transition period  
 $n$  = length of life of investment project  
 $R_t$  = discount rate for period  $t$

The appropriate hurdle for an investment project to clear is the cost of capital, the real pre-tax rate of return that covers both the company's after-tax cost of funds and its tax obligations. The cost of capital is satisfied when revenues cover (1) the cost of equity as weighted by equity's share in the capital structure, (2) the effective cost of debt as weighted by the debt share, and (3) income taxes, taking into account the tax value of any investment tax credit and depreciation allowance and discounting by the after-tax cost of funds (see Appendix).

The country rankings for the required rate of return on an investment in plant or equipment generally match the country rankings for the cost of funds (Table 2). This finding should be understood as the result of two forces working in opposite directions. Higher inflation raises the U.S. and U.K. corporate cost of capital by eroding the present value of depreciation allowances and generating spurious earnings on inventory, developments which both act to raise the tax on economic profits. But higher inflation in the United States and Britain is offset by tax rates that are lower than those in Japan and Germany.

The difference that inflation and investment tax policy make can be seen over time. Observe that the U.S. cost of funds rises over the sample period, while the cost of capital for a 20-year machine falls. High inflation in the early part of the period not only increased the interest tax deductions, as reflected in the cost of funds, but also eroded depreciation and imposed the "inventory tax," as reflected only in the cost of capital. In addition, accelerated depreciation for machinery over most of the latter half of the sample period lowered the hurdle rate for machinery.

That the British cost of capital for 20-year machinery and 40-year buildings tracks the cost of funds is partly coincidental. Sharp depreciation schedules in the first half of the period offset the tendency of inflation to raise the cost of capital.

The cost of capital captures differences in the relative cost of projects. The low cost of funds offers Japanese and German firms a greater advantage in long-term projects. U.S. firms actually had the lowest cost of capital for a three-year expensed project in 1984-86. The shorter the project life, the less important are funding costs, so the low U.S. tax rate dominated. The German and Japanese cost of capital advantage emerges and widens as the project life extends from 3 years to 20 years to 40 years to infinity, the life-span of investment in land.

The required rates of return for a research and development (R&D) project illustrate how a relatively high cost of funds erects a high hurdle for investments with delayed payoff and how a tax credit can lower the

hurdle The archetypal R&D project analyzed here bears fruit after 10 years and its yield falls off geometrically thereafter. The contrast between U S and Japanese required rates shows how delayed revenues magnify cost of funds differences The contrast is equally stark for U K and German required returns Cutting across these funding advantages, the tax credits of 20 percent to 25 percent for R&D enjoyed by U S and Japanese firms over these years lower their hurdle rates as compared to U K and German firms, respectively In the absence of the credits, the U S cost of capital for such projects would approximate the British cost, while the cost of capital for such projects in Japan would be closer to that in Germany It should be noted that these calculations do not capture the uncertainty attending the periodic renewal of the U S R&D credit or the availability of various R&D credits from the provincial governments in Germany

### Explanations of the cost of capital gap

Possible explanations of the gap in the cost of capital

fall into four broad categories (1) corporate and personal income tax structures, (2) factors affecting personal savings efforts, especially the rates of return required by households and the rationing of credit, (3) macroeconomic stability, and (4) capital structure permitted by relations among corporations, banks, and governments We reject the first explanation and accept the others with varying confidence

### Differences in personal and corporate income taxation

In a world with imperfect capital mobility we would expect a higher tax wedge between borrowers and savers to result in a higher cost of capital The reason is that a higher tax wedge requires a higher before-tax return in order to hit an after-tax target return for the investor A comparison of international tax rates, however, suggests that different overall income tax wedges do not explain differences in the cost of capital.

Table 3 shows the portion of a pre-tax dollar of corporate earnings that reaches a top-bracket taxpayer

Table 2

### Cost of Capital for Various Projects

Equipment and machinery with physical life of 20 years												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
United States	11.2	11.7	11.2	11.5	13.5	11.5	10.6	11.3	11.1	9.1	10.2	11.2
Japan	5.9	6.9	7.6	8.8	8.8	8.5	8.8	8.4	8.3	7.8	7.0	7.2
Germany	7.7	7.3	7.5	8.6	8.8	7.8	7.0	7.2	7.1	6.9	7.0	7.0
United Kingdom	8.8	10.8	9.8	12.7	10.3	10.7	10.8	9.3	9.4	7.8	8.2	9.2
Factory with physical life of 40 years												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
United States	10.0	10.4	8.9	9.3	10.1	12.4	10.8	12.8	12.6	9.3	9.0	10.2
Japan	2.8	4.2	5.1	6.2	6.8	6.6	7.0	6.3	6.1	5.8	4.8	5.0
Germany	5.5	5.5	5.6	7.0	7.4	6.3	5.4	5.7	5.5	5.2	5.4	5.4
United Kingdom	6.7	9.9	7.8	12.2	7.7	8.7	8.8	7.6	8.3	6.1	6.6	7.9
Research and development project with 10 year payoff lag												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
United States	12.5	12.9	11.9	12.4	8.3	18.4	15.2	20.3	20.2	16.8	18.2	20.3
Japan	3.9	5.7	6.5	7.3	8.0	8.3	8.7	7.7	9.2	9.4	8.4	8.7
Germany	13.4	13.8	13.3	15.6	15.7	14.7	13.9	14.6	13.9	13.2	14.4	14.8
United Kingdom	18.2	28.4	21.1	33.4	24.2	29.5	29.2	24.4	25.4	18.9	20.6	23.7
Expensed item with physical life of 3 years												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
United States	39.5	40.6	42.4	43.3	38.5	40.5	39.3	39.6	39.1	36.7	39.4	40.4
Japan	35.0	35.1	35.4	36.4	36.1	36.0	36.0	35.7	35.6	35.3	34.8	34.9
Germany	34.7	34.7	34.7	35.4	35.6	35.1	34.7	34.8	34.8	34.6	34.7	34.8
United Kingdom	39.4	40.6	41.4	42.5	40.5	40.0	39.6	38.4	37.7	36.1	37.0	37.4
Land												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
United States	10.5	11.1	8.6	9.6	12.6	15.3	12.5	16.1	15.8	10.4	9.3	10.6
Japan	-5.6	1.3	3.2	4.4	7.0	7.8	8.4	6.6	6.0	6.5	4.8	5.4
Germany	3.1	3.7	3.0	5.5	5.6	4.6	3.7	4.6	3.8	3.0	4.3	4.7
United Kingdom	6.8	14.2	9.6	17.8	11.7	14.6	12.5	9.7	9.2	5.4	6.2	7.7

Source FRBNY staff estimates

with a claim on the firm. The bottom of the table repeats that exercise for untaxed claimants. The tax systems of Britain and Germany are neutral with regard to top-bracket taxpayers: in both countries, after all local and national corporate and personal income taxes have been paid, the investor ultimately pockets about 40 cents of corporate net operating income, whether his claim takes the form of debt or equity. Note that the U.S. tax system is unique in strongly favoring debt issuance to both top-bracket and zero-bracket claimants.

Overall, U.S. and U.K. income tax wedges are no wider than those in Japan and Germany. The portion of financial assets in tax-exempt institutional portfolios is not so much higher in Japan and Germany than in the United States and Britain as to invalidate the comparison across countries for a given tax bracket. Thus tax differences alone do not offer a good explanation for the cost of capital gap. This is not to say that tax structures are without effect or that, say, elimination of the double taxation of dividends would not improve the cost of capital in the United States. Rather, other factors have worked to offset the U.S. advantage.

Since tax wedges in West Germany and Japan are no larger than those in the United States and the United Kingdom, it must be the case that the higher cost of American and British funds makes for higher

returns to savers in those countries. We examine three reasons why rates of return required by households may vary.

### Household thrift

The readiest explanation for the finding that households in Japan and Germany receive a lower rate of return on their savings is that they are thrifter. Certainly the observation that Japanese and German families save more of their disposable incomes (Chart 8) for lower returns provides first blush evidence of greater thrift than shown by American and British families. In other words, Japanese and German households appear to place relatively greater value on consumption tomorrow as compared to consumption today. What is more, U.S. fiscal deficits in the 1980s have reinforced the effect on national savings of U.S. households' impatience.

Some observers have argued that conventionally measured household savings rates overstate international differences because they treat spending on consumer durables as consumption rather than as savings.<sup>10</sup> In particular, Japanese households spend

<sup>10</sup>Michael J. Boskin and John M. Roberts, "A Closer Look at Saving Rates in the United States and Japan," in John B. Shoven, ed., *Government Policy Towards Industry in the United States and Japan* (Cambridge: Cambridge University Press, 1988), chap 5, pp 121-43

Table 3

### Effects of Income Tax Policy

#### Portion of Pre-Tax Corporate Dollar Reaching Top-Bracket Taxpayer through

	Interest	Dividends	Capital Gains
United States	0.65	0.403	0.403
Japan	0.332	0.187	0.4674
West Germany	0.44	0.44	0.41†
United Kingdom	0.40	0.455	0.455

#### Portion of Pre-Tax Corporate Dollar Reaching Zero-Bracket Taxpayer through

	Interest	Dividends	Capital Gains
United States	1.0	0.62	0.62
Japan	1.0	0.5634	0.4674
West Germany	1.0	1.0	0.41†
United Kingdom	1.0	0.65	0.65

Sources: Price Waterhouse, Organization for Economic Cooperation and Development

Memo: Claims of tax-exempt institutions as percentage of total financial claims —

United States 23 percent

Japan 25 percent

Germany 27 percent to 50 percent‡

United Kingdom 44 percent

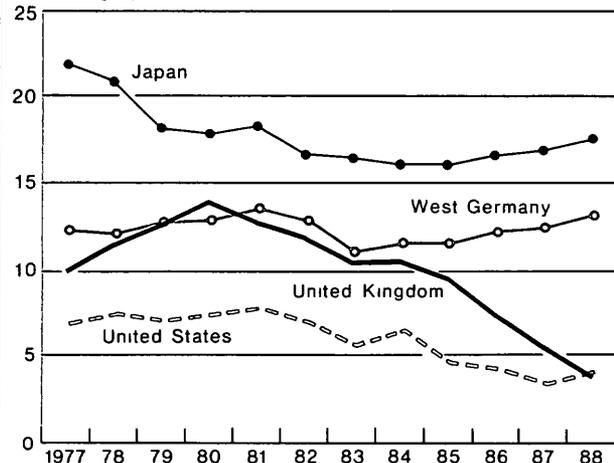
†Reflects long-term (over 6 months) capital gains tax

‡Tax status of some reserve funds unclear

Chart 8

### Household Savings as a Share of Disposable Income

Percentage points



Source: Organization for Economic Cooperation and Development

less on consumer durables than do U.S. households. The difference in purchases of consumer durables, however, is not sufficient to close the savings gap, which amounts to 12 percent of GNP. U.S. households' gross purchases of durables exceed those of their Japanese counterparts by 4 percent of gross national product and their net purchases are higher by only 1 percent of net national product. Furthermore, whether household incomes are spent on long- or short-lived consumption goods makes little difference to the supply of funds by households to business.

Other observers contend that the timing of wage and salary payments in Japan, with about a sixth of yearly pay taking the form of bonuses, accounts for apparently greater Japanese thrift. A study that argues in favor of this view suggests, however, that it cannot be the whole story. In particular, about 3 percent of the 20 percent of disposable income saved by Japanese families is ascribed to the greater propensity to save out of bonuses.<sup>11</sup>

The inference of greater thrift requires that households in the four countries face essentially the same opportunities and, in particular, that households must enjoy equal access to credit. Otherwise, the unavailability of credit compels consumers to save simply to buy an automobile or a house obtainable on credit elsewhere. In addition, the riskiness of fixed income and equity investments must be identical, or the higher rate of return in one economy may simply compensate households for greater risk. The two explanations considered below address differences in credit rationing and macroeconomic risk.

#### **Differences in the rationing of credit**

Systematic differences in credit availability across the four economies could help explain differences in the cost of capital. A report by the President's Commission on Industrial Competitiveness juxtaposed "low interest rates on business debt" in Japan with "a two-tier, regulated rate structure in which interest rates are far higher on consumer loans than on business loans."<sup>12</sup>

One measure of the access of families to credit, the ratio of consumer debt to household disposable income, suggests greater availability in the United States and, more recently, Great Britain and also some convergence of household borrowing across countries.

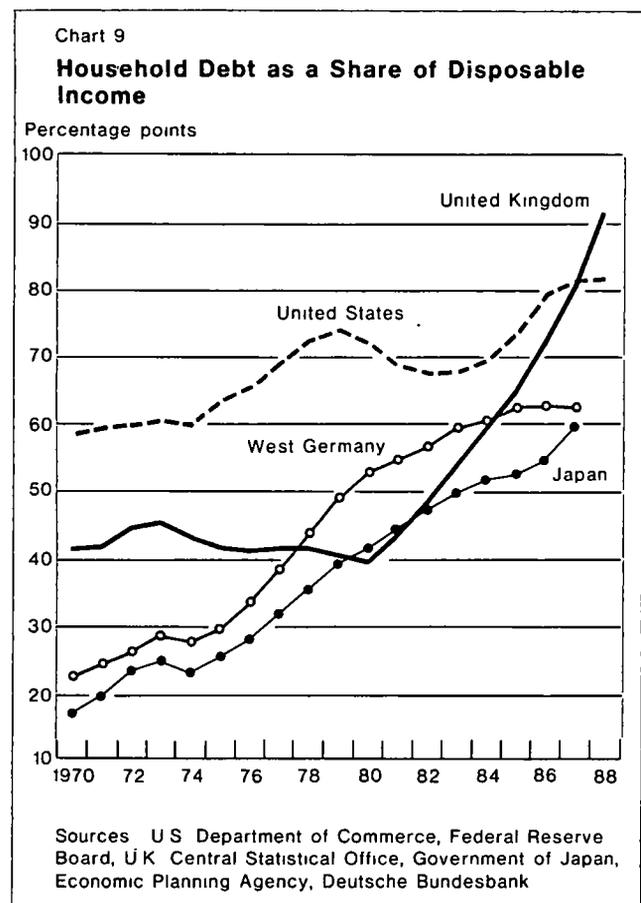
<sup>11</sup>Tsuneo Ishikawa and Kazui Ueda, "The Bonus Payment System and Japanese Personal Savings," in Masahiko Aoki, ed., *The Economic Analysis of the Japanese Firm* (Amsterdam: North-Holland, 1984), chap. 5, pp. 133-92.

<sup>12</sup>President's Commission on Industrial Competitiveness, *Global Competition: The New Reality*, vol. 2 (Washington: Government Printing Office, 1985), p. 114.

in the last 10 years (Chart 9).<sup>13</sup> This measure is hardly perfect, since one would expect it to vary with demographics, attitudes toward debt, and household financial wealth relative to household income, a ratio which remains highest in the United States. Still, these debt-to-income ratios point to the conclusion that the Japanese and German financial systems formerly did not pump much credit to consumers but now circulate credit more evenly, though American and British consumers may still enjoy a stronger flow.

Differences in tax and other policies underlie the place of household credit in the overall financial system. Consider official policies toward housing. U.S. housing finance claims advantage from a separate industry that historically enjoyed favorable administered deposit rates and that continues to enjoy government-sponsored funding and federal and federally sponsored guarantees of home loans. Mortgage

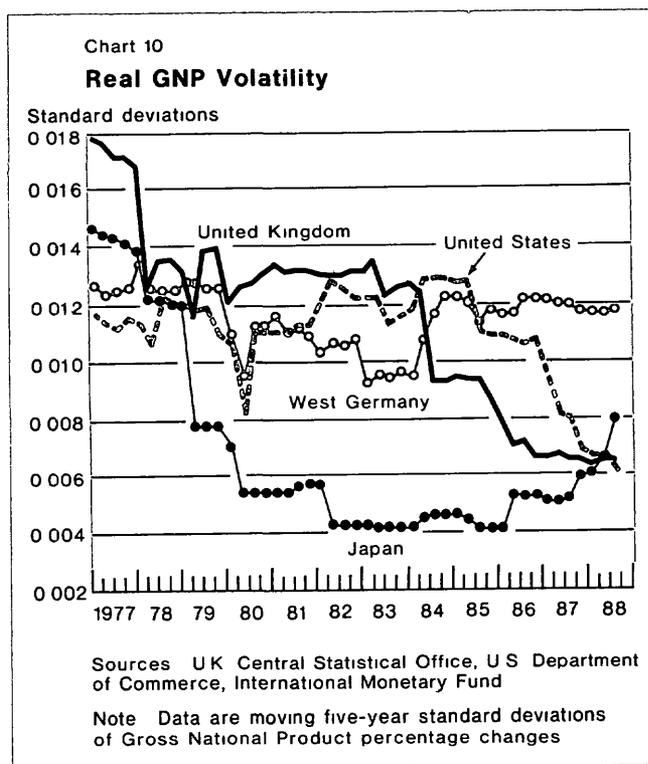
<sup>13</sup>Dorothy B. Christelow, "Converging Household Debt Ratios of Four Industrial Countries," *this Quarterly Review*, Winter 1987-88, pp. 35-47.



interest retains full tax deductibility although tax reform in 1986 equalized the treatment of consumer installment debt in the four countries. In Britain, mortgage credit exploded in the 1980s after quantitative constraints on the growth of bank balance sheets were abandoned and specialized mortgage lenders were afforded the opportunity to borrow funds wholesale. Germany shifted its fiscal support of housing in the last 10 years from permitting tax-deductible savings in mutual associations devoted to mortgage finance to allowing deduction of house depreciation in the first eight years of ownership. Official support in Japan is not so liberal—deductibility of mortgage payments is restricted to the first three years—but a government agency offers direct credit for families of moderate income.

### Macroeconomic stability

Savers in Japan and Germany may accept lower real rates of return because lower risk attaches to these returns. When corporate earnings are steady, equity investors assign a higher value to the earnings stream and the required return is lower. In the case of debt, when the overall level of prices is stable and predictable, savers do not demand compensation for the risk of losing their principal to inflation



Consider the volatility of real GNP as a measure of fundamental earnings risk. Real GNP offers quarterly data of reasonably consistent quality for the four countries. Real GNP volatility is measured as the standard deviation of the logarithm of 4-quarter growth rates over a rolling 20-quarter period (Chart 10). The volatility of corporate profits is not an appropriate measure because profits will tend to be more volatile in more highly leveraged economies, even when the underlying degree of macroeconomic risk is the same.

The steadiness of Japan's GNP growth is consistent with its relatively low equity costs. Note also that the rise in volatility of Germany's real growth in the latter half of the 1980s is consistent with the rise in Germany's equity costs relative to those of the other countries.<sup>14</sup>

An important source of the variability of real rates of return on debt is inflation. To compare price volatility across the four countries, consider a rolling, 36-month standard deviation of the log of the price level (Chart 11). We track the volatility of the level rather than its rate of change because a consistently high inflation rate is taken to pose greater risks to savers than a consistently low rate.

Comparison of the measures shows that Germany has enjoyed lower price volatility than the other countries studied. Low price volatility leaves German savers willing to accept low real rates of return on debt, just as Japan's low volatility of real GNP is associated with savers' assigning high prices to earnings streams. Japan also shows a lower price level volatility than the United States or the United Kingdom over the period examined, an observation consistent with the country's generally lower debt costs.

Viewed from the other side of the creditor-debtor nexus, low and stable inflation limits the risk of paying high real interest rates when an acceleration of inflation induces the monetary authorities to tighten. U.S. corporations and, to a lesser extent, U.K. corporations regularly issue long-term, fixed-interest debt in order to lock in fixed payments to shield their earnings from a sudden rise in higher real interest rates on short-term debt. This insurance carries a cost, however, since long-term, fixed-rate debt exacts over long periods a premium relative to the cost of short-term, floating-rate debt.

<sup>14</sup>Real cash flow volatility, measured as the standard deviation of annual changes in real cash flow, is an alternative measure. Real cash flow consists of after-tax corporate profits plus depreciation charges and interest payments converted into constant purchasing power by the GNP deflator. The ranking of the volatility of real cash flow growth in 1974-86 lines up with the ranking of the cost of equity, with the possible exception of Britain: 0.017 for Japan, 0.018 for Britain, 0.061 for the United States, 0.073 for Germany.

By relying heavily on floating-rate debt from banks, Japanese and German companies avoid paying this premium<sup>15</sup> To see that their funding habitat is associated with lower risks, consider the real interest volatility of prime corporate borrowing rates in the four countries (Chart 12). Corporations in Japan and Germany expose themselves to less risk in funding themselves at the short end of the yield curve owing to the more stable real rates associated with stable prices

What accounts for the differences in macroeconomic stability that affect the terms on which households make debt and equity available to businesses? One important influence is macroeconomic policy, which conventionally takes as its goals a stable price level and a smooth GNP expansion at the potential growth rate of the economy It seems fair, for example, to associate Germany's relatively stable price level with a steadfast anti-inflationary monetary policy But differences in performance reflect factors other than policy Japan's accomplishment of steady growth has been ascribed to the suppleness that its industrial organiza-

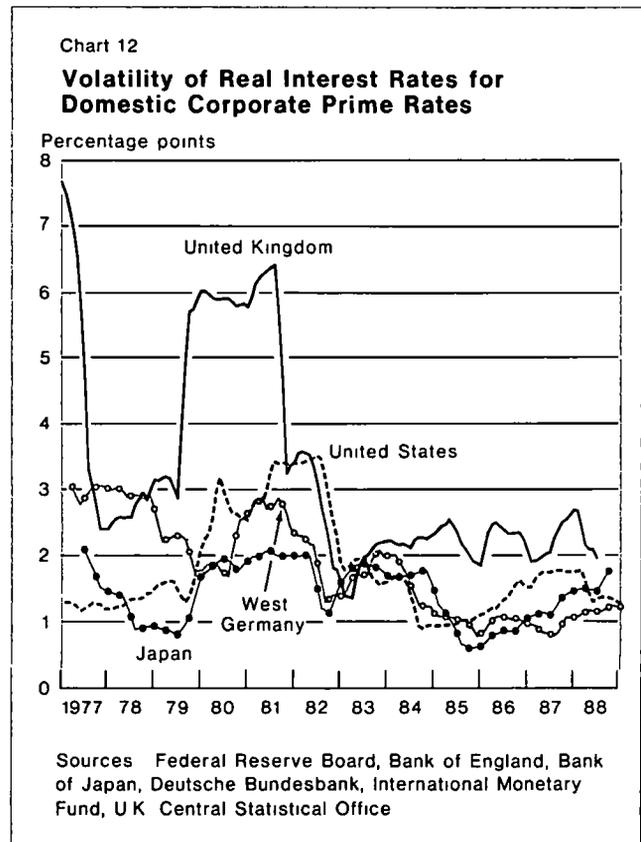
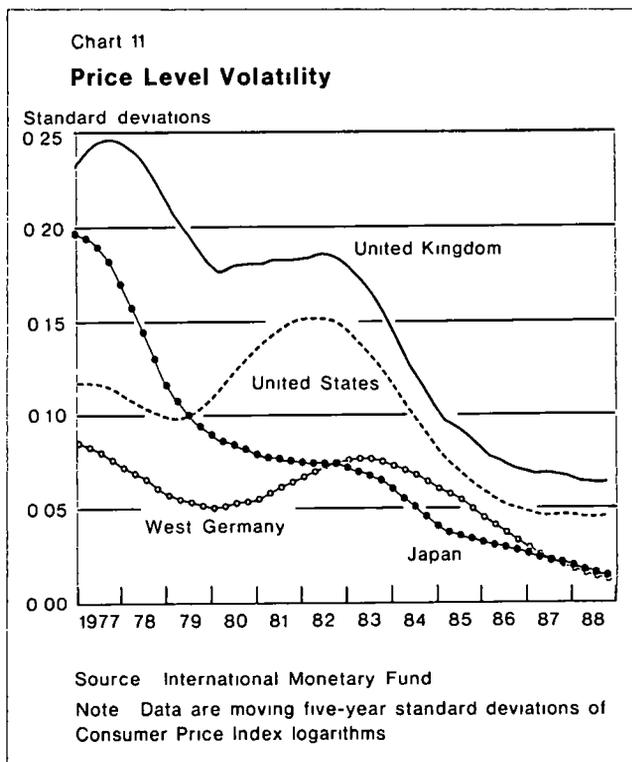
tion imparts to the economy in responding to shocks<sup>16</sup>

### Relations among corporations, banks and governments

Close relations between corporations and banks in Japan and Germany and official efforts in these countries to reduce the private costs of corporate distress permit corporations to finance themselves in ways that cheapen the cost of funds In particular, greater integration of industry and banking has permitted higher leveraging in Japan and Germany without raising bankruptcy rates much above those in the United States and Britain The stronger ties between corporate borrowers and their banks also reduce the liquidity risk that a firm runs by borrowing so much at short term Backstopping private creditors' management of difficulties is the Japanese and German governments' predictable willingness to spread the adjustment costs

<sup>15</sup>Debt to banks and short-term debt as a share of total debt are estimated from national sources at 93 percent for Japanese firms, 88 percent for German firms, 77 percent for British firms, and 28 percent for US firms over the 1977-88 period

<sup>16</sup>"The difference between Japan and other industrial economies in the effectiveness of macroeconomic policy may be attributable to a large extent to the institutional aspects of the industrial structure" Iwao Nakatani, "The Economic Role of Financial Corporate Grouping," in Masahiko Aoki, ed., *The Economic Analysis of the Japanese Firm* (Amsterdam: North-Holland, 1984), chap 6, p 246



beyond the immediately involved workers, managements, creditors, and shareholders to business customers, consumers, and taxpayers.

#### *Relations between corporations and banks: Japan*

A system of stable shareholdings binds most major Japanese corporations, their subsidiaries, suppliers, and sales corporations with one or two lead banks and affiliated mutual life insurers. Financial institutions, mostly banks and insurance companies, own a major and rising share of equities traded on the Tokyo Stock Exchange. Financial institutions appear to be even more important among shareholders of large Japanese companies: of 78 large firms studied 10 years ago, 61 were more than 75 percent owned by financial institutions.<sup>17</sup> The large firms in turn have set up or bought into smaller companies upstream and downstream—some in the same line of business, others in marketing, and still others in diverse fields such as real estate.<sup>18</sup>

Differences in the performance of Japanese firms within and without a *keiretsu*, the enterprise group as just defined, support the hypothesis that the “group functions as a social contrivance for reducing aggregate risk costs for relatively risk-averse member firms, with financial institutions acting as insurers.”<sup>19</sup> Operating profit and growth rates tend to be somewhat lower for firms within a *keiretsu*, but the variation of these rates is smaller. Both the dividend payout rate of affiliated firms and the variance of the interest rate on debt are lower, while their workers are better paid.<sup>20</sup>

The risk-sharing arrangement costs the corporation money and flexibility in good times but offers support in bad times. Corporations must maintain a high and stable outstanding debt to their respective main banks.<sup>21</sup> The short-term loans are governed by conditions that

“give Japanese banks rights to take assets, seize collateral or offset holdings to counter possible losses in event of threatened insolvency even though there is no literal default.”<sup>22</sup> When corporations are “heavy borrowers,” their “bank has considerable influence and, in some cases, veto power over capital spending plans. In the extreme, a firm in financial difficulties may suddenly find several of its top executives replaced by bank personnel.”<sup>23</sup>

When a corporate borrower faces difficulty, the main bank not only coordinates efforts by affiliates to increase purchases, to stretch receivables, or to accept transfers of lifetime workers, but also renders more than its share of financial assistance. This behavior has led more than one U.S. observer to describe the main bank’s lending as subordinated.<sup>24</sup> A comparison of the work-out of troubled companies AEG-Telefunken, Mazda, British Leyland, and Chrysler shows how Mazda benefited from its relation with its bank. Because of the steady information flow between the company and the bank, the bank’s rapid installation of new management, and the easy transfer of people and resources among bank affiliates, Mazda experienced less shrinkage than the other companies and was spared the direct government intervention, in the form of guarantees or loans, that figured in the other three cases.<sup>25</sup>

Financing and risk-sharing within the group of affiliated firms permits higher leveraging, especially for rapidly growing firms.<sup>26</sup> Nakatani finds that the affiliated firms’ ratio of own equity to total assets is 5 to 9 per-

<sup>17</sup>Tadanori Nishiyama, “The Structure of Managerial Control Who Owns and Controls Japanese Businesses?” *Japanese Economic Studies*, vol 11 (Fall 1982), pp 37-77

<sup>18</sup>Hiroshi Okumura, “Interfirm Relations in an Enterprise Group The Case of Mitsubishi,” *Japanese Economic Studies*, vol 10 (Summer 1982), pp 53-82

<sup>19</sup>Aoki, “Aspects,” p 25 Aoki suggests that companies select themselves into *keiretsu* membership according to risk aversion, but it is possible that expectations of strong profits result in nonmembership

<sup>20</sup>Nakatani, “Economic Role,” pp 227-64 Nakatani confirmed an earlier finding that affiliation does not raise profitability See Richard E Caves and Masu Uekusa, *Industrial Organization in Japan* (Washington Brookings Institution, 1976), chap 4, pp 59-87

<sup>21</sup>One observer has argued that Japanese banks forced their corporate customers to rely on bank debt beyond the fraction warranted by the interests of individual shareholders See Masahiko Aoki, “Shareholders’ Non-Unanimity on Investment Financing Banks vs Individual Investors,” in Masahiko Aoki, ed, *The Economic Analysis of the Japanese Firm* (Amsterdam North-Holland, 1984), chap 6, pp 193-224

<sup>22</sup>Andreas R Prindl, *Japanese Finance* (Chichester John Wiley & Sons, 1981), p 60

<sup>23</sup>James E Hodder and Adrian E Tschoegl, “Some Aspects of Japanese Corporate Finance,” *Journal of Financial and Quantitative Analysis*, vol 20 (1985), p 186

<sup>24</sup>Henry C Wallich and M I Wallich, “Banking and Finance,” in Hugh Patrick and Henry Rosovsky, eds, *Asia’s New Giant* (Washington, DC Brookings Institution, 1976), p 273, W Carl Kester, “Capital and Ownership Structure A Comparison of United States and Japanese Manufacturing Corporations,” *Financial Management*, vol 15 (Spring 1986), p 7

<sup>25</sup>Sumitomo knew of Mazda’s problems in part from the automobile firm’s dealers Robert B Reich, “Bailout A Comparative Study in Law and Industrial Structure,” *Yale Journal on Regulation*, vol 2 (1985), pp 163-224 See also Richard Pascale and Thomas P Rohlen, “The Mazda Turnaround,” *Journal of Japanese Studies*, vol 9 (Summer 1983), pp 219-63

<sup>26</sup>Nakatani, “Economic Role,” pp 240-42 Takeo Hoshi, Anil Kashyap and David Scharfstein, “Corporate Structure, Liquidity, and Investment Evidence from Japanese Panel Data,” September 1988, processed, p 30, report a median debt-equity ratio for affiliated firms of 1.09 and for independent firms, 0.76

cent lower than that of independent firms.<sup>27</sup> He interprets this finding: "since the risk of bankruptcy for a given debt-equity ratio is smaller for G [group] firms than I [independent] firms, the optimal debt-equity ratio...will be accordingly higher"

#### *Relations between banks and corporations: West Germany*

Close relations between banks and industry have a longer history in Germany than in Japan. The government initiated Japan's industrial development, and banks and industry conglomerated only after the government divested itself of most industry in 1880. The catch-up industrialization of Germany was directed in the first instance by banks that combined illiquid development or *credit-mobilier* banking with commercial banking in what became known as the universal bank.<sup>28</sup> Despite their long standing, the bank-industry ties in Germany appear weaker, less serviceable, and certainly more controversial than those in Japan.

Ownership stakes, reinforced by holding of proxies for almost all shares held in trust accounts, give rise to strong German bank representation in corporate governance. Thus while banks own less than 10 percent of market equity directly, their proxy voting rights give them control over nearly 60 percent of market equity value. The Gessler Commission in 1974-75 found that of the 66 large companies (excluding banks) surveyed, 51 had more than one banker on the board, and among the 74 large companies surveyed (including banks), 32 bankers served as board chairmen. Proxy holding and membership on boards were both concentrated among the top handful of banks.<sup>29</sup>

<sup>27</sup>A lively debate over whether Japanese firms are more leveraged than U.S. firms continues. Michel and Shaked compare 130 U.S. and 130 Japanese firms, 10 firms in 13 industries each, over 1977-81. The authors find that Japanese firms on average are more leveraged on a book equity basis but not on a market equity basis, although the Japanese average includes more highly leveraged firms. Allen Michel and Israel Saked, "Japanese Leverage: Myth or Reality?" *Financial Analysts Journal*, July-August 1985, pp. 61-66. Aoki knocks the debt-to-asset ratio from 0.82 to 0.62 for 1981 by taking account of the inflation of land prices and reserves for specific purposes and for employees' retirement pay; he notes that an adjustment should be made for shares carried at historic values. Aoki, "Aspects," pp. 16-23. Two economists at the Bank of Japan reduce the leverage of firms listed on the First Section of the Tokyo Stock Exchange to about one by revaluing depreciable assets and land; they note, however, that they did not net out any capital gains tax that might be payable on realization. Iwao Kuroda and Yoshiharu Oritani, "A Reexamination of the Unique Features of Japan's Corporate Financial Structure: A Comparison of Corporate Balance Sheets in Japan and the United States," *Japanese Economic Studies*, vol. 8 (Summer 1980), pp. 82-117.

<sup>28</sup>Alexander Gerschenkron, *Economic Backwardness in Historical Perspective* (Cambridge: Harvard University Press, 1962), pp. 5-30.

<sup>29</sup>Graham Bannock, "Banks and Industrial Management," in Economists Advisory Group, Ltd., ed., *The British and German Banking System: A Comparative Study*, chap. 5, pp. 201-34.

Greater bank control, as measured by bank representation on supervisory boards, proportion of voting rights controlled by banks, and bank loans as a share of total corporate borrowing, makes for a more profitable German company, according to one study.<sup>30</sup> Still, the author recognized the difficulty of attributing this finding to the alternative explanations of improved creditor monitoring or anticompetitive price-setting facilitated by networks of bank representation. The German Cartel Office's proposal to bar a bank's representatives from sitting on the supervisory boards of competing firms takes the second interpretation seriously.

The controversy that bank power has stirred in Germany may limit banks' effectiveness in monitoring firms. This issue arose over 10 years ago when a government-appointed commission measured the role of banks in corporate governance. Last June the Economics Minister, a member of the junior party in the coalition government, proposed a 15 percent limit on banks' stakes in industrial firms and a reduction in the number of supervisory board members from any one bank. The ongoing dispute over bank control can impede the flow of information among management, labor, and bank representatives on the supervisory board and can slow management changes.<sup>31</sup>

#### *Bank/firm relations, credit spreads, and leverage*

Close bank/firm links in Japan and Germany spread risks and reduce incentives for shareholders' agents to exploit creditors, so that leveraging can cheapen capital. In addition, the willingness of banks to lower distress costs by extending fresh credit to firms approaching bankruptcy probably averts a portion of the bankruptcies that would otherwise occur. Finally, even when bankruptcies do occur, the greater concentration of lenders works to minimize the deadweight losses. These institutional differences make it easier to live with relatively high interest costs in relation to cash flow (Chart 13).

The hypothesis that banking relations work differently across the four countries derives support from a comparison of corporate bankruptcy rates. The higher proportion of cash flow devoted to interest payments in Japan and Germany would suggest to a U.S. banker a higher rate of corporate bankruptcy in these countries than in the United States. But frequencies of bankruptcies — 1.6 percent for U.S. firms and 1.3 percent for U.K. firms as against 1.1 percent for Japanese firms

<sup>30</sup>John Cable, "Capital Market Information and Industrial Performance: The Role of West German Banks," *Economic Journal*, vol. 95 (March 1985), pp. 118-32.

<sup>31</sup>Reich, "Bailout," pp. 204-208.

and an estimated 0.7 percent for German firms in 1977-87 — do not bear out this expectation.<sup>32</sup>

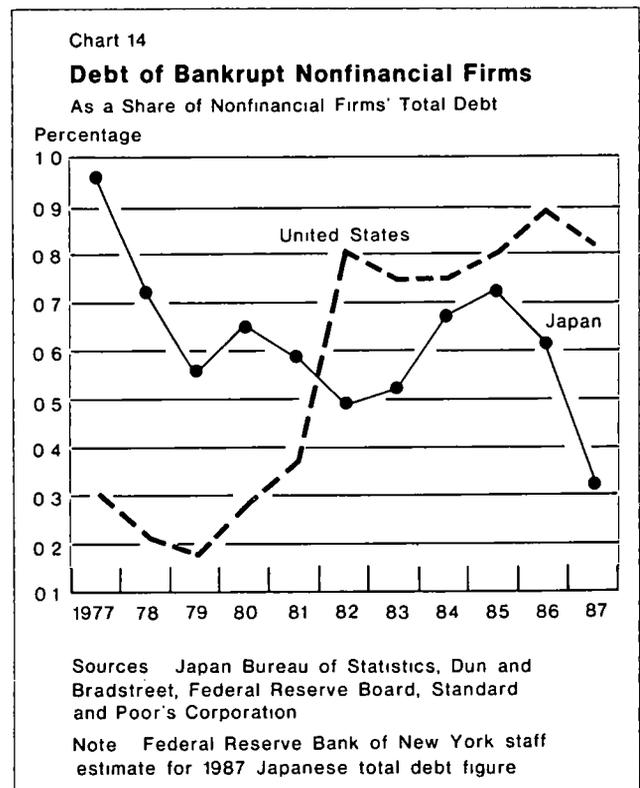
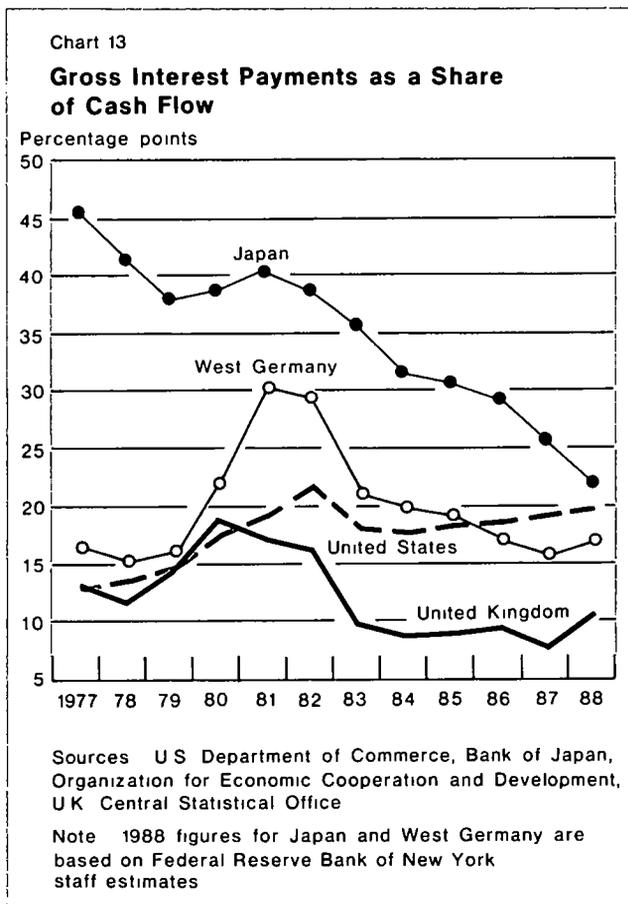
The proportion of corporate debts involved in bankruptcy, rather than bankrupt companies as a share of all companies, offers stronger evidence of the bearing of financial structure on the incidence of costly corporate distress. The measure controls for size of bankruptcy and the overall number of small firms. Although corporate leverage is higher in Japan than in the United States, the percentages of corporate debt in bankruptcy in the two countries from 1977 to 1987

<sup>32</sup>Edward I. Altman, "The Success of Business Failure Prediction Models: An International Survey," Salomon Brothers Center for the Study of Financial Institutions, Occasional Papers in Business and Finance, no. 5 (1982), p. 7. Altman's estimates have been updated with information from U.S. Department of Commerce, *Statistical Abstract of the U.S.*, Tables 836 and 846, *Statistisches Bundesamt, Statistisches Jahrbuch der Bundesrepublik Deutschland*, Table 7.17, Central Statistics Office, *Annual Abstract of Statistics*, Table 17.28, and Japan Bureau of Statistics, *Japan Statistical Yearbook*, Tables 11.1 and 11.8.

(Chart 14) are statistically indistinguishable.<sup>33</sup> The U.S. financial system is paying the price of leveraging up in rising bankruptcies while Japan is enjoying declining bankruptcies as leverage falls. Moreover, bankruptcy responds more strongly to changed leverage in the United States than in Japan. A 10 percent rise in U.S. leverage was associated with a 29 percent rise in the fraction of corporate debt in bankruptcy in 1977-87, over the same period a 10 percent decline in Japanese leverage was associated with a 7 to 10 percent drop in bankruptcy. Thus, the U.S. rate of corporate distress not only matches Japan's at a lower level of leverage but also appears to rise much faster in response to higher leverage.

Given the different relation of bankruptcy risk to cash flow coverage of interest, U.S. firms' ability to cheapen their cost of funds through leverage is limited. Crossing the credit spectrum from prime corporations through the middle market to highly leveraged firms, U.S. and U.K. banks increase credit spreads substantially, while Japanese and German banks, lending against assets

<sup>33</sup>The 0.62 percent average for Japan is insignificantly different from the 0.57 average for the United States, with a t statistic of -0.53.



and monitoring and controlling behavior better, do not.

A rough calculation suggests how doubling U.S. corporate leverage would close the cost of funds gap only marginally. A corporation leveraging up from a debt-equity ratio of 1.1 to 2:1 on a book basis falls from a BBB rating to a B rating, and interest payments rise from 18 percent of pre-tax cash flow to 36 percent.<sup>34</sup> Holding debt costs fixed, the leveraging would lower the overall cost of funds by 100 basis points, given a six percentage point difference in the cost of equity and debt and the shift of one-sixth of financing from equity to debt. But in 1989 B-rated bonds generally yielded over 150 basis points more than BBB-rated bonds.<sup>35</sup> Two-thirds of the capital structure is more expensive by this margin; so before taxes the 100 basis points are reclaimed by the higher credit spread. Because the spread is deductible, however, the net cheapening of the cost of capital is about 40 basis points, or only 40 percent of the value of leveraging up with no change in credit spreads.<sup>36</sup>

The exercise could be repeated for a corporation gearing up from AAA (book debt-equity ratio of 1:4) to A (1:2), with less lost in the 60 to 80 basis point widening of the credit spread. The conclusion to be drawn is that without tight links between creditors and corporations, the returns to gearing up are limited and they become more so as leverage rises.

#### *Government policy toward corporate distress*

Policy toward distressed industries in Japan and Germany also reconciles relatively high leverage with little risk premium in debt costs. The two countries deploy quite different policies to achieve much the same effect of socializing adjustment costs to relieve immediate creditors and employees of the full burden. Since the policies are broadly predictable, if not specified ex ante, risk premia do not have to be added to debt costs.

Japanese officials often waive antitrust structures to manage across-the-board cuts in capacity in distressed industries that allow adjustment costs to be paid out of higher prices. Mikuni provides a useful contrast between the "musical chairs" method of capacity reduction analyzed a century ago by the English economist Marshall, by which the least efficient producer goes out of business, and the "egalitarian method" of

proportional cuts as practiced in Japan, usually under the direction of a ministry, particularly the Ministry of International Trade and Industry.<sup>37</sup>

Japanese officials use other methods as well, and exit by smaller firms plays an important role in more competitive industries.<sup>38</sup> In aluminum smelting, 57 percent of 1977 capacity was targeted for removal, and firms were subsidized in proportion to their capacity cutbacks out of the proceeds of a tariff on imported aluminum. The subsidy of 6.6 percent of book value of the scrapped or mothballed capacity covered interest costs and amounted to over a quarter of the losses reported by the aluminum companies between 1976 and 1983. In the more competitively structured industry of shipbuilding, an industry association was granted an antitrust exemption and received a loan from the governmental Japan Development Bank and commercial banks in order to buy up and to scrap 12 percent of capacity. Official loans to business to enter new lines or to repay loans collateralized by factories in order to scrap them and to sell off land are sometimes extended. Through such means the taxpayer joins the consumer in sharing the costs of shrinkage.

German officials rely much more on subsidies to declining industries, and even to some "sunrise" industries such as aircraft and aerospace, although the European Community oversees concerted capacity shedding in the steel industry.<sup>39</sup> Of course, the U.S. government shelters some industries that are under pressure by establishing voluntary export restraints and has provided federal rescues in the cases of Lockheed and Chrysler. Still, it is fair to say that such intervention remains quite controversial in principle and practice in the United States, where public policy generally seeks to promote competition and economic mobility. Under such a policy stance, however, and from the standpoint of a creditor, any potential government assistance would appear much more uncertain in the United States than in Japan or Germany and thus much less likely to be reflected ex ante in risk spreads.

#### **Forces at work for change**

Long-term structural forces are working in directions that narrow the cost of capital gap, but at slow and uneven rates, so that their effect will probably be lim-

<sup>34</sup>Robert C. Nelson, "Key Industrial Financial Ratios," *Standard & Poor's Credit Week* (September 5, 1988)

<sup>35</sup>The spread averaged 205 basis points in the first half of 1989 and ranged between 122 and 264 basis points, according to *Standard & Poor's Credit Week*

<sup>36</sup>Compare Carliss Y. Baldwin, "The Capital Factor Competing for Capital in Global Environment," in Michael Porter, ed., *Competing in Global Industries* (Boston: Harvard University Press, 1986), p. 199

<sup>37</sup>Akio Mikuni, "Mikuni on Banking," Mikuni and Company, Occasional Paper no. 2, December 1987

<sup>38</sup>See Merton J. Peck, Richard C. Levin, and Akira Goto, "Picking Losers: Public Policy Toward Declining Industries in Japan," in John B. Shoven, ed., *Government Policy Towards Industry in the United States and Japan* (Cambridge: Cambridge University Press, 1988), chap. 8, pp. 195-239

<sup>39</sup>Organization for Economic Cooperation and Development, *OECD Economics Surveys, 1986/1987: Germany* (Paris: OECD, 1987), p. 56

ited for some time.

- Demographic trends in the United States on the one hand, and Japan and Germany, on the other, may favor some closing of the household savings gap. Projections of population shares in the productive and retired years suggest some scope for the improvement of the U.S. savings rate and, to a lesser extent, U.K. savings rate relative to that of Germany over the next decade or so and to that of Japan over the longer term.<sup>40</sup>
- Availability of, and popular attitudes toward, consumer credit in the four countries appear to be converging and may well continue to do so.
- Ongoing restructuring of the U.S. and U.K. financial markets points to some integration of banking, securities, and insurance activities, but not to a tightening of the links between finance and industry. Government intervention on behalf of declining or sunrise industries may have increased, but it remains limited and hardly represents a reversal of U.S. policy. In this context, the corporate leveraging evident in U.S. financial markets, which some observers interpret as an attempt to cheapen capital in response to competitive challenges in the goods market, is likely to ratchet up borrowing costs and to improve the U.S. position only marginally.
- In Japan and Germany, the close relation between banks and industry, one prop for relatively high leveraging, may prove unable to carry as much weight as in the past. Another prop, the government's policies toward sectoral adjustment, may become less reliable as foreign manufactures increase their penetration of the Japanese domestic market.

Several forces are working to drive a wedge between banks and corporations in Japan and Germany. Slower growth of the Japanese economy in this decade and the growing access of larger Japanese corporations to bond finance and, through equity warrants, to equity finance in the Euromarket are freeing them from reliance on their traditional banks to finance growth. Indeed, some large firms are competing with banks as they turn corporate treasuries into profit centers. The equity crossholdings between Japanese banks and their borrowers may diminish, according to some observers, as Japanese banks attempt to meet the new

international capital standards.<sup>41</sup> Japanese banks are looking to raise sums of equity through issuance of shares, convertible bonds, and equity warrants in Tokyo and London; their traditional shareholders may well wind up with a relatively diminished stake. At the same time, Japanese banks may prove less willing to buy the low-yielding and, by the new rules, risky shares of clients or would-be clients. Increasing foreign penetration of the Japanese market for manufactured goods renders the egalitarian method of capacity reduction in troubled industrial sectors more difficult.<sup>42</sup>

German corporations for their part are turning more to their employees for funding, given firms' immediate access to rapidly growing company pension reserves. Further, steps toward financial integration in the European Community may well resolve the long-simmering controversy in Germany over the permitted level of equity participation by banks in corporations and lead to limits on banks' involvement.

In the short run, though, these changes serve only to increase the options open to Japanese and German corporations, which give evidence of improving their competitive position by taking advantage of the new funding opportunities. Only the change in bank capital regulation poses short-term constraints that might create a situation less favorable to the corporations. In the long run, more subtle complications may arise: for instance, the seniority of the claims of German workers over bank creditors might at some point force German banks to reconsider their lending terms.

### The policy challenge

Despite the longer run forces working toward some convergence in household saving behavior and consumer indebtedness, a considerable gap in the cost of capital between the United States and Great Britain, on the one hand, and Japan and Germany, on the other, is likely to remain open. The prospects advise against waiting and hoping for demographic and consumer borrowing trends to improve the U.S. position. The analysis above suggests a role for policy.

First, a monetary policy that takes price stability as its object is critical to U.S. competitiveness. Steadier prices will over time reduce the inflation premium in corporate borrowing costs. In addition, a lower volatility of nominal and real interest rates, typically associated with steadier prices, may allow U.S. corporations to finance themselves more at the short term and thereby

<sup>40</sup>Peter S. Heller, "Aging, Savings, and Pensions in the Group of Seven Countries 1980-2025," International Monetary Fund Working Paper no. WP/89/13, January 31, 1989, pp. 1-35.

<sup>41</sup>Masaaki Kurokawa, Chairman, Nomura Securities International, speech to conference on "The American Corporation and the Institutional Investor: Are there Lessons from Abroad?" Center for Law and Economic Studies, Columbia University School of Law, May 23, 1988, pp. 8-9.

<sup>42</sup>Akio Mikuni, "Mikuni," pp. 8-9.

to avoid paying the risk premium built into longer term yields. In any case, the social benefit from stable prices extends well beyond the welfare costs of the inflation tax, summarized by the increased transactions costs incurred in more active management of cash holdings.

Second, fiscal actions could help close the cost of capital disparity. Even though income tax structures do not themselves account for international differences in capital costs, eliminating the double taxation of divi-

dends in the United States could only work in the direction of improvement. But a lower level of government dissaving is also important. Fiscal consolidation that reduces the government's call on private savings without relying on taxes that discourage savings or investment would also help to narrow the gap.

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## Appendix

This appendix details the calculation of the cost of capital. We follow the same sequence of topics as in the text of the article: the cost of debt, the cost of equity, the cost of funds and the cost of capital.

### Cost of debt

We make the following adjustment for liquid balances

$$(1) \quad i e_t = \left\{ \frac{(i_t \cdot Db_t) - (i_t \cdot l_t)}{Db_t - l_t} \right\} \cdot \alpha_t + (i b_t \cdot (1 - \alpha_t)),$$

where

$i e_t$  = effective nominal interest rate  
 $i_t$  = bank lending rate  
 $i l_t$  = interest rate on liquid assets  
 $i b_t$  = yield on new intermediate term bonds  
 $Db_t$  = book value of bank debt

$$\alpha_t = \text{share of bank debt} = \frac{Db_t - l_t}{Db_t - l_t + B_t}$$

$B_t$  = book value of outstanding bonds

$$l_t = i b_t \cdot \left[ 1 - \left\{ \left[ \frac{i b_t}{B_t + Db_t} \right] \cdot \left[ \frac{i b_t}{B_t + Db_t} \right]^{-1} \right\} \right]$$

$i b_t$  = cash and short-term time deposits

(bar over variable signifies four-country average)

The real cost of debt is calculated by taking the firms' nominal interest costs, factoring out inflation, and subtracting the tax deduction for interest payments

$$(2) \quad r_t = \frac{1 + i e_t}{1 + \pi_t} - 1 - (i e_t \cdot t c_t),$$

where

$r_t$  = real after-tax rate of interest  
 $\pi_t$  = inflation rate for period  $t$  (from GNP deflator)  
 $t c_t$  = corporate tax rate at time  $t$ .

### Cost of equity

We adjust depreciation allowances as follows

$$(3) \quad e d_t = c e_t - \left\{ (c e_t - e_t) \cdot \left[ \sum_{k=1}^n \frac{EDP_k^t}{TDP_k^t} \right] \right\},$$

where

$e d_t$  = earnings/price ratio, adjusted for understatement of depreciation expenses  
 $c e_t$  = cash earnings/price ratio  
 $e_t$  = earnings/price ratio  
 $n$  = number of types of investment projects

$$EDP_k^t = \sum_{i=0}^t \left[ I_k^i \cdot \Theta_k \cdot (1 - \Theta_k)^{t-i} \right]$$

$I_k^t$  = period  $t$  real investment in project type  $k$   
 $\Theta_k$  = economic depreciation rate for project type  $k$

$$TDP_k^t = \sum_{i=0}^t \left[ I_k^i \cdot \delta_k^i \cdot \left[ \prod_{j=1}^t (1 + \pi_j)^{-1} \right] \right]$$

$\delta_k^t$  = period  $t$  depreciation allowance for project type  $k$  initiated in period  $i$

$EDP_k^t$  represents true or economic depreciation while  $TDP_k^t$  represents balance sheet depreciation. Equation 3 is used to calculate the depreciation adjustment for the United Kingdom. We use estimates by King and Fullerton† of economic depreciation rates. The depreciation adjustment for the United Kingdom is positive for the first

†Mervyn A. King and Don Fullerton, eds., *The Taxation of Income from Capital* (Chicago and London: University of Chicago Press, 1984)

## Appendix (continued)

half of the sample period because of very rapid depreciation allowances on all U.K. investment projects.

Since West German tax depreciation schedules tend to be close to economic depreciation rates, we adjust German depreciation figures for inflation only, using a variation of equation 3:

$$(4) \text{ed}_t = \text{ce}_t - \left\{ (\text{ce}_t - \text{e}_t) * \left[ \sum_{i=t-k}^{t-1} w^{t-i} * \left( \prod_{j=i}^{t-1} (1 + \pi_j) \right) \right] \right\},$$

where

$$w < 1, \quad \sum_{i=t-k}^{t-1} w^{t-i} = 1$$

We also use this equation for the inflation portion of the Japanese depreciation adjustment. We use estimates made by Paul Aron<sup>‡</sup> for the understatement of Japanese earnings due to accelerated depreciation over the period.

The U.S. Department of Commerce estimates the discrepancy between balance sheet and economic depreciation;<sup>§</sup> we use their estimates to adjust depreciation for U.S. corporations.

We use inventory cost adjustments for U.S. and U.K. corporations made by the Department of Commerce and the Central Statistical Office, respectively. The following adjustment to earnings is made for Japanese and German corporations

$$(5) \text{eid}_t = \text{ed}_t - \left[ \frac{\text{INV}_t * s_t * \pi_t}{\text{PR}_t} \right],$$

where

$\text{eid}_t$  = earnings/price ratio, adjusted for understatement of depreciation and inventory expenses

$\text{INV}_t$  = dollar value of inventory at time  $t$

$s_t$  = share of inventory under FIFO accounting

$\text{PR}_t$  = dollar value of after-tax, depreciation-adjusted profits in time  $t$ .

Since the distribution of accounting techniques across firms by size of inventories is not available for Japan

<sup>‡</sup>Paul H. Aron, "Japanese Price Earnings Multiples," Daiwa Securities America, 1981-87 reports

<sup>§</sup>U.S. Department of Commerce, *Survey of Current Business*, Table 1 14, December 1978-December 1988

and Germany, aggregate accounting estimates based on secondary references and discussion with market practitioners are used. In Japan, "the most popular methods for inventories are the three (weighted-, moving- and straight-) average methods; the actual cost methods follow. About 80 percent of corporations are covered by these methods. There are few corporations that choose LIFO, and the FIFO method is chosen by only about 10 percent of corporations."<sup>||</sup> Since these average methods may be considered hybrids of LIFO and FIFO, the share of inventories in Japan accounted for under FIFO is taken to be 0.6 for 1977 through 1981, and 0.5 for 1982 through 1988, with the decline reflecting the decreasing use of FIFO. German firms are said to use LIFO almost exclusively. The share of inventory under FIFO accounting is taken to be 0.2, to allow for LIFO firms that are reducing inventories and for firms that use FIFO.

We make an adjustment to earnings to take account of inflation's effect on the value of nominal assets and liabilities of the firm:

$$(6) \text{ev}_t = \text{eid}_t + \left\{ \left[ \frac{\pi_t}{1 + \pi_t} \right] * \left[ \frac{\text{DN}_{t-1}}{E_t} \right] \right\},$$

where

$\text{ev}_t$  = profit rate including debt erosion effects

$\text{DN}_t$  = nominal value of financial liabilities less nominal value of financial assets

$E_t$  = market value of equity at time  $t$ .

This adjustment raises the cost of equity across the four countries by similar magnitudes. The reason is that the two economies with higher net debt relative to earnings, Germany and Japan, also have better inflation records

We make the following adjustment to account for the crossholding of shares by Japanese firms:

$$(7) \text{PRC}_t = \frac{\text{PR}_t}{\left[ 1 - \{ \text{Cr}_t * (1 - x_t) \} \right] + g_t},$$

where

$\text{PRC}_t$  = after-tax Japanese corporate profits with crossholding adjustment

$\text{Cr}_t$  = crossholding rate

<sup>||</sup>John B. Shoven and Toshiaki Tachibanaki, "The Taxation of Income from Capital in Japan," in John B. Shoven, ed., *Government Policy Towards Industry in the United States and Japan* (Cambridge: Cambridge University Press, 1988), chap. 3, p. 67

**Appendix (continued)**

$x_t$  = share of crossheld stocks held in blocks comprising more than 20 percent of firm value  
 $g_t$  = rate of realization of stock gains

We have data on  $Cr_t$ , but not  $x_t$  or  $g_t$ . On the basis of size and structure of the Japanese industrial groups, we estimate  $x_t$  to be 0.30. The turnover rate on stock ownership by Japanese corporations is under 5 percent, however, the sale of holdings by companies with weak earnings typically yields gains that are large relative to their carrying value. To reflect this, we assign a weight of 0.15 to  $g_t$ .

**Cost of funds**

The weighting for the cost of funds uses the market value of equity and the book value of debt

$$(8) \quad cf_t = (d_t * r_t) + \{ (1 - d_t) * ev_t \},$$

where

$cf_t$  = cost of funds at time  $t$

$$d_t = \frac{Db_t + B_t - I_t}{E_t + Db_t + B_t - I_t}$$

**Cost of capital**

The cost of capital,  $p$ , satisfies the following equation for a given investment project

$$(9) \quad \sum_{t=0}^{\infty} \left[ \left\{ \left[ p_t * [1 - tc_t * (1 + inv_t)] * \prod_{i=0}^t (1 + \pi_i) \right] \right. \right. \\
- \left[ \left[ ev_t * \prod_{i=0}^t (1 + \pi_i) \right] * (1 - d_t) \right] \\
- \left[ Ie_t * d_t * (1 - tc_t) \right] \\
+ z_t + \left. \left. \left[ \left[ 1 - (z_t * \varnothing_t) \right] * \delta_t * tc_t \right] \right\} \right. \\
\left. * \left[ \prod_{i=0}^t (1 + cf_i) * (1 + \pi_i) \right]^{-1} \right] = 0,$$

where

$p_t$  =  $p$  when  $t \leq$  length of project life  
 $p_t$  = 0 when  $t >$  length of project life

$$inv_t = \left[ \frac{INV_t * s_t * \pi_t}{PR_t} \right], \text{ from (5)}$$

$\delta_t$  = depreciation allowed for tax purposes  
 $z_t$  = investment tax credit at time  $t$   
 $\varnothing_t$  = share of investment tax credit used in reducing depreciation basis

As explained earlier, profits will be overstated because the costs of inventory items are understated. The accounting profit earned on the marginal product of investment will be overstated, resulting in additional taxes on the output. To take account of this excess taxation, we introduce the variable "inv<sub>t</sub>," which measures the expected excess rate of taxation. This "inventory tax" works to raise the cost of capital much more than the standard corporate income tax does, since it does not enter into the tax deductions for interest payments and depreciation.

As expected, the inventory tax raises the cost of capital more for the United States and the United Kingdom than for Germany and Japan. The average sample period effect for the tax is to raise the corporate income tax rate on profits by about seven percentage points for US and UK corporations and about two percentage points for German and Japanese firms.