Addition to the Nikkei 225 Index and Japanese Market Response : Temporary Demand Effect of Index-arbitrageurs

Okada, Katsuhiko
Isagawa, Nobuyuki
Fujiwara, Kenya

(Citation)
神戸大学経営学研究科 Discussion paper,2004・21

(Issue Date)
2004-12

(Resource Type)
technical report

(Version)
Version of Record

(URL)
https://hdl.handle.net/20.500.14094/80500057

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

KOBE UNIVERSITY

ROKKO KOBE JAPAN

2004.21

Addition to the Nikkei 225 Index and Japanese Market Response: Temporary Demand Effect of Index-arbitrageurs

Katsuhiko Okada
Nobuyuki Isagawa
Kenya Fujiwara

Discussion Paper Series

Addition to the Nikkei 225 Index and Japanese Market Response: Temporary Demand Effect of Index-arbitrageurs

Katsuhiko Okada (Kwansei Gakuin University),

Nobuyuki Isagawa (Kobe University)*,

and Kenya Fujiwara (Kobe University)

Abstract

We examine the Japanese stock market response to addition to the Nikkei 225 Index during the period from 1991 to 2002. Much as in the case of the U.S. markets, the stock prices of added firms go up on the announcement date, continue to increase until one day prior to the effective change date, and then decrease on the change date. We identify that the stock price increase in the run-up period (between the announcement date and the change date) is temporary, because it is completely canceled out by the stock price decline following the change date. We also find that the excess demand of index-arbitrageurs for shares of newly added firms is the main source of the temporary stock price increase.

JEL classification: G14

Keywords: Index effect, Nikkei 225,

Demand shock, Japanese markets

* Corresponding author. Graduate School of Business Administration, Kobe University, 2-1 Rokkodai, Nada, Kobe, Hyogo 657-8501, Japan. Tel: +81-78-803-6907; Fax: +81-78-803-6976. e-mail address: isagawa@kobe-u.ac.jp

1. Introduction

A number of empirical studies, such as those of Shleifer (1986), Harris and Gurel (1986), Lynch and Mendenhall (1997), and Wurgler and Zhuravskaya (2002), have examined the stock price effect associated with a change in the composition of the S&P 500 Index. All of these studies reported that additions to the S&P 500 Index increased the stock prices of added firms. Some recent studies have focused on the non-U.S. stock indices. For example, Chakrabarti, Huang, Jayaraman, and Lee (2004) studied price and volume effects of changes in the MSCI index, which is the most popular international stock index.

Despite the fact that the Japanese stock market has the second largest market capitalization following that of the U.S., few studies have focused on the changes in the composition of the Nikkei 225 Index, which is the most broadly quoted stock index in Japanese stock markets. Hanaeda and Serita (2003) examined the impact of the large composite change of the Nikkei 225 Index on April 24, 2000.[1] However, the restriction of their examination to a single event may have undermined the accuracy of their assessment of the price effect of the Nikkei 225 composite change. Furthermore, concern about the calendar clustering effect arises from a single event study.

Using a relatively large sample of changes in the Nikkei 225 Index, we investigate the stock price behavior of firms newly added to the index.[2] Our sample consists of 69 firms added to the Nikkei 225 Index during the period from 1991 to 2002.

---

[1] The composite change on April 24, 2000 was a very large event in the sense that 30 firms were added to (and deleted from) the Nikkei 225 Index simultaneously.

[2] Although Liu (2000) examined the effects of stock price and trading volume associated with changes in the Nikkei 500 Index, this index is not particularly popular in Japanese markets.

One goal of this study is to compare the market response to an event outside the realm of a firm's discretion. Some empirical studies have reported a difference in market response between Japan and the U.S. when a firm undertakes equity issuance (Kang and Stulz (1996)) or changes its dividend policy (Dewenter and Warther (1998)). Such financial strategies are at the discretion of the firm and the difference in the market response is the proof that the same corporate behavior could be evaluated differently depending on the markets. On the other hand, the decision to join a stock index is not made by the added firm itself. If little difference in the stock market behavior is observed between Japan and the U.S., then one may be able to argue that the market reaction is identical when it comes to an event outside the corporate managers' discretion.

We find that the stock prices of added firms rise significantly in response to the announcements of additions. They continue to increase during the run-up period (between the day after the announcement and one day prior to the change date), and then decrease on the effective date of the change. Such stock price behavior in Japanese markets is very similar to those in the U.S. (Lynch and Mendenhall (1997)) and international markets (Chakrabarti, Huang, Jayaraman, and Lee (2004)). While the positive announcement effect is permanent, the run-up period stock price increase is temporary. The stock price rise in the run-up period is offset by the decline following the change date.

There are two main lines of reasoning to account for the positive market response. One interpretation, which we will refer to as the "information hypothesis", is that the stock price of the newly added firms increases because the addition may convey sound and previously unavailable information about their future perspectives. Consistent with the information hypothesis, Denis, Mcconnell, Ovtchinnikov, and Yu (2003) found that the firms experience unexpected significant improvements in realized earnings following their addition to the S&P 500 Index. Jain (1987) and Dhillon and Johnson

(1991) also reported empirical findings in support of the information hypothesis.

The other interpretation, which we will refer to as the "demand shock hypothesis", sheds light on the demand aspect of the index additions. The demand shock hypothesis suggests that the excess demand from the index-tracking investors (e.g., index-arbitrageurs and index fund managers) is the major source of the stock price increase upon addition. Harris and Gurel (1986) and Shleifer (1986) were the first to demonstrate such a demand shock effect. While Harris and Gurel (1986) identified the temporary demand shock on the stock price of added firms (the price pressure hypothesis), Shleifer (1986) found the permanent demand effect (the downward-sloping demand curve hypothesis).[3]

Recently, Lynch and Mendenhall (1997) and Wurgler and Zhuravskaya (2002) applied the demand shock hypothesis to index additions from a somewhat different angle. Lynch and Mendenhall (1997) investigated stock price behavior surrounding the effective date of the change as well as the announcement date. This separation of the two event dates clarified the stock price behavior during the run-up period. They found that the stock price of the firms added to the S&P 500 Index continued to increase during the run-up period and decreased on the change date. They indicated that such observed stock price behavior was consistent with the demand shock scenario due to heavy index-fund trading around the time of the change date.

Wurgler and Zhuravskaya (2002) developed a theoretical model and examined whether both the demand shock and the arbitrage risk affected the announcement effects of firms added to the S&P 500 Index. In the efficient market, the excess demand due to the portfolio alignment by the index-tracking investors can be cancelled out by the

---

[3] Chen, Noronha, and Singal (2004) found an asymmetric price response between firms added to and those deleted from the S&P 500 Index. They suggested that investor awareness contributes to the asymmetric price effects.

rational arbitrageurs' counter-trading. In the real world, however, there exists an arbitrage risk, and as a result, the risk-averse arbitrageurs would be expected to trade less aggressively than required to offset the demand shock.[4] Consistent with the predictions of the demand shock hypothesis, they found that the magnitude of the announcement day returns of added firms had significant positive relationships with both demand shock and arbitrage risk.

Another goal of our study is to investigate how the demand shock due to the index-tracking investors affects the stock price behavior of firms newly added to the Nikkei 225 Index. Since it is likely that the announcement day return is to some degree affected by the information, we focus on stock returns after the announcement date. As suggested by Lynch and Mendenhall (1997), the index-tracking investors tend to purchase the added stocks as near as possible to the change date in order to minimize the tracking error. Therefore, such a trading strategy on the part of the index-tracking investors affects the volume and the stock price behavior surrounding the change date.

For each stock added to the Nikkei 225 Index, we measure the size of the index-arbitrageurs' demand shock and the stock's arbitrage risk. Our focus is on the index-arbitrageurs rather than the index funds, primarily because the cash-future arbitrage balance on the Nikkei 225 was relatively large during our sample period. For the index-arbitrageurs, the arithmetically averaged Nikkei 225 Index is less risky for conducting the cash-future arbitrage trading than a capital-weighted index like the S&P 500.[5] We find that the temporary abnormal returns observed in the run-up period are

---

[4] Shleifer (2000) stressed that, in the real world, rational arbitrage seems to be costly for several reasons. Empirically, Pontiff (1996) found that market frictions constrain the rational traders' arbitrage process, such that closed-end fund prices can deviate from their fundamental values.

[5] For more details, see Section 2.

related to the demand shock in a significantly positive manner. Index arbitrageurs' rebalancing activity affects the stock price increase of added firms in the run-up window, in which the information effect is less likely to be contained. We also find a positive but insignificant relationship between arbitrage risk and the run-up period stock price increase.

The remainder of the paper is organized as follows. In Section 2, we discuss some of the details associated with the Nikkei 225 Index and the index-arbitrage trading. In Section 3, we describe our addition samples and the methodology of our analysis. In Section 4, we present the results of the stock price behavior surrounding the composite change of the Nikkei 225 Index. In Section 5, we present the results associated with the effects of the demand shock due to the index arbitrageurs' rebalancing. In Section 6, we conclude the paper.

2. Changes in the Nikkei 225 Index and Index-Arbitrage Trading

In Japanese stock markets, there are two popular and widely used market indices: the Nikkei 225 Index and TOPIX. While TOPIX is a value-weighted stock index comprising approximately 1,600 stocks, the Nikkei 225 Index is a simple price-weighted arithmetic average of a selection of 225 actively traded stocks on the first Section of the Tokyo Stock Exchange (TSE). Historically, the *Nihon Keizai Shimbun* obtained a license from the Dow Jones Co., Ltd., to use the name, and the index was published as the Nikkei Dow Average. In 1985, the *Nihon Keizai Shimbun* changed the name of the index to the Nikkei Average Index, which is publicly known as the Nikkei 225 Index in the marketplace.

The *Nihon Keizai Shimbun* has periodically reviewed the composition of the Nikkei 225 Index so that the index would effectively reflect the current structure of the Japanese industry. For example, in our sample period from 1991 to 2002, there were 38 changes in the Nikkei 225 Index. In many cases, announcements of the review results were made in September, only to be effective at the beginning of October. There were, on average, approximately 5 business days between the announcement date and the actual change date. Changes could also be made at any other time, provided a stock was found to be ineligible for the Stock Average.

The criteria used for changing the index composition included a component stock's trading volume and the market capitalization in the preceding three years. A constituent stock would be deleted when its market liquidity, as measured by its trading volume, fells out of the top half of the stocks on the first section of the TSE. Other reasons for deletion included mergers, bankruptcy, and delistings. To fill the vacancies left by the deleted stocks, candidates for addition must be selected. The criteria for addition included the sector distribution (to keep the index well-balanced among industries) and the market liquidity (i.e., within an industry, selecting firms with higher market liquidity). All proposed changes were announced in Japanese newspapers.

The futures markets on the Nikkei 225 Index have been the most actively traded of the stock index futures in Japan.[6] It should be noted that about 80% of the index arbitrage was being carried out on the Nikkei 225 Index.[7] This is one of the most prominent features that distinguish the Nikkei 225 Index from the S&P 500. In particular, for the index arbitrageurs, an arithmetic-averaged index like the Nikkei 225 is less risky in terms of conducting cash-future arbitrage than is a capital-weighted index like the S&P 500. Since a capital-weighted index has different weightings for its component stocks, it is necessary for arbitrageurs to adjust their stock portfolios as the price fluctuates. On the other hand, the Nikkei 225 Index can be entirely hedged with its

[6] For example, see Japan Securities Research Institute (2002).

[7] Interviews with several major arbitrageurs in Japanese stock markets have suggested that roughly 80% of the arbitrage is carried out on the Nikkei 225 Index.

futures contract, regardless of the movement in the price of the component stocks. This safety feature for arbitrageurs promotes the cash-future arbitrage balance on the Nikkei 225 Index. Its balance usually exceeds 1 trillion yen (approximately 10 billion US dollars), and sometimes exceeds 2 trillion yen (20 billion US dollars).

[Insert Table 1]

Table 1 provides information on the cash position of the stock index-arbitrages in Japanese markets during our sample period. Since the composite changes in the Nikkei 225 Index mostly occurred in September, we use data taken at the end of September of each year. The table shows both the amount in million Yen (in the second column) and the total number of shares in all arbitrage positions (in the third column) based on the figure provided by the Tokyo Stock Exchange. Assuming that 80% of the index arbitrage is on the Nikkei 225 Index, we estimate the number of shares per firm held by the Nikkei 225 Index-arbitrageurs. Dividing this number by the total number of outstanding shares of the firm, we obtain the measure of demand shock due to the rebalancing by the index-arbitrageurs.

The measure of the demand shock, indicated by DS, is the percentage of the added firm's shares relative to their outstanding shares to be purchased by the index arbitrageurs when they face changes in the Nikkei 225 Index composition. Specifically, we determine DS=AB/OUT, where AB is the number of an added firm's shares that the index arbitrageurs are to purchase to match the new composite, and OUT is the outstanding number of shares of the firm. In our sample firms, DS is 2.38% on average, as shown in Table 2.

Table 2 presents the average percentage of trading volume for sample firms over the pre-announcement periods. On average, 0.25% of the firm's outstanding shares were traded per day over the 100-day period prior to the announcement of (AD-100, AD-1).[8] Similarly, 0.29% of the firm's outstanding shares were traded per day over the 30-day period prior to the announcement. Comparing DS with these values reveals the impact of the index-arbitrageurs' trading on the stock behavior.

[Insert Table 2]

The typical trading behavior of the index-arbitrageurs facing a change in the composition of the Nikkei 225 Index is as follows. On the first trading day following the announcement, the stocks added to the index are likely to be bought up by numerous bidders. However, the index-arbitrageurs do not rebalance their portfolios until one day prior to the change date (CD-1). This is because, for the index-arbitrageurs, it is of the highest priority not to make a tracking error; thus the arbitrageurs would not dare to take any risk during the interim between the announcement date and the change date. By selling stocks deleted from the index and purchasing stocks added to the index at the closing price on CD-1, the index-arbitrageurs can immunize tracking errors of their cash stock portfolio. In reality, the arbitrageurs start to rebalance their portfolio a few minutes before the closing bell on CD-1.[9,10]

---

[8] Throughout the paper, day AD-*t* (day AD+*t*) denotes *t* days before (after) the announcement date (AD), and day CD-*t* (day CD+*t*) denotes *t* days before (after) the effective change date of the addition (CD).

[9] There is one scenario in which index-arbitrageurs would fail to track the index. Since the TSE has a matching rule for the closing, stocks may not close for the day due to the seller-buyer imbalance. In such cases, index-arbitrageurs are unable to trade relevant stocks, such that their portfolios would be subject to the subsequent price fluctuation. In order to avoid this risk, index-arbitrageurs sometimes attempt to complete their

3. Data and Methodology

Our original sample consists of 82 firms newly added to the Nikkei 225 Index in the period between September 1991 and October 2002. We collect information regarding the changes in index composition from *Nihon Keizai Shimbun*, which is the most popular economic newspaper in Japan. Since the *Nihon Keizai Shimbun* has a policy of making an announcement of composite changes after the stock market is closed, we define the announcement date as the first business day after the release of such information.

From the 82 original samples, we eliminate some firms for two reasons. First, we exclude 10 firms due to a lack of historical returns needed to estimate the market model coefficients and the arbitrage risk measures. Secondly, because our study relies on the separation between the announcement date and the effective date of the change, we exclude 3 firms that were added immediately after the announcement.

Among the remaining 69 firms, 30 firms were added to the index on the same day (April 24, 2000). In order to overcome bias due to the clustering effect, we use two methods. One is a regression model with dummy variables for the event period, and the other is the equally weighted portfolio approach.[11] The results are similar under both methods (see Table 4). Since the reduction of 30 firms to one portfolio will cause a loss

---

rebalancing before the closing bell.

[10] Managers of the Nikkei 225-type index funds are also averse to ignoring the index, and thus could be expected to engage in similar behavior as index-arbitrageurs. Since we could not obtain the complete data of the balance for the index funds, we do not analyze the demand effect due to index-fund managers' behavior.

[11] For the clustering effects, see Peterson (1989) and Henderson (1990).

of information, for the most part in this paper, we present the results from the regression model with dummy variables.

We calculate the daily stock returns by using the closing price taken from the *Nomura Aurora Database*, which is widely used in Japan. The market model residual is considered as a firm's abnormal return on any given day.[12] This residual is calculated as the difference between the actual return and the predicted return based upon the market model parameter estimates and the market return for that day. The parameters of the market model are estimated over a 200-day period between day AD-230 and day AD-31, and we use TOPIX as the market index.

A cumulative abnormal return over the window from day t_1 to day t_2 is calculated by cumulating the daily abnormal returns over that window geometrically. The average abnormal return on day t is denoted by AAR(t), and the average cumulative abnormal return over the window of (t_1, t_2) is denoted by CAR (t_1, t_2).

The volume data are also obtained from the *Nomura Aurora Database* for each firm added to the Nikkei 225 Index. In order to determine whether or not the trading activity increases in the added firms on any given day in the event window, we calculate the mean volume ratio proposed by Harris and Gurel (1986). The volume ratio for firm i on day t, VR_{it}, is calculated by

$$VR_{it} = \frac{V_{it}}{V_{mt}} \cdot \frac{V_m}{V_i}, \qquad (1)$$

where V_{it} is the trading volume for firm i on day t, V_{mt} is the trading volume for the total firms included in the market portfolio of TOPIX on day t, and V_i and V_m are the average trading volumes over the 200-day estimation period of (AD-230, AD-31) for firm i and the total TOPIX, respectively. The sample average of the volume ratio on day t is

---

[12] We also attempted to calculate the abnormal returns of firms using the market-adjusted return model, and observed no significant difference in the results.

denoted as MVR_t. If the addition to the Nikkei 225 Index has no effect on the trading volume, then MVR should not deviated widely from the expected value of 1 surrounding the announcement date and change date.

4. Stock Price Behavior Surrounding the Addition to the Nikkei 225 Index

[Insert Table 3]

Panel A of Table 3 presents the daily average abnormal return (AAR) and the mean volume ratio (MVR) relative to the announcement date, and panel B of Table 3 presents those values relative to the effective change date. For each of the 5 event days after the announcement date (from AD+1 to AD+5), only those firms for which the change date has not yet occurred were used to calculate AAR and MVR. Similarly, for each of the 5 event days prior to the change date (from CD-5 to CD-1), only those firms for which the announcement date occurred on a prior day were used to calculate AAR and MVR.

The announcement of the addition to the Nikkei 225 Index pushes up the stock price by a substantial margin. An abnormal return of 5.16% with a *t*-value of 13.42 is observed on the announcement day. The *t*-value used to test the significance of each AAR is based on the standard deviation of AAR over the 200-day estimation period. As shown in Table 3, the average stock price of added firms continues to increase gradually until one day prior to the change date (CD-1). The added firms experience a significant positive abnormal return of 4.19% with a *t*-value of 10.92 on CD-1.

The announcement of the index addition is made in a well-publicized manner through various media. If the market responds to the new information quickly, it is unlikely that any significant stock price reaction will be observed after the announcement date. However, the average stock price of added firms is found to continue rising after the announcement date, and the magnitude of the increase is conspicuously large on CD-1. One possible explanation for this result would be that the index-arbitrageurs tend to purchase added stocks on CD-1 in order to minimize the risk of making a tracking error, as discussed in Section 2.

Suppose that such a heavy trading of the index-arbitrageurs prior to the effective change date shifts the stocks' prices temporarily away from their equilibrium values. We then would expect to observe the price reversal following the change date as the index-arbitrageurs' trading disappears. Consistent with this expectation, Table 3 shows that the prices of the added stocks decline significantly on the change date (CD) and on the next day (CD+1) as well. The average abnormal return on CD is -3.50% with a *t*-value of -9.11, and that on CD+1 is -1.37% with a *t*-value of -3.57.

We also expect that the trading volumes of added firms would increase on CD-1 for the same reason. The daily average trading volume ratio (MVR) over the event window is presented in the last column of Table 3. As shown in the Table, MVR increases abruptly on the announcement day, and continues to be greater than 1 after the announcement date. The largest MVR is observed on CD-1, which is consistent with the hypothesis that index-arbitrageurs rebalance their portfolios on that day. After the change date, the MVR of added firms is found to decrease gradually.

Next, we examine the average cumulative abnormal returns (CAR) over the event window. Similar to Lynch and Mendenhall (1997) and Chakrabarti, Huang, Jayaraman, and Lee (2004), we examine CAR over five event windows, i.e., the run-up window of (AD+1, CD-1), the release window of (CD, CD+7), the post-announcement windows of (AD+1, CD+7) and (AD+1, CD+10), and the total permanent window of (AD, CD+10). We determine CD+7 as the release-ending day based on the same criterion used by Lynch and Mendenhall (1997).

[Insert Table 4]

Panel A of Table 4 represents the results of AAR on the announcement date and CAR over five event windows for our 69 samples (OLS with dummy variables). Panel B of Table 4 represents those for 40 samples (portfolio approach). We report the results of the 40-sample case in order to show there is little difference in quantitative results between the two methods. In the following, we primarily report the results of the 69-sample case.

If all of the added firms have windows of identical length, then the *t*-value used to test the significance of CAR (t_1, t_2) is given by

$$t = CAR(t_1, t_2) / \sigma\sqrt{(t_2 - t_1)} \ . \qquad (2)$$

However, in the run-up window, the window's length varies across firms. We therefore used the average days of (t_2-t_1) among all 69 samples in equation (2).

On average, the addition samples experience a significant cumulative abnormal return of 5.70% with a *t*-value of 6.99 over the run-up window of (AD+1, CD-1). Note that most of this CAR is the abnormal return on CD-1 of 4.19%. In the release window of (CD, CD+7), the average cumulative abnormal return of the added firms is -6.51%, which is significant at a 1% confidence interval. The stock price rise in the run-up window is completely erased by the decline during the release period. Naturally, in the post-announcement windows of (AD+1, CD+7) and (AD+1, CD+10), the average cumulative abnormal return is almost equal to zero.

Figure 1 plots the average cumulative abnormal return (CAR) for added firms surrounding the announcement date and the effective change date. In the figure, the interval between AD+1 and CD-1 is shown as five days, because the actual average number of days of the interval was 5.5 days, inclusive of AD+1 and CD-1. The CAR is displayed as if each daily AAR over this interval were the interval's CAR divided by five.

[Insert Figure 1]

Figure 1 shows that the average stock price of the sample firms increases in response to the announcement of the addition to the Nikkei 225 index. The average stock price continues to rise over the run-up window, and then begins to revert to the level observed on the announcement date. In particular, the added firms experience a substantial rise on one day prior to the change date (CD-1), and a large drop on the change date (CD).[13]

This pattern of stock price behavior of added firms is very similar to that reported by Lynch and Mendenhall (1997). Although the results are not reported in this paper, we have confirmed that the stock price behavior of firms deleted from the Nikkei 225 Index is also similar to that of counterpart firms deleted from the S&P 500. Thus, little difference is observed between the Japanese and the U.S. markets in terms of the stock price behavior associated with the composite changes in the popular stock index.[14]

The addition to the Nikkei 225 index produces a significant stock price increase on the announcement date, and this rise is permanent rather than temporary. There are two hypotheses that might account for this permanent increase in stock price. One is the information hypothesis and the other is the downward-sloping demand curve hypothesis.

---

[13] As shown in Figure 1, there is no significant stock price change after CD+10. On the other hand, added firms experience a gradual stock price increase prior to the announcement date. This may be because that some analysts report candidate firms for adding to the Nikkei 225 index based on the criteria for changing the index composition, and several investors take a long position based on the analysts' reports.

[14] Chakrabarti, Huang, Jayaraman, and Lee (2004, Table 1) reported essentially the same pattern of stock price behavior in Japanese markets surrounding changes in the MSCI.

However, it is difficult to specify which of the two provides a more plausible explanation. And, as mentioned by Chakrabarti, Huang, Jayaraman, and Lee (2004), these two hypotheses are not mutually exclusive.

The addition to the Nikkei 225 index also produces a continuous stock price increase into the run-up window. Contrary to the announcement effect, the run-up period stock price increase is completely neutralized by the stock price decline in the following release window, and is therefore temporary. In the next section, we examine the effects of the demand shock caused by the portfolio rebalancing on the part of the index arbitrageurs.

5. Effects of Index-arbitrageurs' Demand Shock

Previous studies such as those of Harris and Gurel (1986), Lynch and Mendenhall (1997), and Wurgler and Zhuravskaya (2002) have suggested that the demand shock due to the index-tracking investors' trading affects the stock price behavior of firms newly added to the index. As argued in Section 2, it is likely that, in the case of the Nikkei 225 Index, the rebalancing of the cash stock portfolio by the index-arbitrageurs has an impact on the stock price of added firms. In this section, we will investigate this issue in detail.

Our hypothesis is as follows. Since the information effect is likely to be reflected in the stock price on the announcement date, the excess demand of the index-arbitrageurs for the newly added firms causes their stock price to increase in the run-up window. Thus, we expect the cumulative abnormal return in the run-up window of (AD+1, CD-1) to be positively related to the measure of demand shock created by the index-arbitrageurs.

If an excess demand shock hits the market, it may shift the stock price away from its fair value, because rational arbitrage activity does not function in a perfect way as predicted by the efficient market hypothesis. In an efficient market setting, the rational arbitrages should have the opposite effect of the unsophisticated demand shock and thereby return the stock price to its fair value. However, as argued by Shleifer (2000) and Wurgler and Zhuravskaya (2002), such arbitrage activity entails risk on the part of the arbitrageurs and falls short of the necessary corrective force. The larger the arbitrage risk of the added stock, the more it is overvalued by the excess demand shock. Therefore, we expect the cumulative abnormal return in the run-up window to have a positive relationship to the extent of the stock's arbitrage risk.

For the purpose of testing the above hypothesis, the cumulative abnormal return in the run-up window is regressed on the demand shock and arbitrage risk measures. As explained in Section 2, the measure of the demand shock, DS, is the percentage of the added firm's shares relative to its outstanding shares to be purchased by index arbitrageurs. Taking into account the cross-held shares in the Japanese firms, we also use another measure of the demand shock, DSF. The measure of DSF, the ratio of demand shock to free float, is the percentage of the added firm's free float to be purchased by index arbitrageurs. We collected data on the free float of firms from the *Toyo Keizai Data Bank*. In our sample firms, DSF was 6.58% on average, which is much larger than the average DS of 2.38%. Under the demand shock hypothesis, we expect that DSF would have a stronger influence on temporary stock price than DF.

As a measure of arbitrage risk, which is designated as RISK, we use the variance of the residuals of the market model over a 200-day estimation period. The same arbitrage risk measure is also employed by Wurgler and Zhuravskaya (2002), Hanaeda and Serita (2003) and Chakrabarti, Huang, Jayaraman, and Lee (2004).[15]

---

[15] Wurgler and Zhuravskaya (2002) used another measure of arbitrage risk based on firms that match characteristics of the added firm. They identified that two measures of arbitrage risk were very similar in magnitude and were highly correlated.

Panel A of Table 5 presents the regression results for the stock returns in the run-up period. The regression results show that the abnormal stock return of the added firms during the run-up period has a significant positive relationship with the measure of the excess demand shock. The index-arbitrageurs' excess demand is an important factor for the temporary stock price increase. The results of model (1) and model (2) indicate that DSF has a more significant effect than DS, which is in line with our initial prediction. It should be noted that the regression results provide plausible explanations with large R-squares. Model (1) and model (2) can account for about 25% and 34% of the total variation in abnormal stock price increases in the run-up window, respectively.

Model (1) and model (2) also show that abnormal stock increases are related in a positive manner with the measure of the stock's arbitrage risk (RISK). Although the results are consistent with the qualitative prediction, they are not statistically significant. Hanaeda and Serita (2003) reported that the measure of the arbitrage risk based upon the standard deviation of the error term of the market model had no significant impact on the announcement effect of addition to the Nikkei 225 Index. Such a measure of arbitrage risk might not be effective for explaining temporary stock price changes in response to a change in the Nikkei Index.[16]

Next, we focus on the stock price decrease in the release window of (CD, CD+7). Panel B of Table 5 presents the regression results for the stock returns in the release window. Since the index arbitrageurs retain the stocks that they purchased before the change date as part of their cash portfolios, it is likely that the temporary demand shock will disappear following the change date. Then, we expect that neither DS nor DSF will

---

[16] In their sample of all firms newly added to the MSCI Index, Chakrabarti, Huang, Jayaraman, and Lee (2004, Table 5) found no significant relationship between stock price behavior and the measure of arbitrage risk based on the residuals of the market model.

have a significant effect on the release period CAR. The results are consistent with this prediction, because the coefficient of the demand shock in models (3) and (4) is not significant.

The arbitrage risk has a negative but insignificant relationship with the stock price behavior following the change date. The coefficients of RISK in models (1) and (2) show that the larger the arbitrage risk of the added stock, the more it is overvalued in the run-up period. Then, in the release period, the overvaluation due to arbitrage risk may disappear gradually.

In the regression model, we include the run-up period cumulative abnormal returns, denoted by RUN-UP. The results in models (3) and (4) show that the stock price behavior in the release period has a significant relationship with that in the run-up period. The more the stock price increases in the run-up period, the more it goes down after the change date. We also perform the same regression analysis for cumulative abnormal returns in the two-day period of (CD, CD+1), and we obtain essentially the same results as those obtained for the release window.

6. Conclusion

This paper investigated the stock price behavior of firms newly added to the Nikkei 225 Index, which is the most popular stock index in the Japanese stock markets. We identified the significant positive stock price increase for added firms on the announcement date. The stock price continues to go up into the run-up window (until one day prior to the effective change date), and subsequently declines on the change date. Such stock price behavior in Japanese markets is very similar to that in the U.S. reported by Lynch and Mendenhall (1997). With regard to the addition to the major stock index, which is not under the firm’s discretion, there is little difference in the market responses of the Japanese and U.S. markets.

We then investigated how the demand shock from index-arbitrageurs affects the stock price behavior surrounding the index addition. We found that the cumulative abnormal return in the run-up window is positively related to the demand shock. This finding is consistent with the hypothesis that the excess demand of index-arbitrageurs for newly added firms pushes up stock prices. We also found that the magnitude of the stock price reversion in the release window is significantly related only to the run-up period abnormal return. There was no significant relationship between the magnitude of stock price reversion and excess demand shock. Taking into account the fact that the index-arbitrageurs retain the stocks purchased in the run-up period, this finding is quite plausible.

In sum, the stock price of firms newly added to the Nikkei 225 Index significantly go up in response to the announcement. This announcement effect is likely to be permanent. However, the post-announcement stock price rise in the run-up window turns out to be temporary, because most of the cumulative gains in the window are offset by the stock price declines that follow after the effective change day. The demand shock due to the index-arbitrageurs' portfolio rebalancing has a significant influence on this temporary stock price increase.

[2004.12.13 688]

References

Chakrabarti, R., Huang, W., Jayaraman, N., and J. Lee, 2004, Price and Volume Effects of Changes in MSCI Indices—Nature and causes, *Journal of Banking and Finance*, forthcoming.

Chen, H., Noronha, G., and V. Singal, The Price Response to S&P 500 Index Additions and Deletions: Evidence of asymmetry and a New Explanation, *Journal of Finance*

59, 1901-1928.

Denis, D., McConnell, J., Ovtchinikov, A., and Y. Yu, 2003, S&P 500 Index Additions and Earnings Expectations, *Journal of Finance* 58, 1821-1841.

Dewenter, K., and V. Warther, 1998, Dividends, Asymmetric Information, and Agency Conflicts: Evidence from a Comparison of the Dividend Policies of Japanese and US Firms, *Journal of Finance* 53, 879-904.

Dhillon, U., and H. Johnson, 1991, Changes in the Standard and Poor's 500 List, *Journal of Business* 64, 75-85.

Hanaeda, H., and T. Serita, 2003, Price and Volume Effects Associated with a Change in the Nikkei 225 List: New Evidence from the Big Change on April 2000, *International Finance Review* 4, 199-225.

Harris, L., and E. Gurel, 1986, Price and Volume Effects Associated with Changes in the S&P500 List: New Evidence for the Existence of Price Pressure, *Journal of Finance* 41, 815-829.

Henderson, G., 1990, Problems and Solutions in Conducting Event Studies, *Journal of Risk and Insurance* 57, 282-306.

Jain, P., 1987, The Effect on Stock Price from Inclusion in or Exclusion from the S&P500, *Financial Analysts Journal* 43, 58-65.

Japan Securities Research Institute, 2002, *SECURITIES MARKET IN JAPAN* 2000.

Kang, J-K., and R. Stulz, 1996, How Different is Japanese Corporate Finance? An Investigation of the Information Content of New Security Issue, *Review of Financial Studies* 9, 109-139.

Liu, S., 2000, Changes in the Nikkei 500: New Evidence for Downward Sloping Demand Curves for Stocks, *International Review of Finance* 1, 245-267.

Lynch, A., and R. Mendenhall, 1997, New Evidence on Stock Price Effects Associated with Changes in the S&P 500 Index, *Journal of Business* 70, 351-383.

Peterson, P., 1989, Event Studies: A Review of Issues and Methodology, *Quarter Journal of Business and Economics* 28, 36-66.

Pontiff, J., 1996, Costly Arbitrage: Evidence From Closed-End Funds, *Quarterly Journal of Economics* 111, 1135-1151.

Shleifer, A., 1986, Do Demand Curves for Stocks Slope Down? *Journal of Finance* 41, 579-590.

Shleifer, A., 2000 *Inefficient Markets*, Oxford University Press.

Wurgler, J., and E. Zhuravskaya, 2002, Does Arbitrage Flatten Demand Curves for Stocks?, *Journal of Business* 75, 583-608.

Table 1: Cash Position in Index-Arbitrage during 1991-2002

Year	Amount in million Yen	Total number of shares in all arbitrage positions (in 1,000 shares)	Estimated number of shares per firm in the225 arbitrage position (in 1,000 shares)*
1991	1,138,675	1,014,648	3,607
1992	580,579	741,334	2,635
1993	1,205,743	1,254,016	4,458
1994	737,596	771,877	2,744
1995	1,882,532	2,181,199	7,755
1996	2,796,620	2,757,016	9,802
1997	1,369,777	1,547,996	5,504
1998	538,367	752,001	2,673
1999	801,750	827,508	2,942
2000	3,084,502	2,186,443	7,774
2001	1,507,301	1,599,583	5,687
2002	938,608	980,718	3,487

Note. All values are for the end-of-September of each year. The amount in million yen (the second column) and the total number of shares held in the cash position of index-arbitrage (the third column) are reported by the Tokyo Stock Exchange. The forth column shows the estimated number of shares per firm held in the Nikkei 225-type arbitrage positions.

* Calculated by multiplying the total number of shares held by all arbitrage positions (the third column) by 0.8 and dividing it by 225.

Table 2: Comparison of Demand Shock to Trading Volume in the Pre-announcement Periods

	Sample Mean (n=69)	Standard Deviation
DS=AB/OUT	2.38%	0.0190
Average V/OUT (AD-100, AD-1)	0.25%	0.00045
Average V/OUT (AD-30, AD-1)	0.29%	0.00045

Note: DS=AB/OUT is the measure of demand shock due to the rebalancing by index-arbitrageurs as explained in the text. Average V/OUT (AD-100, AD-1) is the average percentage of the added firm's trading volume (to outstanding shares) over the 100-day period of (AD-100, AD-1). Average V/OUT (AD-30, AD-1) is that over the 30-day period of (AD-30, AD-1).

Table 3: Daily AAR and MVR Surrounding Addition to the Nikkei 225 Index

Panel A: AAR and MVR relative to the Announcement Day (AD)

Days relative to AD	Number of Samples	AAR (%)	*t*-value	MVR
AD-10	69	0.03	0.01	1.06
AD-9	69	0.60	1.57	1.04
AD-8	69	-0.09	-0.23	1.06
AD-7	69	0.15	0.38	1.04
AD-6	69	-0.32	-0.83	1.09
AD-5	69	0.74	1.92*	1.03
AD-4	69	-0.09	0.24	1.06
AD-3	69	1.06	2.75***	1.26
AD-2	69	0.14	0.35	1.21
AD-1	69	0.59	1.53	1.38
AD	69	5.16	13.42***	4.45
AD+1	68	0.55	1.42	4.21
AD+2	65	2.59	6.74***	4.88
AD+3	51	1.35	3.51***	3.48
AD+4	50	1.01	2.63***	3.44
AD+5	16	0.26	0.68	2.37

Panel B: AAR and MVR relative to the Change Day (CD)

Days relative to AD	Number of Samples	AAR (%)	*t*-value	MVR
CD-5	16	0.31	0.79	2.18
CD-4	50	0.83	2.16**	2.19
CD-3	51	0.31	0.81	3.25
CD-2	65	1.67	4.35***	4.40
CD-1	68	4.19	10.92***	8.21
CD	69	-3.50	-9.11***	4.23
CD+1	69	-1.37	-3.57***	2.30
CD+2	69	-0.28	-0.73	2.20
CD+3	69	0.25	0.65	3.40
CD+4	69	-0.53	-1.38	3.72
CD+5	69	-0.76	-1.98*	2.51
CD+6	69	0.21	0.56	1.83
CD+7	69	-0.53	-1.39	1.60
CD+8	69	-0.03	-0.08	1.77
CD+9	69	0.47	1.21	1.81
CD+10	69	-0.38	-0.99	1.46

Note: AAR is the average abnormal return and MVR is the mean volume ratio for the specified day in the event period. *t*-value is the statistic used to test the null hypothesis that AAR=0.
* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 4: Cumulative Abnormal Returns over Four Event Windows

Panel A: 69-sample case

Event Window	Event Days	Average Days	CAR (%)	*t*-value
Announcement day	AD	1	5.16	13.42***
Run-up Window	(AD+1, CD-1)	4.52	5.70	6.99***
Release Window	(CD, CD+7)	8	-6.51	-5.99***
Post-AD Window 1	(AD+1, CD+7)	12.52	-0.81	-0.595
Post-AD Window 2	(AD+1, CD+10)	15.52	-0.75	-0.50
Total Permanent	(AD, CD+10)	16.52	4.40	2.82***

Panel B: 40-sample case (39 individual firms and one portfolio)

Event Window	Event Days	Average Days	CAR (%)	*t*-value
Announcement day	AD	1	4.94	12.41***
Run-up Window	(AD+1, CD-1)	4.9	5.91	6.70***
Release Window	(CD, CD+7)	8	-5.77	-5.13***
Post-AD Window 1	(AD+1, CD+7)	12.9	0.13	0.09
Post-AD Window 2	(AD+1, CD+10)	15.9	0.39	0.25
Total Permanent	(AD, CD+10)	16.9	5.33	3.26***

This table represents the results of average abnormal returns (AAR) on the announcement date and cumulative abnormal returns (CAR) for five different event windows for two samples.

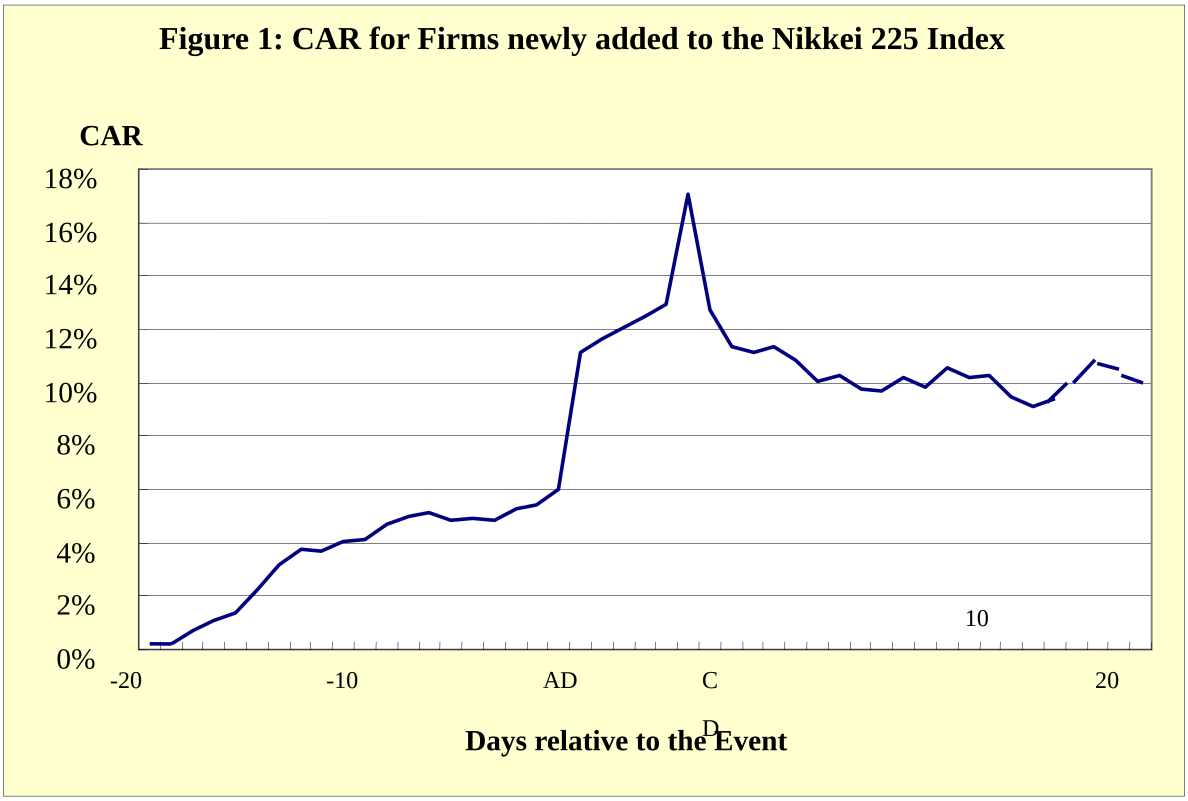
*** significant at the 1% level

Table 5: Cross-Sectional Regressions of CARs

Panel A: Regression Results of CAR in the run-up window of (AD+1, CD-1)		
	(1)	(2)
Constant	-0.004 (-0.12)	-0.025 (-0.71)
DS	2.45 (4.69)***	
DSF		1.10 (5.81)***
RISK	0.50 (0.42)	0.54 (0.53)
R^2	0.25	0.34
Sample Size	69	69
Panel B: Regression Results of CAR in the release window of (CD, CD+7)		
	(1)	(2)
Constant	-0.05 (-1.20)	-0.05 (-1.39)
DS	0.57 (1.00)	
DSF		0.32 (1.39)
RISK	-0.97 (-0.87)	-0.87 (-0.78)
RUN-UP	-0.29 (-2.55) ***	-0.33 (-2.75)***
R^2	0.19	0.02
Sample Size	69	69

Note: Dependent variables are CAR in the run-up window (Panel A) and CAR in the release window (Panel B). DS is the measure of demand shock based on the total outstanding shares, DSF is the measure of demand shock based on the free float, and RISK is the measure of arbitrage risk. RUN-UP is the run-up period CAR. The *t*-value is given in the parentheses.

*** significant at the 1% level.



Note: AD is the announcement date and CD is the effective change date. Since the number of trading days between AD and CD varies across firms, the interval between AD+1 to CD is displayed 5 days (actual average=5.5 days). The CAR is displayed as if each daily AAR over this interval were the interval CAR divided by five.

Discussion Paper

No.	Author	Title		Date
2003・1	Katsuhiko Kokubu	Environmental Accounting for Corporate Management	(in Japanese)	1／2003
2003・2	Kazuhiro Tanaka	Embeddedness and Entrenchment of Managers	(in Japanese)	2／2003
2003・3	Fumitoshi Mizutani Shuji Uranishi	The Effects of Privatization on TFP Growth and Capital Adjustments		2／2003
2003・4	Yang Jia Yin Koji Okubayashi	Labour Turnover of Japan-Affiliated Companies in Shanghai	(in Japanese)	3／2003
2003・5	Mitsutoshi Hirano	Generation and Resolution of Asymmetric Information in Human Resource Management –In the Cases of Job Rotation in Two Retailers in Japan-	(in Japanese)	3／2003
2003・6	Kazuhisa Otogawa	Market Liquidity around Quarterly Earnings Announcements		3／2003
2003・7	Nobuyuki Isagawa Tadayasu Yamashita	Lender's Risk Incentive and Borrower's Risk Incentive	(in Japanese)	3／2003
2003・8	Kenji Kutsuna Marc Cowling	Determinants of Small Business Loan Approval: Evidence from Japanese Survey after 1997 Financial Crisis		3／2003
2003・9	Noriko Masumura	Voluntary Corporate Disclosure and the Cost of Debt: The Case of Quarterly Reporting	(in Japanese)	4／2003
2003・10	Nobuyuki Isagawa Katsuhiko Okada	Corporate Financial Strategy and Stock Price Behavior in a Noise Trader Model with Limited Arbitrage		4／2003
2003・11	Mitsutoshi Hirano	Two Modes of Economic Organization in the Duality Principle and Asymmetric Personal Information	(in Japanese)	5／2003
2003・12	Kenji Kutsuna Richard Smith	Why Does Book Building Drive Out Auction Methods of IPO Issuance? Evidence from Japan (Revised version)		5／2003
2003・13	Kenji Kutsuna Janet Kiholm Smith Richard L. Smith	Banking Relationships and Access to Equity Capital Markets: Evidence from Japan's Main Bank System		5／2003
2003・14	Hideya Kubo	The Present Condition and Problem of Japanese Corporate Pension Systems	(in Japanese)	6／2003
2003・15	Hideki Murakami	An empirical analysis of the spillover and dynamic effects of low-cost airline's presence on rival's price: US duopoly case	(in Japanese)	7／2003
2003・16	Norio Kambayashi	Japanese Style of Management Education	(in Japanese)	7／2003
2003・17	Nobuyuki Isagawa	Unwinding of Cross Shareholding for Business Restructuring	(in Japanese)	7／2003
2003・18	Nobuyuki Isagawa	Unwinding of Cross Shareholding: A Signalling Approach	(in Japanese)	7／2003
2003・19	Huang Lin	Strategies and Store Development of Carregour in the Chinese Continent	(in Japanese)	8／2003
2003・20	Koji Okubayashi	Employment Situation and Measures for Increasing Employment Opportunities; The Case of Japan		8／2003
2003・21	Nobuyuki Isagawa	Lender's Risk Incentive and Debt Forgiveness		8／2003
2003・22	Keizo Mizuno Fumitoshi Mizutani Noriyoshi Nakayama	Industrial Diversity and Metropolitan Unemployment Rate		9／2003
2003・23	Kenji Kutsuna Nobuyuki Harada	Small Business Managers as Latent Informal Investors in Japan: Evidence from a country with a bank-based financial system		9／2003
2003・24	Shigeki Sakakibara Takashi Yamasaki	The First Half of The Year Effect in Japanese Stock Market	(in Japanese)	9／2003
2003・25	Michihiro Ozawa	Audit Risk Model with conditional probability and the importance of risk assessment	(in Japanese)	10／2003
2003・26	Atsushi Takao	A Note on the Securitilization of Catastrophe Risk ～A Study by Especially Attention -Focusing to Insurance Linked Securities ～	(in Japanese)	10／2003

Discussion Paper

No.	Author	Title		Date
2003・27	Koji Okubayashi	Industrial Relations in a Changing Economy: Japan’s Experience		11／2003
2003・28	Nobuyuki Isagawa Tadayasu Yamashita	Debt Forgiveness and Stock Price Reaction of Lending Bank: Theory and Evidence from Japan		12／2003
2003・29	Mitsutoshi Hirano	Self-Reliance Career Development via Change in Organization Mode of Japanese Firm	(in Japanese)	12／2003
2004・1	Koji Okubayashi	New Trends of Japanese Management under IT Revolution		1／2004
2004・2	Huang Lin	The Chinese Companies in the Globalization	(in Japanese)	1／2004
2004・3	Mitsutoshi Hirano Yoshihiro Ogawara	Change in Organization Mode and Asymmetric Personal Information via Merchandising Process Reengineering－From a Case of Big Box Retailer in Japan－	(in Japanese)	1／2004
2004・4	Katsuyoshi Takashima	Competitive Structure of E-Commerce	(in Japanese)	2／2004
2004・5	Susumu Ogawa Manabu Mizuno	Testing CVS folk theories	(in Japanese)	2／2004
2004・6	Susumu Ogawa Manabu Mizuno	CVS Folk theories and systemic advantages	(in Japanese)	2／2004
2004・7	Susumu Ogawa	Seven-Eleven's Systemic Advantages: its integrity and flexibility	(in Japanese)	3／2004
2004・8	Mitsutoshi Hirano	Core Human Resources Management via Change in Organization Mode	(in Japanese)	3／2004
2004・9	Hideki Murakami	An Empirical Analysis of Low-cost Entry's Effect on Market Performance: The case of 3-firm US Oligopoly Air Market	(in Japanese)	5／2004
2004・10	Manabu Mizuno Susumu Ogawa	Positive Effects of Know-How Disclosure to Potential Rivals	(in Japanese)	5／2004
2004・11	Shigeki Sakakibara NaoshiYamazaki	The Half-year Effect of the Japanese Stock Returns and Four Factor model	(in Japanese)	6／2004
2004・12	Susumu Ogawa Hidehiko Nishikawa	An evolution of User-driven Business Models: A case study of MUJI・net	(in Japanese)	6／2004
2004・13	Hiroshi Takamuro Junzo Ishii	The innovation of the selling process and management: the case of IBM	(in Japanese)	7／2004
2004・14	Takayoshi Okabe	Aggregate Accrual Approach in Discretional Behavior Reseach	(in Japanese)	7／2004
2004・15	Susumu Ogawa	Seven-Eleven's Systemic Advantages:	(in Japanese)	8／2004
2004・16	Susumu Ogawa	Multi-cluster product Development	(in Japanese)	8／2004
2004・17	Atsushi Takao	Some Notes on the Weather Derivatives & Temperature Swap in Japan		10／2004
2004・18	Takayoshi Okabe	Premature Revenue Recognition Drived by the Market Competition	(in Japanese)	11／2004
2004・19	Nobuyuki Isagawa	Cross Shareholding and Unwinding of Cross Shareholding under Managerical Entrenchment		12／2004
2004・20	Hideki Murakami	An Empirical Analysis of Low-cost Entry's Effect on Market Performance: The case of 3-firm US Oligopoly Air Market	(in Japanese)	12／2004
2004・21	Katsuhiko Okada Nobuyuki Isagawa Kenya Fujiwara	Addition to the Nikkei 225 Index and Japanese Market Response: Temporary Demand Effect of Index-arbitrageurs		12／2004