ON EFFECTS OF GRADUAL CAPITAL MARKET DEREGULATION
IN JAPAN:
SPILOVERS IN A MILDLY SEGMENTED STOCK MARKET

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAI'I IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

ECONOMICS

MAY 2003

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To my parents
ACKNOWLEDGEMENTS

I wish to express my sincerest gratitude and appreciation to Dr. Byron S. Gangnes, my academic advisor for his tireless guidance, support and encouragement throughout the course of the dissertation work. I am also grateful to the other committee members – Professors Carl S. Bonham, Denise Eby Konan, Sang Hyop Lee, and Mary E. Tiles – for their support during my study. Without them, this dissertation may have never been completed, indeed.
This dissertation discusses Japanese capital market deregulation for 1980:12-1996:12, which began gradually with the capital procurement of the most multinationalized firms and differentiated them from the pure domestic firms. We try to quantify what actually happened in the Tokyo Stock Exchange during the period to see whether the policy design could have contributed to the problems of non-performing loans and monetary policy ineffectiveness in the 1990s.

We first outline the process of deregulation by a literature review. Then, the dissertation compares the statistical properties of monthly share returns for the internationalized corporations with the rest. We detected that the portfolios of internationalized and domestic firms appear to have unequal data generating processes, and possibly different structural break points, around 1984 and 1990, in their relationship with the global market.

Next, we use the mild segmentation model (Errunza and Losq March 1985) to analyze the process of internationalization for the two types of firms. Our estimation suggests the internationalized share appraisal priced not only the world factor but also domestic influence more heavily than the pure domestic stocks, which leads us to reject the hypothesis for our data. We suspect the result may be attributable to the deregulation without an introduction of new valuation rules.
The research concludes with an analysis of the changing function of the call rates as a traditional Japanese monetary policy tool, using the intertemporal capital asset pricing model (Merton 1973). The estimation results report that the pricing of internationalized firms could allocate no importance to the conventional domestic monetary policy instrument. Moreover, the pure domestic shares stopped reacting to the call rate in the 1990s, which implies the traditional monetary policy lost influence over asset pricing in its totality for the 1990s.

Derived from these findings we conclude capital market liberalization / deregulation as an attempt to control the globalization of firms could generate unexpected reactions in the domestic market. Our estimation advises that liberalization ought to consciously reorganize the domestic capital market regulation, and the monetary authority should be flexible enough to find a way to interact with the domestic market valuations during deregulation.
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In this dissertation, we discuss the internationalizing deregulation of the Japanese capital market for 1980:12-1996:12. Japanese capital market deregulation began gradually with the biggest and most multinationalized firms in the late 1970s and ended to cover all the agents in the economy in the 1990s (Hall 1998). At the same time, it is said that there was a decline in the domestic main bank dependence, which may have contributed to a change in the effectiveness of Japanese-traditional monetary policy. On the other hand, the theory for capital market internationalization (integration) could predict, regardless of the degree of liberalization for each firm, that the effect of such regulatory changes would spill over from the firms that are allowed to go abroad to those who are not. However, there is no study for Japan that has focused on the effect of such inch-by-inch regulatory change with respect to capital market internationalization and spillover. We intend to fill this void by the present study. Namely, juxtaposing the theoretical predictions with Japanese experience, we will propose three hypotheses. First, whatever the intention of the government, capital market integration classifies the firms into two categories. One class of firms is for those who can call for capital globally, and another is for the rest. We argue Japanese policy was a deliberate intervention into the sorting process by
the international market force, which could have produced a peculiar market behavior¹ that ended up with an unintended result for the policy-makers. Second, theoretically, integration would bring an increasing influence of the world market for all the companies in an economy. The dissertation examines whether it happened, and, if so, in what way it occurred in Japan. Third, an augmented global effect could, allegedly, accompany a decreased pure-domestic influence. We study the possibility for Japan by assuming the power of the domestic monetary policy as a pure domestic element that can affect the asset market. It will be shown that the overall picture of the market evolution in Japan may have followed these three predictions of the theory, although there were several anomalies. We hope our analysis here could contribute not only to the literature of capital market internationalization, but also for better policy-making in the economies adopting a policy of differentiating internationalization.

The construction of the dissertation is as follows. In this chapter, as an introduction, we briefly review the literature for capital market internationalization. Next, Chapter 2 constructs an appropriation² for the historical process of capital market liberalization in Japan. We also examine statistical differences in the properties between the integrated firms and the rest, especially in terms of the

¹ Any economy shall be constrained by a market intervention of the authority, which is always case-specific because of resulted interactions, or local politics, among the agents (Joskow and Noll 1981, Joskow and Rose 1989, Winston 1993).

² Ricoeur (1988). Fairly briefly put, appropriation is a hermeneutic operation where a narrator chooses (deliberately or otherwise) an angle to describe phenomena. Thus, in this dissertation, we NEVER intend to analyze definitively the Japanese financial deregulation. For example, we do not include in our discussion the effect of international politics concerning the yen-dollar exchange rate that is claimed by some researchers as a source of an abnormally long period of
evolution of asset pricing by structural break tests. Then, Chapter 3 investigates with the mild segmentation model (Errunza and Losq March 1985) the general extent and pattern of Japanese capital market integration. In Chapter 4, we study the changes in the effect of the Japanese-traditional monetary policy on the capital market by the intertemporal capital asset pricing model (Merton 1973). The dissertation concludes in Chapter 5 with a summary of our findings and presents several policy suggestions.

Before launching any discussion about the Japanese capital market, we must clarify our basic concepts for capital market internationalization. In this chapter, we provide a short literature review for capital market integration that serves as a foundation for the dissertation. Let us start with the definition of capital market internationalization. Beckers, Connor and Curds (1996) listed three ways to specify capital market globalization. One is for a "pure" world capital market where all the investors on the planet have perfectly equal access to every existing security. That is to say, any national markets are completely integrated so that the global capital market as a whole obtains, in effect, exactly the same (theoretical) characteristics as one autarkic domestic market. In general, the literature regards such a market as a yardstick and calls capital market internationalization integration. The second approach to determine market integration is when any two assets with an interchangeable level of risk and an

low interest rate policy in Japan for the late 1980s (Konya 1995). In other words, we appropriate
indistinguishable expected cashflow have an identical price in whichever market they are traded. Beckers, Connor and Curds (1996) pointed out that to test integration with this definition we need a fairly long time series under a perfectly stable economic condition (such as no change in discount factor at all), which is practically infeasible. According to Beckers, Connor and Curds, the third way considers integration when the factors explaining the returns are mainly international. As it requires a far smaller data set for empirical research, the literature generally employs the last definition, and we also opt for it in our study. That is to say, when an investment return is described by a common international factor, it is not possible to discern any difference in valuation whether the asset is traded at home or abroad. Thus, we can say a domestic capital market is integrated with the global market when the assets traded at home are evaluated in the same way as in the world market by whatever the currency. (Solnik 1983; Cho, Eun and Senbet 1986; Abeyskera and Mahajan 1990; Koutoulas and Kryzanowski 1994; Akdogan 1995.)

The next basic point we have to ascertain is why firms want to be integrated for their project evaluation. Saudagaran (1988) reported two reasons in his classic survey for the corporations listed in several stock exchanges around the globe. One reason is, when a firm's home capital market is not integrated, or segmented, and illiquid, seeking a more liquid global capital source can save

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Japanese history by ignoring the US-Japan bilateral relation.
cost. Another is, for those firms with plans for globalization, international capital procurement such as incorporation at the foreign market could be advantageous in many respects. For instance, it can alleviate legal barriers for FDI or international merger, facilitate employment of local talent through demonstration effect of perks including stock options, and/or provide a fine advertisement in the form of financial public relations which could stimulate more export. Saudagaran (1988) tested the sample corporations from eight developed countries as of 1982:12, and found there was a positive correlation among home market capitalization, foreign sales, and multiple stock-listings. That is to say, the firms with larger capital demand and with plans for export expansion tended to attain capital globally, possibly because of more need for capital cost reduction and for international advertisement.³

Theoretically, we can resort to the investor recognition hypothesis (Merton 1987) for a reason why international capital procurement can reduce the input cost. Merton (1987) noticed the inherent cost of acquiring information necessary to invest. Basically, there always is an up-front payment for knowing which goods to purchase, whether they take the form of groceries, durable goods, real estate, fine art, security, or anything. Without knowing them, no one opens their purse for shopping. In order to let people recognize the goods, a market must observe the cost of disseminating, gathering, and processing information.

³ Errunza and Senbet (1981) tested and failed to detect a correlation between the security valuation and the level of FDI for the US multinational corporations during 1968:01-1977:12. Hence, an incentive to global capital raising could be small from FDI or international acquisition.
Furthermore, the lower the cost of such knowledge, the larger the number of people would be who acknowledge the goods and invest in them. If there are two projects that differ only in publicity but otherwise are identical, the wider-known business can procure capital more cheaply because the cost of knowing them is cheaper, and hence more investors will bet their funds on them. In other words, the hypothesis says, ceteris paribus, the larger the size of the investor base, i.e., those who recognize the security in a market, relative to the aggregate wealth of an economy, the cheaper the cost of capital for the corporation.

When we transplant the supposition to the integration context, we may encounter two characteristics of the world investment community that can reduce the cost of information (Stulz March 1999, Fall 1999). One is its ability to encourage competition among (local) capital markets. If firms begin to shop around markets globally to have the best deal for their capital obtainment, there is a strong encouragement for the exchanges, market-makers, and investment bankers to provide services for customer firms by smaller fees and expenses. There could occur a world race for the bottom, and the entire global capital market would have reduced informational, and consequently, trading costs that would stimulate a higher trading volume than otherwise. The more the trade, the smaller the bid-ask spreads for capital valuation, which trims down the transaction costs further and induces more trading. The virtuous circle can be created at least for the corporations. (Karolyi 1998; Stulz March 1999, Fall 1999.)
Another characteristic that can reduce costs is the financial and real market rents that the common knowledge of the global investor population creates through international diversification. Stapleton and Subrahmanyam (1977) first suggested that dual-listing and/or international merger would present an opportunity for home investors to share their investment risk with their more numerous fellow, but foreign, investors, which could reduce the risk premium, and hence, the capital cost for firms (Stapleton and Subrahmanyam 1977; Stulz Fall 1999). In contrast, if foreigners have only a limited or no access to domestic security trades, the stocks that the foreigners cannot trade prepare less risk diversification opportunity for the investors. The cost of capital will be higher than the shares whose trade is open to everybody. (Errunza and Losq March 1985; Eun and Janakiramanan 1986; Alexander, Eun and Janakiramanan 1987.) That is to say, integration can create a rent from financial diversification. In addition, there could be a rent from diversification in the goods market. Wagner (2000) emphasized that intensified international competition due to globalization and innovation affects not only good markets, but also input markets. Maintaining an inefficiently regulated labor and/or capital market becomes a losing strategy for each economy, and as a consequence, input market deregulation is required around the globe. Concerning the capital market, the argument develops as follows. Consider a market of incomplete integration. Each home market must have many, including comparatively disadvantaged, industries to satisfy the needs of risk-averse financiers who want to spread their
investment risk among a small domestic investor community. Moreover, with a segmented capital and goods market, country risk cannot be diversified either in real or financial terms. Incomplete integration will accompany inefficiently allocated resources, which renders a higher capital cost than for an integrated capital market. In contrast, capital market integration can facilitate the global usage of a comparative advantage in the goods market that would ensure the investors the most efficient allocation of the fund. Country risks, too, are mitigated by the largest possible number of investors who recognize the firm both financially and in real terms. Thus, there will be the rent of product market globalization if investors are allowed to diversify their investment accordingly. (Tesar and Werner 1998.)

Empirical studies support the merits of integration by examining the relative importance of a global factor in stock valuation. A test by Errunza and Senbet (1984) obtained a statistically significant result such that the US multinational corporations in the 1970s diversified both real and financial activity and reduced the cost of capital especially when the capital control was stronger. Alexander, Eun and Janakiramanan (1988) conducted an event study of cross-listing announcements by US / non-US corporations for 1969-1982, and encountered supportive results for the reduced expected return, and thus a lower cost of capital. Foerster and Karolyi (1993, 1999) examined the data of Canada and other economies, and concluded that when an industry to which a firm belonged was more segmented in real term, American Depository Receipt
(ADR)\(^4\) reduced the capital cost through a smaller correlation with the domestic market. According to the multifactor analysis of Heston, Rouwenhorst and Wessels (1995), there was a tendency to be more integrated and to have lower capital cost for the biggest and often exporting firms from Europe and the US. Errunza and Miller (2000) noticed that the less correlated stock returns were with the US market, the more the capital cost was reduced from the ADR listings, which suggested that the US financiers invested into the assets to diversify their portfolio, and they accomplished their intention in a form of cheaper capital for the firms. Henry (October / November 2000) executed event study tests with the data of emerging capital markets for the late 1980s, and detected a positive correlation between a deregulation to stimulate foreign capital inflow and an increase in investment. He surmised that the cause of the phenomenon was that the capital market liberalization reduced the marginal cost of capital in general.

Despite all of the benefits of capital market integration, in reality not all firms are raising funds globally. The third point we must remember for our study is a limit in informational cost reduction by international capital procurement (for firms), or investment (for investors). Direct impediments to integration include capital and /

\(^4\) A depository receipt is a negotiable certificate that indirectly designates an ownership of foreign shares for domestic investors. Certificates denote depository shares that represent a specific number of underlying stocks remaining on deposit in the issuer's home market. There are Depository Banks, such as Morgan Stanley, which hold the securities in custody in the country of origin, provide necessary stock trading services, and convert all the dividends and other payments into the home currency of certificate holders. Although there are several markets offering depository receipt services, since the deeper the liquidity, the rarer the non-delivery by
or foreign exchange controls, differential taxation for foreign security ownership, limitations of repatriation of capital and/or dividends, restriction over foreign ownership of assets, and high brokerage and trading costs. There are indirect barriers as well, such as non-synchronous business and trading hours across the globe, and high corporate monitoring costs due to the informational environments. (Eun and Janakiramanan 1986; Karolyi 1998.) For instance, Biddle and Saudagaran (1989) enumerated items of the informational cost of multiple listing for firms. At the very least, in order for companies to procure capital internationally they must pay adjustment costs for accounting, auditing, and financial reporting tailored to the foreign markets, in addition to their domestic expenses. For listing their stocks abroad, there are additional back-office expenditures, such as for lawyers, underwriters, translators, and more. These expenditures are required for a substantial period of time during the preparatory stage of multiple listing and, after the initial international capital obtainment, in order to maintain their global presence. Furthermore, once the news of their world strategy is disclosed in a foreign market, the information will at once flow back home even if domestic rule does not require an exposure, which could give an advantage for the domestic competitors. In addition, if there is no regulatory harmonization, one market can explicitly prohibit a certain disclosure that must be done in another. Consequently, firms and the market are

the settlement date following a trade, ADR with the American capital market is the most popular. (Foerster and Karolyi 1993, 1999; Karolyi 1998; Errunza and Miller 2000.)
forced to stay in limbo, which can cost further legal and political fees.\(^5\) (Biddle and Saudagaran 1989.) On the other hand, Stulz (Fall 1999) anatomized the barrier of information for international investors. First, foreign investors are disadvantaged because they do not have the physical proximity to the source of information as do the home investors. Then, there are political risks that are difficult to understand for outsiders. On top of these, foreign and home investors could differ in their investment return-maximizing behavior because of varying consumption baskets and / or tastes. Such divergence in preference can make it harder for overseas financiers to grasp news which might be vital investment information. These obstacles will be reflected in the cost of using the capital market globally.

Of all the trade barriers listed above, controls over international capital flow can be removed relatively easily by policy changes, \textit{i.e.,} deregulation. High trading costs, the problem of time zones, or even issues of foreign language translation could be alleviated by new technology. Nevertheless, there always remains an entrance cost into the global capital market. Even if there is zero regulatory constraint and superb and cheap computational facilities in the market, if a firm wants to raise capital around the globe, it must expend the international legal and accounting fees, the charges to global investment services, the cost of public relations for the world investment community, and others. (Karolyi 1998.)

\(^5\) Biddle and Saudagaran (1989) cited an example of the US restriction over IPO announcement in the 1980s. The regulation practically forbade Japanese firms to reveal in Japan their business plan for international capital attainment.
It is not a project for small local businesses that do not expect a profit after all of these endeavors.

However, under any circumstances, it would be difficult to isolate the “pure” domestic firms from the influence of integrated, large, and often globally exporting corporations, which is the last presumption from the literature of capital market integration for our study. Alexander, Eun and Janakiramanan (1987) modeled a world economy that consisted of two segmented markets with dual-listed firms. While the expected return valuation of these internationalized firms is a function of both home and foreign market portfolios, the investment return from pure domestic firms can also be affected by the overseas market depending on its correlation with the return from the dual-listed stocks. Bekaert and Harvey (1995), too, argued that the effect of integrated firms could reduce the national volatility and risk premium which are the factors for pure domestic asset pricing. As a result, the integration will spill over to the appraisal of the segmented firms through a relative decrease of the influence of pure domestic factors. Several empirical papers suggested this could be an actual case. Bekaert, Erb, Harvey and Tadas (1998) found that in the late 1980s the emerging economies reduced their variance in the return of the country portfolio with the market liberalization. Mittoo (1992) conducted an event study for Canada and found domestic factors were priced more for all Canadian firms in the 1970s. However, in the 1980s, the cross-listed firms at the US and Canadian markets were integrated, and the
appraisal of pure domestic firms also had a significant US market factor with the relatively smaller domestic effect. Henry (April 2000) examined an event study from emerging market indices that are comprised of the entire market, including pure local companies, and observed a reduction in capital cost for the indices after the deregulation. Errunza and Miller (2000) performed an event study for ADR listings and noticed the incidents lowered, though in a small degree, the capital cost of non-cross-listed firms in their home country.

In summary, the literature concludes that firms integrate with the world when they can internationally diversify their activity in both real and financial terms. Their capital cost will be priced globally according to the worldwide risk diversification. On the other hand, the firms that remain domestic have the evaluation largely determined by a smaller real and financial home market with a limited risk diversification. However, there could be a spillover effect of the integrated firms, so that the domestic firms, too, incorporate the influence of the world market into their appraisal schedule. From the next chapter, we study how the conclusions of the integration literature could be applied to the Japanese case. Let us begin with our descriptive appropriation of Japanese capital market deregulation.
CHAPTER 2

Japanese capital market deregulation

2.1 Introduction

In Chapter 1, we have reviewed the studies of capital market internationalization (integration). The theory suggests international capital procurement has a cost advantage for some corporations who can afford the expenses to go global. Moreover, the domestic capital market where those international firms are incorporated will also receive an effect of global capital raising, which is termed an integration spillover. Thus, even a pure domestic firm cannot be insulated from integration. In this chapter, we summarize how these two kinds of firms were actually created and how they acted in the Japanese capital market deregulation. Namely, in this chapter we attempt an appropriation of the history of Japanese capital market deregulation that ended up with a burst of the bubble in 1990 and the subsequent economic slump. We will descriptively summarize a process of reluctant market deregulation by the authority, in contrast to the aggressive worldwide capital attainment by some Japanese corporations. The chapter shall also present statistical indications that the combination of unwilling policy and vigorous private activity may have produced a peculiar two-story structure for the Japanese corporate world. We are going to observe differences

Ricoeur (1988).
between the two categories of firms about evolving relationship with the world capital market. These findings will serve not only as building blocks for the studies in the next two chapters, but also for the policy suggestions in the final chapter.

The chapter is designed in the following way. We first briefly depict the process of Japanese capital market deregulation where the regulatory authority conscientiously planned and executed the policy of differentiation between the firms obtaining capital globally (the "tradables") and those who were not allowed to go overseas (the "non-tradables"). Next, we construct a data set from stock prices of the Tokyo Stock Exchange (TSE) for 1980:12-1996:12 to analyze quantitatively the two kinds of firms during the Japanese financial deregulation. Then, we report statistical properties of the share returns for each group, including the data generating process (DGP) of the portfolio returns. Finally, we check whether we can detect changes in the relationship between the returns of tradable / non-tradable portfolios and the world portfolio during the sample period. We will see the two classes of returns could have a different DGP and a distinct set of two structural breaks. The constructed picture is slightly more complicated than mono-directional spillovers in the prediction of the integration theory.
2.2 Japanese capital market deregulation: a description

2.2.1 In the beginning: pre-deregulatory environment in Japan

Before launching into an analysis of the capital market deregulation, it would be useful to summarize what was there in the pre-deregulatory Japanese economy. We could call it a traditional Main Bank System. Takeda and Turner (1992) summarized the pre-deregulatory policy of Japan as (1) tight exchange controls, (2) strict capital procurement regulation for economic agents, (3) rigorous interest rate management, and (4) emphasis on the importance of public sector financial institutions. The policy created the Main Bank System about which Sheard (1994) gave these stylized facts:

(i) Around 70% of the shares of a corporation in the system were held by a large number of firms in small fractional parcels. The company, in turn, possessed shares of many firms. Consequently, the Japanese economy consisted of groups of firms connected to each other by cross-stockholding.

(ii) At the core of a business group, there was a main bank that orchestrated the web of mutual shareholding. Within a group, firms regarded each other as “stable shareholders” and became friendly to incumbent management. Corporations set preferential share prices

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7 For example, when a firm tried to sell its stable shareholder's security, they consulted with the partner in advance (Sheard 1994).
for each other to compensate for the negation of "property rights" by being a stable shareholder.

(iii) The cross-shareholding relationship always involved some kind of long-term transactional relation such as lender-borrower of capital, or buyer-seller of products.

In 1990, for all the listed Japanese corporations, 45.2% of their shares were held by financial institutions, 23.1% by domestic non-financial corporations, and 4.2% by foreigners. Furthermore, 46.3% of shares were owned in parcels of 5 million or more, whereas 98.6% of shareholders retained parcels of 50,000 shares or less. In such a market, the coalition of top 20 shareholders, who were in almost all cases corporations of stable shareholders, constructed the two-thirds or more majority of the stockholders. Takeover bids were very difficult from the outside of a group so long as the interlocking firms cooperated. (Sheard 1994.)

The system could (famously) trace its origin to at least the 17th century (Sakudoh 1986), and was generalized for an economy wide-institution, or the "1940 system," during the fascist regime (Abe 1996) of the 1930s and the 40s (Aoki 1988, 1997; Noguchi 1995, 1998; Okazaki 1994; Okuno-Fujiwara 1994). The establishment not only escaped demolition during the post-war occupation by the United States, but also strengthened its role for the Japanese economic development. One of the most important reasons for the survival was the policy of foreign exchange control (Moreno and Kim 1993). During the 1950s, when the
economy was smaller than its own level of the 1930s and capital shortage was acute, the Japanese government used the market shares of firms as a criterion for foreign exchange rationing. For success in Japan, all the firms needed to purchase raw materials and advanced technology from abroad, and hence they required foreign currency. To guarantee market shares, the firms exploited fully the connection with banks (i.e., intermediaries for capital) and trading companies (i.e., procurer of raw materials and overseas markets) that by then had been nurtured for decades. The liaison reinforced reciprocal customer relations and stock holdings within a group. (Aoki 1984, 1988; Noguchi 1995.)

With a stable relationship with customer firms, the scheme prepared for the main bankers an equity similar to a quasi-fixed income security that stabilized the inconsistency between the short-term liability (deposits) and the long-term asset (investment into the corporations). The partner firms made a contract with the banks to pay a stable stream of dividends, to allow rights to subscribe preferentially new issues of common stocks, and access to crucial information of the business that facilitated corporate monitoring. As long as the firms stayed in the system, such monopoly rights of the bankers over the businesses created large profits for the financiers during the high growth period (Ide 1996). In addition, until the Financial System Reform Plan of 1996, Japan had a strict

\[ \text{footnote text} \]

\[ \text{footnote text} \]
business demarcation among financial institutions, similar to the Glass-Stegel Act of the US. There was no competitive threat from other sectors. Furthermore, the “convoy policy” of the Ministry of Finance (MOF) guaranteed survival of any banks, and all the bank lending. Finally, a strict interest control always set the lending rate high enough to create a huge economic rent that induced the main banks to vacuum up the deposits from every nook of the economy, to supply loans, and to oversee the group firms. (Aoki 1988, 1994; Noguchi 1995; Hellmann, Murdock and Stiglitz 1996, 1997.)

On the other hand, the system made capital demanders, i.e., Japanese corporations, less concerned for profit maximization. Using the data of 1974-1982, Nakatani (1984) found that the group-affiliated firms had higher interest payments and lower rates of profit and growth than independent firms. However, their growth rate was less variable over time, and they paid higher wages to workers. Nakatani suggested it was an indication that they did not have to think about shareholders. With an assured source of capital from the main bank, and without threats of takeovers by cross-shareholding, corporations could afford share prices lower than their potential. They could concentrate on market share maximization, and distribute earned rents to stakeholders, such as stable shareholders, main bankers or employees. (Nakatani 1984) It also meant the expensive to monitor had the bankers being simultaneously debt holders and shareholders, probably in order to monitor them more closely.

Kato (1997) confirmed that the above features had not been changed by 1985.

For a finishing touch, when they financed the reciprocal shareholdings by borrowing from the financial intermediaries, the higher debt-equity ratio contributed to a lower tax payment, which drove the capital cost down further.
firms without a main bank would be more liquidity-constrained than otherwise. Hoshi, Kashyap and Scharfstein (1991) asserted this possibility with a test of investment pattern by the manufacturing firms from the TSE between 1965 and 1986. Their estimation observed high dependency on the main banks in general, and the independent firms prone to liquidity shortage.\textsuperscript{11}

In contrast, since the origin of its prevalence was total mobilization for the war, the Main Bank System intrinsically maintained indirect finance supremacy and limited the scope of a free market that could be easily out of control for the war commanders (Aoki 1988, 1994, 1997; Cargill and Royama 1992; Noguchi 1995, 1998). The nature of the system appeared in a corporate bond issuance regulation by the Bond Issue Arrangement Committee (BIAC) (Eken 1984; Ueda 1994; Horiuchi 1996; Hoshi 1996). The Committee was orchestrated by the Industrial Bank of Japan (IBJ), consisted of the major banks in Japan, and supervised by the MOF and the Bank of Japan (BOJ). The chain of "command" was from the MOF to the BOJ, the IBJ, and finally to the BIAC. In other words, the BIAC allowed bankers to control corporate fund procurement even from the security market, although the banks were prohibited from underwriting corporate securities by Article 65 of the Securities Transactions Act.

\textsuperscript{11} However, Hayashi (1997) pointed out a problem of measuring Tobin's q in Hoshi \textit{et al} (1991).
The SIAC determined strict eligibility for a bond issuer, the amount of issue, the rate,\textsuperscript{12} the terms, and other details. The eligibility for bond issuance followed the “Collateral Principle,” requiring (1) an ownership of enough collateral in real estate, specified governmental bonds, and / or other assets, and (2) the guideline for issuing a firm’s net worth, dividends per share, profit rate per share and per total capital, and ratio of equity to total assets. An underwriting was allocated to “designated” securities companies by the SIAC. The Committee also discouraged the development of a secondary market, with an implicit agreement such that “any corporate bond should be held till the maturity.”

In addition, to comply with the requirement of the SIAC, all the bond-issuing corporations had to designate corporate bond trustees, who were always the main bank, or the affiliated bank of the main bank. The trustee fee was fixed by a cartel-like convention and charged equally for any firms, without a consideration for the credit-worthiness of the business. Furthermore, there was a so-called “Third Day Rule” that allowed the proceeds to be available only after the third day of the issue. It in effect forced the bond issuers to provide two- to three-day interest-free loans for the designated securities firms and the commission banks.\textsuperscript{13} Finally, hefty taxes were levied on all the securities transactions. (Takeda and Turner 1992.)\textsuperscript{14}

\textsuperscript{12} The authority fully used the legal condition, moral suasion and the Bankers’ Associations’ Gentlemen’s Agreement to set the interest rates always the lowest for governmental bonds, the second lowest to the debentures of long-term credit banks, then for corporate bonds, and finally, to the highest market rate (Ueda 1994).

\textsuperscript{13} In addition to the fee, the financiers received principal interest payment fees in the bond transaction. Over and above these expenses, the firms paid underwriting fees to the securities transactions.
These constraints on the capital market allowed a monetary “planner” to execute an effective policy for a capital-starved economy only by tweaking the main bankers. There were three tools for the BOJ to transmit the policy (Moreno and Kim 1993; Cargill, Hutchison and Ito 1997):

(i) the purchase / resale of bills to set the interest rate in the interbank market,

(ii) administrative guidance of interbank transactions, and,

(iii) credit “rationing” (such as lending limits) through the discount window.

The main apparatus for these three channels was the reserve requirement system (Okina 1993; Ueda 1993). Figure 2.1 summarizes the process. At the foundation of the coordination, there was a law requiring commercial financial institutions in Japan to maintain deposits in non-interest bearing accounts at the BOJ in certain proportions to their liabilities. The reserve amount should have been equal to the reserve ratio multiplied by the average deposit outstanding in a calendar month. This reserve volume was applied for a “maintenance period”

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hous. A comparison in spring 1988 showed the domestic underwriting charge was at least 30 times higher than in the euromarket, which pushed up the total cost of domestic bond issuance more than the offshore issuance. (Okumura 1990.) As of August 1991, even for AA-rated corporations, the domestic trustee fees were still more than 15 times higher than those in the euromarket, and the interest payment fees were about 9 times more expensive. Although domestic underwriting fees were about 80% of the offshore cost, the total fees of bond issuance was about 1.2 times more costly in the domestic market. (Takeda and Turner 1992.)

14 Before April 1989, the tax rate for a transaction without an involvement of securities firms was 55% on share and stock investment trust certificates, 3% on straight bonds and bond investment trust certificates, and 26% on convertible and warrant bonds. On the other hand, the rates for security firms' transactions were 18%, 1%, and 9% respectively. The Tax Reform Act of 1988 (effective in April 1989) reduced the rates to 30% (12% with the securities firms), 3% (1%, ditto), and 16% (6%, ditto) each. (Takeda and Turner 1992.)
Figure 2.1.
The transmission mechanism of Japanese monetary policy for the traditional Main Bank System.

that started on the 16th day of a month and ended on the 15th day of the next month (i.e., the lagged reserve accounting system). If on the final day of a maintenance period a bank failed to meet the amount, the shortfall was subject to a prohibitive level of interest rate, and the reputation of the financier was tarnished. The mechanism became a credible threat for the interbank market, and consequently, the reserve demand was almost interest inelastic at the end of a maintenance period.

On the other hand, the BOJ was legally required to supply / absorb any shortfall / surplus of the total reserve to settle the interbank market for closing a maintenance period. Rather than depending on an open market operation in the shallow bill markets with cumbersome paperwork, the BOJ utilized the discount window lending extensively to clear the market. Since the demand curve was vertical on the settlement day, the BOJ's reserve supply determined the interbank market interest rate, that is, the call rate.

Before reaching the final day of a maintenance period, out of their liabilities including the BOJ lending with the window guidance, financial institutions put the fraction of the required reserve deposits daily. By observing the speed of reserve accumulation, i.e., the reserve progress ratio, the market could infer the BOJ's policy stance: if the pace was fast (or slow), the policy was expansionary (or contractionary). The information of the reserve progress ratio told how much the BOJ would supply the reserve at the end of the maintenance period, and hence, what the call rate would be. The estimated final call rate
became the “anchor” rate for the interbank market that determined the daily call rate, and at which the bankers conducted regular arbitrage. In other words, the daily control of the overnight call rates transmitted the signal of the anchor rate.

At least until 1988:10 (Ueda 1993), effectiveness of the mechanism was guaranteed by another regulation that prohibited a substitute market for funds, including restrictions over transactions in the interbank market, and discipline on arbitrage between open markets (such as euroyen or CD) and the interbank market. Finally, under an absence of short-term governmental bonds thanks to the balanced budget principle which was a legacy of Post-war US occupation (Noguchi 1995), the BOJ could set the call rate always higher than the official discount rate, and supplied credit via the BOJ discount window at the official discount rate. The discount window lending was a “subsidized” fund cheaper than from the market. Inevitably, bankers heavily used the fund and willingly accepted the *sine qua non* to the BOJ’s mandate. The condition included (1) ceilings on new lending at the time of monetary contraction, (2) day-to-day contact (which was called the Real Demand Principle) via deposit / lending transactions (and others) with the BOJ, and (3) a penalty for violators of the ceilings with a reduction in the discount window lending.\(^\text{15}\)

\(^{15}\) Notice this operational métier is different from the spirit of open market operation for a free market. As a matter of fact, though after the first Oil Shock the BOJ watched monetary growth closely, their published forecasts have never shown evidence of private information of the central bank. It is unlikely that the BOJ engaged in dynamic operations based on monetary growth information. (Hutchison and Judd 1992; Cargill, Hutchison and Ito 1997.)
In the process, the window guidance obtained a legendary status. Although the guidance began primarily for the city and long-term credit banks, in the late 1960s the BOJ started to expand the "subjects," and from 1973, all the clients of the BOJ, including foreign banks operating in Japan, became covered by "surveillance." The contents of guidance were not only for the levels of loans, but also about lending to specific sectors, such as to trading corporations, or concerning securities investment by the banks. (Hoshi, Scharfstein and Singleton 1993.) There was no offender to the system until the very late 1970s (Moreno and Kim 1993).

Moreover, with the limited flow of funds, the call rate operation allowed the BOJ's reserve supply to create inflation expectation predominantly. The story goes as follows. The traditional transmission mechanism of the BOJ orchestrated the marginal profit of bank lending, the allocation of funds by the banks, the economy's output and the broad money supply (Kasman and Rodrigues 1991; Moreno and Kim 1993). When there was a tightening in the window guidance, both the credit supply and the excess demand for funds in the interbank market could shrink. They would reduce the BOJ's lending to private banks, and the loans from the banking sector to other industries. That is to say, facing a monetary policy change, the main bank with informational advantage about the corporations could adjust an amount of loans at the fixed prime rate, or

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16 They are the terminology of the Main Bank System, equivalent respectively to the "largest and oldest banks engaged in short-term lending mainly to the largest corporations from deposits," and the "largest and oldest banks lending mainly to the largest corporations for a long-term out of the fund from debentures" (Cargill and Royama 1992).
accommodate the loan-to-deposit ratio for borrowers who were required to maintain compensating balances at the lending bank (Cargill; Hutchison and Ito 1997).

As a statistical endorsement of the process, Ueda (1993) reported a Granger causality test for 1969:01-1989:10 showing that the BOJ loans and the call rate determined money supply and the volume of private bank lending. The macro data of Hoshi, Scharfstein and Singleton (1993) for 1972-1988 showed that the ratio of industrial loans from the financial institutions dropped statistically significantly with a tight monetary policy. From the firm-level micro data of 1979-1980 in Hoshi, Scharfstein and Singleton (1993), the effect of expansive money was more binding for those firms with stronger main bank ties, although a negative shock of the policy was mitigated to them. Morsink and Bayoumi (1999, 2000) also confirmed the crucial role of the main bankers as a monetary transmission channel for 1980:Q1-1998:Q1. In their study, provided the banking sector's equity value was strong enough, the call rate first transmitted almost exclusively to the bank-lending rate, then to private (especially business) demand, broad money and finally to the output.

There is a flip side of the story. Since the system's performance depended on a cumulative effect of the multiple regulations, once a part of the arrangement received a shock, the entire structure could have been affected. We interpret the Japanese capital market deregulation from this angle.
2.2.2 Japanese capital market deregulation

Shocks to the system occurred successively in the 1970s. One of them was the first Oil Shock that changed the balanced budget principle. In order to deal with the supply shock, the government issued a massive amount of debt that failed to be digested by the capital market constrained by the regulation. In order for the financial institutions to absorb the governmental bonds, the policy was altered to create a secondary market for them. It activated the short-term money market, especially the Gensaki market, and provided the banks with a new fund source other than the BOJ's discount window. The bankers shifted the deposit to the Gensaki market (and, from 1979, the CD market) in volume, and the BOJ lost its monopoly position for the supply of funds. (Kasman and Rodrigues 1991; Cargill and Royama 1992; Noguchi 1995.)

Another impact was from the world-class export sector. Already during the 1970s some internationally competitive Japanese firms began to finance their offshore operations from the euromarket, where there were no collateral rule, no mandatory prospectus issues, wider instruments including foreign exchange hedging tools, and low actual fees. As a result, in the total corporate financing of Japanese firms, euro-funding grew from 1.7% in the early 1970s to 19.6% by the late 1970s. (Horiuchi 1996.) In addition, the 1970s was a period of the lower capital demand due to the growth slowdown from the supply shock and the now-abundant domestic capital. The economy found lesser importance for the BIAC to allocate funds among corporations. From 1975, the Committee started to
honor only the amount of the issues so long as a new security met the general offering criteria that were agreed among the Committee members. (Hoshi 1996.)

Finally, the collapse of the Breton-Woods System made autarky with strict capital control impossible. In December 1980, the New Foreign Exchange and Foreign Trade Control Law became effective and the yen was permitted to float freely. The new law also lifted all the restriction on borrowing / lending of foreign currencies at home and abroad by Japanese financial institutions. It liberalized converting yen into foreign currencies for deposits with Japanese banks. The limitation over foreign ownership of Japanese firms, except for some, was eased in principle, and borrowing from foreign sources was facilitated for Japanese firms. (Eken 1984; Kasman and Rodrigues 1991; Cargill and Royama 1992; Noguchi 1995.)

As we have summarized, the traditional Main Bank System was a crystallized result of cumulative regulations. Those three external shocks inevitably modified not only the directly affected policies but also the entire Main Bank System. The consequential institution, then, required additional deregulatory measures, which altered the system further. Appendix 1 is for a chronology of the deregulatory process for the Japanese capital market. For instance, under a flexible exchange rate international competitors obviously required more flexible and cheaper banking service from their global perspective. The conflict between the private sector's demand and the old domestic financial laws became apparent. (Takeda
and Turner 1992.) The Banking Law was amended in June 1981, which included a more flexible regulatory policy towards new financial services. At the same time, the Securities and Exchange Law was revised to admit a quasi-investment banking service of the bankers. (Kanzaki 1995.)

In the sphere of monetary policy since July 1977, the BOJ did gradually reduce the usage of strict window guidance. In 1982, the central bank ended the inspection for lending plans and the active use of reserve requirements. Between 1982-1989, though without a legislature change, the window guidance operated only for notifying “voluntary” plans to the authority. From 1984, the liberalization of bank deposit rates was started from the accounts of the biggest depositors, and there were introductions of new instruments with market-determined interest rates. Credit rationing through the official discount rate dramatically decreased from 1985 on. (Kasman and Rodrigues 1991; Takeda and Turner 1992; Hall 1998.)

On the other hand, with the new foreign exchange law, there was no barrier for foreign firms to seek capital in Japan, except the original regulation under the Main Bank System. Observing that several Japanese firms raised funds in the US, American firms and the US government asked for reciprocal access to Japanese capital. Alarmed by a rapid increase in offshore security issuance by Japanese customers, the Japanese securities firms took advantage of the international politics to lobby for liberalization of the market. Facing these pressures, the Japanese government ordered the IBJ as a coordinator of the
BIAC to draft a policy-change procedure. The bank prepared a plan to introduce deregulation first for the largest corporations who were already active international capital procurers. This opened a gate for gradual retrenchment of the traditional restrictions over domestic corporate bond issues. (Tatewaki 1991.)

Moreover, the Japan-US Yen-Dollar Agreement unwound the restriction for foreign euroyen bond issue in December 1984. In April 1985, the MOF allowed dual currency bond, zero-coupon bond, deep-discount bond, and floating rate notes for the euroyen market. Although the intention of these policy changes was to open the euroyen market for foreigners (Frankel 1984), the outcome was a large-scale use of euroyen swaps\textsuperscript{17} by Japanese institutional investors to arbitrage between the regulation-stricken home and the more efficient and innovative offshore market. (Tatewaki 1991; Takeda and Turner 1992; Kang, Kim, Park and Stulz 1995; Fukuda 1995; Horiuchi 1996; Hall 1998.) Soon after the introduction of swaps, regulation ended the Real Demand Principle and the custom of designated securities companies. Other new

\textsuperscript{17}A swap is an exchange of currencies between two counterparties who typically exploit a home comparative advantage in raising funds; McInish (2000) illustrated an example (despite a touch outdated) as follows. Suppose an exchange rate of DM 2 = US$ 1, and it does not change for a year. There is a German firm A which is well known domestically but not in the US. Consequently, it would borrow DM at a fixed annual rate of 9%, but with 12% for US$. There is another firm, B, which established itself in the US, but is a novice in Germany. It would raise US$ at an annual interest rate of 10%, but DM for 13%. When both firms plan to invest into another's home market, they can make a swap to economize capital cost. Consider firm A domestically borrows DM 10 million today that should be repaid with DM 10.9 million a year later. If it had procured US$ of the same value by itself, it must have incurred the interest cost of DM 1.2 million. On the other hand, firm B domestically raises US$ 5 million now that would be a debt of $5.5 million within a year. Nevertheless, if the firm obtained DM independently, the interest in dollars should have been US$ 0.75 million. For these two corporations, it is a cost saving to exchange DM 10 million and US$ 5 million today, and trade DM 10.9 million and US$ 5.5 million a year from now, and thus there is born a swap contract.
instruments were also introduced both domestically and overseas, slowly but surely. By the end of 1989, the major deregulations were completed, save a dismantlement of the barriers among the banking, the securities business, and the insurance sector.

2.2.3 The market heading for the lost decade

In this climate of deregulation, firms, especially world-competitive manufacturers, aggressively departed from bank borrowing. The market observed a reduction of aggregate debt to asset ratio from 60% in 1970 to 25% in 1991 (Campbell and Hamao 1994). Table 2.1 summarizes the change in bank lending in Japan during the period. Between 1986 and 1989, the Japanese manufacturing sector as a whole had a net repayment of debt and an increase in financial assets (Takeda and Turner 1992; Hodder and Tschoegl 1993). Hoshi, Kashyap and Scharfstein (1993) examined the balance sheet of the firms withdrawn from main bank lending during the 1980s, and found they were the most profitable corporations with the largest collateralable assets and the smallest existing debts. These firms were also active fund procurers from the security markets (Campbell and Hamao 1994; Hoshi 1996).

Table 2.2 shows the statistical data in bond issuance for the period when offshore equity-linked debt market became wildly popular. In addition to the fee advantage, elaborate usage of currency swaps made it possible to achieve lower yen interest payment to dollar-denominated euro-issues, which the exporters
Table 2.1.

Japanese bank lending outstanding by sector.
Percentage shares, at year-end.

<table>
<thead>
<tr>
<th>Year</th>
<th>Manufacturing</th>
<th>Construction</th>
<th>Utility</th>
<th>Transport and Communications</th>
<th>Wholesale and Retail Trade</th>
<th>Finance and Insurance</th>
<th>Real Estate</th>
<th>Services</th>
<th>Local Governments</th>
<th>Individuals</th>
<th>Overseas Loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>35.17</td>
<td>6.08</td>
<td>2.24</td>
<td>3.87</td>
<td>25.33</td>
<td>1.90</td>
<td>6.56</td>
<td>5.63</td>
<td>0.79</td>
<td>10.27</td>
<td>0.82</td>
</tr>
<tr>
<td>1978</td>
<td>33.12</td>
<td>6.05</td>
<td>2.39</td>
<td>3.76</td>
<td>24.96</td>
<td>2.48</td>
<td>6.69</td>
<td>6.06</td>
<td>0.93</td>
<td>11.29</td>
<td>0.91</td>
</tr>
<tr>
<td>1979</td>
<td>30.84</td>
<td>5.87</td>
<td>2.61</td>
<td>3.69</td>
<td>24.74</td>
<td>3.02</td>
<td>6.81</td>
<td>6.83</td>
<td>0.93</td>
<td>12.19</td>
<td>1.39</td>
</tr>
<tr>
<td>1980</td>
<td>30.10</td>
<td>5.69</td>
<td>2.91</td>
<td>3.62</td>
<td>24.64</td>
<td>3.36</td>
<td>6.68</td>
<td>6.94</td>
<td>0.85</td>
<td>12.36</td>
<td>1.61</td>
</tr>
<tr>
<td>1981</td>
<td>29.86</td>
<td>5.65</td>
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<td>3.71</td>
<td>24.03</td>
<td>3.79</td>
<td>6.68</td>
<td>7.27</td>
<td>0.89</td>
<td>12.17</td>
<td>1.74</td>
</tr>
<tr>
<td>1982</td>
<td>28.90</td>
<td>5.62</td>
<td>3.09</td>
<td>3.78</td>
<td>23.53</td>
<td>4.48</td>
<td>6.89</td>
<td>7.88</td>
<td>0.86</td>
<td>11.79</td>
<td>1.98</td>
</tr>
<tr>
<td>1983</td>
<td>27.62</td>
<td>5.69</td>
<td>3.19</td>
<td>3.78</td>
<td>22.92</td>
<td>5.54</td>
<td>7.25</td>
<td>8.88</td>
<td>0.84</td>
<td>11.21</td>
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</tr>
<tr>
<td>1984</td>
<td>26.17</td>
<td>5.78</td>
<td>3.07</td>
<td>3.76</td>
<td>22.37</td>
<td>6.58</td>
<td>7.61</td>
<td>9.57</td>
<td>0.80</td>
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<td>24.94</td>
<td>5.85</td>
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<td>3.73</td>
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<td>7.24</td>
<td>8.18</td>
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<td>3.69</td>
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<td>1987</td>
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<td>3.63</td>
<td>18.93</td>
<td>9.43</td>
<td>11.28</td>
<td>12.41</td>
<td>0.73</td>
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<tr>
<td>1988</td>
<td>18.03</td>
<td>5.37</td>
<td>2.28</td>
<td>3.68</td>
<td>17.96</td>
<td>10.36</td>
<td>11.57</td>
<td>13.49</td>
<td>0.64</td>
<td>13.10</td>
<td>2.67</td>
</tr>
<tr>
<td>1989</td>
<td>16.31</td>
<td>5.22</td>
<td>2.05</td>
<td>3.61</td>
<td>17.14</td>
<td>10.90</td>
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<td>14.22</td>
<td>0.56</td>
<td>14.60</td>
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<td>10.74</td>
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<td>0.55</td>
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<td>0.68</td>
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<td>10.68</td>
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<td>0.81</td>
<td>15.23</td>
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<td>1.59</td>
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<td>16.11</td>
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<td>1.03</td>
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<td>1.33</td>
<td>17.40</td>
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<tr>
<td>1997</td>
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<td>1.51</td>
<td>4.07</td>
<td>15.24</td>
<td>10.02</td>
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<td>15.13</td>
<td>1.48</td>
<td>18.02</td>
<td>1.36</td>
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<tr>
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<td>13.68</td>
<td>6.15</td>
<td>1.31</td>
<td>4.05</td>
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<td>4.25</td>
<td>15.08</td>
<td>8.85</td>
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<td>13.73</td>
<td>1.81</td>
<td>20.00</td>
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<tr>
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<td>14.47</td>
<td>5.85</td>
<td>1.31</td>
<td>4.43</td>
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<td>8.56</td>
<td>12.51</td>
<td>13.44</td>
<td>1.91</td>
<td>21.22</td>
<td>1.03</td>
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</table>

Note: Outstanding loans and discounts of domestically licensed banks.
Table 2.2.

Panel A: Domestic public bond issues (excluding electric corporations and NTT).

<table>
<thead>
<tr>
<th>Year</th>
<th>Straight Bonds*</th>
<th>Convertibles</th>
<th>Warrants</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>885</td>
<td>408</td>
<td></td>
<td>1,961</td>
</tr>
<tr>
<td>1976</td>
<td>411</td>
<td>59</td>
<td></td>
<td>1,450</td>
</tr>
<tr>
<td>1977</td>
<td>326</td>
<td>120</td>
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</tr>
<tr>
<td>1978</td>
<td>509</td>
<td>293</td>
<td></td>
<td>1,833</td>
</tr>
<tr>
<td>1979</td>
<td>242</td>
<td>371</td>
<td></td>
<td>1,722</td>
</tr>
<tr>
<td>1980</td>
<td>185</td>
<td>104</td>
<td></td>
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</tr>
<tr>
<td>1981</td>
<td>358</td>
<td>364</td>
<td>20</td>
<td>1,773</td>
</tr>
<tr>
<td>1982</td>
<td>306</td>
<td>448</td>
<td>44</td>
<td>1,759</td>
</tr>
<tr>
<td>1983</td>
<td>209</td>
<td>827</td>
<td>10</td>
<td>1,590</td>
</tr>
<tr>
<td>1984</td>
<td>85</td>
<td>1,209</td>
<td>13</td>
<td>2,219</td>
</tr>
<tr>
<td>1985</td>
<td>112</td>
<td>1,904</td>
<td>10</td>
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</tr>
<tr>
<td>1986</td>
<td>186</td>
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<td>116</td>
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<td>385</td>
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</tr>
<tr>
<td>1990</td>
<td>6</td>
<td>2,727</td>
<td>925</td>
<td>5,486</td>
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</table>

Panel B: Offshore bond issues (including private placements).

<table>
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<th>Year</th>
<th>Straight Bonds*</th>
<th>Convertibles</th>
<th>Warrants</th>
<th>Total</th>
</tr>
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<td>105</td>
<td></td>
<td>415</td>
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<tr>
<td>1976</td>
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<td>449</td>
</tr>
<tr>
<td>1978</td>
<td>224</td>
<td>338</td>
<td></td>
<td>562</td>
</tr>
<tr>
<td>1979</td>
<td>266</td>
<td>617</td>
<td></td>
<td>883</td>
</tr>
<tr>
<td>1980</td>
<td>219</td>
<td>514</td>
<td></td>
<td>733</td>
</tr>
<tr>
<td>1981</td>
<td>141</td>
<td>811</td>
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<tr>
<td>1982</td>
<td>568</td>
<td>677</td>
<td>101</td>
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<td>128</td>
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<td>625</td>
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<td>446</td>
<td>2,393</td>
</tr>
<tr>
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<td>1,029</td>
<td>679</td>
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<tr>
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<td>1,437</td>
<td>426</td>
<td>2,007</td>
<td>3,870</td>
</tr>
<tr>
<td>1987</td>
<td>1,252</td>
<td>886</td>
<td>3,173</td>
<td>5,411</td>
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<tr>
<td>1988</td>
<td>774</td>
<td>918</td>
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<td>5,374</td>
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<tr>
<td>1989</td>
<td>873</td>
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<td>11,831</td>
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<tr>
<td>1990</td>
<td>1,678</td>
<td>901</td>
<td>2,906</td>
<td>5,485</td>
</tr>
</tbody>
</table>

Source: Hodder and Tshoegl 1993, Table 3.5 and 3.6.
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preferred in order to minimize foreign exchange risks by matching dollar-denominated receivables with dollar-denominated liabilities (Campbell and Hamao 1994). In the second half of the 1980s, the total offshore issuance of equity-linked dollar debt was larger than the total equity and straight bonds raised at home. In 1990, Japanese stocks occupied 26.5% of the turnover of foreign equities in value at the London Stock Exchange (Worthington 1991).

Through 1984 to 1991, the expansion of overseas capital procurement by the superior-credit firms made the Japanese funding pattern polarized between firms with and without bank debts (Campbell and Hamao 1994). In fact, the issuing corporations of the overseas debt almost always dealt out domestic equity-linked bonds as well. Namely, they were large enough firms that could use up the massive funds raised from all over the world. (Kang, Kim, Park and Stulz 1995.) For 1977-1989, only 0.3% of Japanese convertible issuance was by the over-the-counter firms (Horiuchi 1996).

In the first half of the 1980s, during the assertive deregulation in convertible bonds, more than 30% of Japanese firms’ euro-funds were by convertible issues. Firms also bypassed from offshore regulations such as the ban against

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18 Straight corporate bonds are fixed-interest securities for long-term loans. They become convertibles when they carry an option at a fixed future date to convert them into ordinary shares at a fixed price. The option reduces the interest rate for the bond, but the investors could purchase equity cheaply in the future, which may compensate lower return. (Bannock, Baxter and Davis 1992.)
purchases of euro-issued convertibles within three months of issuance.\textsuperscript{19} Recall the ordinary shareholders were the least served in the Main Bank System. So long as shares were listed in the domestic exchange of the Main Bank System, firms could expect to have smaller cash drain from the convertibles by first setting the coupon rate lower, and after the conversion by paying the lower dividend. Moreover, an eventual conversion meant an incessant spare capacity under the bond issuance regulatory limit for the capital and reserve requirement. (Hodder and Tschoegl 1993.) It was no wonder that the newly deregulated instrument was so popular.

On the other hand, after the sanction of warrant trading in November 1985,\textsuperscript{20} the warrant issue dominated the market, because with the known date and amounts of principal and interest payments, firms could effectively combine foreign currency- (especially dollar-) denominated warrants with swaps for hedging foreign exchange risks. As a matter of fact, for the period of 1986 to 1989, the attached warrant resulted in a bond coupon rate that was less costly than the comparable straight debt rates. (Hodder and Tschoegl 1993.)

In contrast, there was no increase in popularity for straight bond issues (Takeda and Turner 1992; Hodder and Tschoegl 1993; Hoshi 1996). Furthermore, from 1984 to 1991, there was a drastic decline in the issue of

\textsuperscript{19} For example, they created an overseas secondary market of corporate securities by using underwriting securities companies in London (Horiuchi 1996).

\textsuperscript{20} A warrant is an asset often issued with bonds, and typically traded separately afterwards. Basically, a warrant gives the purchaser a right to buy the asset to which it attaches at a specified price (the exercise price) before a specified time (the expiration date). Hence, the intrinsic value (premium) of the warrant is the cost difference in buying the asset between the exercise price of the warrant and the market price. (McInish 2000.)
equity-linked bonds explicitly guaranteed by the main banks (Campbell and Hamao 1994).21

Facing the exodus of the best customers with the deregulation, Japanese banks fought to retain profitability. The financiers even prepared the deposit rates for large denominations at more than the rate for commercial paper (Takeda and Turner 1992).22 They cultivated "new" customers, such as small or medium-sized firms and households, who were not allowed to venture out to the global market.23 Although the volume of bank lending to small firms was about one-third of the total bank loan in 1980, it became two-thirds in the late 1980s and stayed as such in the 1990s. (The Bank of Japan 1991; Horiuchi 2000.)

These new customers were often in the real estate industry, new kinds of financial business such as consumer finance, the tertiary sector, or overseas businesses that were different from the manufacturing corporations. The bankers did not have enough information about them, and demanded the most familiar collateral, land. (Ogawa and Kitasaka 2000; Shimizu 2000.) As a result, from the middle of the 1970s, the smaller firms' investment became very

21 Campbell and Hamao (1994) reported the percentage of guaranteed convertibles dipped from 0.2% of the total (home and abroad) to 0.02%. Similarly, the guaranteed warrant percentage observed a dive from 74.1% to 31.7%. However, when firms decided to issue guaranteed bonds, main banks were chosen to be a guarantor for 70% of the cases in the 1980s. (Campbell and Hamao 1994.)
22 Firms that allowed in issuing commercial paper (CP) in November 1987 raised funds by CP, and deposited them at the banks to earn risk-free profit. This "helped" the Japanese CP market to be active right after the deregulation. (Takeda and Turner 1992.)
23 Anderson and Makhija (1999) studied the debt structure of Japanese corporations as of 1990, and found firms were dependent on bank loans when they had difficulty in appealing their growth opportunity at security markets. That is to say, in 1990, the customers of bankers were those who could not fully utilize the deregulated capital markets.
sensitive not only to the bank deposit growth, but also to price of land that would secure the amount of capital the financiers provided for them.\textsuperscript{24} Expansion of the use of land as collateral pushed up land prices, and this in turn increased bank loans to those “unfamiliar” corporations. (Ogawa and Kitasaka 2000; Shimizu 2000.) Sekine (1999) tested the investment pattern of incorporated manufacturers between FY1985 and FY1995, and confirmed that especially in the late 1980s, firms without bond issuance since FY1977 (i.e., small firms) had the most notable investment pattern dependent on debt (bank loan) to asset (land) ratio. Hatakeda (2000) also tested the data of 1975:Q1-1995:Q1, and reported that the aggregate of bank loans in Japan was determined significantly by the deregulation dummy,\textsuperscript{25} banks' own capital, economic activity and land price.

Unlike the investment of smaller firms, between FY1976 and FY1995 that of large firms was far less volatile despite the increase in the price of land (Ogawa and Kitasaka 2000). For 1975:01-1990:12, there was no causal relation either between the land value or the bank loans to the larger corporations. Rather, the deregulated international corporations used the capital raised in the security market to invest in real estate, particularly in the six largest cities in Japan. As the price of land went up, the value of the asset increased, which jacked up their creditworthiness and the security price of the global companies in

\textsuperscript{24} The story is especially true for the relationship between the largest banks and the small firms. The smaller banks, on the other hand, had always used land as a collateral so that the new trend owing to the deregulation reinforced the Japanese “credo” in land. (Ogawa and Kitasaka 2000.)

\textsuperscript{25} In his study, the choice of dummy date was arbitrary at 1987:Q4 and 1993:Q2. We take a different approach that is discussed in Section 2.3.
the capital market, and hence brought them more capital to invest in the real estate. (Shimizu 2000.)

Furthermore, the above story was only one dimension of Japanese capital market internationalization. In the 1984–1990 data of the TSE Second Division, Horiuchi (1995) found that bank borrowing negatively correlated with an increase in shareholding by main banks. In addition, the more a main bank purchased stocks of a firm, the more the firm issued bonds which were also bought by the bank. Namely, a switch from direct to indirect financing was not accompanied by a change in ownership claims of the TSE Second Division firms. It was because whether the purchases were in the form of loans, land, or securities, all the investments were done by the same old main banker who poured the funds into one firm which raised capital in every way. As the underlining business was the same for any asset, the valuation of each could react to the same shock in a similar manner. Bayoumi (2000) reported that a disturbance on any of the land, stock, or bank-loan markets for Japan spread to the others in the same direction.

Takeda and Turner (1992) pointed out that the tendency was the most notable in the offshore market. Notice that, from the biggest financiers' point of view, the Japanese capital market for the period had a rich arbitrage opportunity owing to the completely liberalized capital flow with domestic interest controls. They utilized the market condition fully by transferring the operation to the euromarket. In addition, with expectation for an elimination of domestic
in institutional barriers between retail and investment banking, Japanese banks and securities firms became rivals for obtaining better-credit Japanese firms in the euromarket. Both offered preferential foreign exchange deals in swaps and forward contracts for their fellow countrymen, and competed fiercely to invest into yen-denominated offshore securities. (Takeda and Turner 1992.) Consequently, as Table 2.3 shows, a large part of Japanese offshore issuance during the 1980s was in yen, and in the late 1980s, nearly 90% of the Japanese securities issued in the euromarket ended up in the hands of resident (i.e., Japanese) investors (Okumura 1990).

These business transactions helped preserve the traditional ownership structure even for the internationalized corporations. According to Hodder and Tshoegl (1993), for the period of 1981 to 1990, 26% of new Japanese share issues were from conversion, and between 1987 and 1989, 15% were from exercised warrants. Since the convertible and warrant bond holders overseas were mainly Japanese big institutional investors who were often main bankers at home, Hodder and Tshoegl (1993) pointed out that there was no dilution with the deregulated instruments in the controlling stake of the existing share / debt holders.

Of course, the “self-financing” of the Japanese offshore market does not necessarily mean a continued autarky. There were still some genuine “foreign” investors who were allowed access to Japanese assets owing to deregulation.
Table 2.3.

Currency of Japanese offshore bond issues,
Million US dollar equivalent.

<table>
<thead>
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<th>Year</th>
<th>Dollars</th>
<th>D mark</th>
<th>S franc</th>
<th>Other *</th>
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<td>810</td>
<td>344</td>
<td>413</td>
<td>21</td>
</tr>
<tr>
<td>1976</td>
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<td>349</td>
<td>581</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>1,321</td>
<td>245</td>
<td>485</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>544</td>
<td>1,101</td>
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</tr>
<tr>
<td>1979</td>
<td>720</td>
<td>730</td>
<td>2,714</td>
<td>36</td>
</tr>
<tr>
<td>1980</td>
<td>990</td>
<td>535</td>
<td>1,943</td>
<td>197</td>
</tr>
<tr>
<td>1981</td>
<td>2,410</td>
<td>120</td>
<td>1,831</td>
<td>388</td>
</tr>
<tr>
<td>1982</td>
<td>2,234</td>
<td>241</td>
<td>3,631</td>
<td>197</td>
</tr>
<tr>
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</tr>
<tr>
<td>1984</td>
<td>8,633</td>
<td>504</td>
<td>5,602</td>
<td>355</td>
</tr>
<tr>
<td>1985</td>
<td>11,626</td>
<td>759</td>
<td>6,079</td>
<td>2,249</td>
</tr>
<tr>
<td>1986</td>
<td>16,340</td>
<td>983</td>
<td>7,890</td>
<td>3,754</td>
</tr>
<tr>
<td>1987</td>
<td>26,529</td>
<td>781</td>
<td>8,994</td>
<td>5,887</td>
</tr>
<tr>
<td>1988</td>
<td>33,590</td>
<td>1,503</td>
<td>9,785</td>
<td>2,286</td>
</tr>
<tr>
<td>1989</td>
<td>71,900</td>
<td>3,626</td>
<td>13,610</td>
<td>4,398</td>
</tr>
</tbody>
</table>

Note: * including issues in Euroyen.
Source: Hodder and Tshoegl 1993, Table 3.7.
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With the data for the 1970s and the 1980s, there are several studies that suggested Japanese capital market integration. According to Hamao, Masulis and Ng (1990), in terms of mean responses to volatility surprises, daily Nikkei 225 reacted to a volatility surprise in S&P 500 (the most “recent” market with respect to time zones) and in FTSE 100 (two “previous” market) from 1985:04:01 to 1988:03:31.\(^{26}\) Eun and Jang (1997) conducted a vector autoregression analysis for daily multiple-listed stock returns of 1988:01-1990:12, and noticed an innovation, and particularly the foreign exchange surprise, in the New York Stock Exchange Granger-caused to the trade in the TSE, though the magnitude was smaller than the home impact. From the finding, the authors postulated even a tiny number of foreign investors could bring new information to price equalization around the globe via arbitrages. The Japanese market was surely affected by the world capital market even if the majority of the overseas investors in Japanese businesses were expatriates. An integration test of Gültekin, Gültekin, and Penati (1989, 1990) for 1977:01-1984:12 found the same factor pricing between the US and Japanese share prices after December 1980.

Nonetheless, the character of Japanese capital market integration can be questioned in many ways. Kang and Stulz (1997) analyzed foreign equity investment in Japan for 1975-1991. They noticed the time series plot for the investment volume had a hump-shape with a peak around the mid-1980s.

\(^{26}\) However, Tokyo’s impact on the other markets is a contentious issue. Hamao, Masulis and Ng (1990) did not find its effect on New York for their entire sample period, or on London before 1987:10:19. In contrast, with weekly data, Theodossiou, Kahya, Koutmos and Christofi (1997) found a significantly negative mean reaction and an influence of volatility change in FTSE 100 from TOPIX for 1984:05:04-1994:10:21.
Moreover, trading by foreigners was statistically significantly skewed toward well-known and liquid manufacturing stocks of the largest capitalization, regardless of capital market deregulation. In other words, there is a possibility that the effect of liberalization policy was limited only for brand-named corporations and minimum for general capital market integration.\(^{27}\) As a matter of fact, according to Harvey (1991), comparing with the other G7 countries of the data for 1969:12-1989:05, Morgan Stanley Capital International (MSCI) Japan Index had a very low fit to the asset pricing model in terms of time-varying conditional covariance of the country return to the world stock return. Rowland and Tesar (1998) also contrasted the Japanese portfolio constructed from the Datastream data with the other G7 portfolios for 1984:01-1992:12, and concluded that the Japanese utility gain of portfolio diversification by adding an international portfolio was the largest. Baca, Garbe and Weiss (2000) found among the G7 nations for 1979:03-1999:03, the Japanese portfolio that consisted of the firms in the Datastream Global Equity Index had the largest pure country effect for the determination of stock prices.

The phenomena were, in the end, a vicious circle. Levy (2000) reported that the returns on the equity of the TSE First Division firms were systematically lower than their cost of capital for 1984-1996. In the first half of the 1990s, the most indebted First Division firms had more than 400% of leverage, and it was

\(^{27}\) However, it is a different matter whether the reason for the bias was due to a regulatory policy failure. Rather, Kang and Stulz (1997) argued there could be an inherent problem of information asymmetry between domestic and foreign investment communities.
growing. They were often smaller firms from the non-manufacturing sector whose loans were from their main banks. The numbers tell us the investment during the deregulatory period was into uncompetitive projects that created overcapacity. (Levy 2000.) The TSE collapsed in 1990.

Following a weak investment demand, the overseas issuance of convertible and warrant bonds contracted, and the international liability of Japanese banks plummeted (Takeda and Turner 1992). The value of 1989 issues of Japanese warrants bottomed out in 1990 with deteriorated expectation for increasing share price (Hodder and Tshoegl 1993). As the security investment turned sour, Japanese bankers who faced the Basel Capital Requirement (BIS regulation) decreased lending towards the business, especially without good collateral, i.e., the smaller firms (Shimizu 2000). From around FY1993, the bankers' own balance sheet began to correlate significantly positively with their loans to smaller firms (Sekine 1999). This led to a collapse of aggregate investment in Japan (Ramaswamy 2000), although during the whole process lending to the large firms was not affected either by the price of land or by the bankers' balance sheet (Sekine 1999, Shimizu 2000). Bayoumi (2000) also noticed that the 1990s' output gap in Japan could be mainly explained by a contraction in bank lending.

In the course of the event, the BOJ also experienced a huge change in its authority. For the central bank, the financial deregulation meant
(i) more market sensitive interest rates and portfolio decisions which made the transmission mechanism more complicated,

(ii) more diversified financial assets and services that rendered the route of money supply hard to follow, and,

(iii) less control over, i.e., more volatility in, the supply / demand of money which left policy implementation difficult

(Cargill, Hutchison and Ito 1997). According to the estimation by Hirayama and Kasuya (1996), already in 1980:Q2, the benchmark interest rate\textsuperscript{28} became insignificant to measure the broad money in Japan, whereas the output increased its correlation with the broad money more than in the 1970s. After 1984, the first introduction of liberalized deposit rates, the amount of money held in the unregulated instruments grew sharply. It overtook the still-regulated money in 1989:Q3, and at the same time a structural break occurred for the correlation among money, output and price. Finally in 1990:Q3, all growth of money (regulated and unregulated) halted. (Hirayama and Kasuya 1996.)

Over the period, progressively deregulated money market interest rates quickly converged to the market rate (Ueda 1993, Okabe 1995). For 1985-1991, the call rate could not dominate the long-term governmental bond rates, loan rates, or Gensaki rates, all of which became more volatile than for the pre-1985

\textsuperscript{28} Especially from 1983 the BOJ has explicitly chosen a newly issued 10-year bond with a large outstanding volume as a policy benchmark, and treated it as such for 6-12 months each. The market traded this instrument heavily. Accordingly, for 1980:11-1990:8, the yield and the rate of return on the benchmark issues were highly correlated with the portfolio of 9-10 year bonds’ yields and returns. (Campbell and Hamao 1993.)
period (Kasman and Rodrigues 1991). The BOJ's own estimation showed the bankers' lending rate responded to the lagged monetary tightening in the first half of the 1980s, and then in the second half of the 1980s the response became immediate not to the regulated interest, but to the market rate (Bank of Japan 1991). Moreover, although lending by the largest banks to the tertiary industry was sensitive to the difference in their loan rate and the call rate during FY1976-FY1995, the rate difference was insignificant on the lending volume for the sub-period of FY1987-FY1990 (Ogawa and Kitasaka 2000). Moreno and Kim (1993) mentioned that due to the shrunken linkage between corporate lending and traditional monetary policy for 1981-1990, M2+CD growth did not reflect the BOJ's supply shocks as for 1960-1980, but possibly responded to the demand innovations. All this points to a problem in monetary transmission via the traditional Main Bank System.

The BOJ indeed tried to return to the stricter guidance practice confronting the asset market binge after relaxing the strict window guidance in 1977:07. The central bank lowered lending limits during 1989:03-1991:01, which in 1990:04 abated the BOJ lending to the 12 city banks by 30% of 1989:04. However, with a nose dive of the asset market the BOJ gave up the window guidance in

---

29 Yet, the change is not necessarily a synonym of the alteration in money demand schedule. Cargill, Hutchison and Ito (1997) could not detect a structural break in out-of-sample forecast errors for a money demand function at 1985. Yoshida (1990) concluded a stable money demand function for 1968-1989, whereas Yoshida and Rasche (1990) found a demand shift in 1985 possibly due to both the change in demand and the expansionary policy. We return to the result of Yoshida and Rasche (1990) later in 2.3.
1991:06. (Hoshi, Scharfstein, and Singleton 1993; Cargill, Hutchison and Ito 1997.) When the market collapsed and business deteriorated - especially for the most important policy front, the main banks - the influence of money supply on the output also weakened noticeably. Jinushi, Kuroki, and Miyao (2000) found that from 1990, the BOJ's liquidity supply had not flown into real investment. They indicated as a possible cause that banks with bad loans under the binding BIS regulation did not expand industry investment but built up their own capital requirement with the liquidity.

Notice from the era of the traditional Main Bank System to the 1990s, the policy and the resultant market continuously differentiated into two kinds of firms. The function of the BIAC as a “benevolent dictator” was, in short, to sift out the good-credit corporations in place of invisible hands. The IBJ may have drafted deregulatory policy in order to transfer the role of the BIAC gradually and smoothly to the world market mechanism. However, the abuse of land collateral and the offshore security issuance show it is doubtful that that the policy genuinely activated a usage of the global market. The economy paid a price in the form of a troubled financial system, including monetary policy.

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30 Surely, the central bankers did not forget to confirm lending ceilings in the BIS regulation before abandoning the guidance (Hoshi, Scharfstein, and Singleton 1993).
31 Of course, we do not say there could not be an intention of the IBJ to retain its political power over the security issuance in Japan.
32 Granted, the 1980s was the era of the spectacular growth of the euro-currency market that caused a global shift of capital attainment from direct financing to international indirect financing. The concern was also international for a weakened domestic monetary policy due to this euro-currency market. (Pilbeam 1992.) Nevertheless, we may be able to expect the seriousness of
Namely, here we would summarize the Japanese experience from the above appropriation in three points:

(i) a possible difference between the firms which were permitted to raise funds offshore and the pure domestic corporations,

(ii) a conceivable problem in capital market "integration" of these two groups of firms, and,

(iii) a probable weakening of the traditional monetary transmission during the deregulation.

We are going to check these points quantitatively in turn. First, in this chapter, we consider how different the artificially differentiated two groups of corporations were.

2.3 "Tradables" and "Non-tradables"

2.3.1 Data

To begin with, let us determine the sample period we examine for the Japanese financial deregulation. The story in the previous section argued that the prime movers for the deregulation were the external shocks coming from outside: the Oil Shock, the growth of global trade, and the end of the fixed exchange rate...
These three events collectively forced the Japanese authority to discard its financial autarky, which took almost the entire decade of the 1970s to materialize. Thus, we would treat the inauguration of the New Foreign Exchange and Foreign Trade Control Law as a cumulative impact consisting of all the changes in the 1970s, and regard 1980:12 as the beginning of the Japanese liberalizing deregulation. For the closing date, 1997 was the year when the deflationary spiral began (Jinushi, Kuroki and Miyao 2000; Ahearne et al. 2002), which would require an analytical framework beyond the deregulation. In addition, in 1996:11 the “Big Bang” Reformation Plan for the financial sector was announced by the Cabinet, which advocated a dismantlement of the separation among banking, securities business and insurance. This was a policy that radically departed from the traditional Main Bank System. (Horiuchi 2000.) Therefore, we choose 1996:12 as the closing date for our analysis of the Japanese financial deregulation.

In order to measure the differences between the two categories of corporations in the capital market, we employ the monthly rates of stock return of the firms listed mainly in the First and Second Divisions of the TSE. The reason why we choose stock returns, rather than bond prices or bank lending data, is as follows.

As we have summarized in Chapter 1, integration could alter the cost of capital for a firm that goes global. In other words, regulatory differences among firms would be translated in the price of corporate projects, and hence the rate of
return of the investment in them. For a study of liberalizing deregulation, we must employ a price of firms that reflects most precisely such market conditions. Moreover, for identifying non-uniformity among Japanese companies owing to the policy, we need data of corporate valuation that cover a wide range of firms. However, we have seen in the previous section that the Japanese corporate bond market was the field of regulatory constraints where it is unlikely to encounter a working price mechanism. In addition, the Japanese commercial paper (CP) market was too new and small to examine the deregulatory process, which makes the data of CP price unsuitable for our study. Finally, we do not have access to large, detailed and comprehensive data regarding bank loans. Moreover, our discussion of the above section suggests bank loans could be strongly biased in favor of smaller effects of policy change, especially for the top-rated firms, because the main bankers tried to retain them as customers by any means.

In contrast, even with the cross-shareholdings and the traditional Main Bank System, Japanese stocks have been actively traded in volume (almost) continuously for more than 100 years. Furthermore, although a firm must be large enough to be listed in the stock price sample, equity data remain embracing diverse sets of firms, which enable us to categorize companies according to the regulatory constraint. Therefore, the figures of stock prices could reflect most

---

33 Japanese security trading, in its traditional form, can date back to at least the 18th century. The modern equity markets were established in Tokyo and Osaka in 1878, although between August and December of 1945 trading was stopped due to the US invasion to Japan. (Tokyo Stock Exchange 2002, Osaka Stock Exchange 2002.)
accurately the evolution of the market response to the deregulation. As a matter of fact, Bonser-Neal, Brauer, Neal and Wheatley (1990) confirmed that the weekly Japan fund premiums/discounts for 1981:05:22-1989:01:13 reacted to the changes in restrictions on foreign investment.\textsuperscript{34} For these reasons, we treat in this dissertation the share prices as an indicator of the deregulatory effect on firms’ capital procurement.

We define compounded return without an adjustment of dividends as

\begin{equation}
R_t = \ln P_t - \ln P_{t-1}
\end{equation}

where $P_t$ is the end-of-month share price in dollar at month $t$ (Campbell, Lo and MacKinlay 1997). The data is taken from Kabuka CD-ROM 2001 (Toyo Keizai-Simpoh-sha 2001),\textsuperscript{35} and adjusted by the monthly average of the yen-dollar exchange rate\textsuperscript{36} published by the Federal Reserve Bank of St. Louis (2002). Due to the data restriction, we use the prices of the firms listed at the TSE as of 2000:12:29, i.e., there is a survivor bias. Moreover, to obtain the rate of return at least for 1996:12, we use stock price of a firm quoted at either Division of the

\textsuperscript{34} Since any country fund is to invest domestically into foreign stocks, the authors surmised the fund return was a good indicator for (US) market reaction to (foreign) liberalization. Interestingly, in their event study, Japan fund did not respond to a new rule during the policy announcement period, but answered to it before and after the publication. It might describe the way the information was transmitted, and the difficulty in isolating a representative event, in a political process of deregulation.

\textsuperscript{35} Hence, to derive the rate of return for 1980:12-1996:12, we use the price data for 1980:11-1996:12.

\textsuperscript{36} They are the monthly averages for the noon buying rates in New York City for cable transfers in foreign currencies.
TSE in 1996:11. When at the end of a month some changes occurred for issued volumes, such as splits, buy-backs, buy-outs, mergers, and divestments, and no trade occurred on that particular day, a before-the-change price is employed.

Next, we divide our sample of corporations into those “who were allowed to go abroad first,” and the rest. We define

Tradables: internationalized firms including the firms that do not trade real goods, but are very active in international capital markets (such as financial institutions and trading firms) so that they are recognized by the world, and,

Non-tradables: otherwise.

It would be the best if we could inspect documents listing the names of companies that were permitted to procure capital and that actually went abroad at each stage of the regulatory changes. If there really were such a list, it would be in the archive of the MOF, and probably classified. Unfortunately, we are not aware of the existence of publicly available information of this kind. Therefore,

---

37 That is to say, we do not have the data of those companies, such as Yamaichi Security or Matsushita Electric Trade, de-listed before 2000:12:29. It also means we have to ignore the well-known names, such as Dai’ichi Kangyo Bank and Fuji Bank, which were the core main banks but reorganized themselves as a Mizuho Group with the IBJ to be re-listed at the TSE in 2000:09, after our sample period. Similarly, firms that merged before 1996:12, such as Mitsubishi Bank and the Bank of Tokyo for the Bank of Tokyo-Mitsubishi, or Sumitomo Cement and Osaka Cement for Sumitomo-Osaka Cement, do not appear in our sample independently.

as a second-best solution, we sort the firms into tradables and non-tradables based on the end-of-the-month data from the Financial Times (FT) and the Wall Street Journal (WSJ), of 1980:12:01-1996:12:31. We suppose, as the leading economic newspapers in the two most internationalized asset markets, they picked up the names of companies interesting enough for the world investment community, which would be a necessary condition for a firm to be integrated, *i.e.*, to be a tradable.\(^{39}\)

The window for the categorization is a calendar year. Namely, we set one year for a unit of observation, starting with a lot from 1980:12-1981:12 and ending with 1996:01-1996:12. If a firm was cited in the world market page of either the FT or the WSJ at least once in a unit year, we treat it as a tradable for that year.\(^{40}\)

The total number of tradable firms is 461. As we have found 10 tradables listed

\(^{39}\) However, due to a labor dispute, the FT was not published between 1983:06:01 and 1983:08:08. Therefore, we do not have the data from the FT for this period.

\(^{40}\) The choice of a calendar year as a unit has four reasons. (1) Some firms do not appear regularly on the list. For example, some American Depository Receipts (ADR) firms sporadically popped up in the WSJ only when they were traded on that particular end of the month. However, even if those companies became visible occasionally in the WSJ, as long as they have ADR, they were apparently recognized by the investors in the US. Thus, we need some leeway in the time framework for sorting. (2) For obtaining international recognition, it is more feasible to consider a firm to be watched by global investors not only at a specific date, but also for a certain length of time before and after the name was cited in the papers. For example, even if a firm is not mentioned in the FT or the WSJ in April although it was listed in March, it is natural to expect they were already known by the investors at least for a while unless it went out of business, whose possibility is excluded in our sample. (3) As Bonser-Neal, Brauer, Neal and Wheatley (1990) found, in a political process of deregulation, it is likely that before an actual policy implementation the market could obtain common knowledge of which firm would be allowed to be international. In other words, there is a typical difficulty of regulatory study in determining for an event as a surprise. (Campbell, Lo, and MacKinlay 1997.) Since it is hard to pinpoint the exact date when a firm is recognized, we assume one year is enough for a company to be a tradable. (4) Although it is possible to think of one fiscal year as a unit year, a fiscal year does not necessarily coincide with firms' accounting year that can vary from corporation to corporation. In addition, a regulatory
only in the Osaka Stock Exchange, we include them in our sample. The total number of firms (both the tradables and the non-tradables) in our sample is 1778. Table 2.4 shows the growth of the TSE in terms of the number of quoted firms and of the tradable firms (including those 10 firms from Osaka).

2.3.2 All the corporations were not created equal

From the sample, we first compose a monthly equally-weighted portfolio return series, one for the tradables and one for the non-tradables, and then investigate their statistical properties of each.\footnote{We use Stata Special Edition (2002).} If we find a variation in characteristics between the tradable and the non-tradable portfolios, the reaction of the firms' valuation to the policy can differ as well, which could also be one of the sources of possible integration problems and changes in the power of monetary policy. Table 2.5 summarizes descriptive statistics for the portfolios.\footnote{MSCI World Index will be explained in 2.3.3.}

The negative skewnesses indicate that both the distributions are warped to the left so that the left-tails are elongated. The kurtosis are larger than 3 for both the tradable and non-tradable portfolios, which suggests the distributions have higher central peaks and fatter tails than the normal distribution. These characteristics are consistent with the findings of previous studies such as Fong (1997) for weekly TOPIX of 1986:01:02-1994:12:29; Theodossiou, Kahya,
**Table 2.4.**


<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Tradable Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>1310.5</td>
<td>117.0</td>
</tr>
<tr>
<td>1982</td>
<td>1328.5</td>
<td>138.0</td>
</tr>
<tr>
<td>1983</td>
<td>1351.6</td>
<td>132.0</td>
</tr>
<tr>
<td>1984</td>
<td>1376.3</td>
<td>131.0</td>
</tr>
<tr>
<td>1985</td>
<td>1396.6</td>
<td>147.0</td>
</tr>
<tr>
<td>1986</td>
<td>1422.9</td>
<td>120.0</td>
</tr>
<tr>
<td>1987</td>
<td>1455.4</td>
<td>310.5</td>
</tr>
<tr>
<td>1988</td>
<td>1488.8</td>
<td>426.0</td>
</tr>
<tr>
<td>1989</td>
<td>1528.9</td>
<td>429.0</td>
</tr>
<tr>
<td>1990</td>
<td>1563.1</td>
<td>430.0</td>
</tr>
<tr>
<td>1991</td>
<td>1595.1</td>
<td>432.0</td>
</tr>
<tr>
<td>1992</td>
<td>1612.5</td>
<td>432.0</td>
</tr>
<tr>
<td>1993</td>
<td>1630.1</td>
<td>439.5</td>
</tr>
<tr>
<td>1994</td>
<td>1663.2</td>
<td>440.0</td>
</tr>
<tr>
<td>1995</td>
<td>1712.9</td>
<td>442.0</td>
</tr>
<tr>
<td>1996</td>
<td>1759.8</td>
<td>443.0</td>
</tr>
</tbody>
</table>

Note: The number of tradable firms includes 10 corporations from the Osaka Stock Exchange. As there were firms who became tradable instantaneously once they were listed, the number of tradables has decimal points in spite of the definition.
Table 2.5.

<table>
<thead>
<tr>
<th></th>
<th>Tradable Portfolio</th>
<th>Non-tradable Portfolio</th>
<th>MSCI World Portfolio</th>
<th>Squared Tradable Portfolio</th>
<th>Squared Non-tradable Portfolio</th>
<th>Squared MSCI World Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (%)</td>
<td>0.3384435</td>
<td>0.2489941</td>
<td>0.0083654</td>
<td>35.87819</td>
<td>34.62675</td>
<td>0.0017132</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>5.995825</td>
<td>5.89447</td>
<td>0.0406421</td>
<td>73.55232</td>
<td>66.07804</td>
<td>0.003368</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.3930374</td>
<td>-0.4360693</td>
<td>-0.6087723</td>
<td>3.89946</td>
<td>3.723319</td>
<td>5.962166</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>5.283942</td>
<td>4.702425</td>
<td>5.511452</td>
<td>21.485</td>
<td>19.54095</td>
<td>53.85115</td>
</tr>
<tr>
<td>Bera-Jarque Statistics</td>
<td>46.92 ***</td>
<td>29.42 ***</td>
<td>62.64 ***</td>
<td>3237 ***</td>
<td>2646 ***</td>
<td>22000 ***</td>
</tr>
<tr>
<td>Box-Pierce Q_{20}</td>
<td>20.327</td>
<td>35.126 **</td>
<td>13.158</td>
<td>61.163 ***</td>
<td>88.88 ***</td>
<td>21.827</td>
</tr>
</tbody>
</table>

Note: The null for the Bera-Jarque statistics is normality. The null for the Box-Pierce Q_{20} is no serial autocorrelation jointly for all the lagged values up to t-20. In all cases, ** indicates rejecting the null at 5%, and *** is for 1%.

Figure 2.3 gives the time-series plots of the monthly tradable and non-tradable portfolio returns. Visually, we notice (1) there would be volatility clustering for a certain period of time, and (2) the time-series patterns could vary over the period. For instance, we would say the mean returns were around zero during the first half of the 1980s. Then, the mean may have increased for the latter half of the decade, and turned into a negative trend for the 1990s. Volatility appears to be the lowest during the early 1980s, and to have increased for the second half of the 1980s. Compared with the 1980s, the 1990s could be the most unpredictable period.

Concerning the volatility clustering, it is a standard sign of the changing uncertainty in stock prices over-time which can be modeled by time series in second or higher moments (Bollerslev, Chou, and Kroner 1992). To investigate a difference in data generating process (DGP) between the tradables and the non-tradables, we attempt a simple exercise of fitting a time series model for each portfolio. First, following Fong (1997), de Santis and Gerard (1997), and


Figure 2.2.

Monthly portfolio return density.
Figure 2.3.


- - - - Tradable portfolio return
- - - - - Non-tradable portfolio return
Theodossiou, Kahya, Koutmos, and Christofi (1997), we check serial correlations of the level and the squared portfolio returns. In Table 2.5, Box-Pierce statistics with 20 lags for the level returns say that although the tradable portfolio return cannot reject the hypothesis of no-serial correlation, the non-tradable portfolio could be serially correlated though not so strongly. On the other hand, Box-Pierce $Q_{20}$ for the squared returns implies strong conditional heteroskedasticity in the disturbance terms for the DGP of both portfolios.

In Table 2.6, we also examine autocorrelation coefficients up to lag-6 for both the portfolio returns and the squared portfolio returns. The non-tradable portfolio and both of the squared returns have a strongly significant t-1 coefficient, though no time-series shows unit root. Based on Bollerslev, Chou and Kroner (1992), Fong (1997), de Santis and Gerard (1997), Theodossiou, Kahya, Koutmos, and Christofi (1997), and Mittnik, Paolella and Rachev (1998), we suspect the serial correlations of the squared returns refer to changing uncertainty in share pricing that could be modeled with generalized autoregressive conditional heteroskedasticity (GARCH).

Tentatively, we search for the best fitness of the DGP among GARCH(1,1), GARCH(1,2), GARCH(2,1) for the tradable portfolio, and AR(1)-GARCH(1,1), AR(1)-GARCH(1,2), AR(1)-GARCH(2,1) for the non-tradable portfolio. Tables 2.7 and 2.8 give details of the result. Following the methodology of Enders (1995), we consider a DGP which fits best to the data.
Table 2.6.


<table>
<thead>
<tr>
<th>Autocorrelation Coefficients</th>
<th>Tradable Portfolio</th>
<th>Non-tradable Portfolio</th>
<th>MSCI World Portfolio</th>
<th>Squared Tradable Portfolio</th>
<th>Squared Non-tradable Portfolio</th>
<th>Squared MSCI World Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>t -1</td>
<td>-0.006083</td>
<td>0.1799486 ***</td>
<td>0.0562659</td>
<td>0.3288855 ***</td>
<td>0.2325704 ***</td>
<td>0.0130677</td>
</tr>
<tr>
<td>t -2</td>
<td>-0.0318554</td>
<td>-0.0014399</td>
<td>-0.0296121</td>
<td>0.124474 *</td>
<td>0.0852349</td>
<td>0.0368525</td>
</tr>
<tr>
<td>t -3</td>
<td>0.0269182</td>
<td>-0.0293724</td>
<td>-0.030096</td>
<td>-0.051495</td>
<td>0.0941781</td>
<td>-0.0295583</td>
</tr>
<tr>
<td>t -4</td>
<td>0.0226047</td>
<td>0.0729728</td>
<td>-0.0249725</td>
<td>-0.0484163</td>
<td>-0.0835901</td>
<td>0.0350069</td>
</tr>
<tr>
<td>t -5</td>
<td>0.0925803</td>
<td>0.0795715</td>
<td>0.151744 **</td>
<td>0.1796426 ***</td>
<td>0.1735246 ***</td>
<td>0.0604662</td>
</tr>
<tr>
<td>t -6</td>
<td>-0.0930353</td>
<td>-0.221769 ***</td>
<td>-0.0816655</td>
<td>0.0239597</td>
<td>0.1370959 **</td>
<td>0.0180324</td>
</tr>
<tr>
<td>Augmented Dickey-Fuller Statistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * stands for significance at 10% (a two-sided test), ** is for 5%, and *** is 1%. The null for the Augmented Dickey-Fuller statistics is unit-roots in autocorrelation.
Table 2.7.

\[ R_t^T = \alpha + \varepsilon_t, \quad T = \text{Tradables}, \]

\[ E_{t-1} \varepsilon_i^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}, \quad q \in [1,2], \ p \in [1,2]. \]

<table>
<thead>
<tr>
<th></th>
<th>GARCH (1,1)</th>
<th>GARCH (1,2)</th>
<th>GARCH (2,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>0.7087744</td>
<td>0.6848698</td>
<td>0.7030221</td>
</tr>
<tr>
<td>( \alpha_0 )</td>
<td>3.786409 **</td>
<td>3.902141 *</td>
<td>1.692855</td>
</tr>
<tr>
<td>( \alpha_1 )</td>
<td>0.1676296 **</td>
<td>0.2409926 ***</td>
<td>0.2210927 **</td>
</tr>
<tr>
<td>( \alpha_2 )</td>
<td>n/a</td>
<td>n/a</td>
<td>-0.1237849</td>
</tr>
<tr>
<td>( \beta_1 )</td>
<td>0.7302119 ***</td>
<td>0.0264664</td>
<td>0.8586035 ***</td>
</tr>
<tr>
<td>( \beta_2 )</td>
<td>n/a</td>
<td>0.6373834 ***</td>
<td>n/a</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-604.9638</td>
<td>-603.5668</td>
<td>-604.6295</td>
</tr>
<tr>
<td>AIC</td>
<td>608.9638</td>
<td>608.5668</td>
<td>609.6295</td>
</tr>
<tr>
<td>SBC</td>
<td>615.4892</td>
<td>616.7235</td>
<td>617.7862</td>
</tr>
</tbody>
</table>

Standardized Residual Statistics

| Skewness              | -0.3930374  | -0.3930374  | -0.3930374  |
| Kurtosis              | 5.283942    | 5.283942    | 5.283942    |
| Bera-Jarque statistics| 46.92 ***   | 46.92 ***   | 46.92 ***   |
| Box-Pierce \( Q_{20} \) | 20.327      | 20.327      | 20.327      |
| Box-Pierce \( Q_{20} \) for Squared Residuals | 66.847 *** | 66.899 *** | 66.812 *** |

Note: For coefficient values, * indicates significance at 10% (a two sided test), ** is for 5%, and *** is 1%. Significance is for the conditional mean equation. The null for the Bera-Jarque statistics is normality. The null for the Box-Pierce \( Q_{20} \) is no serial autocorrelation jointly for all the lagged values up to t-20. For both the Bera-Jarque and the Box-Pierce statistics, ** stands for rejecting the null at 5%, and *** is for 1%.
Table 2.8.

\[ R_{i}^{NT} = \alpha + bR_{i-t}^{NT} + \varepsilon_{i}, \quad NT = \text{Non-tradables}, \]

\[ E_{i-t}^{2} = \alpha_{0} + \sum_{i=1}^{q} \alpha_{i} \varepsilon_{i-t}^{2} + \sum_{i=1}^{p} \beta_{i} h_{i-t}, \quad q\in[1,2], p\in[1,2]. \]

<table>
<thead>
<tr>
<th></th>
<th>GARCH (1,1)</th>
<th>GARCH (1,2)</th>
<th>GARCH (2,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.7675405</td>
<td>0.8155477 *</td>
<td>0.6896734</td>
</tr>
<tr>
<td>B</td>
<td>0.2464739 ***</td>
<td>0.2197636 **</td>
<td>0.2732871 ***</td>
</tr>
<tr>
<td>(\alpha_0)</td>
<td>0.5971688</td>
<td>0.833558</td>
<td>0.7206204</td>
</tr>
<tr>
<td>(\alpha_1)</td>
<td>0.1680989 ***</td>
<td>0.2320595 **</td>
<td>0.0695031</td>
</tr>
<tr>
<td>(\alpha_2)</td>
<td>n/a</td>
<td>n/a</td>
<td>0.1389305</td>
</tr>
<tr>
<td>(\beta_1)</td>
<td>0.8284161 ***</td>
<td>0.3292432</td>
<td>0.7880969 ***</td>
</tr>
<tr>
<td>(\beta_2)</td>
<td>n/a</td>
<td>0.4350656</td>
<td>n/a</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-585.3524</td>
<td>-585.8055</td>
<td>-584.6473</td>
</tr>
<tr>
<td>AIC</td>
<td>590.3524</td>
<td>591.8055</td>
<td>590.6473</td>
</tr>
<tr>
<td>SBC</td>
<td>598.5091</td>
<td>601.5936</td>
<td>600.4354</td>
</tr>
</tbody>
</table>

Standardized Residual Statistics

<table>
<thead>
<tr>
<th></th>
<th>GARCH (1,1)</th>
<th>GARCH (1,2)</th>
<th>GARCH (2,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skewness</td>
<td>-0.1515227</td>
<td>-0.18651</td>
<td>-0.1159729</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>5.128665</td>
<td>5.058673</td>
<td>5.203746</td>
</tr>
<tr>
<td>Bera-Jarque statistics</td>
<td>37.18 **</td>
<td>35.20 ***</td>
<td>39.49 ***</td>
</tr>
<tr>
<td>Box-Pierce (Q_{20})</td>
<td>33.923 **</td>
<td>32.725 **</td>
<td>35.403 **</td>
</tr>
<tr>
<td>Augmented Dickey-Fuller statistic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With trend</td>
<td>-10.317 ***</td>
<td>-10.121 ***</td>
<td>-10.525 ***</td>
</tr>
<tr>
<td>Without trend</td>
<td>-10.411 ***</td>
<td>-10.217 ***</td>
<td>-10.617 ***</td>
</tr>
<tr>
<td>Box-Pierce (Q_{20}) for Squared Residuals</td>
<td>120.97 ***</td>
<td>119.98 ***</td>
<td>121.25 ***</td>
</tr>
</tbody>
</table>

Note: For coefficient values, ** stands for significance at 5% (a two sided test), and *** is for 1%. Significance is for the conditional mean equation. The null for the Bera-Jarque statistics is normality. The null for the Box-Pierce \(Q_{20}\) is no serial autocorrelation jointly for all the lagged values up to t-20. The null for the Augmented Dickey-Fuller statistics is unit-roots. For the Bera-Jarque, the Box-Pierce, and the Augmented Dickey-Fuller statistics, ** indicates rejecting the null at 5%, and *** is for 1%.
when it has the lowest Schwarz Bayesian Criterion (SBC).\textsuperscript{43} By this measure, the tradables are best modeled as GARCH(1,1), and the non-tradable portfolio return as AR(1)-GARCH(1,1), though Q-statistic for the non-tradable residuals indicates their error term may still be serially correlated after fitting the GARCH. That is to say, the returns of the tradable and non-tradable portfolios appear to have different time series properties, even if both have a small lag in the fitted GARCH that would express lesser persistence of the innovations in the conditional volatility (Mittnik, Paolella and Rachev 1998). The evidences of longer memory for the non-tradable returns might mean the pure domestic firms had less efficient, and hence less competitive, capital market than the globalized corporations.

Finally, the integration literature in Chapter 1 argued that the influence of internationalization on the pure domestic firms was owing to the correlation between the tradables and the non-tradables. Such correlation would be reflected in the mean returns, and/or in the changeability of the asset valuation for tradable and non-tradable firms. In order to detect this posterior spillover of internationalization in Japan, we examine correlations between the tradable and non-tradable portfolio returns and between the squared returns. Table 2.9 gives

\textsuperscript{43} Although we have reported in Tables 2.7 and 2.8 Akaike's Information Criterion (AIC) as well, we know AIC can overestimate the order of autoregression with a small sample (Judge, Griffiths, Hill, Lütkepohl, and Lee 1985). Moreover, for the tradables, the difference in AIC is smaller than the inequality in SBC between GARCH(1,1) and GARCH(1,2). Finally, since the literature normally favors the more parsimonious DGP, we would choose GARCH(1,1) for the tradable portfolio return during our sample period.
Table 2.9.

Correlation between the tradable and non-tradable portfolio returns.

<table>
<thead>
<tr>
<th>Level Returns</th>
<th>$R_t^{NT}$</th>
<th>Squared Returns</th>
<th>$(R_t^{NT})^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{t-6}^T$</td>
<td>-0.1458852</td>
<td>$(R_{t-6}^T)^2$</td>
<td>0.2025663</td>
</tr>
<tr>
<td>$R_{t-5}^T$</td>
<td>0.0896449</td>
<td>$(R_{t-5}^T)^2$</td>
<td>0.219947 *</td>
</tr>
<tr>
<td>$R_{t-4}^T$</td>
<td>0.08663</td>
<td>$(R_{t-4}^T)^2$</td>
<td>0.1153981</td>
</tr>
<tr>
<td>$R_{t-3}^T$</td>
<td>-0.0096824</td>
<td>$(R_{t-3}^T)^2$</td>
<td>0.1543846 **</td>
</tr>
<tr>
<td>$R_{t-2}^T$</td>
<td>0.0547147</td>
<td>$(R_{t-2}^T)^2$</td>
<td>0.2178129 ***</td>
</tr>
<tr>
<td>$R_{t-1}^T$</td>
<td>0.1334208</td>
<td>$(R_{t-1}^T)^2$</td>
<td>0.2872792 **</td>
</tr>
<tr>
<td>$R_{t}^T$</td>
<td>0.8474236 ***</td>
<td>$(R_{t}^T)^2$</td>
<td>0.7868105 ***</td>
</tr>
<tr>
<td>$R_{t+1}^T$</td>
<td>-0.005032</td>
<td>$(R_{t+1}^T)^2$</td>
<td>0.3396417 **</td>
</tr>
<tr>
<td>$R_{t+2}^T$</td>
<td>-0.0510818</td>
<td>$(R_{t+2}^T)^2$</td>
<td>0.2227624 **</td>
</tr>
<tr>
<td>$R_{t+3}^T$</td>
<td>0.0014286</td>
<td>$(R_{t+3}^T)^2$</td>
<td>0.1378756</td>
</tr>
<tr>
<td>$R_{t+4}^T$</td>
<td>0.0196614</td>
<td>$(R_{t+4}^T)^2$</td>
<td>0.0716467</td>
</tr>
<tr>
<td>$R_{t+5}^T$</td>
<td>0.0674747</td>
<td>$(R_{t+5}^T)^2$</td>
<td>0.2028778 *</td>
</tr>
<tr>
<td>$R_{t+6}^T$</td>
<td>-0.1612776</td>
<td>$(R_{t+6}^T)^2$</td>
<td>0.184779 ***</td>
</tr>
</tbody>
</table>

Note: $R_{t+i}^T, i \in [-6, 6]$ is tradable portfolio return at time $t+i$. $R_t^{NT}$ is non-tradable portfolio return at time $t$. The correlation is estimated by a regression of $R_t^{NT} = \alpha + bR_{t+i}^T$. The value for $R_{t-1}^T$ and $R_t^{NT}$ correlation is by the OLS. For the correlation between $(R_t^T)^2$ and $(R_t^{NT})^2$, the estimation is by the White transformation due to heteroskedasticity. Since all the other estimations have reported a possible OLS residual serial correlation in the Durbin's h and the Breuch-Godfrey statistics, for them, the Newey-West transformation is applied with lag (6). * indicates significance at 10% (a two-sided test). ** is for 5%, and *** is 1%.
the results. Between the level returns, a Period t non-tradable return interacts significantly only with the simultaneous Period t tradable return. On the other hand, between the squared returns, a Period t non-tradable return correlates significantly and consecutively from Periods t-3 to t+2 tradable returns. The observation implies if there were integration spillover from the Japanese tradables, it would be through the stock return volatility. It accords with the integration theory by Bekaert and Harvey (1995), and an empirical finding for the emerging markets by Bekaert, Erb, Harvey and Tadas (1998). Moreover, the correlation with the squared forward variables indicates there might be a spillover from the non-tradables to the tradables in Japan.

As a summary of this section, we would argue that the Japanese deregulation indeed dealt with two statistically heterogeneous groups of firms during our sample period, with possible mutual spillovers.

2.3.3 Structural break tests

Let us return to the observation of Figure 2.3; besides the persistent volatility changes, we might be able to divide our sample period into three. Since our concern is internationalizing deregulation, we enquire about the changes of the returns in their relation with the international market. Namely, we search for possible structural change(s) over 1980:12-1996:12 for the tradable and non-
tradable returns in relation with the world portfolio. First, we employ the simplest model to measure the correlation between the tradable / non-tradable portfolio and the world portfolio such that

\[(2.2) \quad R_t^i = a^i + b^i R_t^w + V_t^i,\]

\[i = T (\text{tradables}), \ NT (\text{non-tradables}), t \in [1980:12, 1996:12],\]

where \(R_t^i\) is a compounded rate of return for equally weighted portfolio \(i, i = T, NT,\) at month \(t,\) and \(R_t^w\) is a compounded rate of return for MSCI World Index at month \(t.\)

When we run a simple ordinary least square (OLS) regression for (2.2), \(V_t^i\) is the noise term independent of \(R_t^w.\) That is to say, here we try to examine whether the relation between the world portfolio return and the tradable or non-tradable portfolio return has changed discontinuously during the deregulatory period. Moreover, if a shift was observed with a partial break test, for example in changes in \(b^i\) only, we would suspect the break was due to the pure time-varying correlation between the tradable or the non-tradable portfolio and the world portfolio. On the other hand, if a partial break test for intercept \(a^i\) detects a break, we may say the alteration is owing to some non-transitory elements in return

\[44\] We must remember that any structural break test depends on the assumption that the model to spot a break is correct. That is to say, we here presume the tradable / non-tradable portfolio is correlated with the world portfolio in a way proposed by (2.2). However, it may not be a farfetched claim. The OLS regressions of (2.2) produced \(F (1, 191) = 172.22\) for the tradable portfolio, and \(68.40\) for the non-tradable portfolio. Moreover \(b^T = 101.5843 (\cdot t = 13.12)\) and \(b^{NT} = 74.47395 (\cdot t = 8.27).\) All the statistics are significant at less than 1%.

\[45\] We use the same equation and \(V_t^T, V_t^{NT}, i = T, NT\) for mild segmentation analysis in the next chapter.
determination which is different from the factor represented by the time-varying world portfolio, \( R_t^w \), or non-world (i.e., domestic) transient factor, \( V_t^i \), \( i = T, NT \). In such a case we may infer that a direct effect of institutional change caused the break.\(^{46}\)

We choose MSCI World Index return as a representative for the global capital market.\(^{47}\) The index is fairly accessible from the internet, and has been one of the most consistently compiled data in the world for more than 30 years.\(^{48}\) The World Index is constructed with the data of 23 developed-country equity markets with guidelines that include value weighting based on free-float\(^ {49}\) adjusted market capitalization, and a replication of each country market. The data cover 85% of the free-floating value of the constituent markets, and excludes investment funds and non-domiciled corporations. (Morgan Stanley Capital International 2001.)

Table 2.5 contains the basic statistics of MSCI World return for our sample period. Although its distributional pattern is similar to our tradable / non-tradable portfolios, the time series properties show no sign of serial correlation either in level return or volatility. This may reflect the diversification effect of international investment that we have reviewed in Chapter 1. On the other hand, since both

\(^{46}\) That said, take note we cannot claim that the intercept exclusively picks up the influence of regulatory changes. It is true that a legal structure provides agents with a background to establish a market. However, a temporary interaction between domestic and world portfolios can also be affected by deregulation, or even by mere rumor of a policy change. We try to measure the issue directly in the next chapter.

\(^{47}\) The index data used here are for 1980:11-1996:12.

\(^{48}\) Consequently, the indices of MSCI are widely used in the literature of financial economics.

\(^{49}\) The term means the shares accessible to the global investment community. In other words, the index leaves out the equities with restrictions such as an investor nationality requirement or exclusive cross-shareholdings.
Japanese portfolios and MSCI do reject unit-roots, there is no possibility of cointegration between them either in (2.2). Figure 2.4 plots the relationship between MSCI World return and the tradable / non-tradable portfolio returns. We notice a possible non-linear association that might indicate an existence of structural breaks.

Unfortunately, there are not many choices in methodology for finding break points endogenously for a model of OLS with stationary variables. Possible candidates are the CUSUM (cumulative sum) test, the CUSUMSQ (cumulative sum of squares) test, the Max-LM (Lagrange multiplier) test, and the Exp-LM (exponential Lagrange multiplier) test (Maddala and Kim 1998). We employ the CUSUMSQ, the Max-LM, and the Exp-LM tests for our examination. We drop the CUSUM test because $R_t^i$, $i = T, NT$, fluctuates noisily, so that we expect the CUSUM cannot detect non-systematic departures of regression coefficients from constancy (Brown, Durbin and Evans 1975; Harvey 1981; Kmenta 1997).50

Let us begin with the CUSUMSQ test. The test statistic for CUSUMSQ is defined as

\[
(2.3) \quad WW_t^i = \frac{\sum_{j=3}^{193} (w_j^i)^2}{\sum_{j=3}^{193} (w_j^i)^2}, \quad i = T, NT, \quad t = 3, 4, \ldots 193,
\]

50 When the changes in the variables are steady, the CUSUM test would be appropriate (Brown, Durbin and Evans 1975).
Figure 2.4.

Correlation between MSCI World Index and the TSE stock portfolio returns.
where $w_j^I$ is a recursive residual for portfolio $i = T, NT$, and $j$ is a month to be checked for a break. The derivation of the statistic is in Appendix 2. The test describes graphically any departure of standardized prediction error from identically and independently normal distribution (i.i.d. normal) when a change occurs. The result will be regarded not as a rigorous hypothesis testing but as a yardstick (Brown, Durbin and Evans 1975; Harvey 1981; Maddala and Kim 1998). Namely, the procedure merely indicates the possible existence of a break when the prediction error first hits the boundary of i.i.d. normal due to a cumulative deviation from the mean that is supposed to be zero without the break.

We obtain test statistics starting with 1981:03, and regard a month as a possible structural break point when its test statistic crossed for the first time over the critical boundary. Figure 2.5 presents the CUSUMSQ plots for the tradable and the non-tradable portfolios. Table 2.10 includes the result of the CUSUMSQ test.\textsuperscript{51} The break points for both portfolios are observed in 1984. However, while the tradable portfolio return traversed the critical value line at 1984:10, the non-tradable portfolio return arrived on the border at 1984:03. In any case, we must remind ourselves that the CUSUMSQ is a weak test so that any breaks could not be very large in 1984.

\textsuperscript{51} We have conducted the same tests for partial breaks in the slope and intercept coefficients. The results are the same as the complete break.
Figure 2.5.
CUSUMSQ tests.

- Tradable portfolio
- - - Non-tradable portfolio
- - CUSUMSQ critical value

1984:03 CUSUMSQ value = 0.054836
1984:10 CUSUMSQ value = 0.09288
Table 2.10.

Structural Break Tests

\[ R_i' = a_i + b_i R_{i+1} + \varepsilon_i, \quad i = T \text{ (tradables), NT (non-tradables), } t \in [1980:12, 1996:12] \]

<table>
<thead>
<tr>
<th>Break Date</th>
<th>Test Statistic</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradable portfolio return</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUSUMSQ</td>
<td>1984:10</td>
<td>0.09286</td>
</tr>
<tr>
<td>LM tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max-LM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Break</td>
<td>1990:01</td>
<td>40.34313248 ***</td>
</tr>
<tr>
<td>Intercept only</td>
<td>1990:01</td>
<td>6.398320356</td>
</tr>
<tr>
<td>Slope only</td>
<td>1990:01</td>
<td>26.98526949 ***</td>
</tr>
<tr>
<td>Exp-LM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Break</td>
<td>1990:01</td>
<td>20.17143644 ***</td>
</tr>
<tr>
<td>Intercept only</td>
<td>1990:01</td>
<td>3.0718603092 **</td>
</tr>
<tr>
<td>Slope only</td>
<td>1990:01</td>
<td>13.48603273 ***</td>
</tr>
<tr>
<td><strong>Non-tradable portfolio return</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUSUMSQ</td>
<td>1984:03</td>
<td>0.054836</td>
</tr>
<tr>
<td>LM tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max-LM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Break</td>
<td>1990:02</td>
<td>43.22078279 ***</td>
</tr>
<tr>
<td>Intercept only</td>
<td>1990:02</td>
<td>8.801743465 *</td>
</tr>
<tr>
<td>Slope only</td>
<td>1990:02</td>
<td>26.48207504 ***</td>
</tr>
<tr>
<td>Exp-LM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Break</td>
<td>1990:02</td>
<td>21.61039026 ***</td>
</tr>
<tr>
<td>Intercept only</td>
<td>1990:02</td>
<td>4.37168217 **</td>
</tr>
<tr>
<td>Slope only</td>
<td>1990:02</td>
<td>13.24042627 ***</td>
</tr>
</tbody>
</table>

Note: * indicates rejecting the null of no structural break at 10%. ** is for 5%, and *** is 1%.
Next, we employ the stricter approach of the Max-LM test (Andrews 1993) and the Exp-LM test (Andrews and Ploberger 1994) that can test the null of no-break. The derivation of the test is in Appendix 3. The test statistic for a full break Max-LM test is

\[
(2.4) \quad \text{Max-LM}_N^\dagger [\pi] = \frac{\{193/\pi(1-\pi)\}(A'B')C^{-1}(A'B')'}{E[\hat{V}_i^{1/2}]}
\]

\[
= \frac{\{193/\pi(1-\pi)\}(A^{12}E[R_i^{w2}] - 2A'B'E[R_i^w] + B^{12})}{E[\hat{V}_i^{1/2}](E[R_i^{w2}] - E[R_i^w])}
\]

For a case of partial break with an intercept change, the test statistic is

\[
(2.5) \quad \text{Max-LM}_N^{i,\text{Intercept}} [\pi] = \{N/\pi(1-\pi)\}(A^{i2}/E[\hat{V}_i^{1/2}])
\]

If a break is only for a slope,

\[
(2.6) \quad \text{Max-LM}_N^{i,\text{Slope}} [\pi] = \{N/\pi(1-\pi)\}(B^{i2}/E[\hat{V}_i^{1/2}]E[R_i^{w2}])
\]

On the other hand, the test statistic for Exp-LM test for our model is defined such as

\[
(2.7) \quad \text{Exp-LM}_N^\dagger [\pi] = \ln\left[\int_{\pi}^{1-\pi} \exp[(1/2)LM_N^\dagger [\pi]]d\pi \right]
\]

(Andrews and Ploberger 1994; Bai, Lumsdaine and Stock 1998.) In order to have a convergence in statistic, we execute tests of (2.4)-(2.7) for t \in [1983:04,
1994:04]. We then study whether the largest test statistic can reject the null of no-break with the critical values reported by Andrews (1993) and Andrews and Ploberger (1994).

Figure 2.6 and Table 2.10 report the result for the LM tests for the tradables and non-tradables respectively. The value for full-break $LM[x]$ for the tradables reached its maximum in 1990:01 at around 40.4 which is well-above the 11.7 of the critical value for 1% significance. A month later, in 1990:02, the full-break LM-statistic for the non-tradables arrived at the peak with 43.3, which is again far greater than the 1% critical value of 12.9. We confirm both of these dates by stricter Exp-LM tests. A month lag for the non-tradable break date may mean a spillover from the tradables to the non-tradables. Concerning the nature of the break, the maximum LM statistic for the intercept of the tradables' regression has failed to reject the null of no-break at 10% level. However, the partial break with the slope coefficient for the tradables can be confirmed with a large margin by both the Max-LM statistic and the Exp-LM statistic. The result could indicate that, although the relationship between the tradables and the world capital market may have transformed during the deregulation, it would not be an "institutional" change. On the other hand, the intercept of the non-tradables marks out a break at 1990:02, though weakly but significantly. Their slope also has the largest and significant LM statistics at 1990:02. The double impact infers that the effect of the world market may have been more profound for the
Figure 2.6. (Continued)
Max-LM test.
structural break of the non-tradable portfolio return, which would have experienced both institutional and market-based alterations.\(^{52}\)

In short, with three approaches for finding a structural break, we have encountered two possible breaks each for the tradable and non-tradable portfolios. Moreover, these dates are not the same between the two groups of firms. Based on these findings, we may divide our sample period such that

| Period 1       | 1980:12-1984:10 for the tradables, |
|               | 1980:12-1984:03 for the non-tradables, |
| Period 2       | 1984:11-1990:01 for the tradables, |
|               | 1984:04-1990:02 for the non-tradables, |
| Period 3       | 1990:02-1996:12 for the tradables, and, |

Table 2.11, Panel A summarizes the DGP of the tradable / non-tradable portfolio for each period. We have tested whether the divided sample periods show a difference in DGP as well, whose result is reported in Table 2.11, Panel B. The logistics of DGP examination is the same as in the previous section, 2.3.2. For the tradable portfolio, both Periods 1 and 2 returns do not show evidence of serial correlation either in mean or variance. We also have failed to detect traces of serial correlation for the consecutive return data between 1980:12 and

\(^{52}\) We return to these points in later chapters.
Table 2.11.

Panel A: Data generating process, period by period.

<table>
<thead>
<tr>
<th></th>
<th>Entire Sample</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of months</td>
<td>193</td>
<td>47</td>
<td>63</td>
<td>83</td>
</tr>
<tr>
<td>GARCH(1,1)</td>
<td>No serial</td>
<td>No serial</td>
<td>GARCH(1,1)</td>
<td></td>
</tr>
<tr>
<td>correlation.</td>
<td>correlation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-tradables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of months</td>
<td>193</td>
<td>40</td>
<td>71</td>
<td>82</td>
</tr>
<tr>
<td>AR(1)-GARCH(1,1)</td>
<td>No serial</td>
<td>No serial</td>
<td>No serial</td>
<td></td>
</tr>
<tr>
<td>correlation.</td>
<td>correlation.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel B: DGP comparison between periods.

<table>
<thead>
<tr>
<th></th>
<th>Tradables</th>
<th>Non-tradables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periods 1 vs. 2</td>
<td>Cannot reject DGP equality.</td>
<td>Cannot reject DGP equality with AR(1) at 5% with</td>
</tr>
<tr>
<td></td>
<td>(No serial correlation.)</td>
<td>F(2, 107) = 1.0922.</td>
</tr>
<tr>
<td>Periods 2 vs. 3</td>
<td>By inspection, different DGP.</td>
<td>By inspection, different DGP.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Different DGP: AR(1)-GARCH(1,1) does not fit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>for Period 2, though Period 3 could be.</td>
</tr>
<tr>
<td>Periods 1 vs. 3</td>
<td>By inspection, different DGP.</td>
<td>By inspection, different DGP.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Different DGP: GARCH(1,1) does not fit for Period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 though Period 3 could be.</td>
</tr>
</tbody>
</table>
1990:01. In contrast, since the Period 3 tradable DGP could be GARCH (1, 1), although neither the Period 1 nor the Period 2 tradable portfolio return has serially correlated properties, we may say the Period 3 tradable return differs from the data for the 1980s.

On the other hand, the non-tradable return has reported a possible AR(1) for Periods 1 and 2 combined (1980:12-1990:02). In order to examine DGP difference statistically, we have tested by the Chow test the equality of AR(1) specification between "before" and "after" 1984:03. The test statistic is

\[
F^{NT} = \frac{\{\text{ess}^N_T - (\text{ess}^1_T + \text{ess}^2_T)\}/k}{(\text{ess}^1_T + \text{ess}^2_T)/((T^1_T + T^2_T - 2k))}
\]

(Johnston 1984, Pindyck and Rubinfeld 1991) where

- \text{ess}^N_T: error sum of squares of AR(1) process with the non-tradable portfolio for 1980:12-1990:02,
- \text{ess}^1_T: error sum of squares of AR(1) process with the non-tradable portfolio for 1980:12-1984:03,
- \text{ess}^2_T: error sum of squares of AR(1) process with the non-tradable portfolio for 1984:04-1990:02,
- k: number of estimated coefficients for AR(1), i.e., \( k = 2 \),
- \( T^1_T \): number of months in the non-tradable Period 1, i.e., \( T^1_T = 40 \),
- \( T^2_T \): number of months in the non-tradable Period 2, i.e., \( T^2_T = 71 \).
The obtained test statistic was $F^{NT}(2, 107) = 1.0922286$ which cannot reject the null of AR(1) equality at 5% between Periods 1 and 2 non-tradable portfolio return.

The same procedure was taken to verify DGP equality between Periods 1 and 2, and Period 3 for the non-tradable portfolio. The non-tradable data for Period 3 could fit to AR(1)-GARCH(1, 1) or GARCH(1, 1). However, both Period 1 and Period 2 return series failed to do so.\(^{53}\) Hence, we may say the Period 3 non-tradable DGP could differ from those for the 1980s.

The uniqueness of the Period 3 DGP in both the tradable and non-tradable portfolios could be in accord with the statistically significant structural break detected by the LM-test regarding their relation with the world portfolio. On the other hand, in comparison to the 1990s breaks, the portfolios do not present the DGP discontinuity with the 1984 rupture, which would be an indication of the weak nature of the CUSUMSQ test. However, since there would be no change in DGP for the return series, we can use model (2.2) for the Chow test and examine directly the degree of possible break between Periods 1 and 2 concerning the world correlation.

The rationale of this exercise is from the fact that any test for regression accordance among several series assumes the same DGP for the data of two regressions. If the DGPs are different, the standard F-test inevitably confronts

\(^{53}\) Although STATA tried to fit AR(1)-GARCH(1,1) or GARCH(1,1) with Kalman filter, the system did not converge on the local optimum for Periods 1 and 2 data individually.
heteroskedasticity for the pooled sample, and hence the result is unreliable.
(Davidson and MacKinnon 1993.) In such a case, a statistical test for regression
equivalence cannot be well defined so that we have to satisfy ourselves solely
with observational contrasts of estimated results. Alternatively, if two portfolios
share the same DGP statistically, we can proceed to an F-test to check the parity
in estimation for a model constructed for the same DGP. We have conducted the
Chow test using the error sums of squares obtained from \( (2.2) \) for both the
tradable and non-tradable portfolios of Periods 1 and 2. Namely, the test statistic
is

\[
F^i = \frac{\{\text{ess}_{p}^i - (\text{ess}_1^i + \text{ess}_2^i)\}/k}{(\text{ess}_1^i + \text{ess}_2^i)/(T_1^i + T_2^i - 2k)}, \quad i = T, NT,
\]

(Johnston 1984, Pindyck and Rubinfeld 1991) where

\( \text{ess}_{p}^i \): error sum of squares of a regression for \( (2.2) \) with portfolio \( i \), \( i = T, NT \), for
Periods 1 and 2 combined,

\( \text{ess}_1^i \): error sum of squares of a regression for \( (2.2) \) with portfolio \( i \), \( i = T, NT \), for
Period 1,

\( \text{ess}_2^i \): error sum of squares of a regression for \( (2.2) \) with portfolio \( i \), \( i = T, NT \), for
Period 2,

\( k \): number of estimated coefficients for \( (2.2) \), \( i.e., k = 2 \),

\( T_1^i \): number of months in Period 1 for portfolio \( i \), \( i.e., T_1^T = 47 \), and \( T_1^{NT} = 40 \),

\( T_2 \): number of months in Period 2 for portfolio \( i \), \( i.e., T_2^T = 63 \), and \( T_2^{NT} = 71 \).
We have obtained the result such that the tradable portfolio has $F^T(2, 106) = 0.19853755$ that cannot reject the null of structural break on 1984:10 in its relation with the world portfolio. Contrariwise, the non-tradable test statistic is $F^{NT}(2, 107) = -2.3649294$ which is negative. That is to say, with the Chow test, we reject the null of break at 1984:03 for the relationship between the non-tradable and world portfolio returns. Remember that the Japanese liberalization policy was for the tradable firms. Therefore, the non-tradable structural break occurring earlier and stronger than for the tradables might be counter to the integration theory if the internationalization for purely domestic firms is from a simple spillover of the integrated corporations. In other words, before 1984 there would be elements in the deregulation for the tradables that could affect the non-tradables.

Screening Appendix 1, we can find 1982:04 when the new legislation for the banks and the securities houses became effective. Recall the importance of the bankers in capital procurement under the traditional Main Bank System. Even if the new laws were to allow main bankers to keep pace with the tradable non-financial firms, the effect of internationalization for the financiers' business could have reached to the capital supply for the non-tradables. Moreover, since by definition the non-tradables were more dependent on the main banks than the tradable corporations, the internationalizing deregulation for the providers of domestic direct capital could affect the non-tradables more quickly. On the other

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54 It is because while $ess_{NT} = 1204.581$ and $ess_{NT} = 243.3611$, $ess_{NT}$ is 1016.931.
hand, the critical crossing for the tradables came just after the beginning of the active deregulatory sequence. It would be a reflection of the fact that the tradables were the “client” of the new policy. In this respect, the reaction of the tradable firms was in accordance with the intention of the policy.

Having two break points for our sample is, in a sense, not incongruous with the literature. Some papers have tested the existence of structural breaks in the Japanese economy, though they did not consider the asset market exclusively. Mehl (2000) conducted unit-roots tests for quarterly Japanese GDP, industrial production, unemployment rate, money supply, and Nikkei 225, and noticed an overall structural break somewhere in 1989-1992. Among them, Nikkei 225 weakly presented breaks at 1984:Q2 with the data for 1955:Q1-1989:Q2, and at 1989:Q1 with the data for 1955:Q1-1998:Q1. Yoshida and Rasche (1990) examined breaks in the Japanese broad money demand for the period of 1956:Q1-1989:Q3. They concluded that even though there was no change in the equilibrium elasticity of the broad money to interest spread, a deregulation of time deposit of large denomination in 1985:Q3 shifted the level of the equilibrium broad money upwards. Similar to these previous studies, we would suggest two shifts in the Japanese stock market in the middle of the 1980s and around

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66 Thus, Yoshida and Rasche (1990) inferred that the interest convergence between the regulated and the deregulated rates we mentioned in Section 2.2.3 would not have modified the relation between the broad money and the GDP, and could not be a cause of the speculative rise in asset prices in the late 1980s.
67 Yoshida and Rasche (1990) argued that this would be one of the reasons for the market peculiarity in the late 1980s.
the burst of the bubble. In addition, we may have found a possible difference in the transition between the tradable valuation and the non-tradable appraisal, especially with respect to their relation with the global capital market during the deregulation.

2.4 Chapter summary

In this chapter, we have summarized the process of Japanese financial deregulation both descriptively and figuratively. The deregulation policy could be regarded as a departure from the traditional Main Bank System by selecting the firms who could raise capital globally from the rest. The result was the market-wide usage of arbitrage opportunities, which cornered the economy at the lost decade. Numerically, we have detected a possible statistical difference between the returns of the firms who were permitted to procure funds overseas (the tradables) and the others that stayed home (the non-tradables). Especially, the non-tradable portfolio could have the AR(1)-GARCH(1,1) process which indicates a more persistent shock to the level return than the tradables of GARCH(1,1). In addition, there is a possibility of spillover from the non-tradables and to the tradables via volatility. Furthermore, CUSUMSQ and LM-tests found two structural breaks in 1984 and 1990 for the relationship between the tradable or non-tradable portfolio and the world portfolio. Interestingly, the tradable break dates do not agree with the non-tradable breaks. Moreover, though statistically
weak, the first structural break in 1984 could have occurred first to the non-tradables. We suspect the reason for the earlier break in the non-tradable return may have come from the deregulation for the capital providers, *i.e.*, the main banks.

Even if it is not sufficient, a statistical difference in return process is a necessity if there were divergent reactions to policy changes between the two sets of firms. A characteristic of the Japanese experience is the categorization of corporations that was not done by a natural market force, but by an artificial selection process of the deregulation. Unless the policy consciously calculated the dissimilar responses from the two sectors of the economy, the result could be chaotic. Recall that it was the non-tradables that may have reacted earlier to the internationalizing deregulation. From the literature depicting the Japanese capital market deregulation, we imagine the non-tradable response would not be a regulator's intention. Hence, we would have observed one of the possible complications in the Japanese approach for capital market liberalization. The next task to which we address our attention is how quantitatively unruly the strategy became. We tackle the problem from two angles. One is to examine the difference in the process of internationalization between the tradables and non-tradables, which is discussed in the next chapter. Another is whether our stock pricing data can verify the claims about the altered power of the BOJ, which we study in Chapter 4.
CHAPTER 3

Japanese capital market internationalization during the deregulation

3.1 Introduction

In the previous chapter, we have argued descriptively and figuratively that Japanese capital market deregulation was a gradual liberalization, which would have artificially categorized the firms into two classes, the tradables and the non-tradables. Moreover, we found the policy could have brought about two structural breaks varying for each type of corporation in its relationship with the world capital market. On the one hand, the tradables reacted to the policy schedule as the integration theory (and the policy makers) would have expected. In addition, the tradable structural break of 1990:01 may not have been affected by an institutional change for their capital market. On the other, the non-tradables may have showed the effect of deregulation in 1984:03, which would have been because of the policy change for the tradable main bankers. The pure domestic firms also provided us with evidence in 1990:02 that the new policy could have affected them, both in their relation with the world market, and in the discontinuity in the nature of the non-tradable capital market. Finally, if there was an integration spillover, the data indicated it would be from the tradable volatility to the non-tradable pricing variability.
Following these findings, we study in this chapter how different the process of internationalization was between the tradables and the non-tradables with the mild segmentation model (Errunza and Losq March 1985). This theory can describe integration of a capital market, like Japan’s, that consists of internationalized (eligible) firms and the (ineligible) rest influenced by spillover. The model also allows for both categories of companies to be priced simultaneously by the world factor and the domestic factor, which could pick up holistically the effects of internationalizing deregulation. Errunza and Losq tested their theory with around 140 stocks each from nine relatively small so-called “tiger” economies and the US. Therefore, our experiment with 130-1400 stocks from the large Japanese economy could add another empirical insight to the mild segmentation of a capital market.

Deducing from the theory and the results in Chapter 2, we hypothesize the tradables could have been integrated with the global capital market from the beginning. In contrast, the non-tradables may show an increasing internationalization due to the spillover, while they would have been more deeply rooted in the domestic economy throughout the sample period. We find evidence that the tradables could have been integrated indeed during the entire deregulatory process, although they may have had a domestic factor loading inconsistent with the theory during the second half of the 1980s. On the other hand, the non-tradables presented an indication of integration only for the

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57 They were Argentina, Brazil, Chile, Greece, India, Korea, Mexico, Thailand, and Zimbabwe.
"bubble" era. Furthermore, the non-tradable return may have a lower pricing for domestic risk premiums than the tradable return, which is contradictory to the theory. These results add new findings to the study by Errunza and Losq (March 1985). It would also reflect problems in the model for the Japanese market. They may be in part an effect of the Main Bank System and/or policy design during the deregulation.

The construction of the chapter is as follows. First, we set out an application of the mild segmentation model to the Japanese capital market deregulation, and formulate propositions to be examined by the data. Next, the procedure and the result of the estimation are explained. In 3.4, we test hypotheses and discuss their implication to understand the results of the policy. For the final section, a summary of the chapter is prepared.

3.2 Measuring the degree of internationalization: the mild segmentation model

Let us go back to our discussion in Chapter 1. When an asset is integrated, and thus evaluated by investors from many parts of the globe, the world factor independent of the non-international factor should be an important determinant for the excess return. Therefore, the pricing of the asset must consider statistically significantly the "world beta," i.e., the risk of an investment in it relative to the uncertainty of the world market portfolio to which the security
belongs. (Akdogan 1995.) For our discussion, the tradables are the firms recognized by international investors as integrated assets. Their valuation can have a significant world beta. At the same time, the nationality of the tradables is Japanese so that they are under the same (legal, political, economic and/or social) condition as the pure domestic firms. The tradable return can be correlated with the return of the non-tradables. In contrast, the non-tradables are segmented because they face the regulatory barriers to raise capital abroad, and/or the firms are not capable of marketing their projects overseas any way. The pricing would reflect the nature of the non-tradables that are segmented from the international market but correlated with the integrated tradables. Starting from the theory of capital market integration, Errunza and Losq (March 1985) presented the mild segmentation model that describes a capital market closer to this reality. Their argument is as follows.

Assume all the investors comply with a standard Capital Asset Pricing Model (CAPM) assumption for risk-averse preference. That is to say, they are homogeneous and none of them has a power to sway asset pricing alone. The investors are rational such that their preference satisfies completeness, transitivity, and continuity. The expected utility of each investor can be represented as a function of only the expected value and variance of the real
returns on the investment portfolio. They maximize this utility with risk aversion at the end of each period, although we don't know the dynamics of how they reach this optimality. Namely, the model is static. The information in the market is complete and perfect so that investors' ex ante investment return expectation is equal to ex post wealth realization. On the other hand, all the asset returns have a jointly normal distribution that makes the wealth yielded from the investment normal as well. The quantity of assets is fixed and all of them are marketable and perfectly divisible so that the liability is limited. There is a risk-free asset as well at whose rate the investors may lend or borrow without restriction. (Copeland and Weston 1992; Eichberger and Harper 1997.)

However, Errunza and Losq (March 1985) added one restriction on these standard assumptions. There are a group of investors who do not have access to a part of domestic securities due to, say, a financial/capital market regulation. Thus, for them, some securities are eligible, but the others are not to invest (i.e., ineligible). The restricted investors make a world portfolio which consists of all the eligible securities on the earth. In consequence, the firms of eligible securities are integrated, and their relative business risk to the global portfolio is taken into account for the project appraisal. We assume the eligible firms are our tradables that have regulatory permission to procure capital internationally.

On the other hand, ineligible securities are the assets obtainable only by unrestricted investors who can buy both international and purely domestic

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\(^{58}\) Hence, the investors are supposed to be concerned not with the actual level of consumption
equities. In our discussion, such a domestic security is for a non-tradable firm. Since the non-tradables do not allow world investors to evaluate their business, the project valuation has a link with the rest of the world only through the domestic market portfolio that consists of both the integrated tradables and the non-tradables. The ineligible non-tradables are also presumably less correlated with the world portfolio than the eligible tradables.

The global investors choose eligible equities which are the most highly correlated with the ineligible shares to achieve diversification at the maximum possible. On the other hand, the unrestricted investors form their portfolio with the world portfolio and the non-tradable stocks that have the minimum correlation with the securities open to everybody. Errunza and Losq (March 1985) pointed out that despite these diversification efforts, comparing with a case without investment barriers, the investors who cannot invest in the non-tradable assets have a smaller investment opportunity set. Moreover, those who can invest in the ineligible projects have a smaller population of fellow financiers who would share the risk with them. In order to clear the market, the capital for the restricted admittance will command a super-risk premium proportional to the conditional domestic market risk because of the limited hedging availability for all

---

59 With a similar assumption as the mild segmentation model, Eun and Janakiramanan (1986) modeled a world capital market which consisted of two markets differing in the degree of foreign access. At the equilibrium of their theory, the investors' diversification demand drove down the capital cost of the unrestricted firms whose return were correlated the most with the restricted share returns. On the other hand, Korkie and Nakamura (1997) tested the diversification merit to the US and Japanese stock indices from small TSE companies which were the subordinates of twenty large firms. They found the contribution of the subsidiaries was statistically significantly
the investors. In other words, the regulation forces the non-tradables into less competitive valuation than the tradables.

Let us restate the above discussion in mathematical terms according to Errunza and Losq (March 1985). The mild segmentation model assumes a standard CAPM return schedule for an investment into an eligible, i.e., tradable (T), firm such that

\[(3.1) \quad E[R_j^T - R^f] = AMCov[R_j^T, \tilde{R}^w],\]

where

- $R_j^T$: return from eligible / tradable (T) security $j$,
- $R^f$: the world risk free rate,
- $A$: a risk-aversion coefficient of the restricted, or world, investors,
- $M$: the world market portfolio value, and,
- $\tilde{R}^w$: the return of the world market portfolio.

On the other hand, a project of ineligible, or non-tradable (NT), firm $j$ which some investors cannot access will have a super-risk premium on their return. Errunza and Losq (March 1985) define the premium of ineligible assets as

\[(3.2) \quad E[R_j^{NT} - R^f] = AMCov[R_j^{NT}, \tilde{R}^w] = (A_u - A)M^{NT}Cov[R_j^{NT}, R^{NT}/R^T].\]

larger than the parents' during the 1980s. These findings would support the assumption for the
where

\( R_j^{NT} \): the expected return of firm \( j \) categorized as an ineligible, i.e., a non-tradable (NT),

\( A_u \): a risk-aversion coefficient of the "unrestricted" investors who can invest into any stocks,

\( M^{NT} \): the value of the portfolio consisting of non-tradable (ineligible) stocks,

\( R^{NT} \): the return of the non-tradable (ineligible) stock portfolio, and,

\( R^T \): the return vector for all the tradable (eligible) securities.

In this framework, less than complete integration bids a super-risk premium for the non-tradables, \((A_u - A)M^{NT} \text{Cov}[R_j^{NT}, R^{NT} | R^T]\), which is proportional to the conditional domestic market risk, \( \text{Cov}[R_j^{NT}, R^{NT} | R^T] \). The covariance is conditional to the existence of the tradables in the domestic market portfolio, because the model takes into account the effect of the tradables affecting the domestic market volatility. Furthermore, \( A_u - A > 0 \) for the model, so long as the difference in investors exists.\(^6\) In other words, the conditional domestic market risk should make unrestricted and risk-averse investors always

\(^{6}\text{To clarify this assertion, recall that the theory is based on the standard capital asset pricing model. The homogeneous investors, hence, have expected utility function of risk aversion which must be expressed fully by a preference relation over mean and variance of the asset valuation, and/or, have a quadratic von Neumann-Morgenstern utility index (Eichberger and Harper 1997). For a purpose of an exposition, assume our investors have quadratic utility. Then, the risk aversion coefficient in either (3.1) or (3.2) is an inverse of the total sum of the absolute risk aversion coefficients evaluated at the expected value of the aggregate investment of endowments. (Eichberger and Harper 1997.) That is to say, since the world investors have a larger population than the unrestricted, but local, investors, \( A_u \) is always greater than \( A \).}
require a positive premium from the non-tradable investment due to its smaller capital base.

Notice, equation (3.2) has orthogonalized the world factor to the non-international factor which is a conditional covariance of the ineligible shares. It enables us to test the degree of international integration by comparing the betas and their significance between the world and domestic factors. The procedure is as follows. First, as Errunza and Losq (March 1985) proposed, let us assume for the tradables a two-factor return-generating process that is a modified version of (3.1).

\[ (3.3) \quad R_T^T = \alpha_T^T + \beta_T^T R_T^w + \gamma_T^T V_T^T + \varepsilon_T^T, \quad \text{Cov}[\varepsilon_T^T, R_T^w] = \text{Cov}[\varepsilon_T^T, V_T^T] = 0. \]

\( V_T^T \) is a pure non-international factor of the portfolio of the tradables. It is orthogonal to \( R_T^w \), i.e., \( \text{Cov}[R_T^w, V_T^T] = 0 \), and defined implicitly by,

\[ (3.4) \quad R_T^T = a_T^T + b_T^T R_T^w + V_T^T, \]

where \( R_T^T \) is the return of the portfolio of tradables. Similarly for the non-tradables, we define,

\[ (3.5) \quad R_{NT}^T = \alpha_{NT}^T + \beta_{NT}^T R_{NT}^w + \gamma_{NT}^T V_{NT}^T + \varepsilon_{NT}^T, \quad \text{Cov}[\varepsilon_{NT}^T, R_{NT}^w] = \text{Cov}[\varepsilon_{NT}^T, V_{NT}^T] = 0, \]

and,

\[ (3.6) \quad R_{NT}^T = a_{NT}^T + b_{NT}^T R_{NT}^w + V_{NT}^T, \quad \text{Cov}[R_{NT}^w, V_{NT}^T] = 0, \]
where $R^{NT}$ is the return of the portfolio of non-tradables.

Second, in theory, $R^f$ is a risk-free rate, i.e., it is non-stochastic, so as $E[R^f] = R^f$ at each point of time. Moreover, since the standard CAPM says $\text{Cov}[R^i, R^w] = \beta_i \text{Var}[R^w]$, we rewrite (3.1) such that

\[(3.7) \quad E[R^i] = R^f + \beta_i AM \text{Var}[R^w].\]

On the other hand, the conditional covariance in (3.2) can be redefined with (3.5) such that

\[
\text{Cov}[R^i_{NT}, R^{NT} | \mathcal{R}_T] \\
= \text{Cov}[\alpha^i_{NT} + \beta^i_{NT} R^w + \gamma^i_{NT} V^{NT} + \epsilon^i_{NT}, R^{NT} | \mathcal{R}_T] \\
= \beta^i_{NT} \text{Cov}[R^w, R^{NT} | \mathcal{R}_T] + \gamma^i_{NT} \text{Cov}[V^{NT}, R^{NT} | \mathcal{R}_T] + \text{Cov}[\epsilon^i_{NT}, R^{NT} | \mathcal{R}_T],
\]

because by definition $R^w$, $V^{NT}$ and $\epsilon^i_{NT}$ are independent of each other. As $\epsilon^i_{NT}$ is idiosyncratic to $R^i$, $\text{Cov}[\epsilon^i_{NT}, R^{NT} | \mathcal{R}_T] = 0$. Moreover, from (3.6),

\[
\text{Cov}[V^{NT}, R^{NT} | \mathcal{R}_T] \\
= \text{Cov}[R^{NT} - a^{NT} - b^{NT} R^w, R^{NT} | \mathcal{R}_T] \\
= \text{Var}[R^{NT} | \mathcal{R}_T] - b^{NT} \text{Cov}[R^w, R^{NT} | \mathcal{R}_T].
\]

Hence,
(3.8) \[ \text{Cov}[R_i^{NT}, R^{NT}|R^T] = \beta_i^{NT} \text{Cov}[R^w, R^{NT}|R^T] + \gamma_i^{NT} (\text{Var}[R^{NT}|R^T] - b^{NT} \text{Cov}[R^w, R^{NT}|R^T]). \]

With (3.8), we rewrite (3.2)

(3.9) \[ E[R_i^{NT}] = R^f + \beta_i^{NT} AM \text{Var}[R^w] + (A_u - A) M^{NT} [\beta_i^{NT} \text{Cov}[R^w, R^{NT}|R^T] + \gamma_i^{NT} (\text{Var}[R^{NT}|R^T] - b^{NT} \text{Cov}[R^w, R^{NT}|R^T]) \]

\[ = R^f + \beta_i^{NT} (AM \text{Var}[R^w] + (A_u - A) M^{NT} \text{Cov}[R^w, R^{NT}|R^T]) \]

\[ + \gamma_i^{NT} (A_u - A) M^{NT} (\text{Var}[R^{NT}|R^T] - b^{NT} \text{Cov}[R^w, R^{NT}|R^T]). \]

Finally, we re-define (3.7)

(3.10) \[ E[R_i^T] = R^f + \lambda^T \beta_i^T, \]

and (3.9)

(3.11) \[ E[R_i^{NT}] = R^f + \lambda^{NT} \beta_i^{NT} + \theta^{NT} \gamma_i^{NT}, \]

where

(3.12) \[ \begin{cases} 
\lambda^T = AM \text{Var}[R^w] \\
\lambda^{NT} = AM \text{Var}[R^w] + (A_u - A) M^{NT} \text{Cov}[R^w, R^{NT}|R^T], \text{ and}, \\
\end{cases} \]

(3.13) \[ \begin{cases} 
\theta^T = 0 \\
\theta^{NT} = (A_u - A) M^{NT} (\text{Var}[R^{NT}|R^T] + b^{NT} \text{Cov}[R^w, R^{NT}|R^T]), \\
\end{cases} \]

97
Consequently, we can specify the excess return schedule of (3.10) and (3.11) such that

\[(3.10)' \quad E[R_j^T] - R^f = E[R_j^T] - E[R^f] = \lambda^T \beta_j^T,\]

and

\[(3.11)' \quad E[R_j^{NT}] - R^f = E[R_j^{NT}] - E[R^f] = \lambda^{NT} \beta_j^{NT} + \theta^{NT} \gamma_j^{NT}.\]

Next, we establish hypotheses in our empirical study for (3.10) - (3.13). First, the system of equations simply indicates the standard CAPM conclusion where in equilibrium the difference between the expected rate of return of any risky asset and the riskless rate of return is positively correlated with the relative risk measures, beta and gamma. Moreover, recall $\beta^i$, $i = T$ (Tradables), NT (Non-Tradables), is the equilibrium risk for an investment into firm $j$ relative to the risk of the world portfolio return, $R^w$. Similarly, $\gamma^i$, $i = T$, NT, is the relative risk of firm $j$

---

61 For a simplification of (3.1) and (3.2) into (3.11) and (3.12), the model assumes

\[
\text{Cov}[\varepsilon^T_j, R^T_j] = \text{Cov}[\varepsilon^{NT}_j, \varepsilon^T_j + \beta^T R^w + \gamma^T V^T + \varepsilon^T_j] = \gamma^T \text{Cov}[\varepsilon^{NT}_j, V^T_j] + \text{Cov}[\varepsilon^{NT}_j, \varepsilon^T_j] = 0,\]

where the underbars stand for vectors. Since $V^T$ is a common factor for all the tradables without any specific characteristics of individual firms, and $\varepsilon^{NT}_j$ is an idiosyncratic disturbance for corporation $j$ categorized as a non-tradable, $\text{Cov}[\varepsilon^{NT}_j, V^T_j] = 0$. Therefore, for $\text{Cov}[\varepsilon^{NT}_j, R^T_j] = 0, \text{Cov}[\varepsilon^{NT}_j, \varepsilon^T_j] = 0$. (Errunza and Losq March 1985.) The assumption entails further implication. Suppose the unique feature of a firm, $\varepsilon^i_j$, $i = T$, NT, is due to, say, production technology or demand peculiar to its industry. Without any residual correlation, the theory has presumed there is no effect in asset evaluation from a linkage of technology or market structure between, for example, a large multinational firm sorted as a tradable and its domestic component supplier labeled as a non-tradable. In other words, the model has distilled capital market integration from the globalization of industries, though it is a different matter whether there is indeed no connection between them. The issue should be a further research topic.
to the risk of the pure domestic portfolio in equilibrium (Fama and Macbeth 1973; Eichberger and Harper 1997). Intuitively, $\beta^i \geq 0$ and $\gamma^i \geq 0$, at least on average (Errunza and Losq March 1985). In addition, any rational investors never expect the return from a risky asset discounted from the risk-free asset return by the risk premiums when they decide to include the asset into their portfolio made of market portfolio(s) and a sure-return asset. The risk premiums financiers require from the risky investment should be reflected in positive valuation, or pricing, of these relative risk terms. For instance, consider a case when the market decides to add asset $j$ into their portfolio. It is equivalent to a net-buying of the security of firm $j$, and the price of stock $j$ goes up, which produces a positive expected return. The phenomena imply the market demands the risk premium to make an expected return larger than the risk-free rate due to the relative risks of asset $j$. Namely, $\lambda^i > 0$ and $\theta^i > 0$, $i = T, NT$. (Fama and Macbeth 1973; Roll and Ross 1994.)

Finally, this standard CAPM conclusion suggests that when the market decides to discard the asset from their portfolio ex post, the relative risk(s) of the security investment send(s) the signal to the investors to divest the asset. Copeland and Weston (1992) discussed the ex post nature of the CAPM-based model with a possibility of negative correlation between the rate of return and beta which was depicted by a negatively sloped empirical security market line. They stated that:
... prices must be established in such a way that riskier assets have higher expected rates of return. Of course, it may turn out that after the fact their return was low or negative, but that is what is meant by risk. If a risky asset has a beta of 2.0, it will lose roughly 20% when the market goes down by 10%. (Copeland and Weston 1992, 214.)

That is to say, when there is a net-selling, and thus a price decrease with negative expected return for (3.10) and (3.11), the pricing of the relative risks, \( \lambda^i \) and/or \( \theta^i \), \( i = T, NT \) will be negative.

We examine the significance of the betas and gammas by the hypothesis testing based on the above logic. First, from the definition of integration for our discussion, we regard an asset is integrated when the world factor is significant for its pricing. That is to say, when \( \lambda^i \), \( i = T, NT \) is insignificant so that it is statistically equivalent to zero, we suspect the group of corporations categorized as \( i = T, NT \) is segmented from the world capital market. On the other hand, when a test produces significantly negative lambdas and/or gammas with non-negative return, and hence non-negative beta and gamma, the model must be rejected, or more precisely, the implied utility pattern by the data is inconsistent with the assumed preference schedule over the mean-variance space.\(^{62}\)

Furthermore, if either or both of the relative risk terms are significant for the coherent equilibrium expected excess return, we can apply the assumed

\(^{62}\) However, there is a caveat for empirical testing due to proxies for the variables. We return to the point in the next section.
difference between the tradables and non-tradables to our analysis. Because of the larger investor base, and thus more diversification possibility, the restricted investors can afford smaller demand for any risk premiums from their tradable investment than the unrestricted investors for the non-tradable assets. In contrast, as the non-tradables can provide only a limited opportunity for diversification, i.e., they are more risky, the market should consider the relative risk terms more seriously with the non-tradables. Therefore, the coefficients for the relative risk premiums will be larger for the pure-domestic firms than for the integrated tradable companies. In other words, if the mild segmentation theory can be supported, we should observe $\lambda^{NT} > \lambda^T > 0$ and $\theta^{NT} > \theta^T \geq 0$. In (3.12) and (3.13) this assumption is expressed by the positive non-tradable beta, which signifies $\text{Cov}[R^w, R_j^l | R^T] \geq 0$.

Being practical as Errunza and Losq (March 1985), let us consider a case where even the tradables can have some loading on the domestic risk premium due to the real-world difficulty in a complete integration. Then, we summarize our hypothesis for a positive equilibrium excess return, $E[R_j^l] - R^l$, such that

**Proposition 1**

(i) $H_0$: $\lambda^l \geq 0$, $i = T, NT$

$H_A$: Otherwise.
(ii) When \( \lambda^i > 0 \), and significant,

\[ H_0: \quad \lambda^{NT} > \lambda^T \]

\[ H_A: \quad \text{Otherwise.} \]

Proposition 2

(i) \[ H_0: \quad \theta^i \geq 0, \; i = T, \; NT \]

\[ H_A: \quad \text{Otherwise.} \]

(ii) When \( \theta^i > 0 \), \( i = T, \; NT \), and significant,

\[ H_0: \quad \theta^{NT} > \theta^T \]

\[ H_A: \quad \text{Otherwise.} \]

Finally, we have to clarify the meaning of intercept in a regression for (3.10)' and (3.11)'. Notice in the derivation of the model, there is no theoretical representation for the intercept. Basically, the mild segmentation model is a derivative of the standard CAPM, and thus the intercept is not a direct reflection of restricted or unrestricted investors' utility maximization. In other words, the term will not express a straightforward difference in the diversification possibility between the tradables and the non-tradables (Errunza, Losq and Padmanabhan 1992). Since (3.10)' and (3.11)' suppose the exact specification of all the explanatory variables, if we obtain a non-zero intercept from the estimation, it is an indication of errors in the actually employed values. Provided the choice of the world portfolio proxy is exact, a significant intercept will state that the applied
world risk-free rate is a poor approximation for the optimal risk-free rate investors need. In other words, significant $a_j$ could be a factor adjusting the observed international sure-rate for the conceptual risk-free rate which asset $j$ needs in order to participate in the world and domestic portfolios at optimum (Brennan 1992).

On the other hand, Black, Jensen and Scholes (1972) pointed out long ago that CAPM could have a factor other than the relative riskiness of an asset to the market portfolio. They suggested further that the hidden factor would be represented by significant intercept. In short, the intercept is another factor outside of the mild segmentation model accommodating the observed institutional sure-rate value for the investors’ optimization. It also implies the term should be institutionally assured for return appraisal so that there is no uncertainty with it. Since the intercept is for deriving an equilibrium risk free-rate for a particular asset $j$, it can differ from asset to asset, and between the tradables and the non-tradables. When the term is significant and positive / negative, it will show that the optimal risk free-rate should be larger / smaller than the actually observed risk-free rate for the portfolio to be held. Moreover, what makes the investors demand this level of excess return comes from other than the relative risk measures, the beta and the gamma. (Roll and Ross 1994.)

Remember that the experiment is inherently the joint tests of market structure hypothesis because we examine the significance of relative risk measures
defined by the model's supposition for the market. In other words, when we cannot decline the conjectures, the validity of the underlying model and the hypotheses cannot be rejected. The alternative hypothesis is "the market is not mildly segmented," or, "the valuation model and its basic assumptions do not apply," which is effective if at least one of the hypotheses is denied. (Errunza, Losq and Padmanabhan 1992.) However, as we are dealing with deregulatory changes, there can be an unconformable outcome. Actually, Faff and Chan (1998) found in their intertemporal CAPM (ICAPM: Merton 1973) for Australia that the significance of the betas was unstable during the financial deregulation. Especially, their industry portfolio had negative and significant pricing on factors for the positive return under the active deregulation. Therefore, we cannot rule out the possibility for a similar extraneous result for the Japanese case.

3.3 Testing the degree of mild segmentation during the Japanese deregulation

In order to test mild segmentation during the Japanese capital market deregulation, we employ monthly stock returns of the firms listed in the Tokyo Stock Exchange (TSE) for 1980:11-1996:12. We sort the firms into the tradables and the non-tradables based on their citation in the Wall Street Journal and the Financial Times. The rationale and logistics taken for the categorization were discussed in Chapter 2. On the other hand, what actually are the world risk-free

---

63 We discuss ICAPM in Chapter 4.
rate and the world market portfolio is a contentious issue. Hence, we simply follow the literature of capital market integration, and employ the US T-bill rate of the closest to 30-days to maturity, taken from the Wall Street Journal, as the world risk-free rate, and Morgan Stanley Capital International (MSCI) World Index from www.msci.com for calculating the world market portfolio return. Both figures are from the last trading day of a month from 1980:11-1996:12.

As we have seen in the previous chapter, the structural break tests present two possible discontinuities for (3.4) and (3.6). This in turn will affect the estimation of (3.10)' and (3.11)'. Therefore, we divide our sample period into three sub-periods. They are

Period 1  
1980:12-1984:10 for the tradables,  
1980:12-1984:03 for the non-tradables,

Period 2  
1984:11-1990:01 for the tradables,  
1984:04-1990:02 for the non-tradables,

Period 3  
1990:02-1996:12 for the tradables,  

Since we never know the true distribution of the variables, we suppose the distribution property of the variables is stable within each period, and reduce the panel-data of return time series for the individual firms into three cross-section data sets. That is to say, within each period, we calculate excess return, beta,
and gamma for every firm and construct a cross-sectional data set to examine (3.10)' and (3.11)' empirically.

In order to obtain beta and gamma, it would be possible to run a regression for (3.3) and (3.5) of each period and use the estimated coefficients as proxies to run second regressions for (3.10)' and (3.11)'. However, Im, Lee and Rhee (2003) pointed out that, due to the first stage sampling errors, the procedure will produce heteroskedastic disturbance correlation for the second-stage regression. Consequently, the OLS estimator shall be biased and inconsistent. Although we know there is no definite remedy for the problem, to avoid the problem as much as possible, following Errunza and Losq (March 1985), we derive the betas and the gammas by the standard CAPM formula for beta. That is to say, we calibrate

\[
\beta^*_j = \frac{\text{Cov}[R^*_j, R^*_w]}{\text{Var}[R^*_w]}, \quad \text{and}
\]

\[
\gamma^*_j = \frac{\text{Cov}[R^*_j, V^*_i]}{\text{Var}[V^*_i]}, \quad i = T, NT,
\]

with the return data for each period.\(^{64}\)

\(^{64}\) Of course, there still remains the possibility for measurement errors in variables by (3.14) and (3.15), due to, say, the assumption for stability in the variable distribution within a period. Nevertheless, for the model estimation we must derive the values for betas and gammas from the data in any way. Hence, we suppose that we have avoided by this method at least the theoretically proved problems in errors-in-variables with the two-stage regression.
Next, we assume the consensus expectations are unbiased so that the rate of return on any asset is fair game. In other words, \( E[R^i_j] - E[R^f_j] = \bar{R}^i_j - \bar{R}^f_j \), \( i = T, NT \), which is a simple average of the excess return during the period. (Errunza and Losq March 1985; Copeland and Weston 1992.) As a result, the experiment is done by *ex post* observations with the model

\[
\bar{R}^i_j - \bar{R}^f_j = a^T + \lambda^T \beta^T_j + \theta^T \gamma_j^T + u^T_j, \quad \text{and,} \\
\bar{R}^{NT}_j - \bar{R}^f_j = a^{NT} + \lambda^{NT} \beta^{NT}_j + \theta^{NT} \gamma_j^{NT} + u^{NT}_j.
\]

where \( \beta^T_j \) and \( \gamma^T_j \), \( i = T, NT \), are the estimated values from (3.14) and (3.15), and \( \bar{R}^i_j - \bar{R}^f_j \), \( i = T, NT \), is the average excess return of firm \( j \) categorized as \( i \) during the period.

As we have discussed in the previous section, (3.10)' and (3.11)' say that when the model fits to the data perfectly, \( a^i = 0 \), \( i = T, NT \). On the other hand, when the intercept is significant, it is an indication that the proposed explanatory variables cannot influence the excess return appraisal as adequately as expected. In such a case, we should acknowledge the problematic validity of the assumed theory for the data. Nonetheless, if we can postulate that the model specification is correct, the significant \( a^i \) lets us adjust the observed average excess return for the conceptual optimal excess return by \( \bar{R}^i_j - \bar{R}^f_j - a^i \) from (3.10)" and (3.11)". The derived value will be the expected excess return at the
general equilibrium that the investors required from their risky investment into assets sorted as i in order to achieve wealth maximization, provided the model is appropriate.

Before examining the estimation result, we must make several disclaimers. First, since we obtain the betas and the gammas by assuming stability in the variable distribution within a period, even if we do not apply the method of two stage regressions, there would still be a problem of errors-in-variable for the experiment. However, we run two separate regressions for the tradables and the non-tradables, so that our discussion implicitly forms two different portfolios that may mitigate an error from an individual corporation's share return by the law of large numbers (Fama and Macbeth 1973; Campbell, Lo and MacKinlay 1997).65

On the other hand, we in effect study the hypotheses by an equally weighted portfolio. As the correlation between an individual asset return and the market portfolio can change according to the investable volume of the share in the market, we have to remember equal weighting for the portfolio could bias our result.66 Third, as any CAPM-based equilibrium portfolio is assumed to be efficient, the relation between the expected returns and "betas" can be very sensitive to a slight diversion from the equilibrium market portfolio in the market

---

65 According to Campbell, Lo and MacKinlay (1997), there is no conclusive remedy yet to mitigate the problem. Usage of portfolios is a common practice to alleviate the bias. Errunza and Losq (March 1985) computed the variables by (3.14) and (3.15) for the return of portfolios maximizing the changeability of beta and gamma within each country of their sample.

66 However, Campbell and Hamao (1992) reported no difference between the equally weighted and value-weighted portfolios for their market integration test between the US and Japan. Thus, the equal weighting may cause no serious problem in our experiment either.
portfolio proxy (Roll and Ross 1994). Unless our choice of MSCI World Index is exact for the market portfolio in Japanese stock pricing, the estimation and the significance of $\lambda^i$ and $\theta^i$, $i = T, NT$, must be treated with reservation.\textsuperscript{67}

Finally, the sampling errors in the explanatory variables could be reflected in the large and significant intercept terms. Having said that, since the intercept does not influence the validity of the mild segmentation hypotheses (Errunza, Losq and Padmanabhan 1992), we would regard any error appearing there will not be serious for testing the model. Rather, the significant intercept may indicate the existence of institutional factors not theorized by the mild segmentation theory, as we have conjectured in the previous section.

Table 3.1 reports the properties of the variables including the averages of the tradable / non-tradable firms' return, excess return, and the averages and the correlations of beta and gamma.\textsuperscript{68} All the average returns are positive during the 1980s, and they turn into negative for the 1990s. The statistics of the excess return show Period 1 tradables cannot reject the normal distribution with the kurtosis approximately 3. Then, from Period 2 they change their statistical property into a rejection of normality. In contrast, throughout the sample period,

\textsuperscript{67} For example, as we have seen in Chapter 2, the belief in real estate was strong among Japanese, i.e., unrestricted, investors during our sample period. Even if there would be a difference in degree, the same might be said for the non-resident, i.e., restricted, investors for Japanese assets. Thus, we expect a problem in estimation for Japanese asset valuation with MSCI World index that is derived only from equity prices. The issue should be investigated further in the future.

\textsuperscript{68} In order to stabilize the estimation, we have dropped outliers that are roughly 1% of each of the sample. Numbers of corporations trimmed are 1 tradable and 12 non-tradables in Period 1, 14 non-tradables for Period 2, and 4 tradables and 19 non-tradables with Period 3.
Table 3.1.

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tradables, Number of Firms</td>
<td>138</td>
<td>435</td>
<td>444</td>
</tr>
<tr>
<td>$\bar{R}_j^T$</td>
<td>0.246192</td>
<td>2.180654</td>
<td>-0.601039</td>
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<tr>
<td>$\bar{R}_j^T - \bar{R}_J^j$</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.5551749</td>
<td>1.67003</td>
<td>-0.9739617</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.9802609</td>
<td>1.162605</td>
<td>0.5429916</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.0948265</td>
<td>-0.0952947</td>
<td>0.1136949</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.514905</td>
<td>3.542327</td>
<td>3.861263</td>
</tr>
<tr>
<td>Bera-Jarque Statistics</td>
<td>1.560</td>
<td>5.989 *</td>
<td>14.68 ***</td>
</tr>
<tr>
<td>Mean $\hat{\beta}_j^T$</td>
<td>0.8825841</td>
<td>0.7327862</td>
<td>1.70358</td>
</tr>
<tr>
<td>Mean $\hat{\gamma}_j^T$</td>
<td>1.09247</td>
<td>0.7741233</td>
<td>0.8797833</td>
</tr>
<tr>
<td>Cor[$\hat{\beta}_j^T, \hat{\gamma}_j^T$]</td>
<td>0.7116</td>
<td>0.6156</td>
<td>0.7079</td>
</tr>
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<td>Non-Tradables, Number of Firms</td>
<td>1249</td>
<td>1435</td>
<td>1332</td>
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<tr>
<td>$\bar{R}_j^{NT}$</td>
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<td>2.239083</td>
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</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
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<td>1.712413</td>
<td>-1.33605</td>
</tr>
<tr>
<td>Standard Deviation</td>
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<td>1.482838</td>
<td>0.8903295</td>
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<tr>
<td>Skewness</td>
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<td>-0.3044291</td>
<td>-1.55904</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>5.405576</td>
<td>4.966466</td>
<td>10.39568</td>
</tr>
<tr>
<td>Bera-Jarque Statistics</td>
<td>520.3 ***</td>
<td>253.4 ***</td>
<td>3575 ***</td>
</tr>
<tr>
<td>Mean $\hat{\beta}_j^{NT}$</td>
<td>0.2574188</td>
<td>0.5534692</td>
<td>1.463232</td>
</tr>
<tr>
<td>Mean $\hat{\gamma}_j^{NT}$</td>
<td>1.382942</td>
<td>0.9019606</td>
<td>0.9109296</td>
</tr>
<tr>
<td>Cor[$\hat{\beta}_j^{NT}, \hat{\gamma}_j^{NT}$]</td>
<td>-0.2760</td>
<td>-0.4158</td>
<td>0.3785</td>
</tr>
</tbody>
</table>

Note: The null of the Bera-Jarque test is normality. * indicates rejecting the null at 10%, ** is at 5%, and *** is for 1%.
the non-tradable excess return keeps rejecting the normality assumption strongly with very fat tails indicated by the kurtosis more than 3.\(^6^9\) Non-normal return distribution cautions us about the CAPM model specification of our estimation.

For a pattern of changes in mean excess return, both categories have a negative value for Period 1 when the deregulation was at a preparatory stage. It is followed by a positive average during the binge era of Period 2, then, returns to a negative in the 1990s. In theory, since an investment into projects of corporations is always riskier than the risk-free rate, excess return must be positive. As we have discussed in the previous section, supposing the theory is pertinent to our data, we expect the intercept for the model estimation to be significant to adjust the observed value for the theoretical optimal, especially when the average excess return is negative. However, US T-bill rate will never be negative, while the share return can be continuously negative so that, when the TSE observed a continuous shrinkage as in the 1990s, an average negative return can happen. Moreover, if as in the early 1980s, the US suffered high inflation that made the T-bill rate high while the Japanese economy was in a relative calm, the average T-bill rate could persistently exceed the average Japanese share return, which would have rendered the negative mean excess returns in Period 1.

The average betas and gammas are all positive. The average \( \tilde{\beta}_p^T \), the equilibrium risk premium of a tradable investment relative to holding the world

\(^6^9\) We have discussed in Chapter 2 the distributional properties of the portfolios of tradables and non-tradables.
portfolio, is about 80% of the world risk during the 1980s. Then, in Period 3, the average value of the relative world risk for the tradables becomes 170%. On the other hand, \( \tilde{\beta}^{NT} \), the relative risk of a non-tradable investment in terms of the world portfolio, starts at about 25% of the world portfolio risk, grows into around 55% for Period 2, and ends the sample period with a roughly three-fold increase to 140%. In contrast, the average gammas, the relative risk of an asset to the pure domestic factor, remain relatively stable, around one (1), for both the tradables and the non-tradables throughout the sample period. The comparatively larger growth of the non-tradable beta may signify it was the non-tradable corporations, rather than the tradable firms, that could have experienced stronger effects of the liberalizing policy that was aimed at the tradable capital procurement.

Table 3.2 presents the estimation results for (3.10) and (3.11). Since all the OLS regression for Period 3 showed heteroskedastic residuals, the reported numbers are after White (1980) adjustment. Concerning the fit of the estimation, \( R^2 \)s are generally low. Although during Period 1 and Period 3, \( R^2 \)s for the tradables are comparable with the results of Errunza and Losq (March 1985), we find a very low \( R^2 \) for the tradables in Period 2, and for the non-tradables of

\[ \text{Table 3.2 presents the estimation results for (3.10) and (3.11). Since all the OLS regression for Period 3 showed heteroskedastic residuals, the reported numbers are after White (1980) adjustment. Concerning the fit of the estimation, } R^2 \text{s are generally low. Although during Period 1 and Period 3, } R^2 \text{s for the tradables are comparable with the results of Errunza and Losq (March 1985), we find a very low } R^2 \text{ for the tradables in Period 2, and for the non-tradables of} \]

70 Recalling possible non-normality for the non-tradable excess returns, we must be conscious of the problem in the generalized least square (GLS) that could assign too much weight on the well-behaved firms without knowing the true covariance matrix (Lettau and Ludvigson December 2001). In addition, GLS is a methodology for adjusting a covariance matrix of returns proportional to the identity matrix, and hence, unless the mean at the global minimum variance portfolio is equal to the mean of all assets, or the market portfolio is completely inefficient, the GLS betas tend to be significant in estimation (Roll and Ross 1994).
Table 3.2.

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th></th>
<th></th>
<th>Period 2</th>
<th></th>
<th></th>
<th>Period 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_0$: Tradables = Non-tradables?</td>
<td>F(2, 1382) = 2.19</td>
<td></td>
<td></td>
<td>F(2, 1865) = 8.52 ***</td>
<td></td>
<td></td>
<td>F(2, 1771) = 27.27 ***</td>
<td></td>
</tr>
<tr>
<td>Tradables $\bar{R}_j^T - \bar{R}_j$ (Number of firms)</td>
<td>-0.5551749 (138)</td>
<td>1.67003 (435)</td>
<td>-0.9739617 (444)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.2602</td>
<td>0.05</td>
<td>0.2262</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$</td>
<td>F(2, 135) = 23.74 ***</td>
<td></td>
<td></td>
<td>F(2, 432) = 11.38 ***</td>
<td></td>
<td></td>
<td>F(2, 441) = 38.75 ***</td>
<td></td>
</tr>
<tr>
<td>$a^T$</td>
<td>-1.577319 (-9.13) ***</td>
<td>1.648573 (19.31) ***</td>
<td>-0.0917964 (-0.68)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda^T$</td>
<td>0.6573951 (2.60) ***</td>
<td>0.4116886 (3.65) ***</td>
<td>-0.2568589 (-2.47) **</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\theta^T$</td>
<td>0.4045302 (2.63) ***</td>
<td>-0.3619867 (-4.67) ***</td>
<td>-0.5057227 (-4.36) ***</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Non-tradables $\bar{R}_j^{NT} - \bar{R}_j^F$ (Number of firms)</td>
<td>-0.2285429 (1249)</td>
<td>1.712413 (1435)</td>
<td>-1.33605 (1332)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.0498</td>
<td>0.0129</td>
<td>0.0222</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$</td>
<td>F(2, 1246) = 15.91 ***</td>
<td></td>
<td></td>
<td>F(2, 1432) = 9.35 ***</td>
<td></td>
<td></td>
<td>F(2, 1329) = 2.77 *</td>
<td></td>
</tr>
<tr>
<td>$a^{NT}$</td>
<td>-0.7721083 (-7.35) ***</td>
<td>1.696077 (24.39) ***</td>
<td>-1.28632 (-12.01) ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda^{NT}$</td>
<td>0.198196 (1.79)</td>
<td>-0.0596641 (-3.45) ***</td>
<td>0.1320527 (1.65)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\theta^{NT}$</td>
<td>0.3576043 (5.64) ***</td>
<td>0.054723 (0.93)</td>
<td>-0.2667102 (-2.35) **</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: $\bar{R}_j^T, \bar{R}_j^F, i=T, NT, j =$ the code for each firm, are the sample averages of the monthly returns of sample stocks and US T-bill rate. Since Period 3 tradables, and Periods 1 and 3 non-tradables showed heteroskedasticity, the statistical inference is based on the White (1980) standard error adjustment. *** indicates significance of 1% level, ** is for 5%, and * is 10%. T-values are in parentheses. The coefficients are examined by a two-sided test.
all the periods. It can mean the mild segmentation model does not fit well to the Japanese capital market. Recall we have found non-normality in asset return distribution which is in accord with the low $R^2$s and a possible problem in the model specification. Furthermore, as our data construction is based on the characteristics of the regulatory policy, the low fit of the data would suggest that another element outside of the deregulation, such as instability in discount factor due to changes in real economy, may contribute to the expected return valuation. On the other hand, Kandel and Stambaugh (1995) reported that $R^2$ tends to be lower when a market portfolio has a poor substitute with respect to the mean-variance efficiency. Therefore, the low fitness of the model could indicate a problem in our use of MSCI World for Japanese share valuation.

Having said this, all the regressions are significant and reject the null of jointly zero coefficients with F-value. In addition, every estimation produced significant $\lambda^i$ and $\theta^i$, $i = T, NT$. In other words, the separate influence of independent variables is always statistically cogent, as well as their joint explanatory power for the excess return. The consistency between the significance of coefficients and the validity of regression suggests that in spite of the non-zero correlation between the beta and the gamma, there is only a limited problem of multicollinearity (Kmenta 1997).

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71 As we have disclaimed in Chapter 1, we do not discuss the issue in this dissertation, although it must be a future research topic.
We have also tested the equality of estimation between the tradables and the non-tradables for each period and individual coefficients. The examined equation is

\[ \bar{R}_j - \bar{R}_f = a + \lambda \tilde{\beta}_j + \theta \tilde{\gamma}_j + \lambda D^{NT} \tilde{\beta}_j + \theta D^{NT} \tilde{\gamma}_j + \hat{u}_j, \]

where

- \( \bar{R}_j - \bar{R}_f \): the excess return of firm \( j \),
- \( \tilde{\beta}_j, \tilde{\gamma}_j \): the world and domestic "beta" for firm \( j \), and,
- \( D^{NT} \) = 0 if \( R_j \) is for a tradable firm,
- \( D^{NT} = 1 \) if \( R_j \) is for a non-tradable firm.

When \( \lambda \) and \( \theta \) are jointly insignificant, we cannot reject the equality of the entire regression between the tradables and the non-tradables. The test statistics for regression equality are shown in the second row of Table 3.2. For Period 1, we have obtained too low an F-value to reject the tradable / non-tradable equality. Accordingly, the value of Period 1 tradable gamma cannot deny the equivalence with the value of Period 1 non-tradable gamma with \( F(1, 1246) = 0.55 \). On the other hand, the other two periods dismiss the regression parity at 1%, although the value of Period 2 intercept could be equal between the tradables and the non-tradables by \( F(1, 1432) = 0.47 \).
Finally, we have checked the inter-period agreement for the regression and for every coefficient of each category of firms. The result is summarized in Table 3.3. The test equation is

$$\bar{R}_i^j - \bar{R}_i^f = a' + \lambda^i \beta_j^i + \theta^i \gamma_j^i + \lambda^i D^p \beta_j^i + \theta^i D^p \gamma_j^i + \hat{\varepsilon}_j^i, \quad i = T, NT$$

where $D^p$ is a period dummy which is zero (0) when the excess return, $\bar{R}_i^j - \bar{R}_i^f$, is for Period 1, or for Period 2 with a comparison of Period 2 to Period 3. $D^p = 1$ when the excess return is for Period 3, or for Period 2 with Periods 1 and 2 juxtaposition. We cannot reject the null of no inter-period difference when $\lambda^i$ and $\theta^i$ are jointly insignificant. However, we have not encountered a case which failed to reject the null. From Table 3.3, we may say a regression for every period of both the tradables and the non-tradables is different from one another. We discuss these findings, together with the hypotheses testing of the mild segmentation in the next section.

3.4 Mildly segmented, and puzzling, Tokyo Stock Exchange

Let us start examining Period 1 with Table 3.2. During Period 1, the observed average return for the tradables is 0.5782, a positive number. On the other hand,

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72 The mild segmentation theory is static in nature, and we do not ask the process of investor optimization within each period. Hence, we can only indirectly infer dynamics in asset valuation from the inter-period comparison of the results. It should be another research agenda to make the mild segmentation theory dynamic.
Table 3.3.
TSE mild segmentation test, inter-period equality.

\[
\overline{R}_i - \overline{R}'_i = \overline{\delta} + \lambda_i \overline{P}_i + \theta_i \overline{\gamma}_i + \hat{\lambda}^p_i D^p \overline{P}_i + \hat{\theta}^p_i D^p \overline{\gamma}_i + \bar{u}_i, \quad i = T, NT, \quad H_0: \hat{\lambda}^i = \hat{\theta}^i = 0
\]

<table>
<thead>
<tr>
<th>Section</th>
<th>Tradables</th>
<th>Non-tradables</th>
<th>Each coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1 vs. Period 2</td>
<td>( F(2, 568) = 59.19 ) ***</td>
<td>( F(2, 2679) = 324.23 ) ***</td>
<td>Every coefficient rejects inter-period equality at 1%.</td>
</tr>
<tr>
<td>Period 2 vs. Period 3</td>
<td>( F(2, 874) = 117.88 ) ***</td>
<td>( F(2, 2762) = 1013.82 ) ***</td>
<td>( \theta^T ) cannot reject inter-period equality at 10%.</td>
</tr>
<tr>
<td>Period 1 vs. Period 3</td>
<td>( F(2, 577) = 37.02 ) ***</td>
<td>( F(2, 2576) = 65.15 ) ***</td>
<td>( \lambda^{NT} ) cannot reject inter-period equality at 10%.</td>
</tr>
</tbody>
</table>

Note: *** indicates rejecting \( H_0 \) at 1%. 

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its intercept is significantly largely negative, which results in an optimal average excess return for the tradables of $1.0221441 (= -0.5551749 + 1.577319)$, which is positive again. The tradable coefficients of the relative risk premium terms, $\lambda^T$ and $\theta^T$, are positive and strongly significant. We cannot reject the first items of Propositions 1 and 2 for the tradables in Period 1. That is to say, the average optimal expected excess return was calibrated by the restricted investors as a sum of relative risk premiums with respect to the world portfolio return and the pure domestic factor. Furthermore, the market regarded that US T-bill rate was too high to be an optimal sure-rate for the tradable pricing.

Similarly, Period 1 non-tradables have a significantly negative intercept, and thus they have an average optimal excess return of $0.5455654 (= -0.2265429 + 0.7721083)$ for the observed positive average return of 0.5961742. Concerning the pricing of the relative risk factors by the unrestricted investors, both $\lambda^{NT}$ and $\theta^{NT}$ are positive, although only $\theta^{NT}$, the price of the relative risk to the pure domestic portfolio, is significant. We would say the Period 1 non-tradables cannot dismiss the non-negative factor loading for the positive expected return either, which is in accordance with the null hypothesis of (i) for Propositions 1 and 2. The US T-bill rate was higher than the conceptual risk-free rate for the non-tradable valuation as well, though the difference between the optimal return and the observed average return suggests the margin is smaller for the non-tradables than for the tradables.
Next, we compare the estimation results between the tradables and the non-tradables for (ii) of Propositions 1 and 2. As the price of the relative world risk is statistically zero for the non-tradables, we cannot proceed further to test Proposition 1 (ii) to see whether $\lambda^{NT}$ is greater than $\lambda^T$. This result of $\lambda^{NT} = 0$ indicates the segmentation of the non-tradables during Period 1. Concerning the domestic factor, on the one hand, the Period 1 F-test suggests the equality of regressions cannot be rejected between the tradables and the non-tradables. Both $\theta^T$ and $\theta^{NT}$ are significant at 5% as well. On the other, the value of $\theta^{NT}$ strongly rejects the equality in the value of $\theta^T$. Moreover, $\theta^T$ is greater than $\theta^{NT}$. Therefore, though the test of value equality is weak, we have to say we are unable to find evidence to support $\theta^{NT} > \theta^T$ in (ii) of Proposition 2. Namely, the restricted investors may have priced both the relative world and domestic risk premiums on their tradable investment more than the unrestricted investors for the non-tradables.

In conclusion for Period 1, the share pricing of our Japanese corporations display characteristics that appear inconsistent with the mild segmentation model. Individually, the two groups of firms presented pricing patterns conformable with the theory. Namely, during the preparatory period of the deregulation, the tradables were integrated with the world capital market with the influence of the domestic factor, whereas the non-tradables were in effect segmented. However, the valuation difference between them contradicts the theory prediction. The global financiers with more diversification opportunities
watched the relative risks to the domestic market more carefully than the unrestricted investors for the non-tradables. In addition, for Period 1 there was some institutional factor that made the US T-bill rate higher than the theoretical risk-free rate for the Japanese stock appraisal.

Furthermore, we have found several intriguing results in Period 2. The tradable intercept is positive and strongly significant. Using the value $a^T = 1.648573$ to adjust the observed average excess return, we have $1.67003 - 1.648573 = -0.021457$ for the conceptual equilibrium expected excess return. However, although $\lambda^T$ is conformably positive and strongly significant, $\theta^T$ is negative with a compelling explanatory power at 1%. For the positive conceptual expected excess return, negative pricing for the relative risk to the domestic portfolio violates the null assumption in Proposition 2, while the positive pricing for the world beta accords with the supposition for risk premium in Proposition 1. Namely, when rationally optimizing unrestricted investors choose to include a risky asset in their portfolio, they will never calculate the uncertainty of the risky investment in a way that can reduce the investment return to less than the sure rate. We must reject the mild segmentation model for the tradables in Period 2. It was the domestic factor that contradicts the theory for the tradable asset pricing.

The non-tradables in Period 2 also have a positive and significant intercept, so that its optimal expected excess return is $0.016336 = 1.712413 -$
1.696077. The coefficient $\lambda^{NT}$, the price of the relative risk in terms of the world portfolio risk, is significant which indicates there might be an integration spillover here. However, $\lambda^{NT}$ is negative. It is contrary to the mild segmentation prediction in Proposition 1. Moreover, $\theta^{NT}$ is insignificant for Period 2 non-tradable valuation. This result, if true, would imply that the domestic and unrestricted investors not only discounted the pure domestic non-tradable pricing with the world factor, but also ignored the domestic risk itself. Proposition 2 cannot be met for the mild segmentation hypothesis by the non-tradable data. We reject the model for Period 2 non-tradables as well.

In brief, the mild segmentation model hypothesis was rejected again for the Period 2 Japanese stock pricing, although it was the time we could consider an integration spillover. In addition, the tradable and non-tradable intercepts are positive, which indicates that the investors for Japanese stocks would set a higher optimal risk-free rate for their investment than the US T-bill rate.

Finally, in Period 3, the intercept for the tradables becomes insignificant, and hence, the restricted investors would have regarded the US T-bill rate as their optimal risk-free rate after the burst of the Bubble. There could be no other institutional factor to influence the optimization of global investors. Moreover, both observationally and conceptually the average expected tradable excess return is negative for the observed negative average return. It means the relative risk measures should tell the restricted financiers to sell the tradable assets in
Period 3. Assuredly, both $\lambda^T$ and $\theta^T$ are negative and significant, so that we would conclude the tradable valuation was in agreement with the prediction of the model in (i) of Propositions 1 and 2.

On the other hand, the intercept for the non-tradables is significant and greatly negative. However, the theoretical average expected excess return after adjustment is $-1.33605 + 1.28632 = -0.04973$, which is still negative for the observed negative average return. We would say the unrestricted investors, too, should have had signals to sell the non-tradable stocks from the relative risk pricing. On the one hand, $\lambda^{NT}$ is insignificant so that after a brief integration in Period 2, the non-tradables reverted to segmentation in the 1990s. On the other, $\theta^{NT}$ is negative and significant, which would have been the instruction for divestment. In other words, both relative risk measures with respect to the world and domestic portfolios were evaluated in conformity with (i) of Propositions 1 and 2. We may say the non-tradables valuation in Period 3, too, agrees with at least a part of the prediction of the theory.

However, when we examine the difference in domestic risk premium between the tradables and the non-tradables, we meet a disagreement between Period 3 data and the model forecast. Although both $\theta^T$ and $\theta^{NT}$ reject insignificance, $\theta^T$ is significant at 1% whereas $\theta^{NT}$ is at 5%. In addition, $\theta^T = -0.5057227 < \theta^{NT} = -0.2667102$, whose value equality is rejected by $F(1, 1432) = 50.28$. Finally, in the second line of Table 3.2, Period 3 F-value from the test of regression equality between the tradables and the non-tradables strongly
suggests that the tradable estimation would differ from the non-tradable results. That is to say, our examination implies the role of domestic risk premium in the asset evaluation could have been bigger for the tradables of our data. Since the mild segmentation anticipates that any risk premiums would be smaller for the tradables than for the non-tradables owing to the international investor base, the result is counter to the model prediction. We must say we have failed to find evidence of $\theta^{NT} > \theta^T$, and we reject the null hypotheses of (ii) in Proposition 2. In this respect, Period 3 Japanese share pricing could not confirm the mild segmentation hypothesis by the same reason as Period 1.

In short, there is another asset pricing peculiarity in the Period 3 Japanese capital market. It seems to us that both restricted and unrestricted investors evaluated their constituent stocks somehow in accordance with the standard wealth optimization in the mean-variance space. Nevertheless, it was now the global financiers who became far more cautious for their investment, while the investors for non-tradables decided to segment their assets again from the world.

In summary, the mild segmentation model has failed to explain dichotomized Japanese share pricing during 1980:12-1996:12. In Period 1, the tradable firms were integrated with the world market, while the non-tradables were segmented. The finding would be an extension of the literature for Japanese capital market integration, such as Gultekin, Gultekin, and Penati (1989, 1990), which analyzed almost the same sample period of Period 1 with the data of the large Japanese
corporations. However, in terms of pricing differences between the tradables and the non-tradables, our data have not prepared supportive evidence for the validity of the mild segmentation theory during the entire sample period, even if Period 2 is the only possible time when we may have observed an integration spillover.

Since any CAPM-based model assumes a perfect asset market that is not the objective of the Main Bank System, so long as the traditional system went strong, the validity of the model for the Japanese asset pricing would be questionable. Here, we have found a support that the tradables could have been integrated with the competitive world market from the beginning. In contrast, the weak non-tradable integration could be, at least in part, explained by the continuing role of the Main Bank System. Consequently, their appraisal would not accord with the CAPM assumption, and hence the significance of the model involving non-tradable appraisal may be unlikely. Moreover, as we have assumed a perfect and complete market for our estimation, and if, for example, there had occurred ex post a completely unforeseen event for the market during the sample period,\textsuperscript{73} the data would simply reject the model specification.

Having said that, we have also encountered that the risk-premium pricing was conformable to the theory for Periods 1 and 3 within each category of firms. It suggests that even though the mild segmentation hypothesis is negated, the CAPM assertion, with respect to the positive correlation between the excess

\textsuperscript{73} The US-Japan bilateral politics for the exchange rate might be one of those unexpected events for the market in the 1980s.
return and the beta, survived for Japanese asset valuation. Therefore, we might not have to discard the model application completely for the analysis. As the conclusion of CAPM in beta-loading depends on the assumptions for investors' rational optimization, it may be possible to construe the estimation result as a sign for problems in capital cost evaluation during the deregulatory period. Notice that Period 2 rejects the model with contradictions between the optimal expected excess returns and the signs of significant lambda and theta, which are implausible if a CAPM agent rationally maximizes payoffs. For us to obtain the result, aside from the error in model specification, mean-variance expected utility hypotheses should be negated in the transition from Period 1 to Period 2.

An examination for inter-period evolution of asset pricing can illuminate further the difference between the two classes of firms. As Table 3.3 reports, all the tradable results of the three periods are different in terms of regression as a whole. Nevertheless, an inspection of Table 3.1 suggests the values for world and domestic factors are comparatively stable for the tradables. Although the Period 3 tradable average world beta is twice as large as the Period 1 average, its change is not so drastic as the seven-fold increase in the average non-tradable world beta during the sample period. The average tradable domestic gamma stays around one (1) as well. In addition, the pricing on the world and domestic betas is continuously significant throughout the sample period.
Recall that the deregulation followed gradually behind the international activity of avant-garde corporations. For the restricted investors of the tradable portfolio, theoretically, those investable stocks were meaningful as such so long as they provided a diversification opportunity through the correlation with the domestic non-tradables. *Ceteris paribus,* simply adding similar kinds of firms to the tradable portfolio by deregulation, as in Japan, would not much change the correlation between the tradable and the world portfolios and the meaning of the asset for the global investors' portfolio. Consequently, $\bar{\beta}_j^T$, $\bar{\gamma}_j^T$, $\lambda^T$ and $\theta^T$ could be relatively steady over the deregulation.\(^{74}\)

However, even though there was no large variation in significance, $\theta^T$ oscillated between conformable and contradictory to the optimal excess return during the sample period. Especially, a negative theta for Period 2 tradables would indicate the restricted, but global, investors' confusion by the institutional development of the domestic economy. The perplexity would have ended up in the 1990s with a very high loading on the tradable domestic factor as a “precaution.”

In contrast, all the inter-period equalities are rejected for the non-tradables, and both the average $\bar{\beta}_j^{NT}$ and $\lambda^{NT}$ fluctuated wildly through the sample period. In particular, the significant Period 2 $\lambda^{NT}$ with a disappeared significance for $\theta^{NT}$ is to some extent in accord with the theoretical

\(^{74}\) The result here also conforms to the characteristics of tradable structural break at 1990:01 in the previous chapter. The partial break tests reported that there would be no intercept-break for the relationship between the tradable portfolio and the world portfolio. In other words, the tradables did not furnish evidence of institutional changes in their market. Accordingly, the pricing of the tradable world beta should be uneventful, as we have seen here.
characteristics of integration. Hence, the transition from Period 1 to Period 2 may imply an existence of the integration spillover due to the deregulation. However, with an insignificant Period 3 $\lambda^{NT}$, the unrestricted investors in the 1990s chose to re-dismiss the world correlation in their appraisal of the non-tradable assets. Besides a possible bias arising from the world market portfolio proxy, we may suspect precariousness in the non-tradable world factor assessment during the Japanese capital market liberalization that negated the mild segmentation model specification. The overall process of transformation in the non-tradable coefficients may represent that the policy influence was bigger, and more erratic, for the pure domestic firms than for the autonomously internationalized corporations.

The question is, what fuelled the domestic market's eccentric factor pricing that can make the model specification and $\alpha$ or the investors' rational optimization doubtful. Remember, significant $\alpha$, $i = T, NT$, represents the problem in the model application and $\beta$ or the institutional factor independent of the market factors, and not explained by the sure-rate (i.e., US T-bill rate) employed for the estimation. Assuming the mild segmentation theory is not completely failing for Japanese asset valuation, recall that in Period 1 the conceptual average expected return was larger for the tradables than for the non-tradables. In

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75 In Chapter 2, both the slope and intercept in (3.6) showed a structural break at 1990:02. The puzzling nature of non-tradable pricing could be one of the descriptions for the large changes the domestic corporations experienced during the deregulatory era.
theory, since the non-tradable investment is riskier, the risk-averse investors should require a higher equilibrium return from the pure domestic firms than from the tradables, which we have not observed from the Period 1 estimation. Therefore, our result indicates there could be an institution inhibiting the restricted investors from demanding the obvious risk premium in the early 1980s. It is also consistent with the lower domestic risk-pricing for the non-tradables. This would be another representation of Nakatani (1984) who discovered the large Japanese firms, such as the tradables, suppressed profits for the shareholders, and distributed the rent among the stake-holders. In this respect, the negative intercept during Period 1 may embody the Main Bank System.

In contrast, for Period 2, both the tradables and the non-tradables have a significantly positive intercept that let the optimal Japanese sure-rate climb higher than the US T-bill rate. If the Period 1 negative intercept were owing to the effect of the System, and it had indicated a conceptual risk-free rate lower than the US rate, the positive Period 2 $a_i$, $i = T, NT$, might reflect a substitution of the old system by the new deregulated market. Lastly, in Period 3, only the non-tradables needed the institutional adjustment for their optimal risk-free rate. Moreover, the intercept brought the non-tradable return less negative than the tradable return again, into line with the smaller non-tradable domestic risk valuation. If the significant intercept represents the domestic market structure, the Period 3 difference between the tradables and the non-tradables would illustrate the market still dependent on the Main Bank System.
The transition of the intercept thus may express the change in the
effectiveness of the Main Bank System during the deregulation. If it were one of
the sources of peculiarity in asset pricing after the middle of the 1980s, we could
speculate how the deregulation transformed the traditional Main Bank System
into an asset evaluation contradictory to the assumed rational optimization for the
mild segmentation model. Notice the deregulation was mainly about allowing
large firms to raise capital overseas. Institutionalizing a new evaluation of
corporate activity was not the main objective. The only move the authority took
in this regard was an introduction of a rating system for convertible issues
(February 1987). The other policies were a monotonic retreat from the command
system of the government.

Since the Main Bank System was in particular the informational structure
for monitoring, it is probable the deregulatory policy, which was not so conscious
about the relationship between the original system and the corporate
governance, could have created a new capital market without appropriate means
of processing investment information. As a consequence, all the investors could
have acted on some popular but vague denominator such as the mood of the
market. Difficulty in being rational would lead to an irrational exuberance, which
may have produced the problematic pricing in our model. We conclude that our
mild segmentation estimation might have epitomized the troublesome process of
Japanese capital market internationalization.
3.5 Chapter summary

In this chapter, we have examined the evolution of integration in the TSE using the mild segmentation model (Errunza and Losq March 1985). As expected, the tradables have supported a hypothesis of integration throughout the sample period, although in Period 2 their valuation may have experienced a domestic factor pricing opposing to the rational investor assumption of the CAPM. On the other hand, the examination of the returns of the non-tradables has reported evidence that only for Period 2 could they be integrated. The estimation has also suggested that although the Periods 1 and 3 non-tradable valuations had a positive correlation with the domestic beta, the loadings of the domestic risk premium were smaller than for the tradables, which does not support the mild segmentation theory. Furthermore, in Period 2 the non-tradable appraisal may have transgressed the standard assumption for mean-variance optimization by the investors. As a whole, the mild segmentation hypothesis has been rejected, even if Period 2 could be the only theoretical occasion for an internationalizing spillover from the tradables to the non-tradables.

We have acknowledged the contradiction between the standard CAPM assumptions for the mild segmentation model and the operative Main Bank System, and the problem in the model specification for Japanese data. Yet, we have also noticed that our estimation does not reject completely the positive correlation between the excess return and the market betas. Hence, our study
has raised the possibility that the model rejection might be because of the policy changes that did not emphasize building a new system for investment evaluation.

There is at least one aspect we should investigate further from the study of this chapter. With the mild segmentation model, we have tested asset pricing which is a function of the world market factor and the domestic market factor independent of the world elements. However, almost all the test results have produced a significant intercept, which means there could be another pricing component reflecting the market institution. We have seen in Chapter 2 that the traditional Main Bank System was not only for interactions within the private sector, but also a command structure of the government to control liquidity. If the mild segmentation estimation for Period 2 had come from a retrenchment of the main bank monitoring, it could involve a difficulty for the central bankers to execute monetary policy. In the next chapter, we study what happened for the Japanese monetary policy, especially for the call rate as its main tool, during the capital market deregulation. If our supposition in a problematic institutional arrangement is viable, there could be a simultaneous change in the effect of the call rate for asset pricing. Let us examine the possibility.
CHAPTER 4

Effects of financial deregulation on Japanese monetary policy

4.1 Introduction

We have seen in Chapter 2 that people suspect the internationalizing deregulation in Japan during the 1980s neutralized the influence of the monetary authority over the domestic capital market. The deregulated international capital procurement by the tradable firms put a huge stress on the traditional Main Bank System, and thus possibly on the liquidity control of the government that was dependent on the System. The results exposed problems of the investment evaluation system and led to the subsequent credit shortage in the 1990s. In the previous chapter, we have argued that this shift would be indirectly reflected in the transition of the priced institutional factor that is the intercept term of the mild segmentation model. On the other hand, there is no publication for the Japanese deregulatory era directly studying possible changes in the monetary policy effect on the asset market. Several empirical studies we have seen in Chapter 2 are done for the Japanese monetary policy before or after the deregulatory period only, or, by neutralizing the changes with an arbitrary dummy in the model. We now try to fill this void by testing changes in the impact of monetary policy on asset prices using the intertemporal capital asset pricing model (ICAPM) of Merton (1973). Namely, we examine the modulation of the power of the
Japanese monetary authority over the appraisal of the tradable and non-tradable portfolio returns from the Tokyo Stock Exchange (TSE) during the three divided periods for 1980:12-1996:12. We apply the assumptions of mild segmentation (Errunza and Losque March 1985) in Chapter 3 for the ICAPM investors who optimize their utility intertemporally. The chapter emphasizes the hedging element in the ICAPM that will reflect the evolving pricing difference between the tradable and the non-tradable portfolios as the deregulation progressed. We shall see the test results provide us with empirical evidences of the shifting correlation between the consecutively liberalized TSE and the disintegrating Main Bank System, claimed by the literature reviewed in Chapter 2, and indicated by our estimation of the mild segmentation model.

The construction of the chapter is as follows. We start from a summary enquiry into the theory of ICAPM and a discussion about the relevance of the model to study the effect of monetary policy. Next, the ICAPM for the TSE tradable and non-tradable portfolios is constructed, along with the hypotheses inferred from the combination of the mild segmentation theory and the ICAPM. In 4.4, we present empirical test results that are examined in the subsequent section. The chapter summarizes the finding in 4.6.
4.2 Deregulatory effects on monetary policy and asset pricing:
an application of ICAPM

Merton (1973) agreed with Black, Jensen and Scholes (1972) who claimed there is at least one more factor for asset pricing other than the standard CAPM market factor. In Merton's framework, called intertemporal CAPM (ICAPM), another set of explanatory variables is needed because investors are forward-looking and consumption-smoothing agents. He pointed out that risk-averse investors, a.k.a. consumers, minimize the unanticipated variability in consumption due to a continuously changing investment opportunity set. His argument is as follows. Assume the market is perfect and thus always in general equilibrium. Suppose further that at any moment in time consumers know the transition probabilities of returns on each asset for future investment opportunities, and of the investment opportunity set itself. In addition, consider a case where the opportunity set is a time-homogeneous Markov process that does not jump, explode, or vanish at any horizon of time. Then, the consumers'-cum-investors' portfolios consist of instrument compensating current market risk in the expected return (i.e., market factor), and funds compensating the future risk of an unfavorable aggregate shift in the investment prospect that can reduce upcoming consumption. Hence, even if there is no current market risk, the consumers will demand a risk premium for hedging on the unforeseen tomorrow at any moment, i.e., at every equilibrium.

Fama (1996, 1998) expounded on Merton's ICAPM further. In the ICAPM world, investors first consider a portfolio which gives presently the largest
expected return at the minimum variance. The formed portfolio is a standard CAPM that covers the investors' present interest. Then, the asset holders turn their eyes to the future uncertainty as consumers who smooth the intertemporal consumption stream. They add another portfolio to the contemporaneously optimizing CAPM portfolio in order to prepare for the unpredictability in the yet-to-come states of nature. The newly appended portfolio instantaneously appraises the expected return of the state-contingent assets at each moment. When the contemporary market portfolio and the state variables for hedging are jointly normally distributed, a linear combination of the two portfolios provides the minimum variance portfolio for the savers at the given expected return schedule for the present, with possibly multiple factors for the future. 76

Moreover, unlike the CAPM for the market portfolio, ICAPM does not theoretically restrict the sign of the correlation between the consumption stream and the hedging portfolio. In a mathematical notation, let us denote $x_k$ as the future opportunity set variable for unit capital $k$, and $C$ as intertemporal consumption stream. According to Merton (1973, 876-877),

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76 Notice, the model is static, where the agents are in equilibrium at every moment of time, which is a conclusion of the dynamics for future contingency. Making our story dynamic would be indeed a future research topic. It is a frontline of asset pricing theory to construct a dynamic model of intertemporal consumption smoothing, with a simplicity such as Merton's ICAPM (Cochrane 2001).
If \( \frac{\partial C}{\partial x_i} > 0 \), then ceteris paribus, they (= risk averse utility maximizer in ICAPM) will demand more of the ... asset (in concern), the more positively (negatively) correlated its return is with changes in \( x_k \).\(^{77}\)

That is to say, the role of the term for a future state of nature is to achieve smoothing so that, depending on its effect on intertemporal consumption, ICAPM coefficient(s) for the hedging can be either positive or negative. Cochrane (2001) emphasized this behavior of insuring an investment based on the theoretical conclusion that equilibrium asset return is the present value of aggregate marginal utility growth where intertemporal utility optimizing investors are ready to tradeoff a current average return with a precautionary measure for a future bear market. He pointed out that in Merton's ICAPM this preparedness will be reflected in the asset's factor which can hedge against the negative contingencies. The only theoretical requirement regarding the factors of hedging is their capability of expressing a conditional distribution of future asset returns that is a proxy for marginal utility growth. Therefore, ICAPM factors do not have to be identically and independently distributed (i. i. d.).

The feasibility of such investor's consumption-smoothing is tested with Consumption CAPM (CCAPM) by Lettau and Ludvigson (June and December 2001). They modeled a representative investor as an intertemporal utility

\(^{77}\) Italics in parentheses added.
maximizer and assumed his / her discount factor as a function of consumption, wealth, and labor income, which reflects the risk of portfolios that forces the future consumption to fluctuate from time to time. The model explains comparatively well the US stock market, and suggests that the state variable for intertemporal utility optimization should signal a change in the environment for investment that will affect the future consumption.

More specifically, their finding indicates that interest rate, the most commonly used proxy for the discount factor, will be a candidate for a hedging portfolio in ICAPM.\textsuperscript{78} Actually, Merton (1973, 879) mentioned interest rates for a state variable. He stated:

\begin{quote}
It (= the interest rate) is observable, satisfies the condition of being stochastic overtime, and while it is surely not the sole determinant of yields on other assets, it is an important factor. Hence; one should interpret the effects of a changing interest rates ... in the way economists have generally done in the past: namely, as a single (instrumental) variable representation of shifts in the investment opportunity set.\textsuperscript{79}
\end{quote}

Several empirical studies for ICAPM found Merton’s assertion valid. Shanken (1990) assumed the hedging portfolio for an ICAPM was an excess return on a

\textsuperscript{78} However, in ICAPM, there is an implicit assumption for preference. Namely, the consumers-cum-investors are standard CAPM utility maximizers with respect to wealth, and the source of their fund is endowment and investment return alone (Eichberger and Harper 1997). In other words, unlike the models of consumption CAPM, there is no influence of either market factor or the hedging factor(s) on the consumers’ labor income and the level of consumption. Consequently, the effects of inflation / deflation on income and goods price are neutralized in ICAPM. A study for a relation between ICAPM pricing factors and the effects of inflation would be achieved by an elaboration of consumption CAPM, which may be a future research topic.

\textsuperscript{79} Italics in parentheses added.
long-term governmental bond index that was a function of a short-term T-bill rate, T-bill volatility and a January effect. He found with a test for the US data of 1953-1982 that the T-bill rate had the highest and significantly negative explanatory power for the asset return. Equally for the US market, Turtle, Buse and Korkie (1994) reported a simple CAPM had a lower fit for the US stock returns of 1983:07-1989:12 than an ICAPM where the hedging portfolio was represented by the excess return from 20-year treasury bonds.

When interest rates are a proxy for state variables that will affect future consumption, and hence the current asset pricing, there can be an effect on ICAPM from monetary policy. In fact, there is the literature, though not with ICAPM, showing influences of monetary policy on stock prices via interest rates. Hardouvelis (1987) examined the US data of 1979:10-1982:10 and found that a pure surprise in borrowed reserve which targeted the real interest rate had a significantly strong negative effect on stock pricing. Thorbecke and Alami (1992) found that an unexpected change in the Federal Funds Rate negatively and significantly affected the US share prices for 1974:01-1986:12. Similarly, Thorbecke (1997) found the US stock returns of 1967:01-1990:12 had a significantly negative relationship with the shocks on the Federal Funds Rate and a significantly positive correlation with the shocks on non-borrowed reserves. The relation was more apparent for smaller firms, which was consistent with the idea that monetary policy would signal future cash flow more for the firms.
susceptible to a fluctuation in *domestic* credit. Meanwhile, Warner and Georges (2001) examined the abnormal rate of return of the US shares, and discovered the returns had a significantly positive correlation with news of monetary expansion (1990:05-1992:09) and a significantly negative relation with information for contraction (1993:09-1995:05). Ewing (2001) too found that the growth rate of the Federal Funds Rate influenced the US asset valuation in 1988:01-1997:12. Gray and Stone (1999) contended that the discount factor for capital cost was affected by monetary policy and the exchange rate which reflected the country risk premium, changes in terms of trade due to macro shocks, and the world interest rate. Their claim resonates with Thorbecke and Alami (1994) who, using the US data of post-1979, saw that when the Federal Funds Rate went up, the dollar appreciated so that there was an increase in real interest rates (Engel and Frankel 1984), and at the same time the stock return was decreased.


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\(^{80}\) The major components of the Gensaki market are Japanese governmental bonds.
would expect an interest rate as a policy tool to be a hedging factor for the intertemporally optimizing investors.

However, as it is inevitable that any monetary policy must work in a domestic financial market, when an institutional alteration is taken, the policy transmission is affected and the role of interest rate can change. Edey and Hviding (1995) stated that financial deregulation was always accompanied by technological innovations and internationalization for the sector, both of which rapidly increase the number of products. Consequently, the conventional route for money through the banks had drastically reduced its importance, which made central bankers use newer transmission mechanisms and change the targets into more market-based numbers such as foreign exchange rates, rate of inflation, and others. As a matter of fact, according to Nowak (1993), the Federal Reserve began to try fine-tuning all the economic statistics with its open market operations when the US financial market deregulation obtained momentum in the 1980s.

On the other hand, if the monetary authority's decision was based on the criterion for a slower-paced segmented market without a measure for the new environment, it could easily lose track of the policy effect, because deregulation could increase market volatility and the speed in which the market reacts to policy. In such a case, the linkage between traditional monetary indicators and policy breaks down. (OECD 1997.) Furthermore, Kashyap and Stein (1993) postulated that particularly the international regulations of risk-based capital
requirement, such as the Basle Accord, could limit the influence of domestic monetary policy via the bank-lending channel. They discussed a case when at least some of the banks must adjust the reserve according to the Accord whatever the stimuli are given by the authority. Thornton (1994) found no statistically significant relation after 1980 between total reserves and commercial banks' loans and deposits in the US, though there were some before 1980. His reasoning for the phenomena was that, since the banks had an incentive to lend more for their locked-in customers under tight money, even if the Fed reduced the credit supply, the financiers invented deregulated fund sources to finance more lending. He added that the borrowers, too, encountered the deregulated non-bank instruments.

The above literature suggests that deregulation and financial innovation could especially weaken the credit channel of monetary policy. The implications of these changes would be far more serious in Japan than anywhere else because, as we have seen in Chapter 2, the Japanese pre-deregulatory policy transmission channel depended mainly on the call rate controls at the interbank market that had a near-monopoly over the liquidity during autarky. If, without an introduction of a new policy tool, the traditional monetary policy with the call rate adjustment becomes less and less accurate in forecasting a future state, the ICAPM investors in Japan can no longer count for an effective hedging tool on any portfolio whose return was determined by the call rate. Unless another policy apparatus replaces the rate swiftly, even the monetary policy itself
could stop being an indicator of the future domestic market. In the next section, we construct testable hypotheses with ICAPM to enquire as to the feasibility of this story.

4.3 Financial deregulation and tradable / non-tradable asset pricing by ICAPM

Assume, in at least a mildly integrated / segmented Japanese market, investors would form a contemporary portfolio with the world market return, and then evaluate the uncertainty of the future states of nature which is not captured by the stocks' sensitivity to the global market. We suppose the central bank's operation could affect the formation of both the expectation and the preference and evaluation of the long-term investment risk, which is then fed into the intertemporal wealth valuation of the investors. Namely, we construct our model analogous to that of Fama and French (1998), where the market portfolio is the world portfolio. Moreover, our hedging portfolio is a long-term asset that is a function of the Bank of Japan's (BOJ's) monetary policy, as Shanken (1990) did with the US long-term bond and the T-bill rate. Accordingly, we write our ICAPM such that,

\[ R_t^i - R_t^f = a^i + b^i(R_t^w - R_t^f) + c^i(R_t^l - R_t^f) + \epsilon_t^i, \]

where
\( R_t^i \): the return of the equally weighted portfolio \( i, i = T \) (tradables), \( NT \) (non-tradables), at time \( t \), \( t \in [1980:12 \, 1996:12] \),

\( R_t^w \): the world risk-free rate at time \( t \),

\( R_t^W \): the return of the world market portfolio at time \( t \),

\( R_t^L \): the time \( t \) return of an asset evaluating the long-term condition of credit supply of the economy, and,

\( e_t^i \): the idiosyncratic error for the portfolio \( i \) at time \( t \).

(4.1) says that, at the equilibrium of any point in time, the excess return of portfolio \( i, i = T, NT \), is a linear function of the contemporaneous excess returns of the world portfolio, and of the hedging portfolio that is a function of the monetary transmission mechanism.

In the orderly Main Bank System, as we have seen in Chapter 2, a future business cycle was reflected in the BOJ’s monetary policy tuned by the call rate. Namely, unlike the Federal Reserve, since the BOJ was more inclined to a direct credit control using monitoring by the main banks, the long-term asset is not necessarily represented by governmental bond, whose price is primarily determined by the market. Rather, the hedging return, \( R_t^L \), could be from a portfolio with a premise that the Main Bank System facilitates the call rate, not the market mechanism, to be the deciding factor for a future state.\(^{81}\) For

\(^{81}\) Moreover, choosing long-term governmental bonds for a hedging portfolio would not be feasible for a discussion of Japanese capital market deregulation. Campbell and Hamao (1992)
example, a portfolio of financial intermediaries, such as the Japanese banking sector, would be a candidate for the hedging portfolio because the Main Bank System assigned the financial institutions to the operational front for monetary policy. The dependency of the portfolio on the well-established Main Bank System allows investors to regard investment into it as a long-term asset holding that is almost a perfect substitute for a long-term governmental bond purchase. We thus suppose that $R_t^L$ is a function of the call rate, so long as the investors care about the domestic economy for their utility optimization under the traditional Main Bank System.

Advancing our presumption further, we assume that $R_t^L$ follows the rational expectation theory of the term structure (Mankiw and Miron 1986; Campbell and Shiller 1991; Gerlach and Smets 1997; Guthrie, Wright and Yu 1999) as the governmental bonds do. In other words, if the market observes the policy tool effectual enough for controlling future liquidity conditions, $R_t^L$ will be the sum of the market’s risk premium and the expected value of the call rates for the duration of the long-term instruments (Okina 1993). In addition, following tested the Japanese fitness of the term structure conjecture for 1971:01-1990:03 and obtained a poor result. They attributed the result to the regulatory constraints to which, as we have seen in Chapter 2, all the interest rates were bound. If that were the case, taking governmental bond rates would complicate our analysis.

82 A capital source of the long-term credit banks, one of the major capital providers of the system, was the debentures that were traded actively in the Gensaki market with the governmental bonds. Therefore, the market indeed could have perceived that an investment into the Japanese banking sector would be similar to a purchase of long-term governmental bonds elsewhere. However, the actual formation of the hedging portfolio with the Japanese bankers could be tricky, because during our sample period the long-term credit banks were not allowed to be stock-listed, the city and regional banks were incorporated, and the credit unions were mutual companies, while the Main Bank System allocated clientele corporations for each of financiers (Cargill and Royama 1992). The issue would be a future research topic.
Thorbecke (1997), our investors are forward-looking, and hence they can simultaneously incorporate implications of monetary shocks for future cash flows and discount factors. Thus, $R_t^L$ is the contemporaneous positive correlation with the call rate plus the risk premium. Finally, since this long-term asset price is a value of the policy transmission mechanism, so long as the market believes the system to be stable in a certain regulatory framework, the risk premium the investors require could be constant. That is to say,

\begin{equation}
R_t^L = mR_t^c + RP
\end{equation}

where,

- $R_t^c$: the call rate at time $t$, and,
- $RP$: risk premium for holding this long-term asset.

The coefficient $m$ approximates the expectation formation of the investors as a correlation between the hedging portfolio and the call rate. It is supposed to be positive and less than infinity, but could be negative or exploding when the rational expectation regarding the term structure breaks down. From our discussion in Chapter 2, we would say the Main Bank System traditionally sustained the positive correlation between the long-term asset return and the call rate by using the banks as a delegation of the central bank. On the other hand, when $m = 0$, the market may have abandoned the rational expectation, and / or, the relation between the Main Bank System and the call rate would have disappeared. Namely, we can reckon the coefficient $m \geq 0$ to be an interpretation
of the rational market for the traditional governmental involvement in the Main Bank System.

With (4.1) and (4.2), we have our regression equation such that

\[ R_t^i - R_t^f = a_i + b_i(R_t^w - R_t^f) + c_i(R_t^c - R_t^i) + e_t^i, \]

\[ = a_i + b_i(R_t^w - R_t^f) + c_i(mR_t^c + RP - R_t^f) + e_t^i, \quad i = T, NT. \]

In conclusion, we estimate

(4.3) \[ R_t^i = \alpha_i + \beta_{ii} R_t^f + \beta_{iw} R_t^w + \beta_{ic} R_t^c + e_t^i, \quad i = T, NT, \]

where

\[
\begin{cases}
\alpha_i = a_i + c_i RP, \\
\beta_{ii} = 1 - b_i - c_i, \\
\beta_{iw} = b_i, \quad \text{and}, \\
\beta_{ic} = c_i m.
\end{cases}
\]

By examining \( \beta_{ic}, i = T, NT \), we can investigate the effect of the capital market deregulation on the power of Japanese traditional monetary policy. Consider a case for the restricted investors (Errunza and Losq March 1985) who can invest in the tradable firms only. Although their activity is somewhat restricted in the Japanese market, they are global investors spreading their investment risk
across the world. Their consumption growth is affected by the global business cycle rather than by the Japanese one. We expect the changes in Japanese domestic credit impose a minimal impact on the intertemporal utility maximization of the restricted investors. That is to say, $c^T = 0$, and the policy impact of the BOJ in the evaluation of the tradables will be zero (0) whatever the effectiveness of the call rate in controlling domestic money.

In contrast, the unrestricted investors (Errunza and Losq March 1985) have a larger exposure to the domestic economy than their restricted fellows, due to their investment in the non-tradables. This makes their consumption stream always sensitive to domestic conditions for credit supply, and thus, $c^{NT} \neq 0$ when they are risk-averse intertemporal utility maximizers and the Main Bank System presides over the domestic money. Provided that the call rate significantly positively correlates with the Main Bank System portfolio, (4.4) says that $c^{NT} \neq 0$ equals to $\beta^{NTc} \neq 0$, and hence, the non-tradable investment return is a function of the call rate. In other words,

Proposition 1:

(i) $H_0$: $\beta^{TC} = c^T m = 0$.
$H_A$: Otherwise.

(ii) $H_0$: $\beta^{NTc} = c^{NT} m = 0$.
$H_A$: $\beta^{NTc} = c^{NT} m \neq 0$. 
We can consider three scenarios when $\beta^{NTc} = c^{NT}m = 0$. One is $c^{NT} \neq 0$ but $m = 0$; that is, the unrestricted investors count on the Main Bank System portfolio as an indicator of future business cycles, possibly because of the system’s ability to forecast future money supply with some reason other than the call rate adjustment of the BOJ. So long as the monetary tool is the call rate, the policy is ineffective for the non-tradable pricing in such a case. A second possibility is $c^{NT} = 0$ but $m \neq 0$. That is to say, although the market deems the governmental presence significant for the appraisal of the Main Bank System portfolio, the unrestricted investors do not reckon the Main Bank System to be a predictor of future domestic economy. From the point of view of the monetary policy practitioner, their activity with the call rate is as ineffective as the first case. The last script is $c^{NT} = m = 0$. There, the unrestricted investors do not consider the Main Bank System portfolio as a tool for prediction, and the Main Bank System valuation does not take into account the call rate. The result is the same as the above two cases for the influence of monetary policy by the call rate. Note, although the model is static, if the statistical significance for $\beta^{NTc}$ decreases, say, from significant to insignificant, over our Periods 1, 2 and 3 as defined in Chapter 2, we may postulate a decline in the potency of traditional monetary policy on the intertemporal asset pricing over the deregulation, as we have discussed its possibility in 4.2, or in Chapters 2 and 3.

Moreover, recall Merton (1973); the relationship between consumption and the state variable can be both positive and negative, subject to the effect of
the state variable on intertemporal consumption smoothing. In our framework, the state variable, $x_k$, is the call rate, $R_t^c$. Suppose the domestic unrestricted investors are net lenders in a rational enough market of $m \geq 0$. The higher the long-term asset interest, the more the lending income the lenders receive. This means the higher the call rate, the more the optimal consumption for them, so long as $m > 0$. That is to say, the correlation between the hedging portfolio and the intertemporal consumption is positive, so that $\frac{\partial C}{\partial x_k} = \frac{\partial C}{\partial R_t^c} > 0$. Now, consider the nature of non-tradable business. They are the firms that cannot internationally diversify their goods market and/or capital market as much as the tradable corporations do. They will be more susceptible to the domestic business cycle, especially at its downturn. Unrestricted and intertemporally risk-averse ICAPM investors surely demand a higher risk premium from their non-tradable investment. The more probable a decrease in consumption is, the higher the risk premium required for the non-tradable portfolio will be. Namely, $\frac{\partial R_t^{NT}}{\partial C} < 0$. In conclusion, for the net-lender and unrestricted investors,

$$\frac{\partial R_t^{NT}}{\partial C} \frac{\partial C}{\partial R_t^c} = \frac{\partial R_t^{NT}}{\partial R_t^c} < 0. \quad ^{83}$$

\hfill ^{83} \text{When the investors are net-borrowers with } m > 0, \text{ the sign will be reversed.}
Finally, we can examine (4.3) whether the deregulation would have made the tradables positively correlated with the global market factor more than the segmented non-tradables. Therefore,

Proposition 2:

\[ H_0: \beta^T_{Tw} = \beta^T_{NTw} = \beta^{NT} \geq 0, \]

\[ H_A: \text{Otherwise.} \]

As in Chapter 3, since (4.3) is a structural model derived from the CAPM-based ICAPM of (4.1), the problem of joint hypothesis applies here again. Namely, our experiment inherently examines the significance of explanatory variables and the claim of ICAPM investor optimization with the hedging by the call rate. The alternative hypothesis is “the call rate is significant for the tradable pricing and insignificant for the non-tradable valuation; the world portfolio is insignificant for Japanese stock pricing,” or, “the valuation model and its basic assumptions do not apply.”

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\(^{64}\) Take note the test is a statistical re-examination of the change in \(\beta \) for (3.10) and (3.11) of
4.4 Testing the deregulatory effects on the call rates with ICAPM

What the world risk-free rate and the world market portfolio actually are is a contentious issue. Hence, we simply follow the literature of capital market integration, and employ the US T-bill rate of the closest to 30-days to maturity, taken from the Wall Street Journal, as the world risk-free rate, and Morgan Stanley Capital International (MSCI) World Index from www.msci.com for the world market portfolio. Both figures are from the last trading day of a month from 1980:12-1996:12. The call rate is the monthly average of the overnight uncollateralized call rate from the data published by the Bank of Japan (1999). Portfolios are constructed with equally weighted shares listed in the Tokyo Stock Exchange (TSE) as of 2000:12. The stocks are classified as either tradable or non-tradable in the way discussed in Chapter 2. As the correlation between an individual asset return and the market portfolio can change according to the investable volume of the share in the market, we have to remember that equal weighting for the portfolio could bias our result.\textsuperscript{85}

The statistics of interest rates are summarized in Table 4.1. Both the T-bill rate and the call rate cannot reject the unit-roots, but become stationary with first differences. Moreover, the Durbin-Watson statistic of a cointegrating regression of the T-bill rate on the call rate is 0.1263 for our 193 observations, which is the mild segmentation model. Therefore, it does not examine the significance of the global factor in the Japanese stock pricing.

\textsuperscript{85} However, Campbell and Hamao (1992) reported no difference between the equally weighted and value-weighted portfolios for their market integration test between the US and Japan. Thus, the equal weighting may cause no serious problem in our experiment either.
Table 4.1.

<table>
<thead>
<tr>
<th></th>
<th>Japanese Overnight</th>
<th>US Treasury Bill Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uncollateralized Call Rate</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.3871713</td>
<td>0.5205504</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.1825906</td>
<td>0.2208387</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.3963111</td>
<td>1.046413</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.151711</td>
<td>4.054808</td>
</tr>
<tr>
<td>Box-Pierce Q&lt;sub&gt;20&lt;/sub&gt;</td>
<td>2013.6 ***</td>
<td>1625.5 ***</td>
</tr>
</tbody>
</table>

Augmented Dickey-Fuller Statistic

- With trend: -1.440, -2.860
- Without trend: -0.875, -2.699

Augmented Dickey-Fuller Statistic for First Difference

- With trend: -8.273 ***, -11.474 ***
- Without trend: -8.293 ***, -11.391 ***

Autocorrelation

- \( \rho_{-1} \): 0.9722, 0.9405
- \( \rho_{-2} \): 0.9436, 0.8955
- \( \rho_{-3} \): 0.9146, 0.8554
- \( \rho_{-4} \): 0.8841, 0.8169
- \( \rho_{-5} \): 0.8571, 0.7878
- \( \rho_{-6} \): 0.8318, 0.7511

Note: The null for the Box-Pierce Q<sub>20</sub> is no serial autocorrelation jointly for all the lagged values up to t-20. The null for the Augmented Dickey-Fuller statistics is unit-roots. ** indicates rejecting the null at 5%, and *** is for 1%.
smaller than the 1% critical value of 0.511 for 100 observations (Engle and Granger 1987). Therefore, we would say these two interest rates are not cointegrated, and are independently stationary with first differences. On the other hand, as we have seen in Chapter 2, the tradable / non-tradable portfolio returns and MSCI World Index return are stationary. This implies that our ICAPM in level will involve a mix of stationary and non-stationary variables. In such cases, a regression coefficient for a variable of the unit-roots reverts to zero, and cannot be reliable due to random walk (Bonham and Cohen 1995).

Following these time series properties of the variables, we conduct the estimations with the first differences of all the variables. Namely, (4.3) is modified into,

\[ R_t^i - R_{t-1}^i = \alpha^i + \beta^{ii} (R_t^i - R_{t-1}^i) + \beta^{iw} (R_t^w - R_{t-1}^w) + \beta^{ic} (R_t^c - R_{t-1}^c) + e_t^i, \]

\[ i = T, NT. \]

The approach may still be problematic, because it discards some information contained in the levels of the series and departs from the theoretical form of the return relation. Nonetheless, the procedure may be necessary for statistical

86 Although they did not test for the data generating process, Campbell and Hamao (1992) found an AR(1) coefficient for the monthly call rate of 1971:01-1980:12 more than 0.99, and that for the T-bill rate of 1971:01-1990:03 between 0.97 and 0.99. Jinushi, Kuroki and Miyao (2000) noticed the quarterly call rate was integrated for 1975:Q1-1995:Q4. Engle and Granger (1987) concluded the T-bill rate of 1952:02-1982:12 to be I(1). On the other hand, Hatakeda (2000) reported stationary process for the call rate of 1975:Q1-1995:Q1. For the T-bill rate of 1982:Q2-1993:Q3, Cheung and Chinn (1999) rejected random walk. Fama and Bliss (1987) argued the month-to-month levels of the one year spot rate of Treasury maturities to five years is near random walk, but reverts to the mean very slowly near the maturity. Their finding suggests it would be possible to observe a difference in data generating processes depending on the data.
analysis, and our methodology should be regarded as a solution in the absence of a definite remedial measure. For examining the robustness of the test, we have studied the same estimation with level variables and with an equation mixed with the level variables and the first differences. The results are discussed in Appendix 3. As a whole, our findings are robust.

As Stulz (Fall 1999) pointed out, any CAPM-based model, including our ICAPM, assumes a stable (real) discount rate for asset pricing throughout the sample period. Therefore, our time series data set should be constructed to satisfy the model requirements for the discount factor. We choose to execute the regressions of (4.5) for periods dividing 1980:12-1996:12 into three, according to the results of the structural break tests in Chapter 2. They are

| Period 1   | 1980:12-1984:10 for the tradables, |
|           | 1980:12-1984:03 for the non-tradables, |
| Period 2   | 1984:11-1990:01 for the tradables, |
|           | 1984:04-1990:02 for the non-tradables, |
| Period 3   | 1990:02-1996:12 for the tradables, and, |
The results are presented in Table 4.2. In Durbin's-h statistic, Breuch-Godfrey statistic, and correlogram, the residuals of standard ordinary least squares reported a possible serial correlation around the order of one (1) for all the tradable portfolios and Period 3 non-tradable portfolio. Hence for these portfolios, we applied the Newey-West estimation (Hamilton 1994) with the order of six (6). Theoretically, ICAPM does not require i.i.d. explanatory variables (Cochrane 2001), so our estimation does not contradict with the assumption. However, we have to remain aware of possible bias in the estimation because any generalized least squares could give too much weight on well-behaved portfolios without knowledge of true distribution of the returns (Letttau and Ludvingson December 2001). We should be content that our methodology will be best for interpreting the statistical significance of the coefficients.

The F-tests for every equation of the tradable portfolio reject the null hypothesis of the entire regression at less than 1%. On the other hand, the non-

---

67 The correlations among independent variables are less than 0.2 in magnitude for all the periods. Therefore, we may not expect a problem of severe multicollinearity.

68 We have experimented also with Prais-Winsten and Cochrane-Orcutt estimations, both of which impose, unlike the Newey-West transformation, a pre-determined formula on the covariance matrix to stabilize the residual correlation (Judge, et al. 1985; Greene 1993). Our result is robust.

69 Moreover, we here implicitly assume our data complies with the assumptions of Merton (1973) for their distributional properties, and hence the static general equilibrium conclusion of ICAPM is appropriate to our research subject. We also presume that the first-differenced returns do not have lagged values for an explanatory term, and no explanatory variable is dependent on the lagged residual. (Davidson and MacKinnon 1993.) In other words, our supposition would be naïve enough to allow the standard criticism about a lack of consideration for an implicit statistical model describing the data (Favero 2001). Nonetheless, it is also true that ICAPM for the Japanese market is too inconclusive to deconstruct with the critique so that we take a very conservative, or old-fashioned, stance in our study. Lettau and Ludvingson (2001:12) consciously avoided the problem of residual autocorrelation by consumption CAPM that made the pricing of time-varying factors to be estimated by cross-section with the Fama-MacBeth (1973) method.
Table 4.2.

\[ R_{t}^{i} - R_{t-1}^{i} = \alpha^{i} + \beta^{i} (R_{t}^{i} - R_{t-1}^{i}) + \beta^{i*} (R_{t}^{w} - R_{t-1}^{w}) + \beta^{i*} (R_{t}^{c} - R_{t-1}^{c}) + \epsilon_{t}^{i}, \quad i = T, NT. \]

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradable Portfolio</strong></td>
<td>[ R^{T} = 0.59869575 \ (1980:12-1984:10) ]</td>
<td>[ R^{T} = 1.796929 \ (1984:11-1990:01) ]</td>
<td>[ R^{T} = -0.9093245 \ (1990:02-1996:12) ]</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>[ \chi^{2}(11) = 25.22312 \ *** ]</td>
<td>[ \chi^{2}(15) = 28.90519 \ *** ]</td>
<td>[ \chi^{2}(20) = 42.83677 \ *** ]</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>[-0.54862647 \ (-3.89434) \ *** ]</td>
<td>[-0.5393386 \ (-4.631051) \ *** ]</td>
<td>[-0.4951694 \ (-4.912781) \ *** ]</td>
</tr>
<tr>
<td>Correlogram</td>
<td>t-1</td>
<td>t-1</td>
<td>t-1</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 42) = 7.70 \ ***</td>
<td>F(3, 59) = 23.03 \ ***</td>
<td>F(3, 79) = 26.98 \ ***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.1123754 (0.34)</td>
<td>-0.01358 (-0.05)</td>
<td>-0.2893024 (-0.83)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-1.296871 (-0.18)</td>
<td>7.96587 (1.17)</td>
<td>-35.13666 (-1.27)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>69.28457 (4.54) \ ***</td>
<td>60.25545 (6.79) \ ***</td>
<td>157.5344 (8.20) \ ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>19.2424 (0.58)</td>
<td>-31.99834 (-1.07)</td>
<td>-19.00861 (-0.53)</td>
</tr>
<tr>
<td><strong>Non-tradable Portfolio</strong></td>
<td>[ R^{NT} = 0.6427931 \ (1980:12-1984:02) ]</td>
<td>[ R^{NT} = 1.70844 \ (1984:03-1990:02) ]</td>
<td>[ R^{NT} = -1.20677 \ (1990:03-1996:12) ]</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>[ \chi^{2}(9) = 13.50684 ]</td>
<td>[ \chi^{2}(15) = 11.2997 ]</td>
<td>[ \chi^{2}(20) = 31.73443 \ ** ]</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>[-0.3286973 (-1.945117) ]</td>
<td>[-0.1696545 (-1.355334) ]</td>
<td>[-0.3285477 (-2.930306) \ *** ]</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>None</td>
<td>t-1</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 35) = 0.47</td>
<td>F(3, 67) = 13.63 \ ***</td>
<td>F(3, 78) = 20.68 \ ***</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.1017189 (-0.19)</td>
<td>0.0633399 (0.13)</td>
<td>-0.2939784 (-0.74)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-6.224749 (-1.11)</td>
<td>16.71406 (2.27) \ *</td>
<td>-40.83026 (-1.79)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>2.449874 (0.22)</td>
<td>39.13365 (4.82) \ ***</td>
<td>135.107 (7.86) \ ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>-3.266097 (-0.13)</td>
<td>-69.87912 (-3.81) \ ***</td>
<td>-9.124527 (-0.25)</td>
</tr>
</tbody>
</table>

Notes: *** indicates significance of 1% level. ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The t-tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. The regressions for all the tradable portfolios and Period 3 non-tradable portfolio are by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS. The rest is by the OLS.
tradable portfolio cannot reject the null of the significance in the regression for Period 1 at 10%. However, for Periods 2 and 3, F values of the non-tradable portfolio reject insignificance for the model of the world market portfolio return at 1%.

As we have mentioned in 4.2, our model is intrinsically static. Nevertheless, we may deduce intertemporal evolution of the tradable / non-tradable valuation with ICAPM by comparisons of estimations among the periods. In order for testing the equality of the regression results between the periods for each portfolio, we take a two-step approach. The logistic for the tests is depicted in Figure 4.1. The rationale of this exercise rests in the fact that any test for regression accordance assumes the same DGP for the data of two regressions. If the DGPs are different, the standard F-test inevitably confronts heteroskedasticity for the pooled sample, and hence the result is unreliable. (Davidson and MacKinnon 1993.) In such a case, a statistical test for regression equivalence cannot be well-defined so that we have to satisfy ourselves only with observational contrasts of estimated results. On the other hand, if two portfolios share the same DGP statistically, we can proceed to an F-test for the conjectured ICAPM to check the parity in estimation. Namely, we first examine an agreement in the data generating process (DGP) between two portfolios, and then carry on to study regression equality in (4.5).
Identify DGP for each period of the tradable (T) / non-tradable (NT) portfolio return.

Inspect whether the DGPs are the same between periods for T or NT.

Different.

Consult (4.5) results for the same pattern in the significance of coefficients between periods.

Different.

By inspection, ICAPM results are different between periods.

Reject insignificance.

ICAPM results between periods are different.

Cannot reject insignificance.

ICAPM results between periods for T or NT are the same.

Same.

Construct a pooled data set of periods for either T or NT.

Same.

F test: are DGPs for each period the same?

Reject equality.

F test for (4.6): are the dummy terms collectively insignificant?

Cannot reject equality.

Observationally, ICAPM results are the same between periods for T or NT.

Figure 4.1.

Panel A: Testing estimation difference between periods for tradable or non-tradable portfolio.
Identify DGP for each period of the tradable (T) / non-tradable (NT) portfolio return.

Construct a pooled data set of T and NT within a period.

Inspect whether the DGPs are the same between T and NT in a period.

Same.

Reject equality.

F test: are T and NT the same in DGP?

Cannot reject equality.

F test for (4.7): are the dummy terms collectively insignificant?

Cannot reject insignificance.

Observationally, ICAPM results are the same between T and NT.

Reject insignificance.

ICAPM results between T and NT are different.

By inspection, ICAPM results are different between T and NT.

Different.

Different.

Different.

Same.

ICAPM results between T and NT are the same.

Figure 4.1. (Continued)
Panel B: Testing estimation difference between the tradable and non-tradable portfolios.
First, we identify a possible data generating process of portfolio returns at each period. Next, if two portfolios show by inspection the same DGP, a pooled data set is constructed using these portfolios to test the DGP agreement statistically. That is to say, with the combined period-by-period or tradable vs. non-tradable data, we conduct a standard F-test to check the statistical DGP equality between the two using the residuals obtained after fitting the DGP. The test statistic for DGP equality is

\[
F^i = \frac{(\text{ess}_{p}^i - (\text{ess}_{1}^i + \text{ess}_{2}^i))/k}{(\text{ess}_{1}^i + \text{ess}_{2}^i)/(T_1^i + T_2^i - 2k)}, \quad i = T, NT,
\]

(Johnston 1984, Pindyck and Rubinfeld 1991) where

- \( \text{ess}_{p}^i \): error sum of squares of possible DGP for a pooled set of portfolio \( i, i = T, NT \), for 2 periods,
- \( \text{ess}_{1}^i \): error sum of squares for the data set of one of the compared two periods of portfolio \( i, i = T, NT \), obtained by fitting the possible DGP process of the pooled data,
- \( \text{ess}_{2}^i \): error sum of squares for another data set of the compared two periods of portfolio \( i, i = T, NT \), obtained by fitting the possible DGP process of the pooled data,
- \( k \): number of estimated coefficients for the DGP,
$T_i$: number of months in one of the compared two periods of portfolio $i$, $i = T, NT$, and,

$T_i^2$: number of months in another of the compared two periods of portfolio $i$, $i = T, NT$.

Table 4.3, Panel A summarized the DGP of each portfolio. For now, the all-firms' ("All") portfolio return is our main concern. Panel B is a summary for DGP comparison between periods for each of the tradable and non-tradable returns. Since the Period 3 tradable DGP differs from the rest, we can reject the statistical equality of ICAPM for any pair involving that portfolio. Concerning Periods 1 and 2, as both the tradable and non-tradable portfolios presented a possible DGP agreement, we did F-tests for the ICAPM equality with pooled data. For each portfolio $i$, $i = T, NT$, the test regression is,

$$R_t^i - R_{t-1}^i = \alpha_i^i + \beta_{if}^h (R_t^f - R_{t-1}^f) + \beta_{iw}^h (R_t^w - R_{t-1}^w) + \beta_{ic}^h (R_t^c - R_{t-1}^c) + \beta_{if}^n D_p (R_t^f - R_{t-1}^f) + \beta_{iw}^n D_p (R_t^w - R_{t-1}^w) + \beta_{ic}^n D_p (R_t^c - R_{t-1}^c) + \epsilon_t^i,$$

where

$D_p = 0$ if $R_t^i$ is for Period 1, and,

$= 1$ if $R_t^i$ is for Period 2.

---

90 We will examine manufacturing / non-manufacturing portfolios in 4.5.
### Table 4.3.

Panel A: Data generating process, period by period, portfolio by portfolio.

<table>
<thead>
<tr>
<th></th>
<th>Entire Sample</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Months</td>
<td>193</td>
<td>47</td>
<td>63</td>
<td>83</td>
</tr>
<tr>
<td>All-Firms'</td>
<td>GARCH(1,1)</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
<td>GARCH(1,1)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>GARCH(1,1)</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
<td>GARCH(1,2)</td>
</tr>
<tr>
<td>Non-manufacturing</td>
<td>GARCH(1,1)</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
<td>GARCH(1,2)</td>
</tr>
<tr>
<td><strong>Non-Tradables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Months</td>
<td>193</td>
<td>39</td>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>All-Firms'</td>
<td>AR(1)-GARCH(1,1)</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>AR(1)-GARCH(1,1)</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
<td>No serial correlation.</td>
</tr>
<tr>
<td>Non-manufacturing</td>
<td>AR(1)-GARCH(1,1)</td>
<td>AR(1).</td>
<td>No serial correlation.</td>
<td>GARCH(1,1)</td>
</tr>
</tbody>
</table>

Panel B: Comparisons between periods for all-firms' portfolio.

<table>
<thead>
<tr>
<th></th>
<th>Tradables</th>
<th>Non-Tradables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periods 1 vs. 2</td>
<td>Cannot reject DGP equality; No serial correlation.</td>
<td>Cannot reject DGP equality for AR(1) at 5% by $F(2, 107) = 1.0922$.</td>
</tr>
<tr>
<td></td>
<td>Cannot reject ICAPM regression equality at 10% with $F(3, 102) = 1.40$.</td>
<td>Reject ICAPM regression equality at 1% with $F(3, 103) = 4.64$.</td>
</tr>
<tr>
<td>Periods 2 vs. 3</td>
<td>By inspection, different DGP.</td>
<td>Different DGP; AR(1)-GARCH(1,1) does not fit for Period 2, though Period 3 could be.</td>
</tr>
<tr>
<td></td>
<td>➤ Observational ICAPM comparison.</td>
<td>➤ Observational ICAPM comparison.</td>
</tr>
<tr>
<td>Periods 1 vs. 3</td>
<td>By inspection, different DGP.</td>
<td>Different DGP; GARCH(1,1) does not fit for Period 1, though Period 3 could be.</td>
</tr>
<tr>
<td></td>
<td>➤ Observational ICAPM comparison.</td>
<td>➤ Observational ICAPM comparison.</td>
</tr>
</tbody>
</table>
We can use the same procedure as above to compare the tradable and non-tradable portfolios at each period. Figure 4.1, Panel B explains the logistic for the tradable and non-tradable comparison at each period. Since we have detected possible DGP differences in any pair including the Period 3 tradable return series, we only inspect the disagreement in significance of the Period 3 coefficients between the tradable and non-tradable portfolios. On the other hand, we cannot identify any serial correlation for the pooled data of the tradables and the non-tradables at Period 1 or Period 2, and thus we went on to the ICAPM equality test with

\[ R_t - R_{t-1} = \alpha + \beta^f (R_t^f - R_{t-1}^f) + \beta^w (R_t^w - R_{t-1}^w) + \beta^c (R_t^c - R_{t-1}^c) \]

\[ + \tilde{\beta}^f D_{NT} (R_t^f - R_{t-1}^f) + \tilde{\beta}^w D_{NT} (R_t^w - R_{t-1}^w) + \tilde{\beta}^c D_{NT} (R_t^c - R_{t-1}^c) + \epsilon_t, \]

where \( R_t \) is portfolio return in the pooled data set,

\( D_{NT} = 0 \) if \( R_t \) is for the tradable portfolio return, and,

\( = 1 \) if \( R_t \) is for the non-tradable portfolio return.

4.5 Farewell, the 1940 System\(^91\) (Version TSE)

First, we examine the regression equality between periods for each tradable and non-tradable portfolio. Table 3, Panel B includes the result. For the pooled

\(^91\) Noguchi 1995.
tradable return data between Periods 1 and 2, $F(3, 102)$ is 1.40 with the null hypothesis in which the dummy terms of (4.7) are jointly insignificant. That is to say, we cannot reject the equality of the ICAPM estimation at 10% between Periods 1 and 2 for the tradable return. It could be another endorsement for our supposition that adding new but similar companies to the tradable portfolio, along with the gradual deregulation, would not change the meaning of the asset for the global investors. In contrast, for the non-tradable return, $F(3, 103)$ is 4.64, that is, larger than $F(3, 100; 1%) = 3.98$. We do reject at 1% the sameness between Periods 1 and 2 by (4.7). Regarding the agreement between Periods 2 and 3, and between Periods 1 and 3, since the tradable portfolio has DGP dissimilarity in these period pairs (Table 3, Panel A), we only say from Table 4.2 that observationally there is no strong indication for estimation difference between periods, at least in terms of the significance of coefficients. For the non-tradable portfolio, we construe from the DGP divergence (Table 3, Panel B) and a juxtaposition of coefficient significances in Table 4.2 that the ICAPM regressions would differ between Periods 2 and 3, and Periods 1 and 3. Together with the rejection of equality for the non-tradable ICAPM between Periods 1 and 2, we may conclude that it was the pure domestic firms, not the corporations targeted by the policy makers, that changed the most during the period when we measure the deregulatory impact, including monetary policy.

Concerning the equality between the tradable and non-tradable return estimations at each period, the test with (4.8) rejected the joint null hypothesis of
dummy terms for Period 1 at 1% with $F(3, 78) = 4.23 > F(3, 80; 1%) = 4.04$. Namely, we reject the ICAPM equality between the tradable and non-tradable portfolios for Period 1. On the other hand, the dummy terms for Period 2 are collectively insignificant, because its $F(3, 127) = 2.06$ is smaller than $F(3, 100; 5%) = 2.70$. It means the tradable and non-tradable returns may have lost their distinguishing characteristics during the so-called bubble period. The result could be consistent with the possible asset pricing problems in the Period 2 mild segmentation analysis. Finally, as we have stated before, due to a unique DGP of the Period 3 tradable portfolio, we only state that the pattern of significance in the ICAPM coefficients is the same between the tradable and non-tradable portfolios for Period 3.

Next, we examine the validity of Proposition 1. The tradable portfolio in every period of Table 4.2 cannot reject the null of significance for the coefficients of the uncollateralized call rate. The result would provide a support for the null of (i) in Proposition 1. On the other hand, we first dismiss the estimation for Period 1 non-tradables due to its low F-value for the entire regression. Then, the Period 2 non-tradable portfolio has a significantly negative $\beta^{NTc}$ so that we reject $H_0$ of (ii) for Proposition 1. A negative coefficient for the call rate also indicates that the unrestricted investors may have been net-lenders during the period. Moreover, in addition to the Period 2 regression difference, the value of $\beta^{NTc}$ for Period 2 is
statistically deviating from the value of $\beta^{NTc}$ in Period 1 with $F(1, 67) = 13.22$.\(^{92}\) In contrast, for Period 3, the period after the artificially differentiating regulation was almost replaced by the market-driven investment evaluation, $\beta^{NTc}$ is not significant for the significant regression; the null of Proposition 1 (ii) cannot be rejected.

In summary, for the 1980s, apart from the rejection of the model by the Period 1 non-tradables, we cannot find counter-evidence to our conjecture that during the period the tradable pricing would ignore the effect of call rate, but the non-tradable valuation would be sensitive to the domestic monetary policy. However, while the Period 3 tradable estimation has produced supportive numbers for our supposition, the non-tradable portfolio return in Period 3 has rejected the hypothesis about its correlation with the call rate. The result suggests that either the model fails to explain adequately the non-tradable pricing behavior for the 1990s, or, in Period 3 the integration spillover from the tradables to the non-tradables may have made the call rate ineffective for the domestic liquidity control.

Turning our eyes to the coefficients of the world market portfolio in Table 4.2, we find $\beta^{Tw}$ is always significant. In contrast, the non-tradable portfolio starts from an insignificant Period 1 regression, and then in Period 2 obtains a moderate $\beta^{NTw}$ whose value is statistically dissimilar to Period 2 $\beta^{Tw}$ at $F(1, 67) = 6.78$.\(^{92}\) Of course, there must be a reservation in the explication of the values of the coefficient due to the nature of GLS.
That is to say, we have an encouraging result for Proposition 2 during the 1980s. What is intriguing is Period 3. The non-tradable portfolio reached in Period 3 a high t-value for $\beta^{NTw}$. Moreover, Period 3 $\beta^{Tw}$ value may vary from its counterparts in Periods 1 and 2, although during the 1980s we cannot reject the equality in $\beta^{Tw}$s between the periods by $F(1, 59) = 1.04$.

As we have discussed in the previous chapter, for the restricted investors of the tradable portfolio, those investable stocks are meaningful as such so long as they offer a diversification opportunity through their correlation with the domestic non-tradables. *Ceteris paribus*, simply adding similar kinds of firms to the tradable portfolio by deregulation, which is the route the Japanese capital market liberalization took, will not change much the correlation between the tradable and world portfolios. A stability of the world beta for the tradable portfolio during the 1980s can be explained in this respect. On the other hand, as the deregulation progressed, there could have been spillovers from the tradables so that the correlation with the world factor could have grown bigger for the non-tradable portfolio, as we have seen here. The increase of $\beta^{NTw}$ may also have been in accord with the largest $\beta^{Tw}$ after 1990.

Before closing our discussion, we have to ascertain that our test is not affected by the goods market internationalization. For example, consider a case where

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83 We cannot test econometrically the difference in coefficients between Periods 2 and 3 because the DGP of the return populations could be different for Period 3 from the previous periods. Moreover, we remind ourselves again of the econometric problem for the interpretation of the value of the coefficient.
the non-tradable portfolio return is strongly influenced by firms that cannot venture out for their capital procurement but earn profit mainly from overseas. In such a case, the investors may not have to watch a correlation between the non-tradable portfolio return and a future domestic bear market. As a result, the difference in coefficients between the tradable and non-tradable portfolios would not tell us the consequence of discriminatory deregulation in the capital market.94

To test whether there is an influence of the goods market internationalization, we suppose manufacturers are more globalized, and decompose our sample firms into manufacturers and non-manufacturers to form portfolios of tradable manufacturing / non-manufacturing firms, and of non-tradable manufacturing / non-manufacturing corporations.95 Manufacturing portfolios are the equally weighted portfolios of corporations with the 3000-mark of the TSE industry code in each of the tradable / non-tradable categories. Non-manufacturing portfolios are constituted of the firms with the rest of the TSE. Table 4.4 describes the industry codes of the TSE. In order to study the equality of estimation among the all-firms', manufacturing, and non-manufacturing portfolios, we employ the same methodology we have taken for the comparison between periods and between the tradable and non-tradable returns. Figure 4.2 explains the procedure we take for testing the equation agreement.

94 As a matter of fact, Griffin and Karolyi (1998) found, in their international sample of 1992:01-1995:04, the variance of traded goods securities was predominantly explained by a weekly world market factor, in contrast to a smaller influence of domestic factor; whereas, the non-traded goods return variance was largely dependent on the country effect.

95 We should not forget we here assume any Japanese manufacturing firm is definitely more globalized than the non-manufacturers. The issue would be a further research agenda.
Table 4.4.

TSE industrial codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Primary Industry</td>
</tr>
<tr>
<td>1050</td>
<td>Mining</td>
</tr>
<tr>
<td>2050</td>
<td>Construction</td>
</tr>
<tr>
<td>3050</td>
<td>Food and Kindred Products</td>
</tr>
<tr>
<td>3100</td>
<td>Textile and Apparel</td>
</tr>
<tr>
<td>3150</td>
<td>Paper and Allied Products</td>
</tr>
<tr>
<td>3200</td>
<td>Chemicals and Allied Products</td>
</tr>
<tr>
<td>3250</td>
<td>Pharmaceuticals and Biotechnology</td>
</tr>
<tr>
<td>3300</td>
<td>Energy, including Petroleum Refining and Related Industries</td>
</tr>
<tr>
<td>3350</td>
<td>Rubber</td>
</tr>
<tr>
<td>3400</td>
<td>Stone, Clay, Glass and Concrete Products</td>
</tr>
<tr>
<td>3450</td>
<td>Steel</td>
</tr>
<tr>
<td>3500</td>
<td>Other Metals</td>
</tr>
<tr>
<td>3550</td>
<td>Metal Products</td>
</tr>
<tr>
<td>3600</td>
<td>Machinery, except Electrical</td>
</tr>
<tr>
<td>3650</td>
<td>Electrical and Electronic Machinery, Equipment and Supplies</td>
</tr>
<tr>
<td>3700</td>
<td>Transportation Equipment</td>
</tr>
<tr>
<td>3750</td>
<td>Measuring, Analysing, and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks</td>
</tr>
<tr>
<td>3800</td>
<td>Miscellaneous Manufacturing Industries</td>
</tr>
<tr>
<td>4050</td>
<td>Utilities</td>
</tr>
<tr>
<td>5050</td>
<td>Ground Transportation</td>
</tr>
<tr>
<td>5100</td>
<td>Water Transportation</td>
</tr>
<tr>
<td>5150</td>
<td>Transportation by Air</td>
</tr>
<tr>
<td>5200</td>
<td>Warehousing and Freight Transportation Services</td>
</tr>
<tr>
<td>5250</td>
<td>Telecommunication</td>
</tr>
<tr>
<td>6050</td>
<td>Wholesale</td>
</tr>
<tr>
<td>6100</td>
<td>Retail</td>
</tr>
<tr>
<td>7050</td>
<td>Banking</td>
</tr>
<tr>
<td>7100</td>
<td>Security and Commodity Brokers, Dealers, Exchanges and Services</td>
</tr>
<tr>
<td>7150</td>
<td>Insurance</td>
</tr>
<tr>
<td>7200</td>
<td>Other Financials</td>
</tr>
<tr>
<td>8050</td>
<td>Real Estate</td>
</tr>
<tr>
<td>9050</td>
<td>Services</td>
</tr>
</tbody>
</table>
Identify DGP for each period of the All-firms', Manufacturing, and Non-manufacturing portfolio returns within a category of the tradables (T) / non-tradables (NT).

Construct a pooled data set of portfolios within T or NT.

Inspect whether the DGPs are the same between the two portfolios within T or NT.

Different.

Reject equality.

Identify DGP of the pooled data.

F test: are DGPs for each portfolio within the pooled data the same?

Cannot reject equality.

F test: are the dummy terms of ICAPM collectively insignificant?

Cannot reject insignificance.

Observationally, ICAPM results are the same for two portfolios.

By inspection, ICAPM results are different between portfolios.

Reject insignificance.

ICAPM results between portfolios are different.

ICAPM results between portfolios are the same.

Figure 4.2.
Testing estimation difference among all-firms' manufacturing, and non-manufacturing portfolios for the tradables or non-tradables.
Table 4.3, Panel A reports the possible DGPs for the portfolios. For the pooled data, Panel A of Table 4.5 depicts the result of DGP comparison. Table 4.5, Panel B summarizes the result of testing for ICAPM regression equality. For the pairs of different DGPs, we compared by inspection the significance of each estimated coefficient in Table 4.5, Panels C (manufacturing) and D (non-manufacturing), and with those in Table 4.2 (All-firms'). To the remaining matches, we executed F-tests for the ICAPM in pooled data with dummy variable regression as we have done for the inter-period and the inter-category comparisons. Statistically or otherwise, no case shows an estimation difference, at least in terms of significance of the coefficients for our hypothesis. In other words, we could not find evidence of influence from the (possible) real sector globalization. Therefore, we may say our experiment has not been affected much by the internationalization of goods market.

In conclusion, for the 1980s the restricted investors evaluated the tradables not with a hedging by the call rate, but with the world market portfolio. On the other

96 We checked symptoms of autocorrelation in both level and squared returns (Enders 1995; Fong 1997; de Santis and Gerard 1997; Theodossiou, Kahya, Koutmos, and Christofi 1997). From the procedure, we would say Period 1 non-tradable non-manufacturing portfolio would be AR(1), Period 3 tradable all-firms' portfolio and non-tradable non-manufacturing portfolio could be GARCH(1,1), and Period 3 tradable manufacturing and non-manufacturing portfolios may be GARCH(1,2). All the other period portfolios did not show evidence of serial correlation. Concerning the pooled portfolios of Period 2 non-tradable all-firms' / non-manufacturers, although the DGP could be ARMA(2,2), an F-test rejected the null of equality in DGP between the two groups of firms. Similarly, Period 2 non-tradable portfolios for manufacturers and non-manufacturers dismissed the time series equality by an F-test, although the pooled data exhibited a possible ARMA(2,1). Finally, though Period 3 tradable manufacturing / non-manufacturing combined data showed some evidence for GARCH(1,1), only non-manufacturing data converged to GARCH(1,1) by the Kalman filter procedure.
<table>
<thead>
<tr>
<th>Period 1</th>
<th>Tradables</th>
<th>Non-tradables</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-firms' vs.</td>
<td>Cannot reject DGP equality; no serial correlation.</td>
<td>Cannot reject DGP equality for AR(1) at 5% with F(2, 76) = 1.0423372.</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td>By inspection, different DGP.</td>
</tr>
<tr>
<td>All-firms' vs.</td>
<td>Cannot reject DGP equality; no serial correlation.</td>
<td>By inspection, different DGP.</td>
</tr>
<tr>
<td>Non-manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing vs.</td>
<td>Cannot reject DGP equality; no serial correlation.</td>
<td></td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-firms' vs.</td>
<td>Cannot reject DGP equality; no serial correlation.</td>
<td>Cannot reject DGP equality for ARMA(2,2) at 5% with F(5, 132) = 1.2653544.</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td>Different DGP; reject ARMA(2,2) for the pooled portfolio at 5% with F(5, 132) = 2.6233124.</td>
</tr>
<tr>
<td>All-firms' vs.</td>
<td>Cannot reject DGP equality; no serial correlation.</td>
<td></td>
</tr>
<tr>
<td>Non-manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing vs.</td>
<td>Cannot reject DGP equality; no serial correlation.</td>
<td></td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-firms' vs.</td>
<td>By inspection, different DGP.</td>
<td>Cannot reject DGP equality for GARCH(1,1) at 5% with F(4, 156) = 0.07392615.</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td>By inspection, different DGP.</td>
</tr>
<tr>
<td>All-firms' vs.</td>
<td>By inspection, different DGP</td>
<td></td>
</tr>
<tr>
<td>Non-manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing vs.</td>
<td>Reject DGP equality; the non-manufacturing portfolio fits GARCH(1,1), though the manufacturing cannot.</td>
<td>By inspection, different DGP.</td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.5. (Continued)

Panel B: ICAPM result comparison among all-firms’, manufacturing, and non-manufacturing portfolios.

<table>
<thead>
<tr>
<th>Period</th>
<th>Tradables</th>
<th>Non-tradables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Period 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-firms’ vs. Manufacturing</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 86) = 0.14.</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 71) = 0.03.</td>
</tr>
<tr>
<td>All-firms’ vs. Non-Manufacturing</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 86) = 0.21.</td>
<td>Observationally same ICAPM results.</td>
</tr>
<tr>
<td>Manufacturing vs. Non-Manufacturing</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 86) = 0.28.</td>
<td>Observationally same ICAPM results.</td>
</tr>
<tr>
<td><strong>Period 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-firms’ vs. Manufacturing</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 118) = 0.34.</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 135) = 0.09.</td>
</tr>
<tr>
<td>All-firms’ vs. Non-Manufacturing</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 118) = 0.72.</td>
<td>Observationally same ICAPM results.</td>
</tr>
<tr>
<td>Manufacturing vs. Non-Manufacturing</td>
<td>Cannot reject ICAPM equality at 1%; F(3, 118) = 0.91.</td>
<td>Observationally same ICAPM results.</td>
</tr>
<tr>
<td><strong>Period 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All-firms’ vs. Manufacturing</td>
<td>Observationally same ICAPM results.</td>
<td>Cannot reject equality at 1%; F(3, 156) = 0.44.</td>
</tr>
<tr>
<td>All-firms’ vs. Non-Manufacturing</td>
<td>Observationally same ICAPM results.</td>
<td>Observationally same ICAPM results.</td>
</tr>
<tr>
<td>Manufacturing vs. Non-Manufacturing</td>
<td>Observationally same ICAPM results.</td>
<td>Observationally same ICAPM results.</td>
</tr>
</tbody>
</table>
Table 4.5. (Continued)


\[ R_t^i - R_{t-1}^i = \alpha^i + \beta^i(R_t^m - R_{t-1}^m) + \beta^i(R_t^c - R_{t-1}^c) + \epsilon_t^i, \quad i = T, NT. \]

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradable Portfolio</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>( \chi^2(11) = 26.8423 *** )</td>
<td>( \chi^2(15) = 21.04982    )</td>
<td>( \chi^2(20) = 42.31561 *** )</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>-0.4905308 (-3.411962) ***</td>
<td>-0.5838849 (-5.183597) ***</td>
<td>-0.4900217 (-4.791893) ***</td>
</tr>
<tr>
<td>Correlogram</td>
<td>t-1</td>
<td>t-1</td>
<td>t-1</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 42) = 8.57 ***</td>
<td>F(3, 59) = 10.47 ***</td>
<td>F(3, 79) = 25.65 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0744048 (0.19)</td>
<td>0.0334771 (0.13)</td>
<td>-0.3574678 (-0.98)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-0.0769027 (-0.01)</td>
<td>13.3322 (1.66)</td>
<td>-42.11953 (-1.49)</td>
</tr>
<tr>
<td>MSCI World index</td>
<td>74.74501 (4.89) ***</td>
<td>57.90748 (4.69) ***</td>
<td>157.446 (7.89) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>15.2177 (0.38)</td>
<td>-36.55721 (-1.43)</td>
<td>-25.87605 (-0.70)</td>
</tr>
<tr>
<td><strong>Non-tradable Portfolio</strong></td>
<td>( \bar{R}^{NT} = 0.8077148 (1980:12-1984:02) )</td>
<td>( \bar{R}^{NT} = 1.555533 (1984:03-1990:02) )</td>
<td>( \bar{R}^{NT} = -1.15228 (1990:03-1996:12) )</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>( \chi^2(9) = 13.99172 )</td>
<td>( \chi^2(15) = 14.04712 )</td>
<td>( \chi^2(20) = 32.32924 ** )</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>-0.3081201 (-1.820097) **</td>
<td>-0.2909151 (-2.4049) **</td>
<td>-0.331871 (-2.937964) **</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>t-1</td>
<td>t-1</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 35) = 0.55</td>
<td>F(3, 67) = 7.75 ***</td>
<td>F(3, 78) = 22.18 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.1539624 (-0.24)</td>
<td>0.0840051 (0.23)</td>
<td>-0.3438644 (-0.80)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-7.529301 (-1.10)</td>
<td>22.30378 (2.72) **</td>
<td>-47.59977 (-2.06) *</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>6.586192 (0.47)</td>
<td>37.66217 (3.73) ***</td>
<td>142.4768 (8.14) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>-2.561792 (-0.09)</td>
<td>-72.9154 (-2.31) **</td>
<td>-11.75226 (-0.32)</td>
</tr>
</tbody>
</table>

Notes: *** indicates significance of 1% level. ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. All the regressions, except for Period 1 non-tradable portfolio, are by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS. Period 1 non-tradable estimation is by the OLS.
Table 4.5. (Continued)

\[ R_{t}^i - R_{t-1}^i = \alpha^i + \beta^i (R_{t}^i - R_{t-1}^i) + \beta^{i\sigma} (R_{t}^\sigma - R_{t-1}^\sigma) + \beta^{i\tau} (R_{t}^\tau - R_{t-1}^\tau) + \varepsilon_t, \quad i = T, NT. \]

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{R}^2 = 0.4370048 ) (1980:12-1984:10)</td>
<td>( \bar{R}^2 = 2.175717 ) (1984:11-1990:01)</td>
<td>( \bar{R}^2 = -1.044602 ) (1990:02-1996:12)</td>
</tr>
<tr>
<td>Tradable Portfolio</td>
<td>Breuch-Godfrey Statistic</td>
<td>Breuch-Godfrey Statistic</td>
<td>Breuch-Godfrey Statistic</td>
</tr>
<tr>
<td></td>
<td>( \chi^2(11) = 18.66618 ) *</td>
<td>( \chi^2(15) = 31.14054 ) ***</td>
<td>( \chi^2(20) = 39.88179 ) ***</td>
</tr>
<tr>
<td></td>
<td>Durbin's h statistic</td>
<td>Durbin's h statistic</td>
<td>Durbin's h statistic</td>
</tr>
<tr>
<td></td>
<td>-0.5872722 (-4.3136) ***</td>
<td>-0.4823422 (-4.063446) ***</td>
<td>-0.5010027 (-5.047159) ***</td>
</tr>
<tr>
<td></td>
<td>Correlogram</td>
<td>t-1</td>
<td>t-1</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>t-1, t-6, t-7</td>
<td>t-1</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>0.1798577 (0.52)</td>
<td>0.1089074 (-0.28)</td>
</tr>
<tr>
<td></td>
<td>US T-Bill Rate</td>
<td>-4.180417 (-0.49)</td>
<td>-21.71897 (-0.76)</td>
</tr>
<tr>
<td></td>
<td>MSCI World Index</td>
<td>58.63855 (3.28) ***</td>
<td>63.67142 (3.68) ***</td>
</tr>
<tr>
<td></td>
<td>Call rate</td>
<td>26.02494 (0.58)</td>
<td>-24.04689 (-0.57)</td>
</tr>
<tr>
<td>Non-tradable Portfolio</td>
<td>Breuch-Godfrey Statistic</td>
<td>Breuch-Godfrey Statistic</td>
<td>Breuch-Godfrey Statistic</td>
</tr>
<tr>
<td></td>
<td>( \bar{R}^{NT} = 0.3539889 ) (1980:12-1984:02)</td>
<td>( \bar{R}^{NT} = 1.984122 ) (1984:03-1990:02)</td>
<td>( \bar{R}^{NT} = -1.27789 ) (1990:03-1996:12)</td>
</tr>
<tr>
<td></td>
<td>Durbin's h statistic</td>
<td>Durbin's h statistic</td>
<td>Durbin's h statistic</td>
</tr>
<tr>
<td></td>
<td>-0.405617 (-2.456143) **</td>
<td>-0.2441569 (-1.985408)</td>
<td>-0.3321885 (-3.00188)</td>
</tr>
<tr>
<td></td>
<td>Correlogram</td>
<td>t-1</td>
<td>t-1</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>None</td>
<td>t-1</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-0.2210054 (-0.05)</td>
<td>-0.2285045 (-0.63)</td>
</tr>
<tr>
<td></td>
<td>US T-Bill Rate</td>
<td>8.415324 (1.10)</td>
<td>-31.78487 (-1.35)</td>
</tr>
<tr>
<td></td>
<td>MSCI World Index</td>
<td>40.402069 (4.87) ***</td>
<td>125.7494 (7.37) ***</td>
</tr>
<tr>
<td></td>
<td>Call rate</td>
<td>-4.636864 (-0.37)</td>
<td>-64.6084 (-3.39) ***</td>
</tr>
</tbody>
</table>

Notes: *** indicates significance of 1% level, ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. All the regressions, except for Period 2 non-tradable portfolio, are by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS. Period 2 non-tradable estimation is by the OLS.
hand, the unrestricted investors for the non-tradables did not have world ICAPM valuation in the first half of the 1980s, then, in the second half, they could have been aware of the influence of the world market portfolio. The estimation indicates there may have been integration spillover from the tradables to the non-tradables in Period 2. Moreover, the negative non-tradable coefficient for the call rate suggests Period 2 financiers for the non-tradables might have become net-lenders. We have seen in Chapter 2 that the “internationalizing” deregulation may have contributed to a speculative and explosive flow of liquidity. Furthermore, as Figure 4.3 exhibits, the call rate was continuously low during the second half of the 1980s; i.e., the policy was expansionary (Konya 1995). It might be possible to say our negatively significant $\beta^{NTe}$ in Period 2 is consistent with a description of the late 1980s in Japan, where the Japanese investors were awash with liquidity, enough to make them net-lenders who expected to have interest income in the future. Finally, in Period 3, although all the Japanese stocks achieved the highest correlation with the world market portfolio, the effect of domestic monetary policy represented by the call rate could have disappeared from the entire home stock appraisal.

Figure 4.3.
4.6 Chapter summary

In this chapter, we recognized the investors' intertemporal optimization proposed by ICAPM, and introduced a possible effect of the monetary policy on the future contingency in the model. We have hypothesized that as long as the traditional institutional framework for the monetary policy transmission mechanism worked, the Japanese non-tradable portfolio return could be respondent to the traditional policy tool, i.e., the call rate, while the deregulated tradable portfolio return was not influenced by the domestic liquidity. At the same time, we have expected that the world market portfolio would be correlated with the tradable return, and that its influence would spill over to the non-tradables. While our empirical results are not uniformly supportive of the ICAPM framework, they do produce some evidence for these conjectures during the 1980s when the deregulation was in progress, and hence, the Main Bank System still functioned somehow for the monetary transmission. After the near completion of the financial liberalization, the model in the first half of the 1990s results suggest almost comprehensive integration of the TSE with the world market, but without an indication for the influence of the call rate.

This chapter thus describes a possible evolution of the power of the traditional monetary policy over the TSE at each stage of the internationalizing financial deregulation. The finding could be relevant for a policy discussion. Based on these points, we advance to possible policy suggestions in the final chapter.
CHAPTER 5

Conclusion:
Things you should not do when you deregulate your capital market

In this dissertation, we have studied the Japanese financial deregulation in the context of capital market integration. We have defined a concept of integration where the shares of internationalized corporations are appraised by an international factor with relatively weakened domestic influence both at home and abroad. The theory of integration suggests that the evaluation of integrated firms (tradables) would spill over to the pricing of segmented corporations (non-tradables) that have the same nationality as the tradables.

Based on these predictions, we have composed three hypotheses. First, Japanese policy could have intervened in a natural market process of discerning the tradables from the non-tradables, which may have created a market of the two distinguished types of assets. Second, there would have been integration spillover from the tradables to the non-tradables during the deregulation. Third, the strengthened international factor should have accompanied the weakened domestic factor, including especially the power of traditional monetary policy. We have tested each of these propositions using monthly share return data from the Tokyo Stock Exchange (TSE) for 1980:12-1996:12. In general, we have
obtained supportive results for our conjectures, though there are several notable anomalies.

In Chapter 2, we have summarized the process of Japanese financial deregulation both descriptively and quantitatively. The deregulation policy could be regarded as a departure from the traditional Main Bank System because it artificially differentiated the firms that could raise capital globally from the rest. This period of liberalization coincides with the speculative bubble and its collapse in the capital market, to which the weakened Main Bank monitoring, caused by the deregulation, may have contributed. Numerically, we have detected possible statistical differences between the returns of the firms that were permitted to procure funds overseas (the tradables) and those of the others that stayed home (the non-tradables). Furthermore, CUSUMSQ and LM-tests found two structural breaks, in 1984 and 1990, in the relationship between the tradable / non-tradable portfolio and the world portfolio. Though statistically weak, the first structural break in 1984 could have occurred first to the non-tradables. We suspect the reason for an earlier break in the non-tradable return would have come from the deregulation for the capital provider, i.e., the main banks.

Chapter 3 investigated the evolution of integration in the TSE using the mild segmentation model. As expected, the tradables have supported a hypothesis of integration throughout the sample period, although in Period 2 their valuation may have violated the model assumption for rational investor optimization. On the other hand, the examination of the return of the non-
tradables has reported evidence that only for Period 2 they could be integrated. However, the estimation has suggested that the Period 2 non-tradable appraisal may have departed from the standard assumption of mean-variance optimization by the investors. Moreover, Periods 1 and 3 non-tradable loading for the domestic factor could be smaller than the pricing for the tradables. This is contradictory to the model, and hence, as a whole, the mild segmentation hypothesis has been rejected. We have conjectured that the result is due to poor model specification for the Japanese market, problems in variable proxies, and/or the policy changes that did not emphasize building a new system for investment evaluation.

Finally in Chapter 4, we recognized the investors' intertemporal optimization, and introduced a possible effect of monetary policy on the future contingency, using the intertemporal capital asset pricing model (ICAPM). We have postulated that, as long as the traditional institutional framework for the monetary policy transmission mechanism works, the Japanese non-tradable portfolio return should respond to the policy tool, i.e., the call rate, while the deregulated tradable portfolio return is not influenced by the domestic liquidity. At the same time, we have expected the world market portfolio is significant for the tradable return, and its influence spills over to the non-tradables. Our examination has confirmed these suppositions during the 1980s when the deregulation was under progress, and thus, the Main Bank System still functioned somehow for monetary transmission. However, after the near-
completion of the financial liberalization, the ICAPM estimation for the first half of the 1990s tells us that the entire TSE could have had the high correlation with the world market, but without an influence of the call rate. It would mean either that the ICAPM specification is wrong, or that the call rate was not the forecasting variable of the domestic business cycle any more even for the non-tradable valuation.

From these findings, we may present several policy suggestions. Let us start from the implications of statistical differences between the tradable and non-tradable portfolios. There are divergences between the two portfolios in DGP and in possible structural breaks. We have also suspected the 1984 non-tradable break could be because the deregulated main banks (tradables) spilled over the international influence to the pure domestic, and main-bank dependent, corporations. Though it could be an unexpected market reaction for the policy makers, the unforeseen may be deduced from the theory of integration.

Recall one of the reasons why integration can reduce the cost of capital. The literature argued that an expanded investor population would bring higher trading volume. It is true that an increased exchange will create more hedging opportunity within an integrated market. However, more diversification by the financiers would be far from a more stable market. Large market transactions can not only lower the capital cost by narrower bid-ask spreads but also increase volatility, and thus more uncertainty, because of its volume. Moreover, we have
found in Chapter 2 that the integration spillover would have been through the tradable volatility. In other words, Japanese deregulation for integration contained inherent precariousness. What was required for the policy planners would have been to provide a new regulatory framework, such as new disclosure measures, for the market of their jurisdiction to minimize the negative impact of higher uncertainty. At the very least, before embarking on the liberalization of capital markets, policy makers should have prepared well enough for the more complicated and unexpected development of the domestic market, with contingency plans to minimize the impact of new market unpredictability.

Unfortunately, we may say the Japanese deregulatory policy was inadequate in this respect. As Appendix 1 depicts, all the measures were primarily aimed at the tradable firms, and there was no discussion how to build a volatile but efficient new market for the firms who were left behind the fashionable international capital-raising. Together with the result of mild segmentation analysis, this fact leads to our next prescription. That is to say, with our study in Chapters 2 and 3 we may reinterpret the Japanese capital market of the 1980s as follows.

In Chapter 2, we have reviewed the literature reporting that during the 1980s the main banks aggressively bought Japanese corporate securities issued overseas by the fleeing customers. In other words, the main banks transferred their role of corporate monitoring to security markets where not only they but also other
investors anonymously participated. Remember, for the traditional Main Bank System, financing and exclusive knowledge of their customers’ business were complementary to maintain sound investment. In contrast, note that the newly deregulated method to finance Japanese business was more incognito, while the ownership claim in aggregate did not change a lot from the pre-deregulatory arrangement. Unless the foreign market where a transaction occurred had stricter disclosure rules than Japan, it was fairly likely that the deregulated corporate monitoring would be more lenient than that of the traditional Main Bank System.

There is a study by Biddle and Saudagaran (1989) which informed that, already in 1981:12, the absolute majority of Japanese choice for multiple-listing was at Frankfurt (55 cases) and Luxembourg (53), in contrast to AMEX (0) or the New York Stock Exchange (6). The authors pointed out that the exchanges of economies with direct financing supremacy (such as West Germany in the 1980s) had far more lax disclosure requirement than the markets dominated by indirect financing (such as the US). Moreover, a test result of them showed, ceteris paribus, firms cross-listed their shares at a market with easier disclosure regulations than home. In other words, from the very beginning of the deregulation, Japanese tradables would have deliberately chosen their playing

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97 Biddle and Saudagaran (1989) reasoned the phenomena with an argument by Gray (1980). According to Gray, informational transparency at the stock exchange can encourage optimistic profit reports and higher dividend payments by the corporations in order to appease shareholders’ demand, which is a wealth transfer from the debt holders. Naturally, a market dominated by debt holders, i.e., lending banks, prefers limiting the openness in the stock market regarding business information.
field for more tolerant corporate monitoring. Furthermore, according to Weisbrod, Lee, and Rojas-Suarez (1992), the deregulation decreased the rent the financiers received from monitoring. A main banker could now discard the less profitable traditional role of supervising, unless there was a new incentive for them to oversee corporations as before. For the non-tradable capital procurement, we have seen the literature describing Japanese faith in land as collateral. With the main banks abandoning their traditional supervising role, but clinging to the largest ownership claim by security and/or collateral holding, the capital market should have questionable asset valuations with the integration. On top of all of these, there was no new policy to maintain (at least) sound corporate monitoring under the market liberalization.

On the other hand, in Chapter 3 the Japanese stock data have rejected the mild segmentation model. We have mentioned a possibility of mismatch between the data and the CAPM supposition for rational optimization. The chapter also noticed, provided the model specification is correct, a probable relation between the policy design and the failure of the model prediction. We could also suspect a problem in asset evaluation after the deregulation may be reflected in the lower significance of the Period 3 domestic factor for the non-tradables than for the tradables. That is to say, the mild segmentation model suggests if the financiers evaluate their investment in accordance with the assumptions for optimization, the non-tradable pricing should have higher domestic loading than the internationalized tradables. Since the non-tradable
firms were financed by the unrestricted home investors, the low home factor pricing for the non-tradables may signify that the disassembled Main Bank System had failed to assess domestic business adequately, and consequently could have reduced the domestic investment. This might be consistent with the Japanese credit crunch and the debt-problems of the banking sector in Japan from 1990. Namely, the deregulation without new rules could have contributed to the asset pricing turbulence during the liberalization in our study.

The obvious policy suggestion is that the policy makers should have done it the other way round. Namely, the Japanese experience indicates to us that to liberalize a capital market the new policy must include measures for reconstructing the domestic system of asset evaluation. Otherwise, without a universal agreement for stricter disclosure rules, the entire capital market will play for integration with moral hazard, which could end up with a sclerotic financial system suffocated by non-performing loans, as in Japan from the 1990s.

Finally, our study with ICAPM suggests that the evaluation problem in the capital market could feed back to monetary policy. Suppose ICAPM is correct with the monetary policy variable as Shanken (1990), Turtle, Buse, and Korkie (1994),

98 Of course, whether we need such system is another topic of international economy / politics. The OECD Regulatory Study (1997) pointed out the importance of international regulatory alignment, such as BIS regulation, but also suggested indispensable reorganization of domestic corporate monitoring rules when an economy deregulates its financial sector.

99 By an approach of political economy, Kanaya and Woo (2000) reached the same conclusion as ours for the Japanese deregulation and monitoring system during the 1980s.
and our study have hypothesized. Like it or not, this ICAPM asset market will watch the activity of the central bank closely, and express their evaluation of the policy at every moment of time.¹⁰⁰ Moreover, as in Japan, financial deregulation lets swings of the asset market affect more the business of financial intermediaries, and hence the liquidity available in the market (IMF 2000). At the same time, the more liquid and internationally sophisticated the assets markets are, the more complex a monetary transmission mechanism should be. In consequence, domestic monetary policy could face difficulty in predicting its effect. (Wagner 2000.) However, Woodford (2002) pointed out that financial market deregulation is not incompatible with better monetary management. Though the policy path would be different from the good-old days, an increased efficiency of the market with a new regulatory framework could spill over to the monetary policy transmission. The only thing the authority should achieve would be a swift adjustment in policy target, instrument, and / or the level of the intensity in the open market operation. (Woodford 2002.)

On the other hand, the change in the vigilant ICAPM market would prepare differentiated challenges for each central bank, depending on the nature of the pre-deregulatory transmission mechanism. These might be the reasons why there are divergent outcomes from the deregulation and the global shift to international indirect financing in the 1980s. For example, some monetary policy makers could have succeeded smoothly in adopting the new policy measures

¹⁰⁰ Recall, ICAPM is static so that the market is at equilibrium for each second.
brought by the deregulation. They might have been able to do so because their traditional transmission path had been accustomed to incorporating the reaction of the market into the policy. In contrast, some others would have confronted greater difficulty in accepting the new market because of their familiar, but rigid, top-down monetary management. Sadly, Japan might be the case of the latter category. Let us interpret our ICAPM result on this line.

In Chapter 4, we have observed that the non-tradable portfolio valuation would not fit to the ICAPM in Period 1, and possibly in Period 3. This may be due to a problem in model specification. Nevertheless, we have not encountered, either, definite evidence to reject the model completely. Thus, let us suppose the ICAPM for the Japanese market is appropriate. In this framework, the estimation result simply states that the Period 3 call rate failed to influence the non-tradable pricing. Moreover, the insignificant coefficients in Period 3 for the call rate does not necessarily mean that the investors for the non-tradables do not interpret the Main Bank System valuation as a future economic indicator any more, nor that they have discarded the ICAPM completely. We have argued that, if the domestic firms were required to ask for help from the main banks, but the relation between the call rate and the activity of the banks had been severed, then, whatever the stimulus via the call rate, the monetary policy would be in effective in influencing asset values. When, on the other hand, bankers adjusted the liquidity holding to the monetary policy, but abstained from intermediating it to the needy economy due to, say, the BIS
regulation, there could be no policy influence for the value of the non-tradable business either. Finally, if all the connections among the call rate, the main bankers, and the domestic economy broke down, any asset pricing of our assumed market would receive no effect of the policy, even though the valuation was still by ICAPM.

Notice that even without the differentiating regulation, the nature of non-tradable business hinders those firms from venturing out abroad. If the ICAPM assumption is relevant for the non-tradables, the investment in the non-tradables will always require a hedge against the domestic business cycle that will keep affecting the non-tradable cash flow. Therefore, there might be another new state variable(s) that do(es) not respond to the policy rate, and that produced the rejection to our specification with the older call rate. The ICAPM valuation might survive, but it shall pose a challenge to the traditional Japanese economic policy with its insignificant call rate.

Unless the government obtains a productive relation with the new hedging variable(s), any economic policy would not be able to respond constructively with the capital market, and hence the business consumption. There could occur monetary policy forbearance (IMF 2000) which represents an unnecessarily long, sluggish, and unconscious looser / tighter money supply, threatening price stability (IMF 2000; Ahearne et al. 2002). If the new hedging tool reflects a straight global market force, such as a dislike of the pro-cyclical non-tradable business or less-diversification opportunity with the non-tradables, their capital
cost should shoot up, compared with prices under the protective traditional Main Bank System. When, in addition, the BOJ could not achieve price stability because of the monetary forbearance, and there was no economic policy to support promising small businesses to acquire capital from the deregulated free market, the non-tradable firms could be thrown into a wilderness devoid of any means to call for help under contraction. Political meddling within the economy would be in order. It could be hard for the nation to prepare a macro-environment of swift restructuring that encourages an exit for non-viable businesses and establishment of new and promising projects (regulatory forbearance, IMF 2000). This could be one of the reasons for the credit crunch in the first half of the 1990s in Japan.

Furthermore, without a new institution that can interact with hedging variables, domestic information about future contingencies could be disseminated so chaotically that the ICAPM investors in Japan would lose their compass, even if they tried to find the state variable. The market would become inefficient, where the agents cannot exploit the available information fully to reach equilibrium in project evaluation. An inefficient capital market should see a subsequent credit contraction in its entirety because of Gresham's Law. The end-product would be a protracted recession (IMF 2000), which would hurt particularly the vulnerable agents of the economy, i.e., the non-tradables. We know, after our sample period, that Japan keeps struggling with a continuously
shrinking economy. This might be part of the causes that have produced the current Japanese situation.

Of course, the above is a possible scenario assuming our ICAPM specification is viable for the Japanese asset market. Nevertheless, when the ICAPM reasoning cannot be rejected, the best policy prescription would be to avoid such a breakdown of the relationship in the first place. Namely, central bankers of a deregulated capital market should be attentive to the correlation between the policy and the hedging portfolio, and should continue to send clear messages of future domestic business cycles to the market. For those poor monetary authorities who lost touch, the first thing to do should be to take steps to restore the global capital market's confidence in them, possibly through sensible dialogue in reconstructing a correlation between the policy and the probably new hedging variable for unrestricted investors.

Due to the assumptions in the models employed for the empirical testing, there are several issues purposely ignored for our analysis of the Japanese capital market deregulation. One of them is about a relation between the policy and the real-financial linkages within the economy. As the rent for goods market diversification suggests, the globalization of the real market would have played a significant role for the Japanese evolution of financial market deregulation. Moreover, we have briefly mentioned in Chapter 2 the real-side linkage within the Main Bank System. In particular, we know there was an intimate buyer-seller
relation of products among corporations belonging to a business group. If the connection was between the tradables and the non-tradables, the integration spillover might have happened on the business appraisal of the non-tradables through this route of the traditional Main Bank System. Though in Chapter 4 we have tentatively tested the topic with the portfolios of manufacturing / non-manufacturing corporations, throughout the dissertation we have implicitly assumed that the effect of goods market internationalization is neutral. The subject should be explored further with more elaborate discussions for the linkage between the integration and the globalization.

Another aspect we have neglected is the reaction of consumption to the financial deregulation. Since we have chosen the asset pricing models derived from the standard assumption of CAPM, our investors-cum-consumers are supposed to be concerned primarily with their wealth maximization. That is to say, we have supposed that actual consumption out of the maximized wealth has no direct effect on optimization (Eichberger and Haper 1997). However, it may be difficult to say this simplification was a proper choice, especially when we have observed a poor fit of the model in Chapter 3. The elements of changes in the real economy, such as consumption, would be an important factor to consider for asset pricing and policies for capital market. As a matter of fact, Vredin (1996) discussed that the financial deregulation in Europe changed the pattern of consumption, which made the new business cycle closer to Ricardian equivalence, and / or higher volatility, i.e., uncertainty, in the asset market. It
also would be possible to expand our discussion to incorporate the relationship
between integration and the call rate to consumption, including business
consumption.

There are of course many other omitted but very important points about the
Japanese capital market deregulation, some of which have been mentioned in
the footnotes as future research topics. Nonetheless, we hope our study can
contribute some considerations for economies engaging in capital market
deregulation / internationalization.
APPENDIX 1.


1979:03  Non-collateralized convertibles were introduced for the firms of at least 150 billion yen net worth (the number of eligibles, 2).

1979:05  The introduction of domestic certificate of deposit (CD) market.

1980:04  A relaxation of the domestic CD issuance.


A revision of the Securities and Exchange Law.

1981:07  Japanese banks’ overseas subsidiaries were allowed to lend euroyen (for one year or less) to finance trade with residents.

1981:10  An introduction of new bank debenture was sanctioned.


1983:01  The non-collateralized convertible eligibility was reduced to the minimum of 110 billion yen (the number of eligibles, 11 → 25).

1983:02  City banks’ overseas subsidiaries were allowed to float bond issues abroad to finance parent banks’ offshore lending.

Securities companies were partially approved selling foreign-currency zero-coupon eurobonds to residents.

More relaxation of the domestic CD issuance.

1983:04  The yen-foreign currency conversion limits were relaxed for foreign banks operating in Japan.

1983:05  Japanese banks were permitted to lend overseas yen on a long-term basis to borrowers of their choice.

1983:06  Securities houses were authorized to extend personal loans with public bonds as collateral.

1983:10  Issuance of unsecured bonds by Japanese residents in overseas market was allowed (with restriction).

1984:01  More relaxation in the domestic CD.
1984:04 The non-collateralized convertible eligibility was reduced to 55 billion yen (the number of eligibles, 26 → 97).

An introduction of swap, including bonds with detachable warrants.

The Real Demand Doctrine was ended with respect to the requirement of underlying trade / securities transactions for forward foreign exchange transactions by residents.

Euroyen bond (straight and convertible) issues by residents were allowed.

An introduction of commercial paper (CP) in Japan.

More relaxation in CD trading (domestic and overseas).

1984:05 The Yen-Dollar Agreement for internationalization of yen.

Including the prospects for
(1) A creation of the banker’s acceptance market,
(2) More permission for Japanese banks to participate in the Euromarket,
and,
(3) A creation of the offshore facilities in Tokyo.

1984:06 The swap limit was abolished.

The ban on short-term euroyen lending to residents was lifted.

The restrictions on conversion of foreign currency into yen were abolished.

1984:07 The Real Demand Doctrine was abolished completely.

Investment in Japanese real estate by non-residents was liberalized.

1984:12 The Designated Securities Firms System was ended.

Lead management of euroyen bond issues was liberalized.

Issuing of euroyen CDs (up to six months’ maturity) was authorized for overseas branches of Japanese banks and foreign banks.

1985:01 The first unsecured straight corporate bond was issued.

1985:04 An abolition of withholding tax on earnings from eurobonds issued by residents for non-residents.

The regulations preventing currency swaps were lifted.

More relaxation in the domestic CD issuance.

1985:06 “Dual-currency” euroyen bond issue was sanctioned.

More relaxation in the domestic CD market.
1985:07 The non-collateralized convertible eligibility was down to 33 billion yen (the number of eligibles, 111 → 175).

The criteria for resident euroyen convertible bond issues were relaxed.

1985:09 Plaza Accord.

1985:10 The criteria for resident euroyen bond (straight and with warrants) issues were relaxed.

More relaxation in the domestic CD issuance, and an introduction of domestic Money Market Certificate (MMC).

1985:11 Japanese securities firms lifted a “self-imposed” restriction on domestic trading of warrants detached from the bonds with which they were issued.

The first euroyen straight bond was issued.

1986:04 Floating-rate euroyen notes and currency conversion euroyen bond issues were sanctioned.

The period during which “flow-back” of resident euroyen bond issues into Japan was barred was cut from 180 to 90 days.

More relaxation in the domestic CD / MMC issuance.

1986:06 Foreign banks were authorized to issue euroyen bonds.


1986:12 The operation of the Tokyo offshore market was commenced.

1987:02 The non-collateralized convertible eligibility was reduced to 20 billion yen (the number of eligibles, 180 → 330+).

An introduction of a rating system for convertible issues.

The contents included

1) Any firm of rating at least A could issue non-collateralized convertibles without any requirements, and,

2) Firms rated BBB and having at least 55 billion yen of net worth were allowed to issue non-collateralized convertibles.

180 firms were permitted the issuance of unsecured straight debt.

1987:04 More relaxation of the domestic CD issuance.

1987:05 Bond short sales were allowed.

Banks, securities houses and insurance companies were approved to trade in overseas financial futures markets.
1987:06 The restrictions on the issue of euroyen bonds with a four-year maturity were lifted.

A re-introduction of domestic stock future market.

1987:07 The criteria for resident euroyen bond issues were relaxed.

1987:10 The complete abolition of the domestic CD issuance ceiling.

1987:11 The euroyen CP market was established.

1988:04 The Tax Reform Act (enforced 1989:04)

A reduction of securities transaction tax on bond transactions, and an introduction of wider capital gains taxation with an abolition of tax exemption for interest on small savings deposits.

The maximum maturity of euroyen CDs was extended from one to two years.

More relaxation in the domestic CD issuance.


Banks were allowed to securitize mortgage loans.

The non-collateralized convertible eligibility for BBB firms was down to 33 billion yen (the number of eligibles, 330+ ➔ 500+).

The BOJ declared a change in its operation that would be more market-oriented through papers with shorter maturities, an extension of the maximum contract period in the uncollateralized call market from three weeks to six months, and the open market operation in CP.

1988:12 The criteria for issuance of domestic / euroyen CP were relaxed.

The MOF required the 35 Japanese banks with overseas branches / subsidiaries to observe the minimum capital requirements of the BIS Regulation.

1989:04 An admission of after-issuance sales of detached warrants and ex-warrant bonds with maturities of more than four years.

1989:05 The voluntary restraint on medium and long-term euroyen loans to residents was abolished.

Facilities for bond borrowing and lending were introduced.

1989:06 Four-year minimum maturity threshold for non-Japanese issues of euroyen bonds was relaxed to three years.

The Tokyo International Financial Futures Exchange (TIFFE) launched.

A relaxation in MMC issues.

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1989:07  A liberalization of rules relating to residents' overseas deposits.
1989:10  An introduction of share price index option trading.
         More relaxation in MMC issues.
1990:02  CP issuance by securities companies was permitted, and the CP issuance
         criteria were eased.
1990:07  A relaxation of restriction on overseas deposit accounts.
1990:03  Banks were allowed to sell securitized corporate loans to institutional investors.
1990:07  The residents' overseas deposit holding was eased.
1991:04  The minimum net asset requirement (33 billion yen) for prospective issuers of CP
         was abolished.
1991:07  The TIFFE launched options on three-month euroyen.
1991:08  The MOF announced it would cease from issuing non-binding verbal directives to
         the institutions under its supervision and rely instead on stricter rules.
1991:10  Discretionary investment accounts were banned; compensating customers for
         investment losses was to incur criminal penalties.
1992:01  The MOF tightened the requirement for financial institutions to hold an increase in
         property lending below their overall lending growth.
         The Act includes
         (1) The easing of the regulation for business demarcation among
             banking, trust and security business,
         (2) Further admission of new financial products,
         (3) Updating informational disclosure requirement,
             and,
         (4) Reorganization of financial regulatory body.
1992:07  The criteria for resident euroyen bond (convertible, straight and with warrants)
         issues were relaxed.
1993:06  CP issuance by non-bank financial institutions was permitted.
1993:07  The criteria for resident issues of foreign currency-denominated bonds were
         relaxed.
1994:04  CP issuance by insurance companies was permitted.
1995:04 “Blanket approvals” became available to non-resident issuers of yen-denominated bonds inside and outside Japan, and to resident issuers of yen-denominated bonds outside Japan.

1995:10 CP issues of less than two weeks of maturity were sanctioned. More relaxation of the domestic CD issuance.

1996:01 “Issuance eligibility criteria” for bond issues in Japan by non-residents and for resident issues of euroyen bonds outside Japan were abolished in their entirety. An abolition of restrictions imposed on payment of interest by banks and securities companies against cash collateral posted by borrowers of bonds.

1996:02 Further relaxation of foreign exchange controls, including an easing of restrictions on resident holdings of foreign currency deposits abroad.

1996:04 The lock-up period in respect of resident issues of euroyen bonds was reduced from 90 to 40 days (the latter period was now also applied to dual-currency bonds). Bond repo market free from transaction tax was launched.

1996:11 The “Big Bang” Reformation Plan for the entire financial sector was advocated by the Cabinet.

APPENDIX 2.

CUSUMSQ statistics for tradable and non-tradable portfolios.

In this Appendix, we derive the CUSUMSQ statistic for our sample. The test is to describe graphically a departure of standardized prediction error from identically and independently normal distribution (i.i.d. normal) when a change occurs. The results will be regarded not as a rigorous hypothesis testing but as yardsticks (Brown, Durbin and Evans 1975). Namely, the procedure merely indicates an existence of a break when the prediction error first hits the boundary of i.i.d. normal due to cumulative deviation from the mean that is supposed to be zero without the break.101

The test is constructed as follows. First, we rewrite (2.2)

\[ R_t^i = a^i + b^i R_t^w + V_t^i, \quad i = T \text{ (tradables), NT (non-tradables), } t \in [1980:12, 1996:12], \]

with vectors, so that we have a regression model under the null of no-structural break such as

\[
(A1.1) \quad Y_t^i = X_{\beta}^i + V_t^i.
\]

The data-stream up until time t will be denoted such as

\[ 101 \text{ For an example of an empirical study, there is Batten, Ellis and Fetherston (2000) who used the CUSUM statistic to identify sub-periods for the time series of yen-dollar rate.} \]
Consider a case to predict $R_i$ using the data for $R_{1980:12}^i, R_{1981:01}^i, \ldots, R_{t-1}^i, i = T, NT$. The forecasted value, $\tilde{R}_i^t$, is obtained from $\tilde{R}_i^t = x_t \hat{\beta}_{t-1}^i$. The null hypothesis of no structural change at $t$ says

$$E[R_i^t - \tilde{R}_i^t] = 0, \quad \text{and,} \quad \text{var}[R_i^t - \tilde{R}_i^t] = \sigma^2 \{1 + x_t (X_{t-1}^i X_{t-1})^{-1} x_t^i\}$$

where $\sigma^2$ is the variance of $V_i^i$. We specify the recursive residuals such that

$$w_i^t = (R_i^t - x_t \hat{\beta}_{t-1}^i) / \{1 + x_t (X_{t-1}^i X_{t-1})^{-1} x_t^i\}.$$

The test statistic for CUSUMSQ is defined as

$$(A1.3) \quad WW_i^t = \sum_{j=3}^{t} (w_j^i)^2 / \sum_{j=3}^{193} (w_j^i)^2, \quad i = T, NT, \quad t = 3, 4, \ldots, 193,$$

whose mean is $(t-2)/191$. Based on Brown, Durbin and Evans (1975), the critical lines are,
(A1.4) $WW^i_t = \pm c_0 + (t - 2)/191$

where the value $c_0$ is determined to provide the equal probability for whichever line is crossed under the $H_0$ at the desired significance level. Harvey (1981) provides the values for $c_0$. We obtain $\hat{\beta}_{i-1}^i = (\hat{a}_{i-1}^i, \hat{b}_{i-1}^i)'$ from an OLS estimation using the above $X_t$ and compute $WW^i_t$ of (A1.3), for $t \in [1981:03, 1996:12], i = T, NT$. The result is shown in Table 2.10 and Figure 2.5.
APPENDIX 3.

LM-tests for tradable and non-tradable portfolios.

Andrews (1993) discussed a structural break test as a variation of a parameter consistency test.\(^{102}\) He also has derived for the purpose an asymptotic null distribution of the sequential likelihood ratio test called Max-LM (Lagrange Multiplier) test. The test for our model with identically and independently distributed residuals is defined as follows.

Let our definition in (2.2), (A1.1) and (A1.2) remain intact. Consider a case where there could be a one-time change in a series of sample size N at time N\(\pi\), \(\pi \in (0, 1)\). Since the sample of 1980:12-1996:12 consists of 193 months, N = 193. \(\pi\) is unknown. The parameters of the model at time \(t\), \(\beta_t^i\), \(i = T, NT\), are under the hypotheses for the structural break such as,

\[
H_0: \beta_t^i = \beta_0^i \text{ for all } t \geq 1.
\]

\[
H_A: \beta_t^i = \beta_1^i \text{ for } t = 1, 2, ..., N\pi,
\]

\[
= \beta_2^i \text{ for } t = N\pi+1, ..., N.
\]

To obtain a convergence of statistic, assume there would not be a break toward the beginning and the end of the series so that \(\pi \in \Pi = [0.15, 0.85]\).

---

\(^{102}\) Note this is a single, not a multiple, break test.
Consequently, we check the LM-statistic between 1983:04 and 1994:04. We assign $\lambda = (1-\pi)^2/\pi^2$, which is used with the tables of critical values in Andrews (1993).

Next, we redefine (A1.1) in terms of the Generalized Method of Moments (GMM) estimation in order to apply LM-tests. The model (A1.1) is for estimating $\beta^i$. Let $m[X_i, \hat{\beta}^i]$ be a continuous $K\times 1$, $K = 2$, vector function of estimated value of $\beta^i$, $\hat{\beta}^i$, whose expectation, $E[m[X_i, \hat{\beta}^i]]$ is finite for all $t$ and $\hat{\beta}^i$. Moreover, suppose with the true value of $\beta^i$, $E[m[X_i, \beta^i]] = 0$ so that the model (A1.1) satisfies the population moment condition for the GMM. That is to say, we run an OLS regression for $R_t^i = a^i + b^i R_t^w + V_t^i = (1 R_t^w)(a^i b^i)' + V_t^i = X_i B^i + V_t^i$, $X_t = (1 R_t^w)$, $B^i = (a^i b^i)'$, and $i = T$, NT. By OLS assumption, $E[V_t^i/R_t^w] = 0$. With the law of iterated expectation, we find

$$E[R_t^w V_t^i] = E[E[R_t^w V_t^i/R_t^w]] = E[R_t^w E[V_t^i/R_t^w]] = 0, \quad \text{and,}$$

$$E[X_t(R_t^i - X_t B^i)] = E[(V_t^i R_t^w V_t^i)] = (E[V_t^i] E[R_t^w V_t^i]) = (0, 0)$$

(Harris and Mátyás 1999). In other words, the GMM condition is satisfied for our OLS estimation with

$$m[X_i', \hat{B}^i] = X_i'(R_t^i - X_i'\hat{B}^i) = (\hat{V}_t^i R_t^w \hat{V}_t^i)'\hat{B}^i = \begin{bmatrix} \hat{a}^i \\ \hat{b}^i \end{bmatrix}.\]
Based on this GMM condition, we specify the terms of Andrews (1993) such that

\[
\hat{M}_i^i = (1/N) \sum_{t=1}^{N} \{ \partial m[X_t, \hat{\beta}_i^i \} / \partial (\hat{\beta}_i^i) \},
\]

\[
\hat{S}_i^i = (1/N) \sum_{t=1}^{N} (m[X_t, \hat{\beta}_i^i]) - \bar{m}_N^i)^2(m[X_t, \hat{\beta}_i^i] - \bar{m}_N^i),
\]

\[
\bar{m}_N^i = (1/N) \sum_{t=1}^{N} m[X_t, \hat{\beta}_i^i],
\]

\[
\bar{m}_N^i = (1/N) \sum_{t=1}^{N} m[X_t, \hat{\beta}_i^i], \quad i = T, NT, \quad N = 193.
\]

Then, the LM statistic can be written such that

\[
(A2.1) \quad LM_N^i [\pi] = (N/\pi (1 - \pi)) (\bar{m}_N^i) \hat{M} - \hat{S} (\hat{S}) - \hat{M} (\hat{M}) - \hat{S} \bar{m}_N^i,
\]

\[
i = T, NT, N = 193, \quad \pi \text{ denotes asymptotic equality. As } \pi \in \Pi = [0.15, 0.85]
\]

changes for (A2.1), there will be a point

\[
(A2.3) \quad \text{Max } LM_N^i [\pi]
\]

that is the candidate for a structural break. If (A2.3) is large enough comparing with a critical value reported by Andrews (1993), we reject the null of no-structural change.\textsuperscript{103}

From the above statistic definition, we derive the actual test statistics for our model. Namely, since we have

\[
\bar{m}_N^i = (1/N) \sum_{t=1}^{N} (\hat{V}_t^i, R_t^w \hat{V}_t^i)^\prime = (E[\hat{V}_t^i], E[R_t^w \hat{V}_t^i])^\prime = (0, 0)^\prime
\]

\textsuperscript{103} Piehl, Cooper, Braga and Kennedy (1999) examined the effect of Boston Youth Homicide Prevention Program with Max-LM test for OLS.
by the construction of OLS estimators, we can simplify the terms in (A2.1) such that

\[ \hat{S}^i = E[(\hat{\nu}_i)^2]C, \quad \text{where} \]

\[ C = \begin{bmatrix} 1 & E[R_{it}] \\ E[R_{it}] & E[(R_{it})^2] \end{bmatrix}. \]

Moreover, when we examine a case both the intercept and the slope coefficient have a structural shift,

\[ \hat{\mu}^i = \hat{\mu}^{\text{full}} = (-1) \begin{bmatrix} 1 & E[R_{it}] \\ E[R_{it}] & E[(R_{it})^2] \end{bmatrix} = -C. \]

Let the values for \( m_{itn} \) of our sample for each \( \pi \) be \( (A^i B)^\prime \), \( i = T, NT \). Then, for a full-break test, we write

\[
\begin{align*}
\hat{M}^{i} & = \hat{M}^{\text{full}} = (-1) \begin{bmatrix} 1 & E[R_{it}] \\ E[R_{it}] & E[(R_{it})^2] \end{bmatrix} = -C. \\
\end{align*}
\]

\[
(LM^N)^{\pi} = \{N/\pi(1-\pi)(A^{\prime}B)^\prime C^{-1}(A^{\prime}B)^\prime \}^{-1} E[(\hat{\nu}_i)^2]
\]

\[
\begin{align*}
= \frac{\{N/\pi(1-\pi)\}^{-1} \{E[(R_{it})^2] - 2 A^{\prime}B^{\prime} E[R_{it}] + (B^{\prime})^2\}}{E[(\hat{\nu}_i)^2] \{E[(R_{it})^2] - E[R_{it}^2]\}}
\end{align*}
\]

which is the full-break test statistic of Max-LM test for portfolio \( i = T, NT \).

Similarly, for a case of partial break with an intercept change, \( \hat{M}^{\text{intercept}} = (-1)(1 - E[R_{it}])' \). Therefore,
(A2.5) $LM_{N}^{i,\text{Intercept}}[\pi] = \frac{(N/\pi(1-\pi))([A]^{\prime}E(\hat{\gamma}^{2})]}{E((\hat{\gamma}^{2})^{2})}$.

If a break is only for a slope, $\hat{M}_{\text{Slope}}^{\pi} = (-1)(E[R_{i}^{w}]E[(R_{i}^{w})^{2}])$, and,

(A2.6) $LM_{N}^{i,\text{Slope}}[\pi] = \frac{(N/\pi(1-\pi))([B]^{\prime}E(\hat{\gamma}^{2})]}{E([\hat{\gamma}^{2}]^{2})E((R_{i}^{w})^{2})}$.

As Andrews and Ploberger (1994) demonstrate, the OLS conditions are applicable to Exp-LM (Exponential LM) test that is a stronger test for a structural change than the Max-LM test and valid for a small sample size. Hence, we can conduct another test of Exp-LM test for our model. The test statistic is defined as

(A2.7) $Exp-LM_{N}^{i}[\pi] = \ln\left[\int_{\pi}^{1-\pi}\exp[(1/2)LM_{N}^{i}[\pi]]d\pi\right]$.

(Andrews and Ploberger 1994; Bai, Lumsdaine and Stock 1998). The table of critical values is reported by Andrews and Ploberger (1994). Our test result is reported in Table 2.10 and Figure 2.6.
For an econometric comparison, we report the estimation results for equation (4.3) in Table A4.1 with the level variables, and in Table A4.2 with a mixture of level variables and the first differences. The correlations among the explanatory variables are less than 0.2 in magnitude for the “Mixed” regression, and for the world portfolio and the call rate of the level variable regressions. However the regressions with level variables have a correlation coefficient of around 0.6 between the T-bill rate and the call rate for Period 1. The coefficient declines to around 0.5 for Period 2 and about 0.35 for Period 3. Thus, we must interpret the statistical inference of the estimation with the level variables with reservation due to the multicollinearity.

Having said that, the insignificance of the regression for Period 1 non-tradable portfolios is observed in both variable specifications, except for the significant regression of the non-tradable non-manufacturing portfolio with the level variables. As the Period 1 non-tradable non-manufacturing estimation does not have a significant coefficient, the relatively significant regression for the portfolio could be due to the multicollinearity between the interest rates in Period 1.
Table A4.1.

$$R_t^i = \alpha^i + \beta^i R_t^I + \beta^w R_t^w + \beta^c R_t^c + \epsilon^i, \ i = T, NT.$$ 

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradable Portfolio</strong></td>
<td>$\bar{R}^T = 0.5869575 (1980:12-1984:10)$</td>
<td>$\bar{R}^T = 1.796929 (1984:11-1990:01)$</td>
<td>$\bar{R}^T = -0.9093245 (1990:02-1996:12)$</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>$\chi^2(11) = 9.352542$</td>
<td>$\chi^2(15) = 20.59173$</td>
<td>$\chi^2(20) = 36.88458 \ * *$</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>-0.0907863 (-0.5672091)</td>
<td>-0.1245849 (-0.0366314)</td>
<td>0.0136884 (0.1193294)</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>t-7</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 43) = 14.36 ***</td>
<td>F(3, 59) = 15.46 ***</td>
<td>F(3, 79) = 42.28 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.333355 (-0.85)</td>
<td>2.16355 (0.91)</td>
<td>0.0431912 (0.03)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>2.288596 (0.80)</td>
<td>4.167721 (0.96)</td>
<td>-4.271367 (-0.95)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>73.43267 (6.25) ***</td>
<td>64.8864 (6.71) ***</td>
<td>155.9307 (10.21) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>3.410857 (0.38)</td>
<td>-9.217777 (-2.42) **</td>
<td>-0.4882192 (-0.18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-tradable Portfolio</strong></td>
<td>$\bar{R}^{NT} = 0.6427931 (1980:12-1984:02)$</td>
<td>$\bar{R}^{NT} = 1.70844 (1964:03-1990:02)$</td>
<td>$\bar{R}^{NT} = -1.20677 (1990:03-1996:12)$</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>$\chi^2(9) = 13.47472$</td>
<td>$\chi^2(15) = 15.82477$</td>
<td>$\chi^2(20) = 32.20631 \ * *$</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>0.2512603 (1.492034)</td>
<td>0.2743773 (2.295816) **</td>
<td>0.2570401 (2.261679) *</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>t-1, t-5</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>F(3, 36) = 2.08</td>
<td>F(3, 67) = 9.33 ***</td>
<td>F(3, 78) = 33.71 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>6.017402 (1.45)</td>
<td>1.774386 (0.82)</td>
<td>0.5135279 (0.25)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-4.565336 (-1.63)</td>
<td>4.506592 (1.09)</td>
<td>-5.746891 (-0.94)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>-2.401203 (-0.16)</td>
<td>39.8226 (5.06) ***</td>
<td>139.3366 (9.17) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>-2.857321 (-0.32)</td>
<td>-7.513856 (-1.38)</td>
<td>-1.287296 (-0.37)</td>
</tr>
</tbody>
</table>

Note: "***" indicates significance of 1% level. "**" is for 5%, and "*" is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. Both Period 1 estimations are by the OLS. Period 2 tradable estimation is by the White transformation due to heteroskedasticity. The rest is by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS.

\[ R_{it}^l = \alpha^l + \beta^l R_{it}^l + \beta^w R_{it}^w + \beta^c R_{it}^c + \varepsilon_i, \quad i = T, NT. \]

<table>
<thead>
<tr>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Tradable Portfolio**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>$\chi^2(11) = 9.845617$</td>
<td>$\chi^2(15) = 12.56757$</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>0.0165899 (0.1037015)</td>
<td>-0.0343068 (-0.254345)</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>$F(3, 43) = 10.75$ ***</td>
<td>$F(3, 59) = 12.50$ ***</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.318493 (-0.89)</td>
<td>2.798511 (1.26)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>2.849007 (0.79)</td>
<td>5.333301 (1.16)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>79.52799 (5.42) ***</td>
<td>59.44773 (5.94) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>4.498193 (0.40)</td>
<td>-12.73874 (-2.55) **</td>
</tr>
<tr>
<td>** Non-tradable Portfolio**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>$\chi^2(9) = 12.89932$</td>
<td>$\chi^2(15) = 15.14017$</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>0.2411879 (1.419722)</td>
<td>0.236833 (1.934618)</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>$F(3, 36) = 1.67$</td>
<td>$F(3, 67) = 3.95$ **</td>
</tr>
<tr>
<td>Constant</td>
<td>5.491525 (1.09)</td>
<td>1.725512 (0.69)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-5.120208 (-1.50)</td>
<td>7.058009 (1.39)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>0.9363987 (0.06)</td>
<td>36.9988 (3.17) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>-0.8212091 (-0.07)</td>
<td>-11.03064 (-1.76)</td>
</tr>
</tbody>
</table>

Notes: *** stands for significance of 1% level, ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lags crossing the 95% confidence bands before t-12. Period 3 tradable and non-tradable regressions are by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS. The rest is by the OLS.
Table A4.1. (Continued)
\[ R_i = \alpha_i + \beta_{i1} r_{i1} + \beta_{i2} r_{i2} + \beta_{i3} r_{i3} + e_i, \quad i = T, NT. \]

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tradable Portfolio</td>
<td>[ R^2 = 0.4370048 \text{ (1980:12-1984:10)} ]</td>
<td>[ R^2 = 2.175717 \text{ (1984:11-1990:01)} ]</td>
<td>[ R^2 = -1.044802 \text{ (1990:02-1996:12)} ]</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>[ \chi^2(11) = 9.118798 ]</td>
<td>[ \chi^2(15) = 19.53343 ]</td>
<td>[ \chi^2(20) = 31.97627 ** ]</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>-0.1299456 (-0.8194098)</td>
<td>-0.1413302 (-1.071749)</td>
<td>-0.0010797 (-0.0094542)</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>t-7</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 43) = 9.84 ***</td>
<td>F(3, 59) = 9.28 ***</td>
<td>F(3, 79) = 49.43 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.505816 (-0.38)</td>
<td>0.6949771 (0.22)</td>
<td>0.0778339 (0.06)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>1.313506 (0.44)</td>
<td>2.155037 (0.33)</td>
<td>-5.267129 (-1.24)</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>61.7984 (5.12) ***</td>
<td>74.85105 (5.23) ***</td>
<td>159.3285 (10.76) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>1.301078 (0.14)</td>
<td>-2.249594 (-0.31)</td>
<td>0.128992 (0.05)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-tradable Portfolio</td>
<td>[ R^\text{NT} = 0.3539889 \text{ (1980:12-1984:02)} ]</td>
<td>[ R^\text{NT} = 1.984122 \text{ (1984:03-1990:02)} ]</td>
<td>[ R^\text{NT} = -1.27789 \text{ (1990:03-1996:12)} ]</td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>[ \chi^2(9) = 17.55264 ** ]</td>
<td>[ \chi^2(15) = 13.63202 ]</td>
<td>[ \chi^2(20) = 30.33571 * ]</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>0.2476851 (14.77968)</td>
<td>0.2133942 (1.757354)</td>
<td>0.242537 (2.127027) *</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>None</td>
<td>t-1</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 36) = 3.09 ***</td>
<td>F(3, 67) = 35.15 ***</td>
<td>F(3, 78) = 30.85 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>7.009491 (1.81)</td>
<td>1.921617 (1.09)</td>
<td>1.491335 (0.89)</td>
</tr>
<tr>
<td>US T-Bill Rate</td>
<td>-3.580726 (-1.14)</td>
<td>0.3036208 (0.07)</td>
<td>-8.605842 (-2.07) *</td>
</tr>
<tr>
<td>MSCI World Index</td>
<td>-8.322446 (-0.84)</td>
<td>44.30102 (7.31) ***</td>
<td>133.979 (9.12) ***</td>
</tr>
<tr>
<td>Call rate</td>
<td>-6.59051 (-0.39)</td>
<td>-1.816207 (-0.39)</td>
<td>57.24005 (2.19) *</td>
</tr>
</tbody>
</table>

Notes: *** stands for significance of 1% level. ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. Periods 1 and 2 tradable estimations are by the OLS. All the regressions, including Period 2 non-tradable estimation, are by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS. Period 2 non-tradable OLS has indicated a possible residual GARCH.
Table A4.2.

\[ R_i^t = \alpha + \beta^1(R_{i,t}^t - R_{i,t-1}^t) + \beta^2 R_{i,t}^w + \beta^3(R_{i,t}^c - R_{i,t-1}^c) + e_i^t, \quad i = T, NT. \]

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tradable Portfolio</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breuch-Godfrey Statistic</td>
<td>$\chi^2(11) = 11.91587$</td>
<td>$\chi^2(15) = 20.72467$</td>
<td>$\chi^2(20) = 33.95353$ **</td>
</tr>
<tr>
<td>Durbin's h statistic</td>
<td>-0.1048757 (-0.6525674)</td>
<td>-0.1183778 (-0.8495984)</td>
<td>0.0346606 (0.2986178)</td>
</tr>
<tr>
<td>Correlogram</td>
<td>None</td>
<td>t-7</td>
<td>None</td>
</tr>
<tr>
<td>F</td>
<td>F(3, 42) = 14.03 ***</td>
<td>F(3, 59) = 20.06 ***</td>
<td>F(3, 79) = 36.66 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>0.396409 (0.92)</td>
<td>0.8041468 (2.13) *</td>
<td>-1.647422 (-3.00) ***</td>
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<tr>
<td>US T-Bill Rate</td>
<td>6.20159 (1.35)</td>
<td>14.38603 (2.31) **</td>
<td>-14.18183 (-1.01)</td>
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<td>MSCI World Index</td>
<td>70.06717 (6.44) ***</td>
<td>60.03272 (6.61) ***</td>
<td>158.6034 (10.43) ***</td>
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<td>Call rate</td>
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<td>15.6092 (0.67)</td>
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<td><strong>Non-tradable Portfolio</strong></td>
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<td></td>
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<tr>
<td>Breuch-Godfrey Statistic</td>
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<td>$\chi^2(20) = 27.43719$</td>
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<td>Durbin's h statistic</td>
<td>0.3164162 (1.956147)</td>
<td>0.4481957 (3.813604) ***</td>
<td>0.2648943 (2.28484) *</td>
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<td>t-1</td>
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<td>F</td>
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<td>16.35539 (2.66) **</td>
<td>0.8872121 (0.05)</td>
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<td>MSCI World Index</td>
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<td>34.72407 (5.63) ***</td>
<td>145.1666 (9.15) ***</td>
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<tr>
<td>Call rate</td>
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<td>-40.10182 (-2.42) **</td>
<td>44.6482 (1.59)</td>
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Notes: *** indicates significance of 1% level. ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. Both Period 1 estimations are by the OLS. Period 2 tradable estimation is by the White transformation due to heteroskedasticity. The rest is by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS.
Table A4.2. (Continued)


\[ R_t^i = \alpha^i + \beta^1(R_t^i - R_{t-1}^i) + \beta^2 w^i + \beta^3 c(R_t^i - R_{t-1}^i) + e_t^i, \quad i = T, NT. \]

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<th>Period 3</th>
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<td>( R^T = 0.6881941 ) (1980:12-1984:10)</td>
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<td>( R^T = -0.8389741 ) (1990:02-1996:12)</td>
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<td>Tradable Portfolio</td>
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<td>Breuch-Godfrey Statistic ( \chi^2(15) = 5.997445 )</td>
<td>Breuch-Godfrey Statistic ( \chi^2(20) = 34.32349 ** )</td>
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<td>Durbin's h statistic (-0.0109753 (-0.076856))</td>
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<td>F ( F(3, 42) = 11.18 *** )</td>
<td>F ( F(3, 59) = 11.53 *** )</td>
<td>F ( F(3, 79) = 33.83 *** )</td>
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<td>Constant ( 0.4538808 ) (0.86)</td>
<td>Constant ( 0.6999567 ) (1.70)</td>
<td>-1.572958 (-2.65) **</td>
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<td>US T-Bill Rate ( 9.577157 ) (1.70)</td>
<td>US T-Bill Rate ( 20.17005 ) (2.69) **</td>
<td>-11.78669 (-0.79)</td>
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<td>Call rate ( -22.2097 (-1.59) )</td>
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<td>Breuch-Godfrey Statistic ( \chi^2(20) = 26.98652 ** )</td>
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<td>Durbin's h statistic ( 0.3732816 ) (3.098836) ***</td>
<td>0.2657326 (2.279178) *</td>
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<td>Correlogram None</td>
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<td>F ( F(3, 35) = 0.61 )</td>
<td>F ( F(3, 67) = 9.08 *** )</td>
<td>F ( F(3, 78) = 37.54 *** )</td>
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<td>Constant ( 0.6926944 ) (1.25)</td>
<td>Constant ( 1.7611 ) (1.83)</td>
<td>-1.725678 (-2.14) *</td>
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<td>US T-Bill Rate ( -3.700259 (-0.64) )</td>
<td>MSCI World Index ( 21.46382 ) (2.82) **</td>
<td>1.223033 (0.06)</td>
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<td>MSCI World Index ( 15.69993 ) (1.05)</td>
<td>Call rate ( 30.45788 ) (3.42) **</td>
<td>152.256 (9.56) ***</td>
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<td>Call rate ( -16.92318 (-0.70) )</td>
<td>Call rate ( -40.36967 (-2.24) )</td>
<td>48.00995 (1.65)</td>
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</table>

Notes: *** indicates significance of 1% level. ** is for 5% and, * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lags crossing the 95% confidence bands before \( t-12 \). Both Period 1 estimations are by the OLS. Period 2 tradable estimation is by the White transformation due to heteroskedasticity. The rest is by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS.
Table A4.2. (Continued)


\[ R_t^i = \alpha^i + \beta^i(R_t^i - R_{t-1}^i) + \beta^{i\text{w}}R_t^\text{w} + \beta^{i\text{c}}(R_t^c - R_{t-1}^c) + \varepsilon_t^i, \quad i = T, \text{NT}. \]

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<th>Period 3</th>
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<td>** Tradable Portfolio**</td>
<td>( R^T = 0.4370048 ) (1980:12-1984:10)</td>
<td>( R^T = 2.175717 ) (1984:11-1990:01)</td>
<td>( R^T = -1.044802 ) (1990:02-1996:12)</td>
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<td>Breuch-Godfrey Statistic</td>
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<td>( \chi^2(15) = 17.19848 )</td>
<td>( \chi^2(20) = 28.25985 )</td>
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<td>t-7</td>
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<tr>
<td>F</td>
<td>F(3, 42) = 9.22 ***</td>
<td>F(3, 59) = 25.50 ***</td>
<td>F(3, 79) = 48.95 ***</td>
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<tr>
<td>Constant</td>
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<td>0.9480785 (2.44) **</td>
<td>-1.791025 (-3.31) ***</td>
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<td>1.949376 (0.37)</td>
<td>-18.9626 (-1.02)</td>
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<td>MSCI World Index</td>
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<td>72.68552 (4.88) ***</td>
<td>162.0123 (11.94) ***</td>
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<tr>
<td>Call rate</td>
<td>0.776228 (0.04)</td>
<td>-14.99195 (-0.64)</td>
<td>18.88491 (0.62)</td>
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<td>** Non-tradable Portfolio**</td>
<td>( R^{NT} = 0.3539889 ) (1980:12-1984:02)</td>
<td>( R^{NT} = 1.984122 ) (1984:03-1990:02)</td>
<td>( R^{NT} = -1.27789 ) (1990:03-1996:12)</td>
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<td>Breuch-Godfrey Statistic</td>
<td>( \chi^2(9) = 18.28809 ) **</td>
<td>( \chi^2(15) = 13.26321 ) **</td>
<td>( \chi^2(20) = 25.79511 )</td>
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<td>Durbin's h statistic</td>
<td>0.3638801 (2.216867) *</td>
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<td>F</td>
<td>F(3, 35) = 0.24</td>
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<td>Constant</td>
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<td>Call rate</td>
<td>11.87809 (2.97)</td>
<td>-39.57716 (-2.53) **</td>
<td>40.17292 (1.47)</td>
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</tbody>
</table>

Notes: *** indicates significance of 1% level. ** is for 5%, and * is 10%. T-values are in parenthesis. For the coefficient of the world portfolio, the result is from a one-sided test. The other coefficients are examined by a two-sided test. The tests by Durbin's h and Breuch-Godfrey statistics are for the rejection of no residual serial correlation. The box for Correlogram reports the lag crossing the 95% confidence bands before t-12. Periods 1 and 3 tradable estimations are by the OLS. All the regressions, including Period 2 tradable estimation, are by the Newey-West transformation of the sixth order due to serially correlated residuals with OLS. Period 2 tradable OLS has indicated a possible residual GARCH.
The patterns of significance / insignificance on $\beta^{iw}$, insignificance of Period 1 $\alpha$, $\beta^d$ and $\beta^{ic}$, $i = T, NT$, are robust with any specification for the variables. The insignificance does not vary either for both the tradables and non-tradables in the Period 2 intercept of manufacturing portfolio, $\beta^d$ for the Period 2 non-manufacturing portfolio, Period 3 $\beta^d$ and $\beta^{ic}$ of “All” portfolio, and Period 3 $\beta^{ic}$ for the manufacturing portfolio.

On the other hand, we have found a difference between the level and the other two specifications in the significance of $\beta^{ic}$, $i = T, NT$, for Period 2 “All” and manufacturing portfolios. Similarly, the level specifications of Period 2 non-tradable “All” and manufacturing portfolios disagree about the significance of $\beta^{NTt}$ with the rest. The Period 3 non-tradable non-manufacturing portfolio has the same problem in $\beta^{NTt}$ and $\beta^{NTc}$.

Nevertheless, we know any statistical inference with non-stationary level variables tends to be biased because of the nature of random walk (Bonham and Cohen 1995), and hence these incongruities could be accountable in this respect. Interestingly, the regressions with the level variables report significant Period 2 $\beta^{Tc}$ at 5% for the all-firms’ / manufacturing portfolios. This indicates there may be some information in the level value of the Japanese call rates that is deleted by differencing (Engle and Granger 1987), but which could affect even the restricted investors’ optimization. As it happens for the Japanese tradable manufacturing portfolio where the firms are assumed to be more globalized in

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their goods market than the non-manufacturing corporations, we would suspect an influence of real market internationalization here. For example, the level value of the call rate may contain information about exchange rate effects or the psychology of the global capital market on the business evaluation for the tradable (and often multinational) manufacturers.

The Period 2 "Mixed" specification for the tradables reported a differentiation about the significance in $\beta^T$ for "All" and manufacturing portfolios, and $\beta^T_{c}$ for the non-manufacturing portfolio from the other variable definitions. However, none of the "Mixed" tradable regressions for Period 2 showed a statistical difference from Period 1 in the joint hypothesis of the entire estimation.\footnote{F values for the "Mixed" tradable regression concerning the equality between Periods 1 and 2 are, $F(3, 102) = 0.58$ with the "All" portfolio, $F(3, 102) = 1.21$ for the manufacturing portfolio, and $F(3, 102) = 1.57$ for the non-manufacturing portfolio. For the level tradable regression, the values are, $F(3, 103) = 0.23$ with the "All" portfolio, $F(3, 103) = 0.77$ for the manufacturing portfolio, and $F(3, 103) = 0.78$ for the non-manufacturing portfolio. The main regressions have, $F(3, 102) = 1.40$ with the "All" portfolio, $F(3, 102) = 2.23$ (significant at 10%) for the manufacturing portfolio, and $F(3, 102) = 0.20$ for the non-manufacturing portfolio.} As we do not have difference in insignificance of $\beta^T_{f}$ and $\beta^T_{c}$ among three variable specifications for Period 1 tradables, Period 2 divergence in $\beta^T_{f}$ and $\beta^T_{c}$ by "Mixed" regressions would not be strong counter-evidence regarding the robustness of our examination.

In contrast, the Period 3 non-tradable manufacturing portfolio produced significant $\beta^N_{f}$ in the principle estimation, which cannot be observed in the level or "Mixed" variable specifications, or "All" / non-manufacturing portfolios. The
instability regarding the significance of the US T-bill rate with the non-tradable manufacturing portfolio may indicate the existence of a linkage between the capital market internationalization and the goods market globalization. For example, we might consider here the influence of the world interest rate on possibly more internationalized manufacturing sectors even if they are non-tradables.

All the dissimilarity in the intercept occurs between the "Mixed" variable and the other two specifications. Among them, since the Period 2 tradable "All" and non-manufacturing portfolios do not have regressions statistically different from the Period 1 estimation, and there is no discord in insignificance of Period 1 $\alpha_T$, we may conclude that they are not a serious problem for our main result.

Nevertheless, the discrepancy in the significance about Period 2 non-manufacturing $\alpha_{NT}$ and Period 3 tradable / non-tradable intercepts among the three variable specifications may indicate there was an evolution of market efficiency during the Japanese capital market deregulation. Recall, in the basic ICAPM specification of (4.1) the significance of the intercept, $a^i$, is a measure for market efficiency. Namely, for the perfect market with the complete model specification, it must be zero (Fama and French 1998). This meaning of $a^i$ will be reflected in the significance of $\alpha^i$ defined in (4.4), provided the ICAPM is viable for our sample. For instance, if $\alpha^i = 0$ with $c^i \neq 0$, $i = T, NT$, since $RP > 0$, $a^i$ must be theoretically non-zero. Hence, an insignificant intercept in (4.3) could
cast doubt on the efficiency of the market in determining the value of the portfolio when there is an influence of the call rate. Otherwise, as for a basic nature of asset pricing testing with CAPM-based specification, we have to reject ICAPM with zero intercept for (4.3). On the other hand, when ICAPM is valid, if \( c^i = 0, i = T, NT \), the intercept must pick up an intertemporal hedging element other than the call rate for the portfolio return. Namely, we need \( \alpha^i = a^i \neq 0, i = T, NT \), for market efficiency with \( c^i = 0 \). If not, both the model and the efficiency of the market can be rejected. Since we have to treat the autocorrelation in the explanatory variables by first differencing, or otherwise the estimation is biased, we are not able to examine reliably the market efficiency by this methodology for our sample. Nonetheless, a low robustness in the significance of the intercept could represent a fluctuation in the Japanese capital market efficiency and / or the model fitness of ICAPM for the Japanese market.
REFERENCES

1. Literature


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Osaka Stock Exchange *(December 16, 2002).* *Rekishi; Enkaku* (*Profile; history*). Retrieved December 31, 2002 from [http://www.ose.or.jp](http://www.ose.or.jp).


2. Data, CD-ROM and Online sources


3. Data, Newspapers

**Financial Times.** *World Stock Markets, Japan.*

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**Wall Street Journal.** *Foreign Markets, Tokyo.*

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1996 February 1, March 1, April 1, May 1, June 3, July 1, August 1, August 30, October 1, November 1, December 2, December 31.

1980 December 1, December 29.
1981 February 2, March 2, April 1, May 1, June 1, July 1, August 3, September 1, October 1, November 2, December 1, December 29.
1982 February 1, March 1, April 1, May 3, June 1, July 1, August 2, September 1, October 1, November 1, December 1, December 29.
1983 February 1, March 1, April 1, May 2, June 1, July 1 August 1, September 1, October 3, November 1, December 1, December 29.
1984 February 1, March 1, April 2, April 30, June 1, July 2, August 1, September 4, October 1, November 1, December 3, December 31.
1985 February 1, March 1, April 1, May 1, June 3, July 1, August 1, September 3, October 1, November 1, December 2, December 30.
1986 February 1, March 3, April 1, May 1, June 2, July 1, August 1, September 2, October 1, November 3, December 1, December 29.
1987 February 1, March 2, April 1, May 1, June 1, July 1, August 3, September 1, October 1, November 2, December 1, December 29.
1988 February 1, March 1, April 1, May 2, June 1, July 1, August 1, September 1, October 3, November 1, December 1, December 29.
1989 February 1, March 1, April 3, May 1, June 1, July 3, August 1, September 1, October 2, November 1, December 1, December 29.
1990 February 1, March 1, April 2, May 1, June 1, July 2, August 1, September 4, October 1, November 1, December 3, December 31.

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4. Econometric Software