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Were Japanese stock prices too high?*

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This paper asks whether market fundamentals can explain the recent run-up and decline of Japanese equity values and price–earnings ratios. Accounting differences explain about half of the long-run disparity between U.S. and Japanese P/Es. For example, if Japanese firms used U.S. accounting rules, the Japanese P/E ratio would have been 32.6, not 53.7, in 1989. Accounting differences cannot, however, explain the doubling of this ratio in 1986, nor its decline in 1990. Similarly, we are unable to isolate changes in required stock returns or growth expectations that are large enough to explain recent Japanese stock price movements.

1. Introduction

Between 1984 and 1989, the Nikkei Index of Japanese stock prices rose at an average annual rate of 27.5%, and its price–earnings ratio increased from 37.9 to 70.9. These dramatic revisions in share prices and price–earnings ratios led many analysts to conclude that Japanese stocks were overpriced. For example, foreign investors were net sellers of Japanese shares in each of

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the last five years of the 1980s. The equally dramatic 39% decline in the Nikkei in 1990, coupled with a drop in its price–earnings ratio to 58.2, provide at least superficial support for those who viewed the high prices as a 'bubble'.

In this paper, we ask whether Japanese prices were, in fact, irrationally high in the 1980s, or whether their rapid increase and sharp decline can be explained by changing expectations about growth opportunities and changes in required rates of return. In some sense, these questions are unanswerable; any time series of prices could be justified by an appropriate set of investor expectations. Although these expectations are unobservable, we search for evidence of *changes* in such expectations, particularly coincident with share price increases or declines. We also examine the extent to which accounting conventions and tax rules can explain the high Japanese price–earnings ratios in the second half of the 1980s.

The paper is divided into five sections. Section 2 presents a stylized overview of the U.S. and Japanese equity markets. It reports the price–earnings and dividend–price ratios in both countries, and documents the relative importance of intercorporate share ownership in the two markets.

The third section explores the role of accounting and tax-rule differences in creating differences between the reported price–earnings ratios of Japanese and U.S. companies. We show that although several factors make the reported price–earnings ratios of Japanese firms systematically higher than those of their U.S. counterparts, they account for neither the increase in Japanese P/E ratios in the mid-1980s, nor the decline in 1990.

Section 4 examines differences in required after-tax returns and expected growth rates in the two countries. We first calibrate the changes in discount factors and growth expectations that would be needed to explain the rise and decline of Japanese share values. We then consider various proxies for actual changes in required returns and growth expectations. We find that rather extreme assumptions about changes in growth or inflationary expectations would be needed to explain the post-1985 increase in Japanese share prices. The market decline in 1990, however, is easier to rationalize, since there was a coincident and significant increase in Japanese interest rates.

Finally, a brief concluding section considers the role of land-price appreciation in 'explaining' share-price gyrations.

2. Overview of Japanese and U.S. equity markets

The relative importance of the Japanese and U.S. equity markets shifted dramatically during the 1970s and 1980s, the result of rapid growth in Japanese share prices and depreciation of the dollar. This section provides background information on these markets.

Panel A: No Cross-Holdings

Firm A		Firm B	
Assets	Liabilities	Assets	Liabilities
Physical Assets: 100	Common Equity: 100	Physical Assets: 100	Common Equity: 100
Total Assets: 100	Total Liabilities: 100	Total Assets: 100	Total Liabilities: 100

Panel B: 25% Cross-Holdings

Firm A		Firm B	
Assets	Liabilities	Assets	Liabilities
Physical Assets: 100 Investments (Firm B): 50	Common Equity: 150	Physical Assets: 100	Common Equity: 100
Total Assets: 150	Total Liabilities: 150	Total Assets: 100	Total Liabilities: 100

Fig. 1. The effect of intercorporate shareholdings on apparent market value.

2.1. Market size

The widely cited data from Morgan Stanley–Capital International (MSCI) *Perspectives* and others suggest that the Japanese equity market was 36% larger than the U.S. market at the end of 1989. However, these data provide a misleading measure of relative market capitalization for two reasons. First, the U.S. data include only shares listed on the New York Stock Exchange (NYSE), so they capture only about 85% of the market value of listed U.S. shares.[1] A second and more important problem is that the reported market values are not adjusted for intercorporate share ownership, which causes double-counting of corporate shares. As McDonald (1989) illustrates using a set of representative Japanese firms, such cross-ownership is much more prevalent in Japan than in the United States. Thus, the size of the Japanese equity market is significantly overstated relative to the U.S. market.

Consider the two all-equity firms in fig. 1. Initially, each firm has assets worth $100, there is no intercorporate ownership, and the total value of traded equity is $200. Suppose firm A now issues $50 in new shares and uses the proceeds to purchase one-half of the equity in firm B. As the second panel of fig. 1 illustrates, this transaction increases the market value of A to $150 ($100 in physical assets and $50 in shares of B), without affecting the market value of B. Although the value of the underlying productive assets

[1]The market value of common equity listed on the NYSE was $2,996.2 billion at the end of 1989, while that on the American Stock Exchange was $120.4 billion. Common shares of domestic corporations (excluding mutual funds) traded in the NASDAQ over-the-counter market were valued at $363.7 billion. The over-the-counter market is less important in Japan. For example, in 1986 the volume of shares traded on the First Section of the Tokyo Stock Exchange was 772 times that on the Tokyo OTC market [Japan Securities Research Institute (1988)].

Table 1

Ownership of common stock, Japan (1989) and the United States (1987).[a]

Ownership group	Japan	U.S.
Individuals	19.9%	48.1%
Nonfinancial corporations	29.0%	14.1%
Foreigners	4.3%	6.6%
Securities companies	2.3%	0.4%
Government	0.4%	6.6%
Banks	21.3%	0.3%
Insurance companies	16.7%	23.9%
Other	6.1%	0.0%

[a]Source: Tokyo Stock Exchange, *1990 Fact Book*; Federal Reserve Board, *Flow of Funds* (1987) with adjustments by the authors. We use lagged U.S. data because we need tax return information. For the U.S., mutual funds are included in individual holdings. Insurance-company holdings are the sum of life, property & casualty, and pension-fund assets. The weights for the U.S. differ from the equity ownership weights in *Flow of Funds* for two reasons. First, intercorporate shareholdings are 'netted out' of the flow of funds, so nonfinancial firms appear with no equity holdings except a small stake in mutual funds. Following Tri (1971), we use IRS data on the ratio of dividends paid by U.S. corporations to domestic dividends received by U.S. corporations to estimate intercorporate holdings. Second, the flow of funds data on equity include stock in closely held corporations, worth $600 billion in 1987. We exclude this component and assume that all closely held corporations are owned directly by individuals.

remains unchanged at $200, the intercorporate purchase of stock raises the *apparent* value of the market to $250.

The apparent market value overstates the value of the firms' underlying assets because half of B's assets are included in the equity of both firm A and firm B. One can eliminate this double-counting and get an accurate estimate of the underlying asset value by measuring only the value of equity held outside the corporate sector. In our example, the public holds $150 of A and $50 of B, so the value of shares held outside the corporate sector is $200, the value of the underlying assets. More generally, the value of the equity held outside the corporate sector is

$$V_{\text{Outside}} = (1 - s) * V_{\text{Total}}, \tag{1}$$

where s is the fraction of the stock held by firms and V_{total} is the total value of equity, measured in the conventional way as the sum of each firm's shares outstanding times its market price.

Table 1 reports data on the aggregate ownership of traded shares in the U.S. and Japan. In the U.S., individuals hold about half of the outstanding equity, either directly or through mutual funds. Intercorporate equity holdings account for only one seventh of total equity. This fraction excludes holdings by defined-benefit pension plans, which are arguably assets of the shareholders. Including these plan holdings as corporate cross-holdings would

raise the U.S. intercorporate ownership to over 20%. We do not make this correction, however, in part because of difficulties in making the analogous correction for Japanese firms. Insurance companies, with holdings for both insurance operations and pension plans, own 23.9% of the U.S. market. Slightly more than 6% of the U.S. equity is held by foreign investors and a similar fraction is held by state and local government pension funds.

Table 2

Equity held by Toyota Motor Company, 1988.[a]

Company name	Toyota ownership share	Net income (¥ mil)
Kanto Auto Works	49.0%	2,500
Toyota Auto Body	41.7%*	2,300
Chiyoda Fire & Marine Insurance	41.4%	6,100
Toyoda Gosei (steering wheels & hoses)	40.0%	2,400
Kyowa Leather	32.4%*	1,600
Tokai Rika (switches and seat belts)	27.8%	1,500
Toyota Automatic Loom Works	24.9%	10,100
Toyoda Machine Works	24.7%	1,600
Toyota Tsusho (trading)	23.2%*	5,400
Nippondenso (auto electronics)	22.5%*	28,000
Koyo Seiko (bearings)	22.3%	3,300
Aichi Steel	21.8%	3,150
Aisin Seiki (auto parts)	21.3%*	7,500
Chuo Spring	20.5%	1,070
Koito Manufacturing (auto lights)	19.8%	2,900
Daihatsu	15.0%	4,000
Akebono Brake	15.0%	1,250
Futaba Industrial (mufflers)	14.3%	2,350
Shiroki (auto interiors)	11.6%	1,000
Hino Motors (trucks)	11.0%	4,300
Toyoda Spinning & Weaving	8.9%*	400
Kayaba Industrial (hydraulics)	8.4%	1,200
Nippon Piston Ring	8.6%	580
Ichikoh Industries (auto lights)	7.5%	1,400
Nachi-Fujikoshi (bearings)	5.9%	1,100
Toyo Radiator	5.8%	1,100
Toyota Motors is owned by:		
Sanwa Bank	4.9%	
Tokai Bank	4.9%	
Mitsui Bank	4.9%	
Toyota Automatic Loom	4.4%	
Nippon Life	3.7%	
Long-Term Credit Bank	3.2%	
Daiwa Bank	2.5%	

[a]Source: Authors' tabulations from *Japan Company Handbook*, Spring 1988. Starred entries indicate substantial ownership by other firms affiliated with Toyota Motors, usually Toyota Automatic Loom.

Corporations of various kinds hold nearly two-thirds of the equity in Japan. These holdings include nonfinancial corporations (29%), banks (21%), and insurance companies (17%). Direct individual holdings account for only one fifth of the market value of the Tokyo Stock Exchange (TSE). Moreover, the fraction of the Japanese market held by individuals has declined through time, from nearly 60% in the early 1950s to only 20% at the end of 1989.

Table 2 presents a detailed example of cross-ownership, the case of Toyota Motor Company. At the end of 1988, Toyota owned more than 40% of four other firms on the TSE First Section, and at least 5% of 22 other companies. Most of these firms are Toyota suppliers. In turn, several banks owned nearly 30% of Toyota's stock. For many other firms, especially those that, unlike Toyota, are part of loosely affiliated corporate groups, the degree of intercorporate holding is substantially greater. [Hoshi, Kashyap, and Scharfstein (1991) discuss the linkages among firms in these groups and how they affect their financial behavior.]

Table 3

Market value of Japanese and U.S. equity markets, 1970–1990.[a]

	Total market value (billion dollars)		Adjusted market value (billion dollars)		Percentage of total world equities	
Year	Japan	U.S.	Japan	U.S.	Japan	U.S.
1970	42.5	636.4	25.2	671.8	2.8	74.1
1971	67.2	741.8	39.8	784.7	3.7	72.3
1972	152.3	871.5	81.6	890.3	6.2	68.1
1973	128.6	721.0	69.2	668.2	6.6	63.7
1974	115.8	510.4	63.7	436.1	8.1	55.8
1975	135.1	683.6	75.9	660.8	6.9	60.3
1976	179.3	856.4	100.0	786.2	8.2	64.4
1977	205.1	793.9	116.1	742.1	9.3	59.5
1978	327.3	816.7	183.0	787.6	12.6	54.0
1979	274.0	960.2	153.2	923.5	9.1	55.1
1980	356.6	1240.0	200.8	1179.9	9.5	56.0
1981	402.7	1145.4	225.1	1106.7	11.2	54.9
1982	410.2	1308.3	232.2	1281.5	10.8	59.7
1983	519.2	1578.3	286.6	1506.3	11.2	59.0
1984	616.8	1593.2	327.5	1477.6	12.9	58.2
1985	909.1	1955.4	480.0	1845.7	13.7	52.7
1986	1746.2	2203.2	883.6	2187.2	18.5	45.9
1987	2978.2	2216.1	1489.1	2206.9	26.5	39.3
1988	3840.2	2480.9	1908.6	2433.9	28.7	36.4
1989	4102.1	3027.1	2038.7	2989.6	25.4	37.2
1990	3265.7	3044.4	1623.0	3006.7	20.8	38.6

[a]The 1970–1989 estimates are for the end of December. The 1990 estimate is for the end of June. The total equity values for 1970–1988 are from Tokyo Stock Exchange, *Monthly Statistical Report*, and NYSE, NASDAQ, and SEC sources described in the text. The total values for 1989 and 1990 are from Morgan Stanley–Capital International. The adjusted market values exclude intercorporate equity holdings. Our estimates of each country's weight in the world equity portfolio ignore all cross-holdings except those in Japan and the U.S.

Table 3 presents both unadjusted and corrected measures of stock-market value in the U.S. and Japan. The adjustments for intercorporate holdings have a surprising effect. Although the unadjusted figures suggest that the Japanese market was larger than the U.S. market at the end of each year between 1986 and 1989, the market value of the outside equity in Japan is never more than 80% of the value of outside equity in the United States. With these adjusted estimates, Japan accounted for only 25.4% of the world equity portfolio at the end of 1989, while the U.S. accounted for 37.2%. The gap between the U.S. and Japanese market shares became even larger during the first half of 1990 as a result of dollar appreciation and the decline in Japanese share prices. At the end of June 1990, the last date for which we have complete data on the value of world equity markets, the Japanese share of the world equity portfolio was 20.8%, compared with a U.S. share of 38.6%.

2.2. *Valuation, trading, and leverage trends*

Table 4 presents price–earnings ratios and dividend–price ratios for the Nomura Research Institute 350, a broad index of nonfinancial Japanese firms, and for the S&P Industrial index of nonfinancial American firms. We use the NRI 350 to measure the Japanese market because other major indices have limitations for our purposes. The aggregate P/E ratio for the First Section of the Tokyo Stock Exchange includes financial firms, for which accounting issues are more complex than they are for nonfinancials. The MSCI indices also include financials, and they include consolidated earnings for some firms and unconsolidated earnings for others. The average P/E ratio reported in the *Daiwa Analysts Guide* is the ratio of the average price and average earnings based on number of shares outstanding, not value, so it is less representative of the value-weighted market than the NRI measure. The TSE, MSCI, and Daiwa P/E ratios were 58.3, 52.7, and 82.4 at the end of 1987. The comparable ratio for the NRI 350 was 50.4[2]

Table 4 documents the growth of the Japanese P/E ratio in 1986 and its decline in 1990. The disparity between the Japanese and U.S. P/Es in the second half of the 1980s is apparent. Between 1974 and 1984, the Japanese P/E was about twice the U.S. P/E. During 1986, however, the Japanese P/E ratio doubled from 29.4 to 58.6, while the U.S. ratio increased by only 21%, from 15.4 to 18.7. The Japanese P/E remained in the 50s through the end of 1989 and then fell, along with Japanese stock prices, to the mid-30s by mid-1990.

[2]Although some measures of aggregate Japanese P/Es were affected when the Nippon Telephone and Telegraph Company went public in 1987 with a price–earnings ratio of 285, this firm is not included in the NRI 350 index.

Table 4

Price–earnings ratios, dividend–price ratios (in percent), foreign equity holdings (in percent), and debt–equity ratios, Japan and the United States, 1970–1990.[a]

	Price–earnings		Dividend–price		Foreign holdings		Debt–equity	
Year	Japan	U.S.	Japan	U.S.	Japan	U.S.	Japan	U.S.
1970	9.0	18.6	4.57%	3.3%	4.9%	3.7%	1.63	0.54
1971	13.5	18.7	3.57%	2.9%	5.2%	3.6%	2.13	0.50
1972	23.3	19.3	1.81%	2.5%	4.5%	4.0%	2.23	0.48
1973	13.9	12.3	2.62%	3.4%	4.0%	4.3%	1.38	0.69
1974	16.5	7.9	2.93%	5.0%	3.2%	4.5%	1.44	1.04
1975	25.2	11.8	2.20%	3.8%	3.6%	4.8%	2.13	0.78
1976	22.0	11.2	1.93%	3.7%	3.7%	4.7%	1.88	0.72
1977	19.3	9.1	2.11%	5.0%	3.0%	4.6%	1.82	0.85
1978	21.5	8.2	1.71%	5.2%	2.7%	4.7%	1.62	0.91
1979	16.6	7.5	1.78%	5.3%	3.0%	4.6%	1.78	0.83
1980	17.9	9.6	1.72%	4.4%	5.8%	4.8%	1.59	0.64
1981	24.9	8.2	1.46%	5.3%	6.4%	5.1%	1.64	0.76
1982	23.7	11.9	1.39%	4.6%	7.6%	5.3%	1.44	0.70
1983	29.4	12.6	1.15%	3.7%	8.3%	5.6%	1.03	0.64
1984	26.3	10.4	1.17%	4.1%	8.8%	5.6%	0.93	0.75
1985	29.4	15.4	1.10%	3.4%	7.4%	5.9%	0.85	0.67
1986	58.6	18.7	0.75%	3.0%	7.0%	6.7%	0.58	0.67
1987	50.4	14.1	0.72%	3.2%	5.3%	7.0%	0.52	0.73
1988	54.3	12.9	0.60%	3.0%	4.8%	7.2%	0.48	0.74
1989	53.7	14.8	0.52%	2.8%	4.3%	7.7%	0.45	0.67
1990	36.6	15.9	0.73%	3.2%	—	—	—	—

[a]Source: Price–earnings ratios and dividend yields for 1970–1989 are for the last trading day of each year; those for 1990 are for the last trading day of August. Foreign holdings of U.S. equity are from the Federal Reserve Board *Flow of Funds* tables. Foreign holdings of Japanese equity are from the Tokyo Stock Exchange, with 1988 value estimated from monthly net sales data in *Monthly Statistics Report*. The debt–equity ratio is defined as the book value of debt divided by the market value of equity. The debt–equity ratios for the U.S. are from the Federal Reserve Board, *Balance Sheets of the U.S. Economy*, 1988. The debt–equity ratios for Japan for 1970–1975 are from Ando and Auerbach (1988). Ratios for 1976–1989 are based on the data for 'All Industries' in *Daiwa* (1980, 1984, 1987, 1990). Debt is defined for Japanese firms as total liabilities excluding accounts payable. The Japanese data actually understate the decline in debt–equity ratios. The number of firms in the Daiwa sample increases substantially through time, and firms added to the sample in recent years had higher debt–equity ratios before they were added than did firms already in the sample.

The Japanese dividend–price ratio (table 4) declined throughout the 1970s and 1980s, reflecting sluggish nominal dividend payments and rising share prices. In 1970, the Japanese dividend yield, 4.57%, was higher than the U.S. yield of 3.3%. Although the U.S. yield showed no particular trend over the 1970–1989 period, the Japanese yield fell systematically, reaching 0.5% at the end of 1989.

Turnover rates, measured as the value of shares traded as a fraction of market capitalization, were similar on the TSE and the NYSE in the late 1980s. The average annual turnover rates for 1986–1989 are 70% in Tokyo and 64% in New York. (See the 1989 *TSE Fact Book* and *NYSE Fact Book*.)

Table 4 also documents that foreigners were net sellers of Japanese stocks during the period of most rapid price appreciation. Foreign ownership of U.S. stocks increased during both the 1970s and the 1980s, from 3.7% of the market in 1970 to 7.7% in 1989. Foreign holdings of Japanese stock also rose between the mid-1970s and the early 1980s, increasing from less than 2.7% in 1978 to 8.8% in 1984. After that, foreigners were net sellers of Japanese equities. By 1989 foreign holdings of Japanese equities (4.3%) were only 49% of their previous peak value. The persistent selling by foreigners during the second half of the 1980s is consistent with a widespread perception outside Japan that Japanese equities were overpriced.

Some have argued that high Japanese stock returns and P/E ratios during the 1980s were the result of high debt–equity ratios. This explanation is inconsistent with the data in table 4 on the book value of debt divided by the market value of equity. In Japan, where most debt is short-term, the differential between market and book values for debt is small. The divergence could be larger for the United States. American debt–equity ratios show no particular trend, varying between 0.48 (1972) and 1.04 (1974). In contrast, Japanese debt–equity ratios decline during the sample period, from 1.63 in 1970 and 2.23 in 1972 to 0.45 in 1989. Although Japanese debt–equity ratios are substantially higher than their U.S. counterparts during the 1970s, they are significantly below U.S. ratios during the 1986–1989 period.

3. U.S. and Japanese accounting differences and P/E ratios

Many analysts interpret high Japanese price–earnings ratios during the second half of the 1980s as evidence that Japanese stock prices were irrationally high. Others argue that the high P/Es are an artifact of Japanese accounting conventions. In this section we examine whether differences between Japanese and American accounting practices can explain the behavior of Japanese P/Es in the 1980s and 1990.

Two factors suggest that even if accounting considerations can explain the historical difference between U.S. and Japanese P/E ratios, they are unlikely to explain the growth of this difference in the second half of the 1980s, or its narrowing in 1990. First, changes in generally accepted accounting practices (GAAP) in Japan reduced the accounting disparities between Japanese and American firms during the period that Japanese P/Es were growing [Aron (1981, 1988)]. Second, as fig. 2 shows, the growth in the Japanese P/E ratio from 29.4 in 1985 to 53.7 in 1989 is dominated by rising stock prices, rather than by falling earnings. The real price per share tracks the price–earnings ratio reasonably well. It was roughly constant from 1970 to 1980, grew gradually during the next five years, and then rose at an average annual rate of 27.1% from 1986 to 1989. In contrast, real earnings per share were roughly constant over the 1970–1990 period. A 28% decline in the earnings per share in 1986 helped double the P/E ratio during that

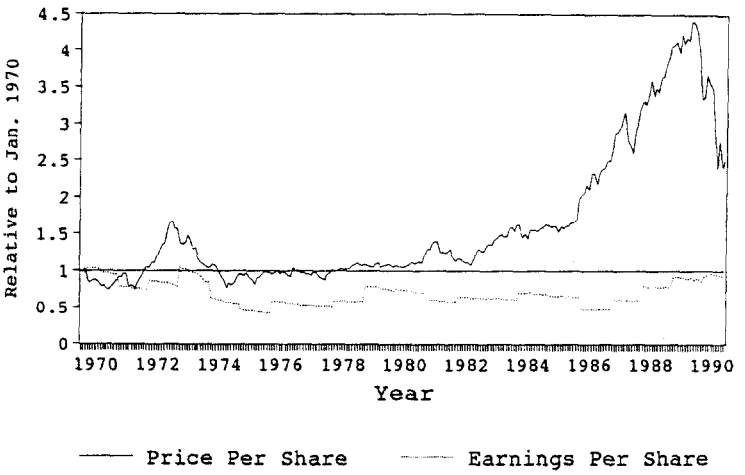

Fig. 2. Inflation adjusted price and earnings per share for NRI 350.

year, but the ratio remained above 50 for the next three years despite annual earnings growth rates of 26%, 30%, and 18%.

Even if differences in accounting conventions cannot explain the growth of the Japanese P/E ratio during the second half of the 1980s, these differences may explain the smaller historical disparity between Japanese and U.S. P/Es. Three factors are particularly important: (i) differences in the importance of subsidiaries and the use of consolidated earnings, (ii) differences in 'reserve accounts' that permit Japanese firms to deduct significant amounts from reported earnings as advance funding for future expenses, and (iii) differences in depreciation practices. This section discusses each of these, and concludes with a brief analysis of the divergence between accounting and economic profits in Japan and the U.S.

3.1. Consolidation and intercorporate ownership

Consolidated earnings, which include the net income of subsidiaries and of firms in which the parent holds more than 20% of the outstanding equity, are the dominant measure of earnings in the United States. In contrast, unconsolidated earnings are the dominant measure in Japan. Although Japanese GAAP require firms to report consolidated earnings, unconsolidated earnings are the basis for most market analyses, and they are used in the denominator of most common Japanese P/E ratios, including the NRI 350 index reported here. Moreover, since intercorporate equity holdings are far more important in Japan than in the U.S., and since even consolidated

earnings do not reflect the retained earnings of subsidiaries in which the parent holds less than a 20% stake, comparisons of consolidated earnings are also inappropriate. Since share prices reflect the parent companies' full claim on subsidiaries' profits, whereas unconsolidated earnings reflect only the dividends received from subsidiaries, there is a systematic upward bias in conventional Japanese P/E ratios relative to those in the U.S.

To avoid this bias, we compute price–earnings ratios based on only parent-company earnings and assets. Thus, in the spirit of our earlier adjustment for double-counting of equity holdings, we try to eliminate the effect of cross-holdings on both prices and earnings.[3]

Two adjustments are needed to correct P/E ratios for consolidation. First, we adjust prices to remove that part of value derived from intercorporate equity holdings. Since we are interested in P/E ratios for nonfinancial corporations (NFCs), the adjusted price is $P^* = (1 - \mu s')P$, where μ = (value of all traded shares)/(value of NFCs' traded shares) and s' is the share of the total market owned by NFCs. This procedure essentially redefines the market value of nonfinancial corporations as the value of outstanding equity *less* the value of shares held on corporate account.

Second, we remove intercorporate dividends from the reported earnings of parent firms. If the fraction of earnings paid out as dividends by both financial and nonfinancial corporations is d, then the relevant earnings measure is $E^* = (1 - s'\mu d)E$. The adjusted price–earnings ratio is therefore

$$P^*/E^* = [(1 - s'\mu)/(1 - s'\mu d)] * (P/E). \tag{2}$$

Note that if the dividend payout ratio of firms owned by traded nonfinancial firms is higher than the payout ratio of the traded firms, our correction will understate the actual adjustment to P/E ratios.

Table 5 shows the impact of the cross-holding adjustment on Japanese P/E ratios between 1975 and 1990. In August 1990, when the Japanese payout ratio (d) was 0.267 and $\mu s'$ was 0.391, the adjustment factor was 0.680. The cross-holding adjustment therefore reduces the reported P/E ratio from 36.6 to 24.9. The impact of cross-holdings on the P/E ratio grows through time. This largely reflects an increase in cross-holding during the 1980s.

3.2. *Accounting for special reserves*

The Japanese tax code allows firms to set aside funds each year against future contingencies including product returns, repairs, payments on guaran-

[3]Variants of this approach are used by Ando and Auerbach (1990) and Ueda (1990). An alternative approach would involve full consolidation of the retained earnings of all subsidiaries. Our analysis neglects any capital gains that may enter earnings when a firm sells shares in other firms, an issue that McCauley and Zimmer (1990) address for financial firms.

Table 5

Adjusted price–earnings and price-to-cash-earnings ratios, Japan and United States, 1975–1990.[a]

	Japan						United States		Japan	U.S.
		Cross-holding								
Year	Unadjusted P/E	Factor	Interim P/E	Reserves factor	Depreciation factor	Adjusted P/E	Unadjusted P/E	Adjusted P/E	P/CE	P/CE
1975	25.2	0.784	19.8	0.98	0.786	15.2	11.8	11.0	6.6	6.9
1976	22.0	0.824	18.1	0.98	0.837	14.9	11.2	10.1	7.7	6.9
1977	19.3	0.797	15.4	0.98	0.866	13.1	9.1	8.1	6.2	5.6
1978	21.5	0.792	17.0	0.98	0.890	14.9	8.2	7.5	7.4	5.1
1979	16.6	0.778	12.9	0.98	0.906	11.5	7.5	6.8	6.9	4.7
1980	17.9	0.770	13.8	0.98	0.931	12.6	9.6	8.7	6.3	5.6
1981	24.9	0.764	19.0	0.98	0.910	17.0	8.2	7.6	6.9	4.6
1982	23.7	0.769	18.2	0.98	0.913	16.3	11.9	11.1	7.2	5.5
1983	29.4	0.795	23.4	0.98	0.938	21.5	12.6	11.9	9.3	6.4
1984	26.3	0.734	19.3	0.98	0.950	18.0	10.4	9.4	9.3	5.6
1985	29.4	0.694	20.4	0.98	0.928	18.6	15.4	14.2	9.0	6.9
1986	58.6	0.695	40.7	0.98	0.913	36.5	18.7	17.5	14.4	7.2
1987	50.4	0.665	33.5	0.98	0.926	30.4	14.1	12.9	14.7	6.9
1988	54.3	0.656	35.6	0.98	0.936	32.7	12.9	11.7	17.2	6.5
1989	53.7	0.663	35.6	0.98	0.936*	32.6	14.8	13.5*	18.4	7.7
1990	36.6	0.680	24.9	0.98	0.936*	22.8	15.9	14.5*	12.6	7.3

[a]Source: Price–earnings ratios are from authors' calculations described in the text. Price-to-cash-earnings ratios (P/CE) are from Morgan Stanley–Capital International. The unadjusted P/E ratios correspond to the NRI 350 index and the S&P Industrials index. Starred values for 1989 and 1990 are estimated using 1988 data. We study the P/E ratios for the NRI 350 and S&P Industrials at the end of each calendar year for 1975–1989, and at the end of August 1990. The S&P ratio divides earnings for each calendar year by year-end prices. For the NRI 350, the Nomura Research Institute forecasts what earnings will be in the current fiscal year, which typically ends in March, and divides these forecasts by December prices. This biases the Japanese P/E ratio downward relative to the U.S. ratio when earnings are rising.

tees, losses due to doubtful accounts, and payment of retirement benefits. Japanese workers retire when they are roughly sixty years old, and their employer typically provides a large one-time retirement payment that can equal several times the employee's annual salary. Firms can create a reserve equal to 40% of the amount workers would receive if the firm were liquidated and all workers retired. Because Japanese accounting practices require conformity between tax returns and financial statements, reductions to taxable income reduce accounting earnings as well. The net effect of contributing before-tax income to these reserves is to reduce reported earnings below what they would be in the U.S.

Aron (1988) suggests a procedure for undoing the effect of reserve contributions on reported earnings. He calculates the net contribution firms make to reserve accounts and notes that without such contributions, after-tax earnings would increase by

$$E_{\text{adj}} - E_{\text{report}} = (1 - \tau) * (\text{net reserve contribution}), \tag{3}$$

where τ is the corporate tax rate. Shoven and Tachibanaki (1987) and Aron (1988) estimate the combined marginal tax rate from national corporate income tax, enterprise tax, and local inhabitants tax at between 50% and 55%. We use a value of $\tau = 0.52$ for 1990, and lower rates earlier in the sample period. We use Aron's estimate that reserve contributions average approximately 4% of net income for large Japanese firms over the entire 1975–1990 period. The resulting adjustment factor, shown in the fourth column of table 5, has a small effect on the reported price–earnings ratio.

3.3. Depreciation accounting

The last major difference between the accounting practices of U.S. and Japanese firms concerns depreciation. In the U.S., the possibility of using one set of accounting rules for tax purposes and another for financial reporting leads most firms – 75% according to Schieneman's (1986) citation of the American Institute of Certified Public Accountants – to choose accelerated depreciation for the former and straight-line depreciation for the latter. This reduces current taxable income relative to reported earnings.

Japanese firms may also choose straight-line or accelerated depreciation, but they must use the same technique for tax and financial reporting purposes. Virtually all firms choose accelerated depreciation, which minimizes current taxes, rather than straight-line depreciation, which maximizes current reported earnings. Thus, the typical Japanese firm depreciates its assets more quickly than the typical American firm; Japanese depreciation charges are higher when assets are relatively new and lower when they are old.

This difference in depreciation rules does not imply any systematic difference in P/E ratios across nations. If most firms in the rapid-depreciation nation acquired their assets in the distant past, the net effect of faster depreciation will be a *higher* P/E ratio. In practice, however, many Japanese firms were growing rapidly during the 1970s and 1980s, so they had a preponderance of young assets with depreciation deductions exceeding those of comparable U.S. firms. Therefore, the use of accelerated depreciation tends to lower reported earnings, and raise price–earnings ratios, for Japanese firms in comparison with their U.S. counterparts.

Exact comparison of the depreciation claims of U.S. and Japanese firms would require detailed information on the asset mix and investment history of firms in both nations. These data are not readily available. We can bound the effect of accelerated depreciation on Japanese price–earnings ratios, however, by making the extreme assumption that all Japanese assets were placed in service during the previous year. Since virtually all Japanese firms use double-declining-balance depreciation, straight-line depreciation would be roughly half the reported depreciation. Thus, the maximum understatement of before-tax earnings caused by accelerated depreciation is half of total depreciation claims, and the maximum understatement of after-tax earnings is $(1-\tau)$ times this amount where τ is the corporate tax rate.

This implies that a depreciation-adjusted price–earnings ratio must be at least $E_{\text{report}}/[E_{\text{report}} + (1-\tau) * \text{depreciation}/2]$ times the unadjusted ratio. Based on the parent-company income statement data in the 1989 *Daiwa Analysts Guide*, which covers virtually all nonfinancial firms listed on the First Section of the TSE, this lower bound for the Japanese price–earnings ratio is 24.8 at the end of 1989 and 17.3 in mid-1990.

Rather than rely on the lower bound estimates above, we estimate the depreciation-induced understatement of earnings using a simple model of continuous investment and depreciation.[4] This model assumes that firms have homogeneous assets that depreciate at a constant rate δ, and that investment in these assets grows exponentially at rate g. We also simplify the double-declining-balance technique used in Japan by assuming that accelerated depreciation charges are always 2δ times the current book value.

Each firm's investment at time t, per dollar invested at time s, is $e^{g(t-s)}$. Since accelerated depreciation reduces the book value of an $e^{g(t-s)}$ dollar

[4]Several studies, including Aron (1988), try to adjust reported earnings for different depreciation rules by assuming that the ratio of depreciation to cash earnings should be identical for U.S. and Japanese firms. Since different depreciation rates are not the only reason for differences in the amount of depreciation claimed by U.S. and Japanese firms, however, this assumption is likely to correct more than just accounting practices. It also undoes, for example, genuine differences in capital–labor ratios.

investment at t ($t < s$) to $e^{g(t-s)}e^{2\delta(t-s)}$ dollars at s, the book value of a firm's assets per dollar of current investment is $\int_{-\infty}^{s} e^{g(t-s)}e^{2\delta(t-s)}dt = 1/(2\delta + g)$. Given our simplifying assumption about double-declining-balance accounting, the current accelerated (AC) depreciation expense per dollar of current investment is $AC = 2\delta/(2\delta + g)$.

To model straight-line (SL) depreciation, we define each asset's depreciable life as the time until two-thirds of the asset is eroded, $L \equiv \ln(0.67)/\delta$. This yields depreciable lives of about 15 years throughout our sample period. We also assume that, for accounting purposes, there is no salvage value. With these assumptions, the current straight-line depreciation charge per dollar of current investment is $SL = \int_{s-L}^{s} e^{g(t-s)}dt/L = (1 - e^{-gL})/gL$.

This model implies that straight-line depreciation charges would be $SL/AC = (1 - e^{-gL}) * (2\delta + g)/2\delta gL$ times accelerated depreciation charges. Thus, converting from accelerated to straight-line depreciation increases after-tax earnings by $(1 - \tau) * [1 - (1 - e^{-gL}) * (2\delta + g)/2\delta gL]$ times the accelerated depreciation actually reported by Japanese firms.

We use the ten-year change in nominal business investment, from the national income accounts, to estimate the exponential growth rate for investment, g. We estimate δ as one-half the ratio of current depreciation charges to the value of depreciable assets, since for Japanese firms using double-declining-balance methods the instantaneous depreciation rate will be approximately twice the economic rate. The accounting data for this estimate are from the *Daiwa Analysts Guide*.

As the results in the seventh column of table 5 show, the conversion from accelerated to straight-line depreciation has a larger effect in the 1970s than in the 1980s. This reflects a decline in the rate of growth of nominal business investment in Japan. For example, the average annual rate of growth is 14.9% between 1965 and 1975, and 7.0% between 1975 and 1985. The earnings adjustment factor (the ratio of reported to adjusted earnings) is above 0.9 throughout the 1980s. Thus, even after we adjust for accelerated depreciation, our estimate of the Japanese P/E ratio is above 30.0 at the end of each year from 1986 to 1989. The adjusted ratio does fall, along with Japanese stock prices, in 1990. After converting to U.S. accounting practices, we estimate that the Japanese P/E ratio is 22.8 in mid-1990.

The price-to-cash-earnings (P/CE) ratios in table 5 provide additional perspective on the impact of the different depreciation methods used by U.S. and Japanese firms. Since cash earnings are defined as the sum of reported earnings plus depreciation, they are unaffected by a company's choice of depreciation method. The U.S. P/CE ratio shows no particular trend during the 1975–1990 period. In contrast, the Japanese P/CE ratio behaves like the Japanese P/E ratio. It rises from 9.0 in 1985 to 18.4 in 1989, and then falls to 12.6 during the first eight months of 1990.

3.4. Adjusted U.S. P/E ratios

The adjustments for depreciation and reserves described above attempt to make reported earnings of Japanese firms comparable to those of U.S. firms. The adjustment for intercorporate holdings, however, converts Japanese earnings to a base case with no intercorporate ownership. Thus, we must also adjust the P/E ratio of the S&P Industrials to remove the effects of U.S. intercorporate holdings. The eighth and ninth columns of table 5 present the unadjusted S&P P/E ratio and the adjusted series using the procedure we applied to the Japanese data. Since intercorporate holdings in the U.S. are smaller than those in Japan, the adjusted P/E ratio for the U.S. (14.5 in 1990) is closer to its unadjusted value (15.9).

Although accounting adjustments reduce the differences between Japanese and American P/E ratios, they do not eliminate them, particularly during the 1986–1989 period. For example, at the end of 1989, the adjusted P/E ratio is 13.5 in the U.S. and 32.6 in Japan. Moreover, like the unadjusted ratio, the adjusted Japanese ratio essentially doubles in 1986. Accounting-based hypotheses can explain much of the difference between U.S. and Japanese P/Es before 1986, but they cannot explain the doubling of Japanese ratios in 1986 or the high ratios during the next four years.

3.5. Accounting versus economic earnings

Our analysis has attempted to place U.S. and Japanese earnings on a comparable accounting base. It has not tried to translate accounting earnings into economic earnings. Other studies, notably Ando and Auerbach (1990) and McCauley and Zimmer (1990), pursue that issue. In principle, deviations between economic and accounting profits could cause reported price–earnings ratios in the two nations to diverge, and changes through time in this deviation could lead to divergent movements in P/E ratios.

Inflation is the principal source of differences between accounting and economic earnings.[5] First, because depreciation is calculated using the historical cost of physical assets, true depreciation costs are understated and profits are overstated in periods of high inflation. Second, the failure to distinguish between the real and nominal cost of debt understates earnings when inflation is high. Although the economic cost of borrowing is measured by the real interest rate, reported earnings reflect nominal interest charges. Debt–equity ratios in Japan are higher than in the U.S. during much of our sample period, so this overstatement is more important for Japanese than for U.S. earnings. Third, inflation induces spurious profits for goods held in inventory or for assets that are sold. Nominal appreciation of inventories is

[5]One other factor, of some importance in the Japanese context, is accrued but unrealized appreciation of assets that may contribute to economic but not accounting earnings.

recorded as a profit, even though the firm receives no real gains. Similar problems arise if the firm sells appreciated assets, since accounting profits will show the nominal rather than the real capital gain.

Ando and Auerbach (1988) study the differences between accounting and economic earnings in Japan and the United States due to inflation. For the high-inflation period 1967–1983, the average reported earnings–price ratio for their sample of Japanese firms is 0.065, and that for their U.S. sample is 0.094. After correcting earnings for inflation-induced errors, they find a 'corrected' E/P ratio of 0.092 in Japan and 0.085 in the United States. Because of differences in leverage between U.S. and Japanese firms and differences in depreciation rates, inflation leads to overstatement of U.S. earnings but understatement of economic earnings for Japanese firms.

Inflation during the decades before 1985 causes Japanese P/E ratios to be higher than they would have been if accountants measured economic earnings, and has the opposite effect in the United States. Although this may further explain the historical disparity in the level of P/E ratios, it makes it more difficult to explain the changes since 1985. The slowing of inflation, which reduced the disparity between accounting and economic earnings, should have reduced measured Japanese P/E ratios and raised their U.S. counterparts. This effect is strengthened by the fact that inflation declined faster in Japan than in the U.S. after 1984. Rather than explaining recent events, the disparity between economic and accounting earnings therefore magnifies the P/E puzzle.

4. Required returns and expected growth: Japan and the U.S.

The apparent inability of accounting factors to explain why adjusted Japanese price–earnings ratios are high in relation to historical values and in relation to U.S. P/Es during the second half of the 1980s leads us to consider two alternative explanations. First, investors may have believed that Japanese firms had extraordinary growth opportunities. Second, the required return on equity may have been lower in Japan than in the U.S., so the two markets were capitalizing earnings differently.

This section considers these explanations for the Japanese stock market boom of the mid-1980s and the collapse of 1990. It is inherently difficult to evaluate these explanations, however. First, the market's expectations about growth and required returns almost certainly vary with the forecast horizon. Most earnings- and dividend-discount models collapse the vectors of growth expectations and required returns into scalars, but this abstracts from the rich patterns of expected earnings and discount rates used by the market when setting prices. Second, the market's expectations of these variables are unobservable. Even if we were confident that our models captured the market's pricing function reasonably well, we could not be sure that we have

selected appropriate inputs. The results in this section are therefore suggestive, rather than conclusive.

4.1. Growth and required returns in infinite- and finite-horizon models

Miller and Modigliani (1961), in their classic paper on share valuation, offer a convenient framework for considering the effect of expected growth and required returns on price–earnings ratios. In their model, the discount rate r is constant and firms can invest a fraction k of each period's earnings in projects that have a perpetual supernormal return of r^*. If the firms pay out their remaining earnings as dividends, earnings grow at the rate $g = kr^*$ while the supernormal investment opportunities are available.

Within this framework, one obtains the standard earnings-discount model,

$$P/E = (1-k)/(r-kr^*) = (1-k)/(r-g), \tag{4}$$

by making the extreme assumption that the supernormal opportunities are available forever. With the more realistic assumption that supernormal investment opportunities are available only for the next T years, Miller and Modigliani approximate the price–earnings ratio as

$$P/E = [1 + kT(r^* - r)]/r = [1 + T(g - kr)]/r. \tag{5}$$

In table 6 we use these relations, along with the 1985–1986 and 1989–1990 pairs of adjusted P/E ratios, to estimate the implied growth rate g for various required returns r. Under the extreme assumption that Japanese firms will always be able to invest their retained earnings in supernormal investment opportunities (infinite T), the estimated value of $r-g$ in the first panel of table 6 falls from 2.25% in 1985 to 1.37% in 1986.

This relatively small implied change in $r-g$, coupled with the large increase in Japanese asset values and P/Es over this period, illustrates the nonlinearity of eq. (4). When the P/E ratio is large, the implied value of $r-g$ is small and subject to large percentage changes with relatively small absolute changes. Thus, if we are willing to assume that supernormal investment opportunities will always be available in Japan, the doubling of P/Es in 1986 can be explained by an unanticipated, once-and-for-all decline of less than one percentage point in the required return or by a similar increase in the (perpetual) growth rate.

The results for 10 and 25 years of supernormal growth opportunities illustrate that the foregoing calculations are sensitive to the assumption that new opportunities are available forever. If we use a long-term growth forecast of about 4.5% per year (which is comparable to the reported expectations of Japanese growth for 1985 discussed below) and a horizon of

Table 6

Growth rates implied by adjusted price–earnings ratios with supernormal investment opportunities of various durations.[a]

Year	Required return, r								
	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%
					Japan: 10-year horizon				
1985	−2.02	−0.70	0.63	1.96	3.29	4.62	5.95	7.28	8.61
1986	3.10	5.28	7.46	9.65	11.83	14.01	16.20	18.38	20.56
1989	2.30	4.34	6.39	8.44	10.49	12.54	14.59	16.64	18.69
1990	−0.62	0.94	2.51	4.07	5.63	7.20	8.76	10.32	11.89
					Japan: 25-year horizon				
1985	0.63	1.40	2.17	2.94	3.71	4.48	5.25	6.03	6.80
1986	2.53	3.62	4.70	5.79	6.88	7.97	9.06	10.14	11.23
1989	2.43	3.50	4.57	5.64	6.71	7.78	8.86	9.93	11.00
1990	1.28	2.16	3.03	3.91	4.79	5.67	6.55	7.43	8.31
					United States: 10-year horizon				
1985	−4.19	−3.23	−2.26	−1.29	−0.32	0.64	1.61	2.58	3.55
1986	−3.32	−2.20	−1.09	0.02	1.14	2.25	3.37	4.48	5.59
1989	−4.08	−3.10	−2.11	−1.12	−0.14	0.85	1.84	2.82	3.81
1990	−4.06	−3.07	−2.08	−1.09	−0.10	0.89	1.88	2.87	3.86
					United States: 25-year horizon				
1985	−0.75	−0.21	0.33	0.87	1.42	1.96	2.50	3.04	3.58
1986	−0.47	0.12	0.71	1.30	1.89	2.48	3.07	3.65	4.24
1989	−0.51	0.07	0.65	1.23	1.81	2.40	2.98	3.56	4.14
1990	−0.67	−0.11	0.44	1.00	1.55	2.11	2.66	3.22	3.77

[a]Source: The implied growth rates are calculated using eq. (5), $P/E = [1 + T(g - kr)]/r$, with T equaling 10 or 25 years.

ten years, the estimates in the lower panel of table 6 imply that the required annual return on Japanese equity was about 6% at the end of 1985. If the required return remained at 6%, the doubling of the adjusted P/E ratio from 1985 to 1986 implies a ten-percentage-point increase in the expected annual growth rate, to 14.5% per year for the next ten years. Alternatively, one can hold the expected growth rate fixed at 4.5%. In this case, eq. (5) implies that the required return fell from about 6% in 1985 to 3.6% in 1986.

If the supernormal growth opportunities in Japan were expected to persist for 25 years, the implied changes in r and g from 1985 to 1986 are smaller, but still substantial. For example, if the expected growth rate is assumed to be 4.5% in both 1985 and 1986, the implied required return falls from 6.5% to 4.5%. This decline is more than twice the change implied by the perpetual growth model.

The calculations for the decline in Japanese share prices in 1990 suggest similarly large changes in expectations. If the required return is 5% and supernormal profits last for 25 years, the expected growth rate would have to decline by two hundred basis points to justify the downward revision in Japanese share prices. If the supernormal profits last for only ten years, the implied growth rate falls by 5%.

Assuming that supernormal profits are not available forever, the doubling of Japanese P/Es in 1986 and their collapse in 1990 requires a substantial shift in required returns, expected growth rates, or both. The next two subsections provide some suggestive evidence on the movements in these variables.

4.2. Evidence on changing growth expectations

Long-term forecasts by econometric forecasting firms provide some guidance on investors' growth expectations. Table 7 presents long-term forecasts of growth made by Data Resources, Inc., a major U.S. forecasting firm. Although these forecasts are for real GNP, not corporate earnings, they provide evidence on growth expectations during the 1980s. There is a small decline in the ten-year forecasts for the U.S. between 1984 (2.9%) and 1988 (2.3%). The ten-year growth rates forecast for Japan are surprisingly constant, varying between 4.3% in 1985 and 3.9% in 1988 and 1990. Forecasts made after the Iraqi invasion of Kuwait in August 1990 show somewhat lower Japanese growth rates, 3.3% for ten years, but this change follows the decline in Japanese share values. DRI's five-year forecasts for Japan, which span the 1985–1986 period, display somewhat greater volatility. They decline from 4.0% in 1985 to 3.3% in 1987, and then rise to 3.9% in 1988. Five-year forecasts from the Japan Center for Economic Research (4.6% in 1985, 3.0%

Table 7

Expected annual growth rates and nominal and real yields on long-term government bonds, United States and Japan, 1982–1990.[a]

	Expected long-term growth			Before-tax yields			
	U.S.	Japan		Nominal		'Real'	
Year	10-year	5-year	10-year	U.S.	Japan	U.S.	Japan
1982	3.2	4.6		10.3	7.8	4.0	2.4
1983	3.2		3.8	11.4	7.4	5.6	4.2
1984	2.9	3.7	4.0	11.5	6.9	6.1	4.4
1985	2.9	4.0	4.3	9.2	6.3	4.4	4.1
1986	2.6	3.6		7.3	5.5	2.6	2.9
1987	2.3	3.3		8.9	5.2	3.9	3.3
1988	2.3	3.9	3.9	9.2	4.8	4.1	3.0
1989	2.3		4.0	7.8	5.8	3.1	3.0
1990	2.3		3.9*	8.5	6.8	4.4	4.0

[a]Notes: The U.S. long-term growth forecasts are from the winter issues of Data Resources Inc.'s *Long Term Review*. For example, the 1980 forecast is from the winter 1980–81 issue. Japanese growth forecasts are from various issues of the Data Resources/Nikkei *Japanese Review*. Nominal yields are for the Nikkei Long-Term Government Bond Index and the Moody's 10-year Government Bond Index. The 'real' yields are calculated by subtracting DRI's long-term inflation forecast from the contemporaneous nominal yield. *denotes the forecast from August 1990; the October 1990 forecast called for 3.3% annual growth.

in 1986, 3.8% in 1987, and 3.2% in 1988) also suggest that growth expectations in Japan declined from 1985 to 1986.

These forecasts do not support the view that accelerating growth expectations in Japan are responsible for the 1986 rise in share values. If anything, the expected growth rate for the next decade declined. Although some might argue that equity values depend on growth forecasts over periods longer than a decade, revisions in longer-term growth prospects are not likely to explain the observed price changes. As the horizon grows, forecasts of significantly more rapid growth in one economy than in another become less reliable and less plausible. Recent empirical findings [see Barro (1989)] suggest that national growth rates exhibit mean reversion. It is also difficult to imagine the type of news investors could have received that would affect growth prospects more than a decade into the future without changing near-term forecasts. Thus, we find it hard to justify the increase in P/E ratios as the result of increased optimism about future expected growth.

A similar argument applies to the Japanese P/E decline of 1990. While the Japanese economy's short-term growth prospects were reduced by fears of recession, in June and July 1990, long-term growth forecasts were only a few basis points below the projections at the end of 1989. There is consequently little evidence for concluding that declining Japanese share prices were the result of slowing growth expectations.

4.3. Required returns: Explaining the price increase

P/E ratios depend on both expected growth rates and required equity returns. Unfortunately, measuring required returns is at least as difficult as calibrating growth expectations. *Ex ante* expected returns are not observable, and neither the risk premium on equities nor the required return on riskless assets can be estimated precisely from historical data on asset returns [see Merton (1980)].

Before considering the recent changes in some proxies for required returns, it is useful to ask whether differences between required returns in the U.S. and Japanese equity markets are consistent with capital-market equilibrium. Because of the increasing integration of world financial markets, required returns in each market are linked to those in other markets. The linkage between U.S. and Japanese financial markets has grown significantly during the last decade. Before 1980, and to a lesser extent between 1980 and 1986, Japanese investors faced capital controls that limited their ability to invest in other markets. Since 1986, however, explicit barriers to capital mobility into and out of Japan have been minimal. Recent studies [see Ito (1990)] suggest that short-term riskless interest rates in Japan are now determined by world market conditions. Whether markets for long-term assets such as corporate equities are equally well integrated remains an open issue.

Required equity returns in the United States and Japan could differ for at least three reasons. First, investors may expect systematic long-term changes in real exchange rates. Frankel (1989) presents evidence of 'country effects' in real interest rates, and argues that these are the result of expected currency movements. From this perspective, lower real interest rates and required equity returns in Japan would be consistent with expectations that, after adjustment for inflation, the yen will appreciate against the dollar. There is little evidence, however, that investors expected real yen appreciation in the late 1980s.

A second possibility is that perceived risks associated with cross-border equity investments allow substantial disparities between expected returns in different markets. Despite large cross-border capital flows during the 1980s, most corporate equity is still held in the country of issue [see French and Poterba (1991)]. The cross-border equity flows may therefore be insufficient to equate expected returns. This argument is consistent with frequent claims that Japan's high savings rate has reduced required returns on Japanese assets relative to similar assets in the U.S.

Third, taxation could lead to differences in required returns for U.S. and Japanese investors. If capital markets are not perfectly integrated, differences in local tax rates can cause differences in the pre-tax returns demanded by investors in the two markets. In addition, some investors face different tax

burdens on foreign and domestic securities, making these imperfect substitutes. For example, U.S. pension funds cannot reclaim the 20% withholding tax that Japan levies on dividend payments to foreign investors. Similar problems may affect some Japanese investors, since the U.S. also requires 20% withholding on dividends remitted abroad.

The foregoing considerations make it impossible to determine *a priori* whether the expected returns on long-term assets in Japanese and U.S. capital markets differ. We therefore consider the available empirical evidence on long-term real interest rates in the two nations in an effort to evaluate required returns on riskless assets; we do not attempt to measure the equity risk premium.

Nominal interest rates in both Japan and the U.S. declined significantly between 1985 and 1988. Table 7 reports the nominal rates on U.S. and Japanese ten-year government bonds during the 1982–1990 period. Japanese long-term rates declined by 150 basis points from 1985 to 1988, a factor that is often cited [for example by Takagi (1989)] as influential in the rise in equity prices. However, the significant increase in Japanese prices and price–earnings ratios during this period must be explained by changes in real (probably after-tax) interest rates, not nominal interest rates.

Macroeconomic forecasts of long-term Japanese inflation rates suggest that real interest rates also declined in the mid-1980s. The sixth and seventh columns of table 7 report estimates of real yields calculated by subtracting Data Resources' long-term forecast of annual inflation from the contemporaneous nominal yield on government bonds. These estimates suggest that the real Japanese interest rate declined from 4.1% in 1985 to 2.9% in 1986. Similar estimates based on the five-year inflation forecast of the Japan Center for Economic Research suggest a real interest rate of 4.4% in 1985 and 3.1% in 1986, a decline of about 125 basis points during the year when P/E ratios doubled. Real interest rates in the U.S. declined even more. DRI's ten-year inflation forecasts imply that the real yield on U.S. government bonds fell from 4.4% in 1985 to 2.6% in 1986, a drop of 280 basis points. The real interest rates in table 7 also show that, before the removal of capital controls in the mid-1980s, estimated real long-term interest rates were more than 150 basis points lower in Japan than in the U.S.

The substantial changes in these crude measures of required returns on long-term riskless assets suggest that required returns on corporate equities may also have declined, in both Japan and the U.S., during the 1985–1986 period.[6] The key questions are: 1) Is the decline in required returns in Japan large enough to explain the increase in Japanese prices and P/Es? and 2) If

[6]The change in real after-tax interest rates in Japan is even larger, in percentage terms. With a 50% tax rate, the implied real after-tax borrowing rate in 1985 is 0.95, compared with 0.15 in 1986. Real after-tax rates are absolutely less sensitive to changes in nominal rates, but proportionally more sensitive, than the real interest rates reported in table 7.

the decline in required returns in Japan does explain this behavior, can we reconcile a smaller increase in U.S. prices and P/Es with a substantially larger decline in the required returns on long-term riskless assets in the U.S.?

Several factors might explain why U.S. prices and price–earnings ratios increased less than their Japanese counterparts. First, since the U.S. P/Es began at a lower level, possibly because of higher initial discount rates, the same absolute change in required returns should have a larger effect in Japan. Second, the rise in U.S. P/E ratios may have been blunted by tax changes in 1986. These changes lowered marginal tax rates on interest and dividend income for top-bracket individual investors from 50% to 28%. Part of the reduction in the tax burden on dividends, however, was offset by an increase in capital-gains tax rates. For individual investors the net effect of the U.S. tax changes should have been a substitution toward debt and away from equity.

In contrast, for an important class of Japanese investors, tax changes during the mid-1980s reduced after-tax returns on debt relative to those on common stock. Before 1987, Japanese individual investors were able to avoid taxation on interest through a system of Maruyu accounts. By the mid-1980s, nearly 70% of Japan's personal savings were in these tax-exempt accounts [Japan Securities Research Institute (1988)]. The Maruyu system was largely eliminated by the 1987 Japanese tax reform. Effective April 1, 1988, households face a 20% tax on all interest income. These tax changes should have induced a substitution from debt to equity among some Japanese investors, possibly raising stock prices. These changes, however, did not affect large classes of institutional investors.

Although these factors might explain why Japanese stock prices and P/Es increased more than their U.S. counterparts, our rough estimate of a 125-basis-point drop in Japanese required returns seems too small to explain the doubling of P/Es in 1986. In the Miller–Modigliani growth model, if supernormal investment opportunities were expected to persist for 25 years and earnings were expected to grow by 4.5% per year, a 1.25% decline in the required return would have lifted the adjusted P/E from 18.2 in 1985 to 27.7 in 1986. This implied value is much lower than our adjusted estimate of 35.7 for 1986.

4.4. Required returns: Explaining the Japanese price decline

Movements in required returns are more successful in explaining the decline of Japanese prices and P/Es in 1990. Japanese real interest rates increased by approximately 100 basis points in early 1990. This change is roughly consistent with the observed change in P/E ratios. Consider, for example, the second panel of table 7, where we examine 25 years of supernormal growth opportunities. A shift from a required return of 5% to

one of 6% between 1989 and 1990 leaves the implied expected growth rate virtually unchanged, suggesting that shifts in real interest rates could be a key factor in the recent Japanese stock market decline.

Our confidence in this analysis is weakened by the behavior of the U.S. market in 1990. If our estimates of rising U.S. real interest rates and constant growth expectations are correct, the Miller–Modigliani growth model of eq. (5) predicts a decline, rather than the observed increase, in U.S. share prices and price–earnings ratios during the first half of 1990.

5. Conclusions

Our analysis does not fully explain differences through time in the price–earnings ratios in the U.S. and Japanese stock markets. It does imply, however, that such differences are less puzzling than casual observation suggests. Roughly half of the discrepancy, even at the height of the Japanese market in the late 1980s, is due to differences in the accounting practices of the two countries. We estimate that if Japanese firms used U.S. accounting practices, the P/E ratio for the Tokyo Stock Exchange would have dropped from its reported value of 54.3 to 32.1 at the end of 1988. Accounting differences explain much of the persistent disparity between U.S. and Japanese price–earnings ratios, but they appear unable to explain the doubling of Japanese P/E ratios in 1986, from 29.4 to 58.6, or the decline during 1990.

Because Japanese stocks have traded at higher earnings multiples than U.S. stocks throughout the last five years, a given absolute change in either discount rates or growth expectations would induce larger changes in the P/E ratios of Japanese shares than in their U.S. counterparts. We find no evidence of upward revisions in expected growth rates for the Japanese economy during this period, however. There is evidence of a substantial drop in required riskless returns between 1985 and 1986, but the decline appears to be too small to explain P/E increases as large as the actual changes. In contrast, the Japanese share-price decline of 1990 seems much easier to rationalize as the result of rising Japanese required returns.

Our analysis has focused on the relation between earnings and share prices, with no discussion of the replacement value of corporate assets or changes in this value through time. This omission is potentially important, because the rapid increase in Japanese equity values during the second half of the 1980s coincides with a similar increase in Japanese land prices. Data from the Economic Planning Agency in Japan show that the value of Japanese corporate land holdings more than doubled between 1984 and 1988. Land's share of the tangible assets in Japan also grows, from 45.8% to 56.9%. In contrast, the share for U.S. corporations remains roughly constant at just over 12%.

Some analysts argue that the increase in land prices explains much of the growth of Japanese equity values in the 1980s. This argument is not entirely satisfying because it does not explain why land prices rose. As with equities, the increase in Japanese land prices is more difficult to explain than their high level. Ito (1988) identifies several reasons why land prices in Japan should be higher than those in other nations: the tax system places very low burdens on land, especially in agricultural uses; higher population density makes the marginal product of land higher than that in many other developed nations; and the archaic system of land use precludes space-efficient development of high-rise office buildings and similar structures. None of these factors, however, seems to have changed during the 1980s.

Although Japanese land prices rose significantly in the 1980s, rents did not. For example, although the price of residential land in Tokyo was 150 times that in New York City in the late 1980s, the monthly rent on new commercial office space in Tokyo was only four times that in New York [Boone and Sachs (1989)]. Value-to-rent ratios in the Japanese land market behave like price–earnings ratios in the Japanese stock market in the 1980s.

The increases in Japanese share values and land values appear to be manifestations of a single underlying phenomenon. Arguing that high land values explain the Japanese stock market's movements is unsatisfying, since corporations hold land – either as an investment or as an input for production – because of its potential contribution to earnings. If the growth in Japanese corporate land values during the 1980s is rational, this growth must reflect an increase in land's contribution to current earnings, an increase in its expected contributions, or a reduction in the rates used to discount future contributions. These are exactly the explanations we consider for rising Japanese equity values in the late 1980s. Our incomplete explanation of the movements in Japanese share prices thus raises questions about the valuation of Japanese land as well.

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