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Block holding and keiretsu in Japan: the effects of capital markets liberalization measures on the stock market

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Long-term block holding among large industrial corporations and financial institutions is prevalent in Japan. Little is known about the implications of such business practice on portfolio returns. We document the portfolio relationships of parent firms, sub firms and specific industry portfolios and we hypothesize that these relationships have changed substantially in Japan. Using certain measures for evaluating portfolios and mean-variance spanning, we test the hypothesis. Our empirical results suggest that market efficiency and integration of the Japanese stock market may have been greatly enhanced by the Japanese government's capital markets' liberalization measures, implemented in the 1970s and early 1980s. (JEL: F36, G11, G28). © 1997 Elsevier Science Ltd

Large industrial corporations in Japan own blocks of shares in smaller industrial firms on a long-term basis. Many of these smaller firms (called 'sub firms' hereafter) begin as spin-off divisions of larger firms (called 'parent firms' hereafter). Some sub firms start as joint ventures between their parent firms and other firms, as a result of the bail out by the parent firms of other firms in financial distress, or as a result of a strategic alliance between sub firms and parent firms.

Spun-off divisions, however, are the most common reason for the creation of sub firms; since, it is customary for large Japanese industrial firms to spin off certain types of new business operation, with growth prospects, as separate

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corporations. There are a number of advantages associated with this arms-length approach commonly taken by many large Japanese corporations. Smaller firms are often better suited for developing new products and services, which lie outside the focus of a parent firm. Separate sub firms can take advantage of more freedom to concentrate on such new activities. Wages at smaller firms are in general lower than those at large firms. Finally, parent firms suffer less from any agency cost that increases with firm size.

A parent firm and its sub firms form the core of a production-based (i.e. vertical) corporate group called a capital keiretsu. These sub firms are generally encouraged to expand their business transactions beyond those with their parent firms. Parent firms, however, do exert their influence on their sub firms' operations. Blocks of sub firms' shares held by parent firms and the dependence of sub firms' business on the tangible and intangible assets of their parent firms make it impractical for sub firms to pursue a business policy that is totally independent of their parent firms.

One of the major goals of newly spun-off divisions, among other types of sub firm, is to have their shares listed on a stock exchange. Parent firms generally encourage their sub firms to go public and pursue their own growth strategies. In addition to expanded financing opportunities, going public gives a sub firm an opportunity to organize its business activities so that it can withstand investors' scrutiny in the stock market. In this paper, we focus our attention on parent firms' block holding of their sub firms' listed shares.[1] We are also interested in the diversification and investment opportunity set implications for international investors using the frameworks of Treynor and Black (1973) and Huberman and Kandel (1987).

The implications of large Japanese industrial firms' block share holding in their listed sub firms on portfolios are not clear. First of all, listed firms including both parent and sub firms are subject to common shocks. On the other hand, because parent firms can be viewed as owning a fixed portfolio consisting of some shares in their sub firms as well as the return to their own business activities, there may be some observable systematic cross-sectional relationships between the asset returns of parent and sub firms. It is an empirical matter to determine the effects of any relationships between the asset returns of parent and sub firms. Potential investors would also be interested in such relationships.[2]

A testable implication of business relationships of the sort discussed above is that sub firms make better additions to index portfolios than parent firms.

In addition to production-based (vertical) corporate groups discussed so far, there are bank-based (horizontal) corporate groups. In the latter, a large bank holds small fractions (up to 5%) of shares in other group firms. Such bank-based groups include large general trading firms as well as large industrial firms and other firms, some of which own small fractions (often as low as a fraction of 1%) of other group firms and banks.[3] Since large banks and general trading firms are the major equity holders in other firms in bank-based corporate groups, it is of interest to see the portfolio implications of such block holdings. A testable empirical implication is that the stocks of banks and general trading firms are even more diversified than the average parent and sub firms.

The Japanese government removed many of the capital-market restrictions in the early 1980s in their major effort to deregulate Japanese financial industries. We are particularly interested in knowing the impact that these capital-market deregulation measures had on the degrees of diversification of various types of Japanese industrial and financial firms viewed as portfolios.

I. Japanese government measures for liberalizing capital markets

There is a general consensus among finance practitioners and academics in Japan that the Japanese financial system went through a major reform in the period from the late 1970s to the mid 1980s. (See, for example, Horiuchi and Yoshino, 1992, p.1) and Takahashi, 1991). In order to meet a major shortfall in its tax revenues during the prolonged recession following the first oil shock in 1973, the Japanese government issued special (deficit) bonds in large quantities. In addition, ensuing high levels of public spending was further financed by the special bonds as well as construction bonds also issued by the Japanese government. The total amounts of these newly issued government bonds ranged from 10 to 14 trillion yen every year between 1978 and 1986.

This massive issuing of government bonds became the driving force to change the Japanese financial system from one based on the banking sector to a more Western-like system. In particular, direct financing through expanded securities markets has become a prominent means of raising corporate capital and has replaced many of the financing functions once performed by the banking sector (Horiuchi and Yoshino, 1992).

The Japanese government had to relax the rules under which these large quantities of government bonds were transacted in the bond market. The traditional, almost exclusive dependence on the banking sector for underwriting government bonds had to be abondoned. Financial institutions became unwilling to underwrite the massive government bonds under the existing strict sale restrictions on government bonds. The strict restrictions were largely removed by the late 1970s.

Additional liberalization measures were introduced. Under the new measures, banks started to sell government bonds at their branches in 1983, bank dealings of all types of bond were allowed in 1984, and the bond futures market was established in 1985.

These bond market liberalization measures were also accompanied by many other measures liberalizing the rules under which banks and securities firms could operate their business. Some of these measures were revisions of existing laws while others took the form of Ministry of Finance's administrative guidance. For example, securities firms benefitted from: relaxed rules for establishing new branches (1977); getting the same level of flexibility as banks for dealing with Japanese government bonds (1983); and further liberalization in establishing small branch offices for marketing bonds as well as mutual funds (1984).

Banks were also given almost full-fledged entry rights into the securities business during this period. Many new financial products became available under the liberalized rules. Such products include: transferable certificates of

deposits, government bond mutual funds, and money market certificates. These and other similar products were marketed by both banks and securities firms. Other 1977 liberalization measures allowed securities firms to charge discounted commission fees for transactions in the Japanese stock exchanges based on the total monetary amounts rather than the number of shares transacted. Further volume discounts in commission fees were allowed for transactions above 50 million yen in 1985 and for transactions above 100 million yen in 1986.

Another major change in the stock market started with the revision of the Japanese Securities Exchange Law in 1965 and 1971. More stringent disclosure requirements and more transparent description of the underwriters' responsibilities were imposed, respectively, on firms and their underwriters planning to issue new equity. An implication of these measurements is that corporations began issuing new equity in public offerings at market value rather than at par value, which is usually 50 yen per new share (Wallich and Wallich, 1976). The Japanese corporations' traditional method of giving valuable equity subscription rights at par to existing shareholders, which impeded the development of new equity markets, lasted into the early 1980s. The proportion of the new equity financing on the Tokyo Stock Exchange that was public offerings (i.e. not at par) increased gradually from 0% in 1965 to 38% in 1971, to 66% in 1977, to 80% in 1982 and to over 90% in 1985.

Remaining restrictions on foreign access to Japanese stock markets were removed, and US and other foreign stock brockerage firms were allowed to have membership on the Tokyo Stock Exchange by 1985. Also, additional capital control measures were largely removed by 1985.

Another liberalization measure that the Japanese Ministry of Finance took in the late 1970s was to promote the market for bonds with equity nature. As a result, many industrial and financial firms started to issue convertible and warrant bonds in large quantities. The proportion of convertible bonds in all corporate bonds issued increased from 9% in 1980 to 63% in 1985. It is believed that the public offering practice of new equity at market value and the issuance of bonds with equity nature that became prevalent by 1985 have contributed considerably to the efficient operation of the Japanese stock market.

In the latter half of the 1980s and in response to the newly instituted restrictions on insider trading, information disclosure requirements and also to investors' demand for such information disclosure, more information on firm operations was disclosed by firms issuing equity and/or bonds with an equity nature than in the early 1980s. In the late 1980s, Mitsubishi Bank lead the banking industry by disclosing information based on SEC standards, which are more stringent than the Japanese requirements.[4]

In addition to the government liberalization measures, the development of information technology helped increase the efficiency of the Japanese stock market operations. For example, during the early 1980s banks and security firms jointly developed on-line computer information systems for investors. Also in 1983, the Tokyo Stock Exchange Price Information System provided

real-time prices to all branches of securities firms through monitors and price boards. By 1985 all stock transactions were computerized.

Because of the major liberalization measures that took place in Japan in the period 1981–1985 deregulating foreign exchange, capital markets, and financial institutions, considerable structural change is expected to have taken place in the 1981–1985 sub-period of our analysis. Our empirical analysis will focus on identifying the impact of the financial liberalization measures by comparing certain firm performance measures between the two sub-periods, 1981–1985 and 1986–1990.[5]

Next, we document the risk-return performance of parent and sub firms in these periods.

II. The portfolio effects of parents and subs over the deregulation event

The deregulation of Japanese markets was a significant event in Japanese economic history. It is likely that the event had an impact directly upon Japanese firms' real assets holdings as well as on the financial market in which they trade. Undoubtedly, other events have occurred over the same time period, which may lessen or enhance any portfolio effects that we observe. The deregulation itself may have contributed to a change in business opportunities and the business risk of Japanese firms.

Unfortunately, we do not separate the effects of business risk and business opportunity changes that are not the result of the deregulation; although, we do have a variety of control variables. Therefore, any observed portfolio effects may be attributable to other synchronous events as well as to the deregulation. In the tests of section II, we control for the calendar time of the deregulation and for market returns, but not for other variables. In section III, we are able to control for other variables such as the Gensaki rate, serial correlation in a longer term Gensaki's returns, the predictive ability of the lagged TSE index, the exchange rate between the Japanese yen and US dollar, and the month of January.

We are interested in whether the deregulation had any effects on the joint, first and second, return moments of Japanese stocks, particularly parents and subs, in a portfolio context. This is perhaps a more general approach to event studies in that some event studies examine the significance of only returns. Specifically, we wish to measure whether the assets have changed in their portfolio performance, when held alone or with a broadly based US or Japanese index, and we wish to measure whether the financial investment opportunity set has changed over the event period. Respectively, we use the Sharpe ratio, the appraisal ratio, and the spanning statistic for measuring these effects.

There are at least three reasons why the deregulation may have altered the portfolio attributes of parents and subs. First, firms were able to raise debt capital and substantially more equity capital more efficiently and in a more informationally efficient market, after the deregulation. International information and capital flow restrictions were reduced. Asset prices and returns more

fully reflected potential value, thereby altering the structure of financial investment risk and return. A priori, it is difficult to say how the removal of the operating and informational efficiencies would affect the portfolio measures of Japanese equities. However, we do expect changes in our portfolio measures.

Second, after deregulation, Japanese firms expanded and some Japanese firms were able to pursue an international diversification strategy. The portfolio implication is that previously less diversified parent or sub firms would become more attractive as stand-alone investments and would not significantly contribute to index diversification because the firms were more like the index itself. This would mean that the benefits of diversification, both international and domestic, would be reduced but not necessarily eliminated. On the other hand, sub firms that did not or could not diversify may be attractive to hold with an index or parent and would contribute more to enhancing the performance of the Japanese index and parent. Parent firms would benefit because of their equity position in the subs. An implication is that Japanese investors need not be as concerned about international diversification and home country bias because the home country index became more similar in performance to the US index after deregulation.[6]

Third, the deregulation of markets may have removed any microstructure impediments that prevented stock returns from being influenced by common domestic and international economic shocks. Correlations should rise, the betas of many stocks should become more similar, and spanning of the investment opportunity set by a small number of mimicking portfolios should be enhanced. Overall, the deregulation should contribute to the similarity or integration of the US and Japanese markets.

II.A. Performance measures for parent and sub firms in Japan

Suppose investors face an N asset opportunity set with $(N \times 1)$ mean excess return vector μ and $(N \times N)$ covariance matrix Σ. A portfolio position is characterized by an $(N \times 1)$ vector x. A portfolio is efficient in the mean-variance sense if it has the smallest return variance among all the portfolios, which have the same mean excess return. One measure of the performance of a portfolio p relative to its efficient counterpart is the Sharpe (1966) measure of performance:

$$\langle 1 \rangle \qquad Sh_p = \mu_p / \sigma_p,$$

where μ_p and σ_p are, respectively, portfolio p's mean excess return and return standard deviation defined by

$$\mu_p = \mu' x_p \qquad \text{and} \qquad \sigma_p = \left(x' \mu_p \sum x_p \right)^{1/2}.$$

The Sharpe measure of performance is maximized by choosing x to be

$$\langle 2 \rangle \qquad x_m = \Sigma^{-1} \mu / i' \Sigma^{-1} \mu,$$

where i is an $(N \times 1)$ vector of ones, Σ^{-1} denotes the inverse, and the resulting

Sharpe performance measure is[7]

$$\langle 3 \rangle \qquad Sh_m = \mu_m / \sigma_m = \sqrt{a}\,,$$

where $a = \mu' \Sigma^{-1} \mu$ and $Sh_p \leq Sh_m$.

In the following, we compare Japanese parent firms and their sub firms using the Sharpe performance measure as a descriptive measure of the degree of mean-variance efficiency. If firm efficiency is gained by diversification, *ceteris paribus*, then the Sharpe measure for a parent firm is larger than that for its sub firms. In addition, a well-diversified market index, which approximates the theoretical construct of a mean-variance efficient market portfolio better than parent or sub firms, may have a larger value for the Sharpe performance measure. Thus, our hypothesis is that Sharpe performance measures for parent firms are larger than those for sub firms, but are not as large as those for a market index. (See, for example, Levy and Lim, 1994, for another application of Sharpe measures of portfolio performance.)

We are interested in the location in return-total risk space of parents and subfirms. More particularly, we are interested in whether those locations in a cross-sectional sense change before and after the financial liberalization event. We summarize this change by the respective Sharpe measures of parents, subfirms and indexes before and after liberalization. In addition, the values of the means and standard deviations are measured on the respective portfolios before and after liberalization.

A Sharpe performance measure uses total risk and does not distinguish between systematic and idiosyncratic risks and hence does not control specifically for systematic risks. Investors, however, may be interested in measuring a firm's idiosyncratic performance after controlling for common risk factors. That is, we may be interested in knowing whether or nor parent or sub firms make good additions to holding an index portfolio. A descriptive statistic for measuring the degree of such an incremental contribution of owning shares in firm i together with an index portfolio I is given by the Treynor–Black appraisal ratio (Treynor and Black, 1973)[8]

$$\langle 4 \rangle \qquad AR_i = \alpha_i^2 / S_{\epsilon_i}^2,$$

where α_i and $S_{\varepsilon i}$ are defined in the following regression context

$$\langle 5 \rangle \qquad \left(r_{it} - \bar{r}_f\right) = \alpha_i + \beta_i \left(r_{it} - \bar{r}_f\right) + \varepsilon_{it}, \qquad t = 1, 2, ..., T,$$

$$\langle 6 \rangle \qquad \varepsilon_{it} \sim \left(\mathrm{O}, \mathrm{S}_{\epsilon_i}^2\right),$$

and $\bar{r}_f = (1/T)\sum_{t=1}^{T} r_{ft}$ is the time average of risk-free rates, r_{ft}.

It can be shown that AR_i is related to the Sharpe performance measures, Sh_m and Sh_l, as follows (Jobson and Korkie, 1982, 1984):

$$\langle 7 \rangle \qquad AR_i = Sh_m^2 - Sh_l^2,$$

where Sh_m is the maximum value for the Sharpe performance measure that can be attained by a combination of firm i and index l.

If sub firms are less correlated with the index than parent firms, for example, then sub firms may have contributed more to holding index (i.e. to enhancing

the performance of the index); therefore, we would expect AR_i to be larger for sub firms than for parent firms.

We employ both US and Japanese market indices in our computations. This allows us to interpret the results of adding a Japanese asset to an index portfolio held by a US investor and Japanese investor, respectively.

While Sharpe performance measures assess the value of holding parents and subfirms separately, the appraisal ratio allows one to assess the value of adding either the parent or the sub firm to a market index. As in the case of the Sharpe measure, we are particularly interested in whether the value added has changed before and after the liberalization event. If we find that sub firms' and parents' contributions to the Japanese index change over the event period, then this will reflect a change in the diversification level and performance of the Japanese market before and after the event. This will be independent of firm size because subfirms will be small relative to the parent firms before and after the event date.

II.B. Results for large industrial firms and their sub firms

We calculated the Sharpe performance measure ⟨1⟩ and the Treynor–Black appraisal ratio ⟨4⟩ for the period 1981–1990 for 20 large Japanese industrial firms (parent firms) and their sub firms, all of which are listed in the First Section of the Tokyo Stock Exchange.[9] Equation ⟨4⟩ was calculated using both the value-weighted Tokyo Stock Price Index (TOPIX) and the CRSP value-weighted US Index. The sample period is divided into two sub periods: 1981–1985 and 1986–1990.

Table 1 shows the parent firms included in our sample, their industrial affiliation, the numbers of sub firms and parent firms' fractional ownership in them, and continuously compounded mean returns. The last row in the table gives overall mean returns and standard deviations for sub firms and parent firms.

Table 2a and b and show values for the Sharpe performance measure and the Treynor–Black appraisal ratio for parent and sub firms. Surprisingly, mean Sharpe performance measures, which do not control for systematic risks, are similar for both parent and sub firms for both sub periods 1981–1985 and 1986–1990. This behavior of average Sharpe performance measures is explained by the fact that the mean returns and their total risks for these firms remained relatively constant over the two sub periods.[10]

Treynor–Black appraisal ratios ϕ, which control for systematic risk factors, do have the expected patterns for the sub period 1981–1985 (Table 2a) for the US index but do not have the expected patterns for the Japanese index for most industries. (The mean values given in the last row of Table 2a are 0.013 (subs) and 0.024 (parents) for the Japanese index compared with 0.010 (subs) and 0.008 (parents) for the US index.)

For 1986–1990, however, the Treynor–Black appraisal ratios for sub firms are larger than for parent firms for both Japanese and US indices. (The mean values for subs and parents are 0.008 and 0.004 using the Japanese index and 0.008 and 0.005 using the US index. See the last row of Table 2b.) The

differences in the means for the appraisal ratios between sub and parent firms are significantly different from zero at a 1% level. Therefore, holding sub firms enhances the portfolio performance of either Japanese or US indices more than holding parent firms do. The mean values for the Treynor–Black appraisal ratio are quite similar for both Japanese and US indices. This suggests that, for the sub period 1986–1990, US and Japanese indices have similar portfolio implications from holding Japanese parent or sub firms. That is, similar improvements in the US and Japanese indices are achieved from adding Japanese firms. More improvement, however, is obtained from the addition of sub firms versus parent firms.[11]

The performance contributions by subs and parents to the Japanese index evidently change before and after the event date. Substantial improvement in the performance of the Japanese index was possible, from adding subs and parents, before liberalization. After liberalization, the magnitude of this improvement declined and is more akin to the contributions to the US index, which change little over the event. This is suggestive of more integrated markets.[12]

II.C. Banks, fire and casualty insurance firms and general trading firms

Large Japanese banks, fire and casualty insurance firms, and general trading firms hold small blocks of shares in other large listed firms. (Japanese anti-monopoly laws prohibit financial institutions from owning more than 5 or 10% of the shares in other firms, where the holding limit depends on the type of the financial institution.) Cross shareholding is prevalent among large banks, general trading firms and large industrial firms; but, the actual fractions of shares held in cross shareholding rarely exceed a few percent of the total shares outstanding. Bank-based corporate groups are characterized by large banks, insurance firms, and general trading firms holding small blocks of shares in other group firms. It is therefore of interest to see how these finance-oriented firms compare with other large industrial firms in terms of their performance as portfolios. Our hypothesis is that these horizontally integrated firms are more diversified and do not add to the performance of a well-diversified market index.

Table 3a and b show portfolio performance measures, betas, returns and other moments for these financial firms as well as for industrial firms for the sub periods 1981–1985 and 1986–1990. A comparison of the appraisal ratios for banks between the sub periods 1981–1985 (Table 3a upper panel) and 1986–1990 (Table 3a, lower panel) clearly shows that the idiosyncratic nature of Japanese banks' share price movements in the early 1980s lessened after 1985. That is, the decline in the appraisal ratios with respect to the Japanese and particularly the US indices indicates more efficient indices and more integrated markets. This is considered to be the result of the liberalization measures for deregulating Japanese foreign exchange and capital markets, as well as financial institutions, that took effect in 1983.

The betas calculated using the Japanese and US indices for the sub period 1986–1990 presented in Table 3b are much closer to each other than for the

TABLE 1. Returns and block shares held by Japanese industrial firms

Parent firm	Number of sub firms (1981–1985, 1986–1990)	Fractions owned by parent firms (1981–1985, 1986–1990)	1981–1985 monthly return[a] Parent sub firms	1986–1990 monthly return[a] Parent sub firms
Manufacturing: electronics/electric machinery				
Fujitsu	11, 12	0.10(0.02), 0.16(0.17)	0.016(0.039) 0.013(0.101)	0.000(0.015) 0.001(0.108)
Hitachi	21, 21	0.29(0.24), 0.28(0.23)	0.014(0.031) 0.009(0.062)	0.008(0.008) 0.008(0.062)
Matsushita	17, 19	0.25(0.23), 0.23(0.23)	0.009(0.031) 0.007(0.093)	0.004(0.015) 0.008(0.077)
Mitsubishi Elec.	7, 9	0.08(0.01), 0.10(0.10)	0.007(0.039) 0.010(0.054)	0.011(0.015) 0.006(0.085)
NEC	21, 21	0.17(0.03), 0.18(0.17)	0.018(0.031) 0.020(0.093)	0.000(0.015) 0.005(0.093)
Toshiba	15, 17	0.23(0.24), 0.23(0.24)	0.011(0.023) 0.010(0.062)	0.012(0.023) 0.007(0.077)
Manufacturing: iron and steel				
Kobe steel	9, 11	0.17(0.04), 0.16(0.19)	0.002(0.015) 0.005(0.101)	0.018(0.008) 0.013(0.039)
Kawasaki steel	4, 3	0.08(0.10), 0.11(0.12)	0.000(0.015) 0.007(0.101)	0.020(0.004) 0.014(0.039)
NKK	16, 15	0.05(0.04), 0.06(0.09)	0.001(0.015) 0.007(0.062)	0.018(0.054) 0.015(0.031)
Nippon steel	43, 39	0.11(0.12), 0.11(0.12)	0.004(0.015) 0.008(0.008)	0.018(0.023) 0.015(0.054)

Manufacturing: automobile						
Honda	5, 5	0.04(0.02), 0.05(0.04)	0.016(0.015)	0.010(0.046)	0.001(0.023)	0.009(0.046)
Nissan	35, 35	0.14(0.15), 0.12(0.12)	0.001(0.015)	0.008(0.062)	0.005(0.008)	0.008(0.101)
Toyota	36, 41	0.13(0.11), 0.12(0.12)	0.014(0.023)	0.010(0.085)	0.010(0.023)	0.012(0.046)
Manufacturing: heavy industrial/shipbuilding						
Mitsubishi H.I.	25, 23	0.04(0.03), 0.04(0.02)	0.013(0.015)	0.007(0.062)	0.010(0.015)	0.012(0.046)
Manufacturing: textile						
Toray	17, 19	0.05(0.05), 0.05(0.04)	0.013(0.023)	0.007(0.062)	0.002(0.015)	0.013(0.085)
Construction						
Taisei	14, 16	0.06(0.13), 0.06(0.12)	0.010(0.008)	0.014(0.046)	0.019(0.015)	0.010(0.046)
Transportation						
Kintetsu	6, 6	0.24(0.59), 0.23(0.19)	0.013(0.031)	0.013(0.062)	0.012(0.008)	0.014(0.062)
Tokyo	8, 11	0.19(0.08), 0.17(0.09)	0.022(0.023)	0.015(0.116)	0.011(0.062)	0.009(0.077)
Daiei	4, 10	0.16(0.16), 0.12(0.09)	0.004(0.008)	0.010(0.101)	0.012(0.008)	0.015(0.062)
Ito Yokado	—, 3	—, 0.44(0.12)	—	—	0.003(0.046)	0.007(0.054)
All	314, 336	0.14(0.03), 0.14(0.16)	0.010(0.054)	0.010(0.077)	0.010(0.077)	0.010(0.054)

Notes: These parent firms and their sub firms were listed in the first section of the Tokyo Stock Exchange during the period 1981–1990. The names of sub firms are available on request from the authors.

[a]Continuously compounded mean monthly returns (standard deviations in parentheses).

TABLE 2a. Mean Sharpe performance measures and mean Treynor–Black appraisal ratios for parent and sub-firms, 1981–1985

	Sharpe measure		Treynor–Black ratio			
			Japan index		US index	
Parent firm	Sub	Parent	Sub	Parent	Sub	Parent
Manufacturing: electronics/electric machinery						
Fujitsu	0.066	0.118	0.008	0.008	0.008	0.009
Hitachi	0.038	0.097	0.019	0.012	0.010	0.008
Matsushita	0.012	0.038	0.018	0.017	0.018	0.006
Mitsubishi Elect	0.030	0.007	0.015	0.072	0.006	0.012
NEC	0.118	0.140	0.015	0.004	0.021	0.012
Toshiba	0.048	0.060	0.013	0.021	0.009	0.004
Manufacturing: iron and steel						
Kobe steel	−0.028	−0.037	0.016	0.030	0.011	0.002
Kawasaki steel	0.000	−0.062	0.016	0.074	0.004	0.008
NKK	0.010	−0.059	0.012	0.055	0.009	0.007
Nippon steel	0.026	−0.014	0.012	0.036	0.009	0.002

Manufacturing: automobile						
Honda	0.050	0.095	0.006	0.004	0.004	0.002
Nissan	0.031	−0.058	0.014	0.059	0.010	0.012
Toyota	0.042	0.087	0.011	0.004	0.006	0.003
Manufacturing: heavy industrial/shipbuilding						
Mitsubishi H.I.	0.022	0.075	0.009	0.006	0.007	0.005
Manufacturing: textile						
Toray	0.021	0.092	0.007	0.010	0.007	0.006
Construction						
Taisei	0.093	0.067	0.007	0.007	0.011	0.012
Transportation						
Tokyu	0.113	0.214	0.011	0.027	0.015	0.045
Retail						
Daiei	0.037	−0.043	0.010	0.006	0.006	0.002
All industries	0.042	0.046	0.013	0.024	0.010	0.008

TABLE 2b. Mean Sharpe performance measures and mean Treynor–Black appraisal ratios for parent and sub firms, 1986–1990

Parent firm	Sharpe measure		Treynor–Black ratio			
			Japan index		US index	
	Sub	Parent	Sub	Parent	Sub	Parent
Manufacturing: electronics/electric machinery						
Fujitsu	−0.042	−0.033	0.019	0.006	0.021	0.010
Hitachi	0.028	0.036	0.005	0.000	0.006	0.001
Matsushita	0.030	0.002	0.008	0.001	0.008	0.002
Mitsubishi Elect.	0.019	0.063	0.008	0.001	0.008	0.002
NEC	0.006	−0.032	0.010	0.003	0.010	0.003
Toshiba	0.022	0.062	0.008	0.003	0.008	0.003
Manufacturing: iron and steel						
Kobe steel	0.075	0.102	0.006	0.007	0.006	0.006
Kawasaki steel	0.082	0.115	0.004	0.010	0.003	0.010
NKK	0.086	0.090	0.010	0.004	0.005	0.010
Nippon steel	0.082	0.109	0.013	0.008	0.011	0.007

Manufacturing: automobile						
Honda	0.033	−0.034	0.003	0.005	0.004	0.010
Nissan	0.033	0.009	0.008	0.001	0.007	0.002
Toyota	0.068	0.057	0.008	0.002	0.006	0.005
Manufacturing: heavy industrial/shipbuilding						
Mitsubishi H.I.	0.054	0.054	0.004	0.001	0.003	0.001
Manufacturing: textile						
Toray	0.065	−0.017	0.010	0.010	0.011	0.007
Construction						
Taisei	0.048	0.116	0.004	0.012	0.003	0.010
Transportation						
Kintstsu	0.080	0.073	0.005	0.001	0.005	0.003
Tokyu	0.038	0.044	0.003	0.000	0.007	0.004
Retail						
Daiei	0.087	0.057	0.010	0.001	0.009	0.001
ItoYokado	0.031	−0.020	0.002	0.004	0.003	0.009
All industries	0.048	0.045	0.008	0.004	0.008	0.005

sub period 1981–1985 and again suggest that considerable integration of the capital markets in both countries took place in the second half of the 1980s. The difference in return behavior between financial and industrial firms observed for the 1981–1985 sub period also disappeared in the 1986–1990 sub period (Table 3b). On the other hand Table 3b also shows that excess returns and residual variances have not been substantially affected by the liberalization measures.[13,14]

The appraisal ratios in Table 3a suggest that city and long-term banks, insurance firms, and general trading firms enhance little the portfolio performance of the Japanese or US indices during 1986–1990. This is consistent with the fact that their highly diversified finance and business operations of Japanese city banks and general trading firms work as proxies for the indices. On the other hand, some small gains in portfolio efficiency may be obtained by adding casualty and fire insurance firms to holding either of the indices. This may reflect the fact that considerable regulations, which still remain in the insurance sector in Japan, prevent Japanese casualty and fire insurance firms from diversifying their operations. Similarly, the Japanese regulations remaining in the trust banking sector may explain why trust banks seem to add to the performance of the Japanese index.

III. Mean-variance spanning of the Japanese market, 1981–1990

Another way to measure cross-sectional relationships that may exist between the returns for firms holding block shares and the held firms is the amount of the mean-variance opportunity space generated by all listed firms that is spanned by block share holding firms.

We follow the unconditional mean-variance spanning framework put forward

TABLE 3a. Portfolio performance measures for large banks, casualty/fire insurance firms, general trading firms and industrial firms, 1981–1985 and 1986–1990

	Banks				Casualty/fire insurance	Trading firms	Industrial firms	
	City	Long-term	Trust	All			Parent	Sub
1981–1985								
Sharpe index	0.320	0.322	0.266	0.307	0.152	0.000	0.046	0.042
Appraisal ratio								
Japan index	0.063	0.086	0.031	0.059	0.005	0.015	0.024	0.013
US index	0.103	0.103	0.066	0.094	0.012	0.006	0.008	0.010
Number of firms	12	3	5	20	13	8	20	314
1986–1990								
Sharpe index	0.042	0.079	0.071	0.056	0.051	0.064	0.045	0.048
Appraisal ratio								
Japan index	0.001	0.005	0.131	0.038	0.007	0.001	0.004	0.008
US index	0.000	0.002	0.002	0.001	0.007	0.001	0.008	0.008
Number of firms	12	3	6	21	14	8	20	336

TABLE 3b. Moments and other information for city banks, casualty/fire insurance firms, general trading firms and industrial firms as portfolios, 1981–1985 and 1986–1990

	City banks	Insurance firms	Trading firms	Industrial firms		Index	
				Parent	Sub	Japan	US
1981–1985							
Return, μ	0.034	0.018	0.005	0.010	0.010	0.014	0.012
(SD, σ)	(0.118)	(0.004)	(0.006)	(0.007)	(0.009)	(0.035)	(0.041)
Beta, β							
Japan index	1.329	1.313	0.580	1.256	0.613		
	(0.215)[a]	(0.268)	(0.342)	(0.207)	(0.492)		
US index	0.101	0.144	0.077	0.463	0.232		
	(4.76)[a]	(3.48)	(3.01)	(0.602)	(1.34)		
Excess return[b]							
Japan index	0.015	0.000	−0.000	−0.007	0.001		
US index	0.032	0.016	0.004	0.004	0.007		
Error term SD, S[c]							
Japan index	0.061	0.005	0.025	0.049	0.012		
US index	0.094	0.148	0.053	0.050	0.072		
1986–1990							
Return, μ	0.008	0.010	0.012	0.010	0.010	0.008	0.010
(SD, σ)	(0.010)	(0.037)	(0.034)	(0.009)	(0.007)	(0.069)	(0.052)
Beta, β							
Japan index	1.028	1.207	1.179	0.911	0.835		
	(0.121)[a]	(0.111)	(0.130)	(0.185)	(0.230)		
US index	0.717	0.729	0.751	0.495	0.588		
	(0.318)[a]	(0.372)	(0.362)	(0.555)	(0.500)		
Excess return[b]							
Japan index	0.000	0.000	0.002	0.002	0.003		
US index	0.001	0.003	0.004	0.005	0.004		
Error term SD, S[c]							
Japan index	0.004	0.004	0.081	0.043	0.037		
US index	0.074	0.032	0.141	0.056	0.046		

[a]Mean standard errors in parentheses.
[b]Expected excess return defined by $\alpha = \mu - \beta\mu_I$, where μ_I is a Japanese (I = Japan) or US (I = US) market index.
[c]The standard deviation S for the error term ϵ in regression equation ⟨5⟩ in the text.

by Huberman *et al.* (1987a) and Huberman and Kandel (1987) as well as the conditional mean-variance framework proposed by Ferson *et al.* (1993). Our objective is to measure the degree of spanning using regressions of size-sorted portfolios that mimic unobservable factors underlying asset pricing. We replicate for Japan the procedure employed by Huberman and Kandel (1987) who

analysed mean-variance spanning of the space generated by listed assets on the New York stock exchange. The mimicking portfolios used are three size-based indices. We then compare these spanning results with the results that are obtained by using the indices for banks and general trading firms as mimicking portfolios.

III.A. Spanning of size-based indices by size-based indices

Following the notation used in Huberman and Kandel (1987), we denote by r_1, $r_2, \ldots, r_{33}$ the returns for 33 equally weighted, size-sorted sets of stocks from the First Section of the Tokyo Stock Exchange. (For example, $r_1(t)$ denotes the time t returns on the portfolio of the smallest stocks where $t = 1, 2, \ldots, T$.) The returns on the three size-based indices are $(R_1(t), R_2(t), R_3(t))$ where R_1, R_2, R_3, respectively, denote the equally weighted averages of $(r_1, r_2, \ldots, r_{11})$, $(r_{12}, \ldots, r_{22})$ and $(r_{23}, \ldots, r_{33})$. Regressing r_i $(i = 1, 2, \ldots, 33)$ on the R_1, R_2 and R_3 provides the four regression coefficients a_i, b_{i1}, b_{i2} and b_{i3}:

$$\langle 9 \rangle \qquad r_i(t) = a_i + b_{i1}R_1(t) + b_{i2}R_2(t) + b_{i3}R_3(t) + e_{it}, \quad i = 1, 2, \ldots, 33, \quad t = 1, 2, \ldots, T.$$

The coefficients a_i, b_{i1}, b_{i2} and b_{i3} $(i = 1, 2, \ldots, 33)$ are estimated by the generalized method of moments (GMM).[15]

Mean-variance spanning of the space generated by $(r_1, r_2, \ldots, r_{33})$ by (R_1, R_2, R_3) is equivalent to the linear restrictions

$$\langle 10 \rangle \qquad a = 0 \quad \text{and} \quad b_{i1} + b_{i2} + b_{i3} = 1.$$

The degree of spanning can be measured by the R^2 for the regression equation $\langle 9 \rangle$ subject to the linear restrictions $\langle 10 \rangle$. GMM χ^2 tests of $\langle 10 \rangle$ for unconditional and conditional mean-variance spanning, which do not assume homoscedasticity or normality, can also be conducted.

The (33×1) disturbance vector from the multivariate regression is $e_t = r(t) - (a, b)\ (1,\ R(t))'$ where $a = 0$ and the b_i sum to one under the spanning restriction. Letting f_t be the values of a set of information instruments, the GMM sample moment restrictions are

$$e_t \otimes [R(t), f_t] = 0$$

from which the GMM χ^2-statistic is computed. The distinction between unconditional and conditional spanning is that in the former f_t is empty and in the latter it contains the information instruments. Instruments used for conditional GMM are: a constant, the level of the 1-month Gensaki (bonds with repurchase agreement) rate, the lagged excess returns of a 3-month over a 1-month Gensaki, the lagged return of the equally weighted Tokyo Stock Exchange Stock index, the Japanese yen per US dollar exchange rate, and a dummy variable for the month of January.

Huberman *et al.* (1987b) and Huberman and Kandel (1987) find that the restrictions $\langle 10 \rangle$ are satisfied for NYSE size-sorted portfolios. They also find that the b_1 coefficients of R_1 decrease as one moves from r_1 to r_{33}, the b_3 coefficients of R_3 increase as one moves from r_1 to r_{33}, and the b_2 coefficients of R_2 take their higher values in the middle. We observe exactly the same

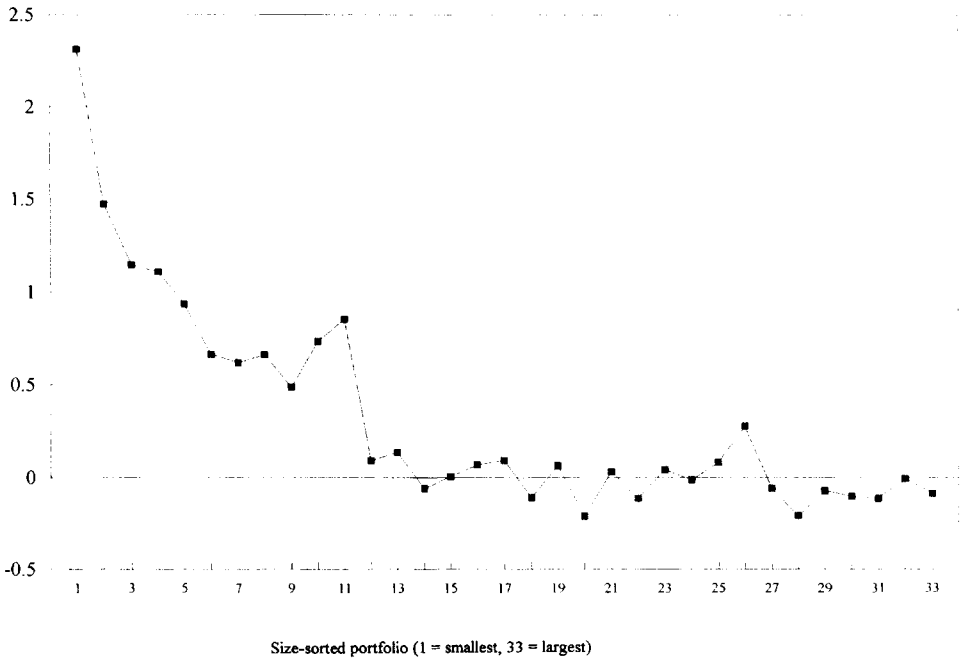

FIGURE 1. Regression coefficients for small-size index.

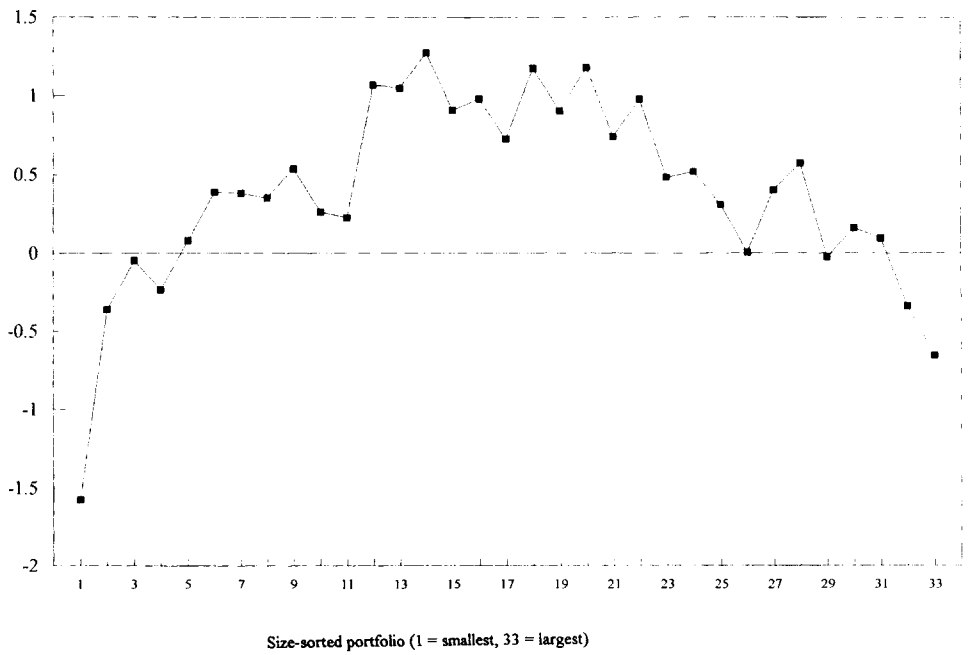

FIGURE 2. Regression coefficients for medium-size index.

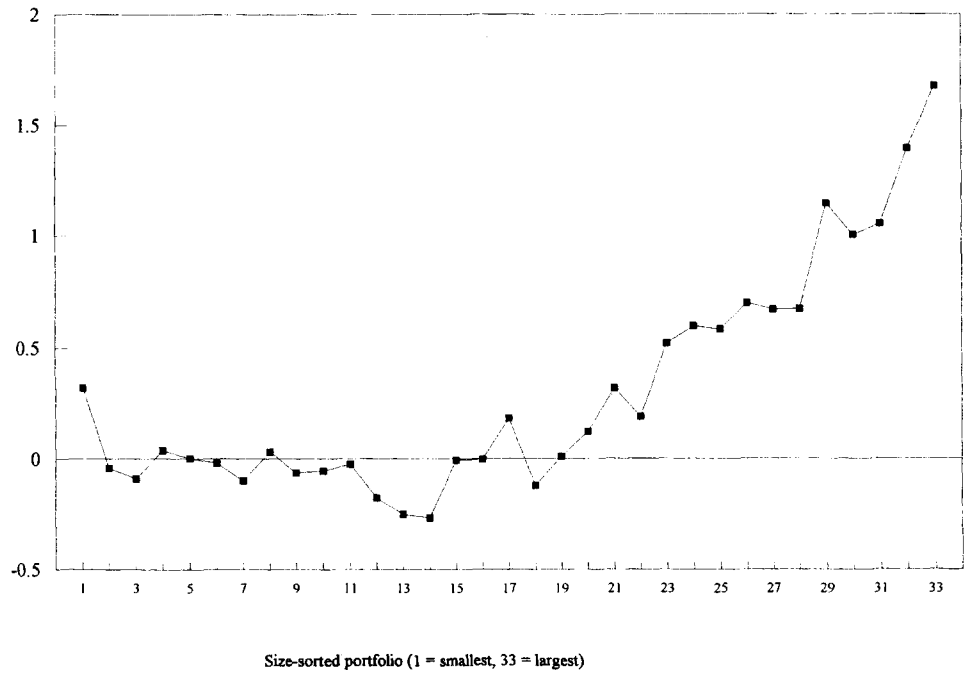

FIGURE 3. Regression coefficients for large-size index.

coefficient patterns for the First Section of the Tokyo Stock Exchange. Figures 1–3 show, respectively, the coefficients b_1, b_2 and b_3 for the period 1986–1990.[16]

The R^2s and the sum of the slope coefficients (Σb_i) for mean-variance spanning of Japanese size portfolios are presented for the periods 1981–1985 and 1986–1990 in Table 4. For both periods, the slope sums Σb_i are numerically close to one but the average slope sums for the second period 1986–1990 (1.006 and 0.999 for unconditional and conditional spanning, respectively) are slightly closer to one than the average slope sums for the first period 1981–1985 (1.020 and 0.994). The R^2s increase considerably from 0.739 and 0.719 for the 1981–1985 period to 0.935 and 0.931 for the 1986–1990 period. However, the spanning hypothesis is rejected in both periods in contrast to the NYSE research, suggesting that a more diverse investment opportunities set exists in the Japanese versus the US market. The three indices are insufficient to generate the investment opportunities of the Japanese market, whereas spanning by three indices occurs in the US market.

III.B. Spanning of industry-based indices by size-based indices

Table 5 reports the R^2s for the mean-variance spanning equations of Japanese manufacturing industry portfolios by the indices for smallest, medium and largest size portfolios. As in Table 4, the mean R^2s in the last row increase

TABLE 4. Mean-variance spanning of Japanese size portfolios by indices for smallest, medium and largest size portfolios—goodness of fit, 1981–1985 and 1986–1990

Size-sorted portfolio number[a]	1981–1985				1986–1990			
	Unconditional spanning[b]		Conditional spanning[c]		Unconditional spanning[b]		Conditional spanning[c]	
	R^2	Σb_i	R^2	Σb_i	R^2	Σb_i	R^2	Σb_i
1	0.656	0.976	0.642	1.127	0.911	1.050	0.911	1.080
4	0.706	0.919	0.660	0.909	0.946	0.909	0.939	0.890
8	0.732	1.065	0.700	0.910	0.933	1.040	0.929	1.020
12	0.680	0.876	0.628	1.001	0.937	0.988	0.935	0.975
17	0.684	1.180	0.677	0.859	0.926	1.001	0.923	0.910
21	0.753	1.024	0.744	0.930	0.958	1.098	0.955	1.114
25	0.791	1.084	0.787	1.183	0.926	0.980	0.921	1.008
29	0.799	0.954	0.777	0.838	0.948	1.046	0.943	1.089
33	0.848	1.100	0.856	1.237	0.928	0.941	0.927	0.902
Mean	0.739	1.020	0.719	0.994	0.935	1.006	0.931	0.999

[a]These represent the returns for nine out of the 33 equally weighted, size-sorted sets of stocks from the First Section of the Tokyo Stock Exchange. Portfolios 1 and 33, respectively, denote the smallest and largest size portfolios. The regressors are three size-based indices (R_1, R_2 and R_3) where R_1, R_2 and R_3, respectively, denote equally weighted average returns for portfolios 1, 2, ... , 11, portfolios 12, 13, ... , 22 and portfolios 23, 24, ... , 33.

[b,c]Multivariate estimation is based on the seemingly unrelated method for unconditional spanning and conditional GMM for conditional spanning. See text for the instruments used. For each of the equations estimated by each of the methods, R^2 and the sum of the slope coefficients (Σb_i) were calculated. A high R^2 and a high value of the sum Σb_i, which are close to one, indicate a high degree of mean-variance spanning.

substantially from 0.516 (unconditional spanning) and 0.496 (conditional spanning) for the period 1981–1985 to 0.684 and 0.617 for the period 1986–1990.

These unconditional and conditional mean-variance spanning results seem to suggest that the spanning properties of the size portfolios are much better for the second period than for the first period. We attribute this to the changes in the capital market attained by the Japanese liberalization measures that were enacted during the first half of the 1980s.[17] As expected from previous empirical results using GMM, however, the GMM χ^2-tests for mean-variance spanning generally reject the hypothesis that the three size-based indices span the mean-variance space for both sub periods, 1981–1985 and 1986–1990. The implication is that the three indices are insufficient to generate the investment opportunities of the entire Japanese market.

In order to see if major block holders such as banks and general trading firms have any additional spanning power, we added the indices for banks and general trading firms to the spanning equations presented in Tables 4 and 5. These additional explanatory variables did not change the regression R^2s and added very little to mean-variance spanning by the three size-based indices.

TABLE 5. Mean-variance spanning of Japanese manufacturing industry portfolios by indices for smallest, medium and largest size portfolios—goodness of fit, 1981–1985 and 1986–1990

Manufacturing industry portfolio[a]	1981–1985		1986–1990	
	Unconditional spanning[b] R^2	Conditional spanning[c] R^2	Unconditional spanning[b] R^2	Conditional spanning[c] R^2
Food	0.621	0.597	0.780	0.760
Textile	0.534	0.503	0.811	0.798
Pulp and paper	0.392	0.380	0.470	0.420
Chemicals	0.633	0.615	0.835	0.831
Petrol and coal	0.166	0.132	0.484	0.477
Rubber	0.330	0.279	0.831	0.815
Glass andpottery	0.723	0.706	0.871	0.865
Iron and steel	0.511	0.457	0.566	0.504
Non-ferrous metal	0.439	0.423	0.762	0.762
Metals	0.596	0.598	0.751	0.734
General machinery	0.649	0.632	0.906	0.905
Electric machinery	0.638	0.632	0.436	0.394
Transportation machinery	0.492	0.489	0.567	0.558
Precision	0.482	0.481	0.567	0.574
Other	0.542	0.521	0.622	0.613
Mean	0.516	0.496	0.684	0.617

[a]These represent returns for equally weighted sets of stocks sorted by industry from the First Section of the Tokyo Stock Exchange. The regressors are three size-based indices (R_1, R_2 and R_3) where R_1, R_2 and R_3, respectively, denote equally weighted average returns for portfolios 1, 2, ..., 11, portfolios 12, 13, ..., 22 and portfolios 23, 24, ..., 33.

[b,c]Multivariate estimation is based on the seemingly unrelated method for unconditional spanning and conditional GMM for conditional spanning. See text for the instruments used. For each of the equations estimated by each of the methods, R^2 and the sum of the slope coefficients (Σb_i) were calculated. A high R^2 and a high value of the sum Σb_i, which are close to one, indicate a high degree of mean-variance spanning.

III.C. Spanning by industry indices

In order to see the spanning power of banks and general trading firms, we also ran spanning regressions using the indices for large banks, small banks, and general trading firms. These regression results are reported in Tables 6 and 7. Of particular interest is whether the liberalization measures, deregulating Japanese foreign exchange and capital markets and financial institutions in 1983, had any impact on the spanning ability of bank indices.

We see from the last row in Table 6 that, for size portfolio equations, both the mean R^2s and the sum of the slope coefficients (Σb_i) for unconditional and conditional spanning increase greatly from the period 1981–1985 to the period 1986–1990. For example, for unconditional spanning, the mean R^2 and Σb_i

TABLE 6. Mean-variance spanning of Japanese size portfolios by indices for general trading firms, small banks and large banks—goodness of fit, 1981–1985 and 1986–1990

Size-sorted portfolio number[a]	1981–1985				1986–1990			
	Unconditional spanning[b]		Conditional spanning[c]		Unconditional spanning[b]		Conditional spanning[c]	
	R^2	Σb_i	R^2	Σb_i	R^2	Σb_i	R^2	Σb_i
1	0.219	0.572	0.067	0.906	0.373	0.861	0.333	1.081
4	0.203	0.489	0.105	0.651	0.451	0.739	0.452	0.822
8	0.205	0.494	0.189	0.610	0.474	0.778	0.465	0.859
12	0.226	0.555	0.012	0.726	0.542	0.776	0.538	0.817
17	0.192	0.305	0.147	0.376	0.530	0.746	0.526	0.775
21	0.207	0.394	0.192	0.529	0.597	0.799	0.585	0.862
25	0.185	0.408	0.163	0.609	0.649	0.754	0.648	0.785
29	0.244	0.325	0.235	0.396	0.756	0.788	0.749	0.860
33	0.441	0.470	0.401	0.824	0.822	0.745	0.818	0.754
Mean	0.236	0.446	0.168	0.625	0.577	0.776	0.568	0.846

[a]These represent the returns for nine out of the 33 equally weighted, size-sorted sets of stocks from the First Section of the Tokyo Stock Exchange. Portfolios 1 and 33, respectively, denote the smallest and largest size portfolios. The regressors are three indices (R'_1, R'_2, and R'_3) where R'_1, R'_2 and R'_3, respectively, denote equally weighted average returns for eight general trading firms, 56 small local banks and 21 large banks including long-term, city, foreign exchange and trust banks. (The names of these trading firms and banks are available on request from the authors.)

[b,c]Multivariate estimation is based on the seemingly unrelated method for unconditional spanning and conditional GMM for conditional spanning. See text for the instruments used. For each of the equations estimated by each of the methods, R^2 and the sum of the slope coefficients (Σb_i) were calculated. A high R^2 and a high value of the sum Σb_i, which are close to one, indicate a high degree of mean-variance spanning.

are, respectively, 0.236 and 0.446 for the period 1981–1985 and 0.577 and 0.776 for the period 1986–1990. Similarly, the R^2s reported in Table 7 for spanning of Japanese manufacturing industry portfolios improve substantially from the first half to the second half of the 1980s. For example for unconditional spanning, the mean R^2 increases from 0.211 for 1981–1985 to 0.441 for 1986–1990.

The effects of Japanese capital market liberalization measures are evident in that the bank indices, together with the index for general trading firms, span substantial portions of the mean-variance space generated by the assets traded in the First Section of the Tokyo Stock Exchange for the sub period 1986–1990 but not for 1981–1985. Since very little changed in the shareholding patterns by banks and general trading firms between these two sub periods, we attribute the difference in spanning behavior to the government measures.

Finally, comparing the goodness of fit results for spanning by size-based portfolios reported in Tables 4 and 5 and the goodness of fit results for

TABLE 7. Mean-variance spanning of Japanese manufacturing industry portfolios by indices for general trading firms, small banks and large banks—goodness of fit, 1981–1985 and 1986–1990

Manufacturing industry portfolio[a]	1981–1985		1986–1990	
	Unconditional spanning[b] R^2	Conditional spanning[c] R^2	Unconditional spanning[b] R^2	Conditional spanning[c] R^2
Food	0.322	0.343	0.506	0.501
Textile	0.327	0.311	0.633	0.605
Pulp and paper	0.331	0.300	0.423	0.365
Chemicals	0.181	0.180	0.494	0.471
Petrol and coal	0.188	0.159	0.341	0.329
Rubber	0.257	0.195	0.532	0.509
Glass and pottery	0.243	0.231	0.577	0.573
Iron and steel	0.307	0.295	0.566	0.545
Non-ferrous metal	0.250	0.153	0.674	0.679
Metals	0.297	0.270	0.252	0.243
General machinery	0.117	0.102	0.554	0.550
Electric machinery	0.080	0.018	0.178	0.185
Transportation machinery	0.063	0.000	0.461	0.462
Precision	0.074	0.019	0.196	0.202
Other	0.128	0.072	0.234	0.221
Mean	0.211	0.178	0.441	0.429

[a]These represent returns for equally weighted sets of stocks sorted by industry from the First Section of the TokyoStock Exchange. The regressors are three indices (R'_1, R'_2 and R'_3) where R'_1, R'_2 and R'_3, respectively, denote equally weighted average returns for eight general trading firms, 56 small banks and 21 large banks including long-term, city, foreign exchange and trust banks. (The names of these trading firms and banks are available on request from the authors.)

[b,c]Multivariate estimation is based on the seemingly unrelated method for unconditional spanning and conditional GMM for conditional spanning. See text for the instruments used. For each of the equations estimated by each of the methods, R^2 and the sum of the slope coefficients (Σb_i) were calculated. A high R^2 and a high value of the sum Σb_i, which are close to one, indicate a high degree of mean-variance spanning.

spanning by bank and general trading firm portfolios reported in Tables 6 and 7, we conclude that the indices for general trading firms, small banks, and large banks span substantially less of the mean-variance space than size-based portfolios, and hence do not substitute for the three size-based mimicking portfolios.[18]

IV. Concluding remarks

Long-term block holding among Japanese corporations and financial institutions implies certain types of restriction on their stock returns. In this paper we

have put forward a hypothesis that the stock returns for sub firms enhance the performance of US and Japanese index portfolios more than the parent firms. We have tested this hypothesis using certain portfolio performance measures and mean-variance spanning. Our empirical results appear to be consistent with the hypothesis. In testing our hypothesis, we also paid attention to the effects of the Japanese capital market liberalization measures which took place in the 1970s and the early 1980s.

The empirical evidence is consistent with the interpretation that the liberalization measures have contributed to the efficiency and integration of the Japanese market with the US market. We find that Japanese firms have return properties much more similar to the US index after liberalization. This implies that not much is to be gained in a portfolio sense, from adding Japanese firms to a US index and vice versa. This reduces the incentive to hold larger amounts of foreign assets in a home country portfolio; therefore it helps to explain the 'home bias' in the holding of home country assets.[19] We also find in the Japanese market similar but not identical spanning results to those found in the US market. Three size-based portfolios are insufficient to span the Japanese market but the spanning is much improved after the liberalization measures.

Notes

1. There is no evidence that Japanese firms changed their behavior towards spinoffs as a result of the capital market liberalization. An interesting question, however, is whether a change in the financial market might cause a wealth effect in the portfolio of the parent or any investor owning the sub-firm's equity. It seems to us that this is quite plausible particularly if the deregulation enhances the informational, operational, and allocational efficiency of the market. This would cause both real effects in the firms capital accumulation as well as changes in the joint return moments of the equity as prices reflected information more quickly. This view is consistent with our results.
2. For example, Green and Hollifield (1992) discuss potential implications of holding assets, which are themselves portfolios, on the degree of diversification of a mean-variance efficient portfolio. Kandel (1984) discusses the effect of excluded assets on mean-variance efficiency.
3. Note, however, that holding firms, whose sole objective is to hold other firms' shares without their own business operations, are still illegal in Japan. (Holding firms will likely become legal soon.)
4. The Mitsubishi Bank, which satisfied its disclosure and other listing requirements, was listed on the NYSE in 1989.
5. The Japanese government also allowed introduction of stock index options and other financial derivatives in the 1986–1990 sub period. The introduction of these products added to efficient stock market operation and is also thought to have contributed to the structural change that took place in the Japanese stock market between the 1981–1985 and 1986–1990 sub periods. Bonser-Neal *et al.* (1990) provide some evidence for the presence of such a structural change in the Japanese stock market by showing that observed premiums for closed-end Japan funds are considerably smaller for the latter half of the 1980s than for the first half when many capital control laws were removed.
6. This would mitigate the home country bias puzzle but it does not eliminate it. Other common explanations such as differential information and consumption/inflation hedges would remain important.
7. Roll (1977) has suggested that the CAPM is untestable because the true market portfolio is unknown. Here we do not test the CAPM nor impose it, but we do utilize

market indexes for the US and Japan. The underlying asset pricing model could be the CAPM, intertemporal or multi-factor asset pricing models. We compare the performance of Japanese parents and sub-firms to the index. Because of this, as a referee points out, our results are index-dependent; however, we do use the literature's market index standards.

8. The appraisal ratio is a scalar multiple of the alpha coefficient's squared t statistic. The significance of the appraisal ratio is tested with an F-statistic with 1 and $(T-2)$ degrees of freedom, where T is the number of returns.
9. The parent companies included in the sample are large, representative firms listed in the First Section of the Tokyo Stock Exchange in respective industries for which data on equity holdings in their sub firms are reported in Toyo Keizai (1981–1990), for the sample period. The sub firms used in the sample are also the ones reported in Toyo Keizai and are listed in the First Section of the Tokyo Stock Exchange. Our sample does not include unlisted sub firms for the following reasons. First, Japanese business practice generally encourages firms to spin off and list as soon as possible their divisions which are not essential to the firms' core competencies. As a result, most important sub firms of large Japanese firms get listed. Secondly, large, listed sub firms' performance is more relevant to investors who invest in parent and sub firms. Thirdly, data on unlisted firms are not generally available.
10. The mean returns (standard deviations) for parent and sub firms are 0.010 (0.007) and 0.010 (0.009) for 1981–1985 and 0.010 (0.009) and 0.010 (0.007) for 1986–1990, respectively.
11. Our performance results may be the size effect and nothing else. It is true that one expects small firms to make better additions to a diversified portfolio and our results are consistent with this. However, sub firms remain small firms after the deregulation and yet we find different results before and after. This suggests that something other than the small firm effect is happening. But in the spirit of the referee's comment, we cannot say for sure that the effect is due to deregulation unless we control for many variables. On the other hand, we can't reject it either.
12. Our data shows that there is still improvement to be gained from the addition of Japanese firms to a US index; but, we maintain that there seems to be a change in the contribution over the event period.
13. We thank a referee for pointing out that some moments are likely to remain unaffected by the liberalization measures.
14. The liberalization measures allowed large qualified Japanese firms to rely more on direct debt and equity financing than on indirect bank loans which had been the predominant means of major financing until before the liberalization for most firms. It is possible that such a change in the financial structure of the firm had some impacts on certain firm-specific variables such as betas. Although our results do not contradict such changes in Japanese firms' financial structures, this topic warrants further investigation. Additional research on the impacts of the liberalization measures on industrial firms' real variables is also warranted. We are indebted for a referee for this point.
15. See also Roll (1977) for earlier contributions to mean-variance theory. If one is interested in spanning in the Japanese financial market, there is no methodology other than what we have used. The tests suggest that there has been a change in the spanning of the Japanese market before and after deregulation. The unconditional GMM procedure and ordinary least squares regression are equivalent for estimating each of these 33 unrestricted equations (Mackinlay and Richardson, 1991).
16. Estimated constant terms are consistently close to zero and the null hypothesis $a = 0$ is always accepted for these spanning equations. Therefore, the constant term will be omitted from the following econometric specifications.
17. The underlying null hypothesis being tested here is that there is no change in the spanning properties of the market due to the liberalization measures. One might argue that the R^2 in the Japanese market increased generally over the period and that the increase is not due to the liberalization event or spanning changes. However, Kariya and Tsukuda (1991, Ch. 6), among others, find no empirical evidence for any systematic

change in the behavior of the R^2 nor the betas in general market model regressions. Most importantly, the R^2 we use here are for restricted regressions that measure whether the fit of the restricted regressions has changed. These restricted R^2 are proportional to the degree of spanning in the market and can change in the opposite way to unrestricted R^2.

18. Because of the large amounts of stock holding by Japanese general trading firms and banks it is of interest to see whether or not the portfolio of their stocks spans the mean-variance space as well as size-based portfolios. We also estimated our spanning equations for Japanese non-manufacturing industry portfolios for the two sub-periods, 1981–1985 and 1986–1990. Our conclusions hold for the non-manufacturing industry portfolios as well.
19. We have not attempted to solve the home country bias problem, although we may have a partial explanation for it in our results. US or Japanese investors would be less concerned about investing a large portion of their portfolio in home assets if the home assets (TOPIX) were already reasonably well diversified in an international sense. This is what we find and we attribute it to the deregulation of financial markets, which allowed parent firms to grow and diversify through more efficient capital accumulation. In addition, prices would be more informationally efficient due to deregulation. We agree that other explanations of the home bias such as information asymmetries and consumption hedging remain.

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