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Discussion Paper 02-10-Rev.

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Running title: Competition in Japanese Securities Industry

Abstract

This paper investigates the competitive condition of the Japanese securities industry over the period 1983 to 2002 using the H-statistic proposed by Panzar and Rosse. Our results indicate that the Japanese securities industry was not in monopoly equilibrium in period 1 (1983–88) and period 3 (1997–2002), while this possibility cannot be rejected in period 2 (1991–96). Thus, competition deteriorated in period 2, and then it recovered and became more competitive recently, even compared with period 1. The industry has not faced perfect competition, notwithstanding its undergoing financial reform.

JEL Classification Numbers: G24, L13
Keywords: Panzar-Rosse, H-statistic, degree of competition, securities industry, Japan

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1. Introduction

The purpose of this paper is to elucidate how the competition of Japanese securities companies changed over the period 1983 to 2002. We apply the method proposed by Panzar and Rosse (1987) that measures the competitive condition of an industry by examining elasticity of revenue with respect to input price.

After the unprecedented stock price bubbles in the late 1980s and the stock market crash in the 1990s, the Japanese government introduced several measures to promote competition in the securities industry. The industry has been gradually deregulated since 1993, including a liberalization of the brokerage fee. Until 1998, a license was required to start up a securities company in Japan. Registration is now the only requirement. Consequently, the securities industry might have become more competitive over the period. However, degree of competition may be influenced by business conditions. The bubble of the 1980s and the stagnation of the 1990s, called the Heisei Depression, might have impacted on the competitiveness of securities firms.

There is a considerable literature on the application of the Panzar-Rosse method to the banking industry (Nathan and Neave 1989, Shaffer and DiSalvo 1994, Molyneux *et al*. 1994, Hondroyiannis *et al*. 1999, Coccorese 1998, Bikker and Groeneveld 2000). However, there are only a few studies of the competitive condition of the financial sectors in Japan.

Molyneux *et al*. (1996) estimated the H-statistic for Japanese banks in 1986 and 1988, and they could not reject the hypothesis that bank revenues behave as if earned under monopoly in 1986, but as if under monopolistic competition in 1988. Alley (1993) estimated the degree of collusion in the Japanese banking sector and found a high degree of collusion in 1986 and 1987. Uchida and Tsutsui (2004) proposed a new method and estimated the degree of competition in the Japanese banking sector from 1974 to 2000. They found that the market had become more competitive in the 1970s, and judged that Japanese city banks faced perfect competition in the middle of 1990s. Souma and Tsutsui (2000) applied a similar method to the Japanese life insurance industry for the period 1986 to 1997. They found that the industry was not very competitive, but had become more competitive since 1995, when the New Insurance Industry Law was promulgated.

Fukuyama and Weber (1999) estimated the efficiency of production for the Japanese securities industry.

The rest of the paper is organized as follows. In section 2, we give an overview of the history of liberalization of the Japanese securities industry. In section 3, we explain the model used in this paper. Results are presented in section 4. In section 5, we provide a check on the robustness of our results. In section 6, we draw a conclusion.

2. Liberalization of the Japanese Securities Industry

Liberalization of Japanese financial industries has been ongoing since 1974 (Cargill and Royama 1988). The liberalization of foreign exchange and deposit interest rates was an important area of deregulation in the 1980s. Private banks and the Ministry of Posts and Telecommunications, which operates postal savings, were allowed to sell government bonds in 1983 and 1988, respectively. Consequently, pressure may have been applied on the securities industry, affecting its competitiveness.

In 1993, regulation governing segregation of business areas in the financial industries was relaxed. Banks and securities companies were allowed to enter each other's industry by establishing subsidiaries. Based on this deregulation, many securities companies were established as subsidiaries of banks, but no new banks, other than trust banks, were established as subsidiaries of securities companies. This is probably because banks had more competitive power than securities companies in Japan. Because the subsidiaries of banks were not allowed to conduct brokerage business, they mainly entered underwriting and distributing businesses. Their share of the market for underwriting and distribution of corporate bonds increased substantially in subsequent years.

In January 1996, regulation of the issuing of corporate bonds was relaxed.

Consequently, the amount of corporate bonds issued increased significantly. In Figure 1 we show the amount of corporate bonds issued from 1983 to 2002. The corporate bond here is defined as excluding those issued by nine electric power companies, Nippon Telegraph and Telephone Corporation and Japan Railway Companies.[1] The amount was almost zero until 1990, then rapidly increased until 1998, and became stagnant thereafter.

In November 1996, the then Prime Minister Hashimoto commenced 'the Financial Big Bang'. In the securities industry, the most important reforms were liberalization of brokerage commissions and conversion from a licensing system to a registration system. Liberalization of brokerage commissions in 1999 and 2000 induced a significant decline in the level of commission. Until 1999, the commission fee was fixed at 1.15% for all trades equal to or less than one million yen. However, after the liberalization, this fee has decreased dramatically, and each securities firm applied its highest discount rate on transactions through internet accounts. One of the famous internet trading securities companies in Japan, Matsui Securities, ceased to charge a trading commission fee for internet trades from April 2004, as long as their customer's trades for one day do not exceed ten thousand yen. When their customer's trades exceed ten thousand yen, they

[1] Electric power companies and Nippon Telegraph and Telephone Corporation were a few exceptions that issued bonds earlier than our period. This is why we exclude their data. However, if their data are added, the essentials do not change except that issues before 1990 were not close to zero.

still charge only 3150 yen for all transactions executed on the same day, as long as the total trades for the day do not exceed three million yen, no matter how many times the customer trades. As shown in this example, some securities companies seem to have engaged in price competition in the brokerage business since 1999.

In Figure 2 we show stock transactions listed in the first section of the Tokyo Stock Exchange. The Figure clearly shows the vivid increase of the bubble period of the 1980s, and remarkable decline and consecutive long stagnation in the 1990s. Transactions recovered substantially in 1999, although the Japanese economy did not fully recover. How did securities companies respond to these changes in business conditions? In Figure 3 we show the number of securities firms, their branches and employees. The number of employees and branches increased until 1990 and 1991, respectively, and then decreased until 1999. After 1999, they have not decreased monotonically. Comparing Figure 3 with Figure 2, we see that the number of branches and employees synchronized with the business condition represented by the volume of stock transactions. It is reasonable for firms to expand when revenues increase and to shrink with adversity. The number of firms in Figure 3, however, changed quite differently from the number of branches and employees: it increased steadily except for the first and the last two years and 1990–93. Considering that the first two years were not in the bubble period and that the bubble burst in 1990–92, the change might be interpreted as reflecting the change in business conditions. It is not easy to interpret the rise in the number of firms in 1994–97 and the decline after 2000 in terms of the degree of competition in the industry.

3. Model

We employ the method proposed by Panzar and Rosse (1987) to estimate the degree of competition. Panzar and Rosse focused on the sum of input elasticity of revenue, $\sum_{k=1}^{K} \frac{p_k}{R} \frac{\partial R}{\partial p_k}$, which is called the H-statistic, where R is the revenue, p_k, the k-th input price, and K is the number of inputs. They demonstrated that $H \le 0$ in case of a monopoly, $H \le 1$ in case of monopolistic competition (Chamberlinian equilibrium), in which marginal revenue equals marginal cost and profit is zero, and $H = 1$ in case of perfect competition in the long run.

Under a monopoly, an increase in input prices will increase marginal costs, so that it decreases output and revenues. Under perfect competition in the long run, an increase in input prices increases both marginal and average costs, so as to equalize an increase in revenue to the increase in costs. Although different interpretations of the H-statistic have been offered (see Hondroyiannis *et al*. 1999; p.382), many scholars believe that a positive H rejects monopoly equilibrium (Shaffer and DiSalvo 1994; p.1075). We should be aware that Panzar and Rosse (1987) only show a necessary condition for monopoly, monopolistic competition, and perfect competition. Thus, we should be careful in interpreting our results.

However, Shaffer (1983) showed that under some conditions, the H-statistic is inversely related to Bresnahan's (1982) index of monopoly power, which is equal to $\frac{q}{Q}\frac{\partial Q}{\partial q}$ under quantity competition, where q is a firm's output and Q is total market output. According to this relation, we interpret the H-statistic value as the degree of competition.

Panzar and Rosse denoted a revenue function as

$$R = R(y, z), \qquad (1)$$

where y is output, and z stands for exogenous variables that affect revenue.

The cost function is assumed to be

$$C = C(y, p, t), \qquad (2)$$

where p represents input prices, and t stands for other exogenous variables. Since profits are defined as $\pi \equiv R(y, z) - C(y, p, t)$, profit-maximizing y is written as $y^* = y(z, p, t)$.

Substituting this into (1), the reduced form of the revenue function can be written as

$$R^* = R(y(z, p, t), z) \equiv \tilde{R}(z, p, t). \qquad (3)$$

Thus, Panzar-Rosse's H-statistic is calculated using estimates from equation (3).

Securities companies often operate four types of businesses: brokerage, underwriting and distributing, dealing, and margin transaction businesses.[2] Thus, it is difficult to specify what is the relevant measure of outputs of securities firms. To estimate the H-statistic, however, we need not specify the output level. It is necessary only to specify the securities firm's revenue *R*, and *z*, *p*, and *t*. This is a great advantage of the H-statistic as a measure of the degree of competition in the securities industry.

Now, let us specify the variables in eq. (3). We use operating revenue for *R*. For input prices, *p*, we use the wage rate, *w*, financial cost, *r*, and capital equipment cost, *k*. For wage rate and financial cost, we define

$$w \equiv \frac{\text{personnel expenses}}{\text{number of employees}},$$

and

$r \equiv$ (total financial cost) / (short-term loans + borrowings from securities finance company + borrowings for margin transaction + fixed debt).

Capital equipment cost is difficult to define. We use two definitions, k_1 and k_2, for this variable. Specifically, we define

$$k_1 \equiv \frac{\text{depreciation expenses} + \text{equipment expenses} + \text{expenses related to real estate}}{\text{fixed asset}}$$

and

$$k_2 \equiv \frac{\text{real estate expense}}{\text{total area of all branches}}.$$

[2] Securities companies in Japan do not correspond to any financial institutions in the U.S. They do investment banking and also brokerage business.

In addition, we estimate the equations excluding the capital equipment cost variable to check the robustness of the results.

For the exogenous variables in the revenue function, *z*, and cost function, *t*, we define variables that represent the composition of the four businesses, because we believe that business composition generally affects revenues as well as costs. Suppose there are two firms, A and B, whose total assets are the same. Firm A conducts only brokerage business, while firm B conducts only underwriting business. Then revenues of these firms are generally different. If the revenue of firm A is larger than that of firm B, brokerage business tends to earn more revenue than underwriting given total assets of the firms.

We define three business compositions, *BROKER*/*ASSET*, *DISTR*/*ASSET*, and *MARGIN*/*ASSET*, where *BROKER* stands for brokerage fee, *DISTR* is underwriting and distributing fee, *MARGIN* is income from margin transaction, and *ASSET* stands for total assets. We do not specify the fourth ratio, revenue from dealing business to total asset, to avoid co-linearity, since the operating revenue sums the four business fees. It is residually determined by the three ratios above. Other specifications of business composition are possible and will be examined in section 5.2. In addition, we use the logarithm of total assets, *LASSET*, as a size variable of the securities companies.

We consider other firm-specific variables—age of firms, concentration of shareholders, and location of head office—and conduct additional analyses in section 5.4.

Descriptive statistics of the variables are given in Table 1. Revenue is about 43000 million yen on average for the whole period. The revenue of the first period is the largest, reflecting the stock market boom in the 1980s. The revenue in the third period decreased to half that of the first period. Financial cost is about 5.8% for the whole period. It decreased from 6.7% in the first period to 3.4% in the third period, reflecting the decline of the market interest rate. Wage rate is about 8.6 million yen for the whole period. It slightly increased from period 1 to period 3. Capital equipment cost, k_1, is about 24%, and decreased from period 1 to period 2. Capital equipment cost, k_2, is about 0.2 million yen per $1000m^2$, which is too small to be the rental of branches. This might be due to the fact that the data for total area of branches includes not only rented branches but also owned branches, while the real estate expense does not include that of owned branches. Brokerage fees decreased throughout the period. Underwriting and distributing fees decreased from period 1 to period 2, but increased again in period 3. Income from margin transactions decreased dramatically in period 3. Thus, we know that business composition changed considerably throughout the period.

De Bandt and Davis (2000) specify the revenue equation for banks as

$\ln R_{i,t} = \sum_{j=1}^{J} \alpha_j \ln p^{j}{}_{i,t} + \sum_{k=1}^{K} \beta_k \ln S^{k}{}_{i,t} + \sum_{n=1}^{N} \gamma_n X^{n}_{i,t} + \varepsilon_{i,t}$, where p is a three-dimensional vector of factor prices (wages, interest rate on liabilities, and other cost), S is a vector of scale variables, and X is a vector of exogenous and bank-specific variables that may shift business mix. It is remarkable that our variable selection conforms closely to their specification. We employ three prices, log of scale variable, and business mix variables, as they do. We also adopt exogenous firm-specific variables, such as firm age and firm location in section 5.4.

For our basic regression equation, we examine the following Cobb-Douglas and translog functions. We call the following 'basic equations'.

Cobb-Douglas function:

$$\begin{aligned}\ln R_{i,t} &= a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} \\ &\quad + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t}\end{aligned} \tag{4}$$

Full translog function:

$$\begin{aligned}\ln R_{i,t} &= a_0 + a_1 \overline{\ln r_{i,t}} + a_2 \overline{\ln w_{i,t}} + a_3 \overline{\ln k_{i,t}} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} \\ &\quad + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t} + b_1 (\overline{\ln r_{i,t}})^2 + b_2 (\overline{\ln w_{i,t}})^2 + b_3 (\overline{\ln k_{i,t}})^2 \\ &\quad + b_4 (\overline{\ln r_{i,t}})(\overline{\ln w_{i,t}}) + b_5 (\overline{\ln r_{i,t}})(\overline{\ln k_{i,t}}) + b_6 (\overline{\ln w_{i,t}})(\overline{\ln k_{i,t}}) + u_{i,t}\end{aligned} \tag{5}$$

Partial translog function:

$$\ln R_{i,t} = a_0 + a_1\overline{\ln r_{i,t}} + a_2\overline{\ln w_{i,t}} + a_3\overline{\ln k_{i,t}} + a_4\frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5\frac{DISTR_{i,t}}{ASSET_{i,t}}$$
$$+ a_6\frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7\ln ASSET_{i,t} + b_1(\overline{\ln r_{i,t}})^2 + b_2(\overline{\ln w_{i,t}})^2 + b_3(\overline{\ln k_{i,t}})^2 + u_{i,t} \tag{6}$$

where variables with upper bars are deviations from their means.[3]

H-statistic is defined as

$$H \equiv a_1 + a_2 + a_3 \tag{7}$$

where it is evaluated at the mean of price variables for translog cases.[4]

4. Basic Results

Our sample firms are 54 to 62 securities firms depending on the year. There are a total of 247 to 297 securities firms in our observation period. The number of firms in our sample is only about 1/5 of this total. However, since our sample of companies includes all those listed on the stock exchange or that publish financial reports, we have relatively large samples. For example, if we look at the number of employees, our sample firms employ 42% of the total for all firms in 1999 and 57% in 1983, implying that our sample covers the principal part of the Japanese securities industry.

As De Bandt and Davis (2000) mentioned, the estimates of year-by-year cross-section analysis are usually unstable and this is really the case in our study;

[3] Using deviations from the means in the translog function is a convention to avoid possible multi-collinearity.

therefore, we pool our data for several years to guarantee stable estimates. Based on the competitive background and stock market conditions in Japan, we pool our data and estimate the model for three periods between 1983 and 2002. Period 1 is from 1983 to 1988, when Japan went through the unprecedented stock price bubble; period 2 is from 1991 to 1996, when the market faced the large stock price crash; and period 3, from 1997 to 2002, is when the government implemented several regulatory changes to promote competition in the securities industry. Nonetheless, Japanese financial industries fell into crisis during period 3.

We excluded 1989 as the accounting period changed in that year. Before 1989, the period was the twelve-months ending September 30, and after 1989, it ended March 31. Because the dataset for 1989 accounts for only six months, October 1988 to March 1989, we deleted that year.[5]

We also excluded 1990, since our financial data in that year reflect not only 1989 but also 1990. While the stock price index, *Nikkei average*, grew from 9893 yen in 1983, the first year of our dataset of period 1, to 38915 yen in 1989, the index started to fall steeply from the beginning of 1990. Thus, by deleting 1990, period 1 is purely a period of

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[4] At the mean of price variables, variables with upper bars are zero.

[5] In this paper, we designated the year by the end of the accounting year. Before 1989, using 1984 as an example, the accounting year was from October 1, 1983 to September 30, 1984. After 1990, using 1995 as an example, the accounting year was from April 1, 1994 to March 31, 1995.

the Japanese stock market boom or bubble.

All the data were extracted from the *Nikkei NEEDS Corporate Financial Data File* (*Securities Companies*), unless otherwise mentioned.

We estimated equations (4)–(6) with plain OLS, fixed effect model, and random effect model. As plain OLS was always rejected against the fixed effect model by the F-test for intercepts, and the random effect model was rejected against the fixed effect model for most cases by the Hausman test, we will present the results of the fixed effect model. We will present the results using k_1 for capital equipment cost, k.

To discover the appropriate functional form, a conventional F-test was applied to the three equations and the results are presented in Table 2. Table 2 makes it clear that the Cobb-Douglas function is not rejected against the partial translog function in any period, but it is rejected against the full translog function in periods 2 and 3. Given these results, we will report the results of the Cobb-Douglas and full translog functions in this section. The results of partial translog function are not remarkably different.

In Table 3, we present the results of eq. (4). The fit was good for all periods. The coefficient of *LASSET* ($\ln ASSET$) is highly significant and takes on the value of 0.9 throughout the period. The coefficient of *BROKER/ASSET* was positive and also highly significant throughout the period, implying that the brokerage business earned relatively more revenue. The coefficient of *DISTR /ASSET* was significantly positive in periods 1 and 3, but was negative in period 2, suggesting that profitability of the distributing business in period 2 was poor. The coefficient of *MARGIN/ASSET* was insignificant in periods 1 and 3, but significantly positive in period 2.

The H-statistic is shown in Figure 4 with a 95% confidence interval. The H-statistic took on a value of 0.216 in period 1, and was significant. In period 2, the H-statistic decreased to 0.085, and standard error increased resulting in a wider confidence interval, so that the H-statistic was statistically indifferent from zero. In period 3, the H-statistic increased to 0.338 and was significant at a 1% level. The H-statistic was significantly different from unity for all periods, implying that the industry was not in perfect competition.

In Table 4, we present the results of eq. (5). The signs of the coefficients of *BROKER/ASSET*, *DISTR/ASSET*, and *LASSET* we found to be almost the same as in Table 3. However, *MRAGIN/ASSET* became significantly positive in period 2. The coefficients of *DLR* $(\overline{\ln r})$, *DLW* $(\overline{\ln w})$, and *DLK* $(\overline{\ln k})$ are also similar to those in Table 3. The second order terms of *DLW* and *DLK* are only significant in period 3 and in period 2, respectively. The cross terms were not significant except for *DLW***DLK* in period 3. The H-statistic is almost the same as in Figure 4.

In sum, estimation results of Cobb-Douglas and translog revenue function suggest the following:

1) That the industry was in monopoly equilibrium is rejected in periods 1 and 3, but the possibility that the industry was in monopoly equilibrium in period 2 cannot be rejected.
2) Firms with higher brokerage business ratio earned more revenue than others in all sub-periods.
3) Period 2 was difficult for the underwriting and distributing business.

These conclusions are robust to the Cobb-Douglas and translog functional forms, and to the variable used to measure capital equipment cost.

We interpret the first conclusion as follows. In period 1, 1983–88, which is characterized by a big bubble, the Japanese stock market was excited, with a sharp rise of stock prices along with a sharp increase in trading volume (see Figure 2). In this atmosphere, securities companies expanded their businesses enthusiastically. In period 2, 1991–96, facing dramatic decline of transaction demand, securities companies contracted their businesses and their firm size, losing their eagerness to expand (see Figure 3). Although liberalization, such as relaxation of the segregation of business areas in the financial industries, was implemented in this period, its impact on competition was limited. Our result, a high H-statistic in period 1 and a low one in period 2, reflects business conditions for securities companies and their attitude toward expansion of their businesses. However, after the failures of large banks and securities companies in 1997 and 1998, brokerage commissions were liberalized, which was a remarkable achievement, which clearly caused a decrease of commission fees. Our finding that the H-statistic recovered in period 3 reflects the effect of liberalization.

5. Checking Robustness of the Results

In this section, we provide a check on the robustness of the results in the previous section.

5.1 Simple specification

First, we check whether the conclusion based on the basic estimation presented in section 4 remains valid, when we delete the variables representing the business composition of each firm. The regression equation is now

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_7 \ln ASSET_{i,t} + u_{i,t} \tag{8}$$

The estimates of eq. (8) with within-estimation are shown in Table 5. The coefficients of *LASSET* and all the coefficients of the input prices, except for the coefficient of *LR* for period 2, are significant in this Table. The estimates of the

H-statistic become substantially larger when we exclude the variables of business composition for the periods 1, 2, and 3, respectively. However, the results are consistent with Table 3 in that the H-statistic is significantly different from zero in periods 1 and 3, while it is not in period 2 at a 5% significant level. In addition, the H-statistic in period 3 is slightly larger than that in period 1.

Excluding the business composition variables, similar results are obtained when we estimate translog function, and when k_2 is used as the measure of k (results are not shown). Therefore, our conclusion based on our basic model in the previous section is robust when we exclude the variables of business composition.

5.2 Other specifications of 'business composition' variables

In section 4, we used the revenue of each business divided by total asset, *BROKER/ASSET*, *DISTR/ASSET*, and *MARGIN/ASSET* for the data of business composition variables. In this section, we check whether the conclusions in the previous section are robust, when we adopt other specifications for these variables.

We examine the case in which the revenues of each business, i.e. brokerage fee, underwriting and distributing fee, and income from margin transactions, are adopted as the business composition variables. Thus, the regression equation becomes

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 BROKER_{i,t} + a_5 DISTR_{i,t} + a_6 MARGIN_{i,t} + a_7 \ln ASSET_{i,t} + u_{i,t} \quad (9)$$

Since *BROKER*, *DISTR*, and *MARGIN* may be endogenous variables, we estimate eq. (9) using the instrumental variables method. Specifically, we used rank variables of these variables as the instrumental variables for the estimation.[6]

The estimation results using within-estimation are shown in Table 6. The coefficients of these business composition variables become smaller in magnitude than those in Table 3, but the signs are unchanged except that the coefficient of *MARGIN* becomes negative and insignificant in the second and third periods and significantly positive in period 1.

We show the H-statistic in Figure 5. The H-statistic in the first period becomes insignificant when we use revenues of each business as the business condition variables. Since the H-statistic is also insignificant in the second period, the results do not reject the proposition that the security industry was in monopoly equilibrium in both the first and the second periods. Looking at the point estimates of the H-statistic, the results indicate that competition grew stronger over the period.

Next, we use the business composition variables divided by total revenue. Thus, the regression equation is

[6] Rank variable of X_i is the variable whose value is the order of X_i ranked in ascending order. See Maddala (1977; pp.297–298).

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{REV_{i,t}} + a_5 \frac{DISTR_{i,t}}{REV_{i,t}} + a_6 \frac{MARGIN_{i,t}}{REV_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t} \qquad (10)$$

The estimates are shown in Table 7. They are quite different from previous estimations. First, the H-statistic takes on the larger values 0.279, 0.600, and 0.763 in periods 1, 2, and 3, respectively. These are all significantly different from zero, implying a rejection of monopoly equilibrium in all periods (see Figure 6). They are relatively larger than those in previous results, implying that the industry was more competitive than the other estimations suggest. Second, the signs of the coefficients of business composition variables are all negative, implying that income from dealing, which is excluded to avoid co-linearity, has a strong positive effect on revenue throughout the period. This result is quite different from results in both Tables 3 and 5, leading to doubt about the results in Table 7.

In sum, these two investigations suggest that the selection of the business composition variables critically influences the estimated value of the H-statistic. Although reaching a decisive conclusion is a task for the future, we consider that our conclusion based on the basic model in section 4 is more reliable because the simple models in section 5.1, which do not use business composition variables, produce results consistent with those of the basic models.

5.3 Endogeneity of the wage rate

Some may argue that the wage rate is not exogenous, but endogenously determined, reflecting the performances of securities companies. Considering such a characteristic of the wage rate, we estimate equation (4) treating $w_{i,t}$ as an endogenous variable. Specifically, we use rank variables of *LW* as the instrumental variable for the estimation.

The within-estimation results for the Cobb-Douglas function are shown in Table 8. The coefficient of *LW* does not change dramatically, although that for period 3 became smaller. The coefficients of *BROKER/ASSET* and *DISTR/ASSET* are significant and are all positive except for the coefficient of *DISTR/ASSET* for period 2.

The results confirm the previous results in Table 3, in that the H-statistic is significantly different from zero in periods 1 and 3, but not in period 2. The estimates of the H-statistic in period 3 are slightly larger than for period 1.

Similar results are obtained for the translog function. Therefore, we conclude that our results are robust when we consider the wage rate to be endogenous.

5.4 Characteristics of firms

In section 4, we reported that the plain OLS estimation was rejected in favor of the fixed effect model (within-estimation). This implies that the characteristics of securities firms are important to explain their revenues. Thus, it is interesting to see how the characteristics of the firms affect the degree of competition. In this section, we use information on the age of the firm, *AGE*, its location, *TOKYO*, and the holding ratio of the largest shareholder, *SHARE*, and analyze their impact on competitiveness. The regression equation is now:

$$\begin{aligned}
\ln R_{i,t} &= a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} \\
&\quad + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t} + a_8 AGE_{i,t} + a_9 SHARE_i + a_{10} TOKYO_i \\
&\quad + c_1 AGE_{i,t} \ln r_{i,t} + c_2 AGE_{i,t} \ln w_{i,t} + c_3 AGE_{i,t} \ln k_{i,t} \\
&\quad + c_4 SHARE_i \ln r_{i,t} + c_5 SHARE_i \ln w_{i,t} + c_6 SHARE_i \ln k_{i,t} \\
&\quad + c_7 TOKYO_i \ln r_{i,t} + c_8 TOKYO_i \ln w_{i,t} + c_9 TOKYO_i \ln k_{i,t} + u_{i,t}
\end{aligned} \tag{11}$$

The H-statistic is defined as

$$H \equiv a_1 + a_2 + a_3 + (c_1 + c_2 + c_3)\underline{AGE} + (c_4 + c_5 + c_6)\underline{SHARE} + (c_7 + c_8 + c_9)\underline{TOKYO} \tag{12}$$

where underlined variables stand for their means.

The precise definition of the firm-specific variables is as follows.

AGE: age of company since its establishment (years);

SHARE: the holding ratio of the top shareholder in March, 2000 (%);[7]

TOKYO: a dummy variable which is unity if the head office is located in Tokyo, and zero otherwise.

[7] For some firms, this information was not available for the year 2000. Thus, we use the data for

Data on these variables are taken from Nikkei Kaisha Joho (Nikkei Information on Companies), Annual Corporation Reports, and several other sources including webpages of the companies. Their descriptive statistics are shown in the bottom rows of Table 1. Average *AGE* of these firms is about 52 years. Average *SHARE* is about 19%. Average *TOKYO* is 0.745, implying 2/3 of the securities firms of our sample have their head offices in Tokyo.[8]

We present the results of OLS estimation in Table 9, since *SHARE* and *TOKYO* are only firm-specific, and do not vary over time, so that within-estimation is impossible in this case.

The estimates are somewhat different from those of Table 3. For example, the coefficient of *LW* in the third period was 0.352 in Table 3, and 0.788 in Table 9. However, the signs of the coefficients of the price variables are not dramatically different from Table 3. The signs of *BROKER/ASSET* and *DISTR/ASSET* of Table 3 and Table 9 are similar except for *DISTR/ASSET* in period 2, which becomes insignificant, and the coefficients of *MARGIN /ASSET*, which are insignificant throughout.

1995, 1999, and 2002 for 13, one, and 10 firms, respectively.

[8] Although *SHARE* and *TOKYO* show different figures for each period in Table 1, this is because the observations are slightly different between periods.

The level of the H-statistic becomes slightly lower compared with the other estimations without firm-specific variables. However, the result that the H-statistic is significantly different from zero in the first and the third periods, while it is insignificant in the second period, is unchanged. Thus, the basic conclusion is confirmed.

As shown in equation (12), the H-statistic consists of four parts: $a_1 + a_2 + a_3$, which we name *PH* (pure H); $(c_1 + c_2 + c_3)\underline{AGE}$, which represents the effect of *AGE*, which we name *EFA*; $(c_4 + c_5 + c_6)\underline{SHARE}$, which represents the effect of *SHARE*, which we name *EFS*; and $(c_7 + c_8 + c_9)\underline{TOKYO}$, which represents the effect of *TOKYO*, which we name *EFT*. If we consider that young firms are innovative and eager to compete, we expect *EFA* to be negative. Similarly, if we consider that managers of the firms with a higher holding owned by the largest shareholder will be more disciplined and tend to be more eager to seek profits, *EFS* is positive. We can also expect competition in Tokyo to be more severe, since there are many securities firms. If this is the case, we expect a positive value for *EFT*.

The estimates of *EFA*, *EFS*, and *EFT* are shown in the bottom rows of Table 9. *PH* shows the same tendency as the H-statistic though its magnitude is larger: it is significant in periods 1 and 3 and insignificant in period 2. Unfortunately, *EFA*, *EFS*, and *EFT* are insignificant in most cases. Interestingly, however, *EFS* is significantly positive at a 1%

level in the third period, implying that firms with a higher holding owned by the largest shareholder are more competitive. In contrast, *EFT* in the third period is unexpectedly negative at a 1% significance level, implying that firms in Tokyo are less competitive.

6. Conclusions

This paper investigates changes in the competitive condition of the Japanese securities industry from 1983 to 2002. The H-statistic is estimated for three periods reflecting differences in the competitive environment. Our results indicate that the Japanese securities industry was not in monopoly equilibrium in period 1 (1983–88) or period 3 (1997–2002), while that possibility cannot be denied in period 2 (1991–96). Looking at the point estimates of the H-statistic, competition deteriorated in period 2, and then recovered and became more competitive recently even compared with period 1. The industry has not faced perfect competition, notwithstanding the financial reforms implemented during this time. This conclusion is robust to both the Cobb-Douglas and translog revenue functions.

We interpret this result as the outcome of business conditions cum development of financial liberalization. Specifically, we argue that a bubble in the 1980s accelerated competition, while stagnation in the 1990s depressed competition. While relaxation of segregation of business lines in 1993 did not promote competition, deregulation of brokerage fees in the late 1990s did have a strong impact on competition. This suggests that a policy measure does not have a constant influence on competition. Relaxation of segregation of business lines did not have prompt strong impact because it was done at a time of very severe business conditions for securities companies. In contrast, deregulation of brokerage fees was very timely, as internet trading became popular from that time. In addition, the failure of the Yamaichi Securities Company in 1997 made all the securities firms feel anxious for their safety and compete with each other to attract new customers. Policy measures should take into account business conditions for the firms being regulated.

We provided a further check on the robustness of these conclusions. First, we estimated a simple specification excluding the variables representing firms' business composition. Our results support the conclusions of the former sections. Second, we estimated the equations using different specifications for the variables representing business composition. Specifically, we used the revenues from each business, as well as those divided by total revenues. The conclusions critically depend on the specification of business composition variables. However, we consider that the results in section 4 are more reliable. Third, we checked the possibility of the endogeneity of the wage rate. The estimation with instrumental variables of wage rates supports the conclusion based on the basic estimation. Fourth, we considered additional firm-specific variables, age of the firms, *AGE*, shareholding of the largest shareholder, *SHARE*, and location of the firm, *TOKYO*, and re-estimated the equations adding these variables. The conclusions based on the basic equations are confirmed. However, the effect of these variables on competitiveness (H-statistic) is ambiguous except the result that firms with a higher holding of the largest shareholder are more competitive in the third period.

Finally, we compare our results with those of the other financial industries in Japan. Souma and Tsutsui (2000) concluded that the degree of competition of the Japanese life insurance industry was low, although it has increased since 1995. On the other hand, Uchida and Tsutsui (2004) concluded that the Japanese city banks were subject to perfect competition in the middle of the 1990s. In view of these studies, competition in the securities industry stands in the middle of the banking and life insurance industries in Japan.

References

Alley, W. A. (1993.) Collusion versus efficiency in the Japanese regional banking industry. *Economic Studies Quarterly* 44: 206–215.

Bikker, J. A., and Groeneveld, J. M. (2000.) Competition and concentration in the EU banking industry. *Kredit und Kapital* 62–98.

Bresnahan, T. F. (1982.) The oligopoly solution concept is identified. *Economics Letters* 10: 87–92.

Cargill, T. F., and Royama, S. (1988.) *The Transition of Finance in Japan and the United States.* Stanford: Hoover Institution Press.

Coccorese, P. (Jun. 1998.) Assessing the competitive conditions in the Italian banking system: Some empirical evidence. *BNL Quarterly Review* 205: 171–191.

De Bandt, O., and Davis, E. P. (2000.) Competition, contestability and market structure in European banking sectors on the eve of EMU. *Journal of Banking and Finance* 24: 1045–1066.

Fukuyama, H., and Weber, W. L. (1999.) The efficiency and productivity of Japanese securities firms, 1988-93. *Japan and the World Economy* 11: 115–133.

Hondroyiannis, G., Lolos S., and Papapetrou, E. (1999.) Assessing competitive conditions in the Greek banking system. *Journal of International Financial Markets, Institutions and Money* 9: 377–391.

Maddala, G. S. (1977.) *Econometrics*, Tokyo: McGraw-Hill Kogakusha Ltd.

Molyneux, P., Lloyd-Williams, D. M., and Thornton, J. (1994.) Competitive conditions in European banking. *Journal of Banking and Finance* 18: 445–459.

Molyneux, P., Thornton, J., and Lloyd-Williams, D. M. (1996.) Competition and market contestability in Japanese commercial banking. *Journal of Economics and Business* 48: 33–45.

Nathan, A., and Neave, E. H. (1989.) Competition and contestability in Canada's financial system: Empirical results. *Canadian Journal of Economics* 22 (3): 576–594.

Panzar, J. C., and Rosse, J. N. (1987.) Testing for 'monopoly' equilibrium. *The Journal of Industrial Economics* 35 (4): 443–456.

Shaffer, S. (1983.) Non-structural measures of competition: Toward a synthesis of alternatives. *Economics Letters* 12: 349–353.

Shaffer, S., and DiSalvo, J. (1994.) Conduct in a banking duopoly. *Journal of Banking and Finance* 18: 1063–1082.

Souma, T., and Tsutsui, Y. (2000.) Recent competition in Japanese life insurance industry. *Discussion paper* 00–19 (Osaka University).

Uchida, H., and Tsutsui, Y. (2004.) Has competition in the Japanese banking sector improved? forthcoming in *Journal of Banking and Finance*.

Table 1 Descriptive statistics of variables

	whole period		period 1		period 2		period 3	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
operating revenue, *R*	42916	99220	60884	130003	38910	84581	29719	74027
financial cost, *r*	5.798	3.627	6.696	1.941	6.835	4.183	3.740	3.365
wage rate, *w*	8.642	1.766	7.873	1.515	8.335	1.048	9.750	2.078
capital equipment cost, k_1	24.162	11.999	27.585	10.844	22.981	10.955	22.122	13.443
capital equipment cost, k_2	0.201	0.546	0.138	0.326	0.223	0.558	0.236	0.687
brokerage fee	20510	46029	33937	69806	16828	30223	11427	22414
underwriting and distributing fee	3770	11050	3764	10853	2520	7438	5190	14105
income from margin transaction	3027	6065	4683	7304	3615	6857	729	826
AGE	52.388	13.231	44.795	11.833	52.745	11.778	59.477	12.011
SHARE	19.035	15.558	19.039	15.880	18.612	15.269	19.509	15.599
TOKYO	0.745		0.757		0.747		0.730	
number of observations	948		300		344		304	
number of observations for k_2	868		267		338		263	

Notes: Operating revenue, brokerage fee, underwriting and distributing fee, and income from margin transaction are in million yen. Financial cost, capital equipment cost, k_1, and *SHARE* are in percentage. Wage rate is in million yen/person. Capital equipment cost, k_2, is in million yen/1000m^2. *AGE* is in years. *TOKYO* is a dummy variable that takes on unity if head office is in Tokyo. Therefore, mean of *TOKYO* means the ratio of the number of firms whose head office is in Tokyo to the total number of firms.

Std Dev stands for standard deviation.

Period 1 is 1983–88, period 2 is 1991–96, and period 3 is 1997–2002.

Table 2 F-test of the Cobb-Douglas and translog functions

	period 1		period 2		period 3	
	F-value	P-value	F-value	P-value	F-value	P-value
H_0: Cobb-Douglas vs. partial translog	1.099	0.350	1.409	0.240	1.908	0.128
H_0: Cobb-Douglas vs. full translog	7.581	0.000	1.378	0.223	2.556	0.020
H_0: partial translog vs. full translog	13.764	0.000	1.319	0.268	3.112	0.027

Notes: Conventional F-test is applied to Cobb-Douglas, eq.(4), Full translog, eq. (5), and partial translog, eq. (6), to find out which is the appropriate functional form. Period 1 is 1983–88, period 2 is 1991–96, and period 3 is 1997–2002.

Table 3 Estimates of Cobb-Douglas function: eq. (4)

	period 1		period 2		period 3	
Variable	**Coefficient**	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
LR	0.032	[.157]	0.002	[.933]	0.016	[.445]
LW	0.142	[.003]	0.151	[.359]	0.352	[.000]
LK	0.041	[.052]	-0.068	[.199]	-0.029	[.449]
BROKER/ASSET	7.325	[.000]	12.950	[.000]	9.120	[.000]
DISTR/ASSET	10.603	[.000]	-24.562	[.015]	5.838	[.000]
MARGIN/ASSET	0.078	[.965]	7.507	[.004]	5.866	[.286]
LASSET	0.872	[.000]	0.894	[.000]	0.863	[.000]
$\bar{R}^2$	0.998		0.987		0.988	
H-statistic	0.216	[.000]	0.085	[.651]	0.338	[.000]
number of observations	300		344		307	
number of individual firms	55		58		62	

Notes: Equation (4)

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t}$$

is estimated by within-estimation. k_1 is used for k. *LR* stands for $\ln r$, *LW* for $\ln w$, and *LK* for $\ln k$. Precise definitions of the variables are given in the text.

Table 4 Estimates of full translog function: eq. (5)

	period 1		period 2		period 3	
Variable	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DLR	0.060	[.092]	-0.014	[.652]	0.019	[.372]
DLW	0.136	[.058]	0.165	[.333]	0.302	[.000]
DLK	0.026	[.413]	-0.056	[.307]	-0.029	[.463]
BROKER/ASSET	7.634	[.000]	12.472	[.000]	9.457	[.000]
DISTR/ASSET	12.397	[.000]	-24.341	[.017]	5.843	[.000]
MARGIN/ASSET	-1.229	[.555]	8.313	[.003]	8.108	[.162]
LASSET	0.866	[.000]	0.890	[.000]	0.886	[.000]
DLR DLR*	-0.053	[.244]	-0.016	[.519]	-0.011	[.451]
DLW DLW*	-0.044	[.749]	-0.241	[.708]	0.339	[.019]
DLK DLK*	0.056	[.145]	-0.126	[.042]	-0.013	[.734]
DLR DLW*	-0.073	[.488]	0.216	[.111]	0.066	[.368]
DLR DLK*	-0.001	[.988]	0.022	[.523]	-0.046	[.116]
DLW DLK*	-0.124	[.225]	-0.335	[.247]	-0.292	[.011]
$\bar{R}^2$	0.998		0.987		0.989	
H-statistic	0.222	[.014]	0.094	[.627]	0.292	[.002]
number of observations	267		344		307	
number of individual firms	54		58		62	

Notes: Equation (5)

$$\ln R_{i,t} = a_0 + a_1 \overline{\ln r_{i,t}} + a_2 \overline{\ln w_{i,t}} + a_3 \overline{\ln k_{i,t}} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t}$$
$$+ b_1(\overline{\ln r_{i,t}})^2 + b_2(\overline{\ln w_{i,t}})^2 + b_3(\overline{\ln k_{i,t}})^2 + b_4(\overline{\ln r_{i,t}})(\overline{\ln w_{i,t}}) + b_5(\overline{\ln r_{i,t}})(\overline{\ln k_{i,t}}) + b_6(\overline{\ln w_{i,t}})(\overline{\ln k_{i,t}}) + u_{i,t}$$

is estimated by within-estimation. See notes to Table 3. *DLR* stands for $\overline{\ln r}$, *DLW* for $\overline{\ln w}$, *DLK* for $\overline{\ln k}$.

Table 5 Estimates of simple specification: Cobb-Douglas case, eq. (8)

	period 1		period 2		period 3	
Variable	**Coefficient**	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
LR	**0.171**	**[.000]**	**0.000**	**[.998]**	**-0.060**	**[.006]**
LW	**0.459**	**[.000]**	**0.574**	**[.004]**	**0.708**	**[.000]**
LK	**0.119**	**[.002]**	**-0.149**	**[.025]**	**0.147**	**[.004]**
LASSET	**0.915**	**[.000]**	**1.122**	**[.000]**	**0.578**	**[.000]**
$\overline{R}^2$	**0.992**		**0.978**		**0.977**	
H-statistic	**0.749**	**[.000]**	**0.426**	**[.061]**	**0.795**	**[.000]**
number of observations	**300**		**344**		**307**	
number of individual firms	**55**		**58**		**62**	

Notes: Equation (8)

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_7 \ln ASSET_{i,t} + u_{i,t}$$

is estimated by within-estimation. See notes to Table 3.

Table 6 Estimates of eq. (9): revenues for each variable for business composition variables

	period 1		period 2		period 3	
Variable	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LR	-0.019	[.506]	0.066	[.026]	0.030	[.116]
LW	0.037	[.407]	0.026	[.859]	0.222	[.000]
LK	0.018	[.371]	-0.027	[.567]	0.025	[.401]
BROKER	0.923	[.000]	0.812	[.000]	0.675	[.000]
DISTR	0.052	[.000]	-0.038	[.077]	0.042	[.000]
MARGIN	0.122	[.029]	-0.011	[.759]	-0.026	[.550]
LASSET	-0.180	[.074]	0.272	[.005]	0.176	[.000]
$\overline{R}^2$	0.998		0.987		0.991	
H-statistic	0.036	[.580]	0.064	[.690]	0.277	[.000]
number of observations	300		344		307	
number of individual firms	55		58		62	

Notes: Equation (9)

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 BROKER_{i,t} + a_5 DISTR_{i,t} + a_6 MARGIN_{i,t} + a_7 \ln ASSET_{i,t} + u_{i,t}$$

is estimated by within-estimation. See notes to Table 3.

Table 7 Estimates of eq. (10): business composition variables divided by total revenues

	period 1		period 2		period 3	
Variable	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LR	0.178	[.000]	0.013	[.665]	-0.015	[.571]
LW	0.079	[.251]	0.688	[.000]	0.601	[.000]
LK	0.021	[.486]	-0.101	[.061]	0.178	[.000]
BROKER/REV	-0.821	[.000]	-0.032	[.760]	-0.177	[.319]
DISTR/REV	-2.289	[.000]	-2.974	[.000]	-0.294	[.182]
MARGIN/REV	-3.238	[.000]	-0.331	[.126]	-2.295	[.000]
LASSET	0.880	[.000]	1.129	[.000]	0.613	[.000]
$\overline{R}^2$	0.996		0.986		0.978	
H-statistic	0.279	[.000]	0.600	[.002]	0.763	[.000]
number of observations	267		344		307	
number of individual firms	54		58		62	

Notes: Equation (10)

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{REV_{i,t}} + a_5 \frac{DISTR_{i,t}}{REV_{i,t}} + a_6 \frac{MARGIN_{i,t}}{REV_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t}$$

is estimated by within-estimation. See notes to Table 3.

Table 8 Estimation results with instrumental variable of wage rate: Cobb-Douglas function

	period 1		period 2		period 3	
Variable	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LR	0.032	[.117]	0.002	[.932]	0.012	[.504]
LW	0.128	[.014]	0.146	[.372]	0.230	[.004]
LK	0.041	[.030]	-0.069	[.157]	-0.028	[.420]
BROKER/ASSET	7.347	[.000]	12.953	[.000]	9.611	[.000]
DISTR/ASSET	10.560	[.000]	-24.511	[.008]	5.825	[.000]
MARGIN/ASSET	0.047	[.977]	7.516	[.001]	3.937	[.428]
LASSET	0.875	[.000]	0.894	[.000]	0.873	[.000]
$\overline{R}^2$	0.998		0.987		0.988	
H-statistic	0.201	[.001]	0.080	[.668]	0.214	[.017]
number of observations	300		344		307	
number of individual firms	55		58		62	

Notes: Equation (4)

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t}$$

is estimated, treating $w_{i,t}$ as an endogenous variable. Rank variables of *LW* are used as an instrumental variable. Results by within-estimation are shown.

Table 9 Estimates of Equation (11): firm-specific variables

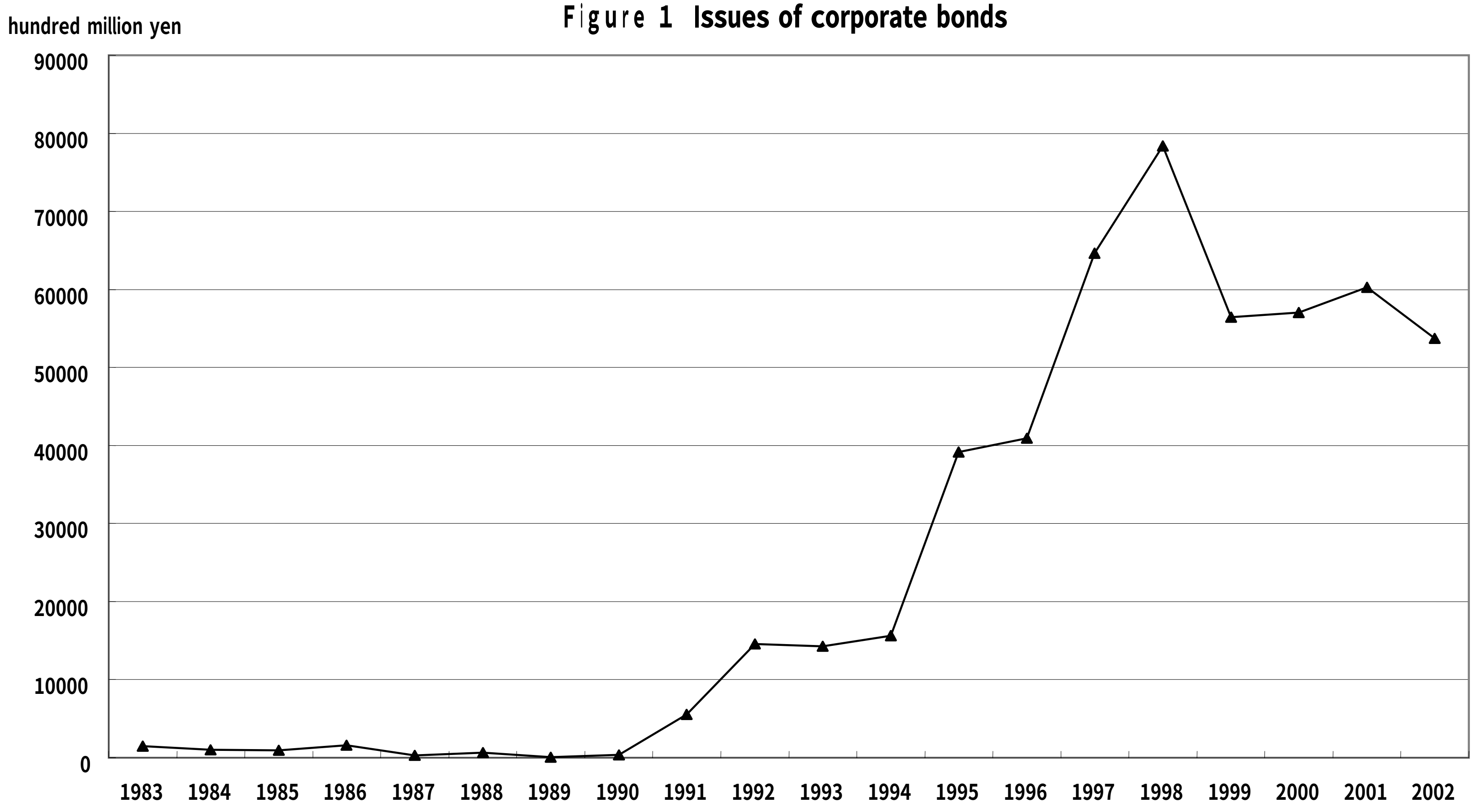
Variable	period 1 Estimate	P-value	period 2 Estimate	P-value	period 3 Estimate	P-value
CONSTANT	-3.540	[.000]	-3.791	[.000]	-4.227	[.000]
LR	0.274	[.027]	-0.020	[.805]	0.110	[.242]
LW	0.120	[.540]	-0.003	[.993]	0.788	[.025]
LK	0.073	[.420]	0.122	[.283]	-0.079	[.455]
BROKER/ASSET	8.545	[.000]	15.476	[.000]	11.184	[.000]
DISTR/ASSET	15.990	[.000]	8.325	[.275]	9.796	[.000]
MARGIN/ASSET	3.275	[.119]	-0.370	[.848]	-3.906	[.443]
LASSET	0.974	[.000]	1.030	[.000]	0.958	[.000]
AGE	0.012	[.343]	0.009	[.578]	0.022	[.198]
SHARE	0.010	[.254]	0.000	[.996]	-0.032	[.003]
TOKYO	-0.070	[.778]	-0.340	[.469]	1.078	[.003]
AGE LR*	-0.003	[.275]	0.001	[.333]	-0.001	[.627]
AGE LW*	0.000	[.953]	-0.001	[.893]	-0.011	[.104]
AGE LK*	-0.002	[.255]	-0.004	[.059]	0.001	[.551]
SHARE LR*	-0.001	[.714]	0.002	[.116]	0.001	[.290]
SHARE LW*	-0.007	[.021]	0.001	[.930]	0.015	[.000]
SHARE LK*	0.002	[.256]	-0.002	[.178]	-0.001	[.325]
TOKYO LR*	-0.084	[.161]	-0.002	[.967]	-0.032	[.334]
TOKYO LW*	0.057	[.491]	0.126	[.550]	-0.415	[.002]
TOKYO LK*	0.054	[.230]	0.038	[.458]	-0.036	[.453]
$\overline{R}^2$	0.992		0.981		0.980	
H-statistic	0.143	[.031]	0.040	[.733]	0.137	[.088]
PH	0.467	[.096]	0.098	[.816]	0.820	[.060]
EFA	-0.222	[.409]	-0.182	[.665]	-0.620	[.185]
EFS	-0.122	[.131]	0.003	[.984]	0.290	[.002]
EFT	0.020	[.815]	0.122	[.461]	-0.353	[.003]
number of observations	300		344		304	

Notes: Equation (5)

$$\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} a_7 \ln ASSET_{i,t}$$
$$+ a_8 AGE_{i,t} + a_9 SHARE_i + a_{10} TOKYO_i + c_1 AGE_{i,t} \ln r_{i,t} + c_2 AGE_{i,t} \ln w_{i,t} + c_3 AGE_{i,t} \ln k_{i,t} + c_4 SHARE_i \ln r_{i,t}$$
$$+ c_5 SHARE_i \ln w_{i,t} + c_6 SHARE_i \ln k_{i,t} + c_7 TOKYO_i \ln r_{i,t} + c_8 TOKYO \ln w_{i,t_i} + c_9 TOKYO_i \ln k_{i,t} + u_{i,t}$$

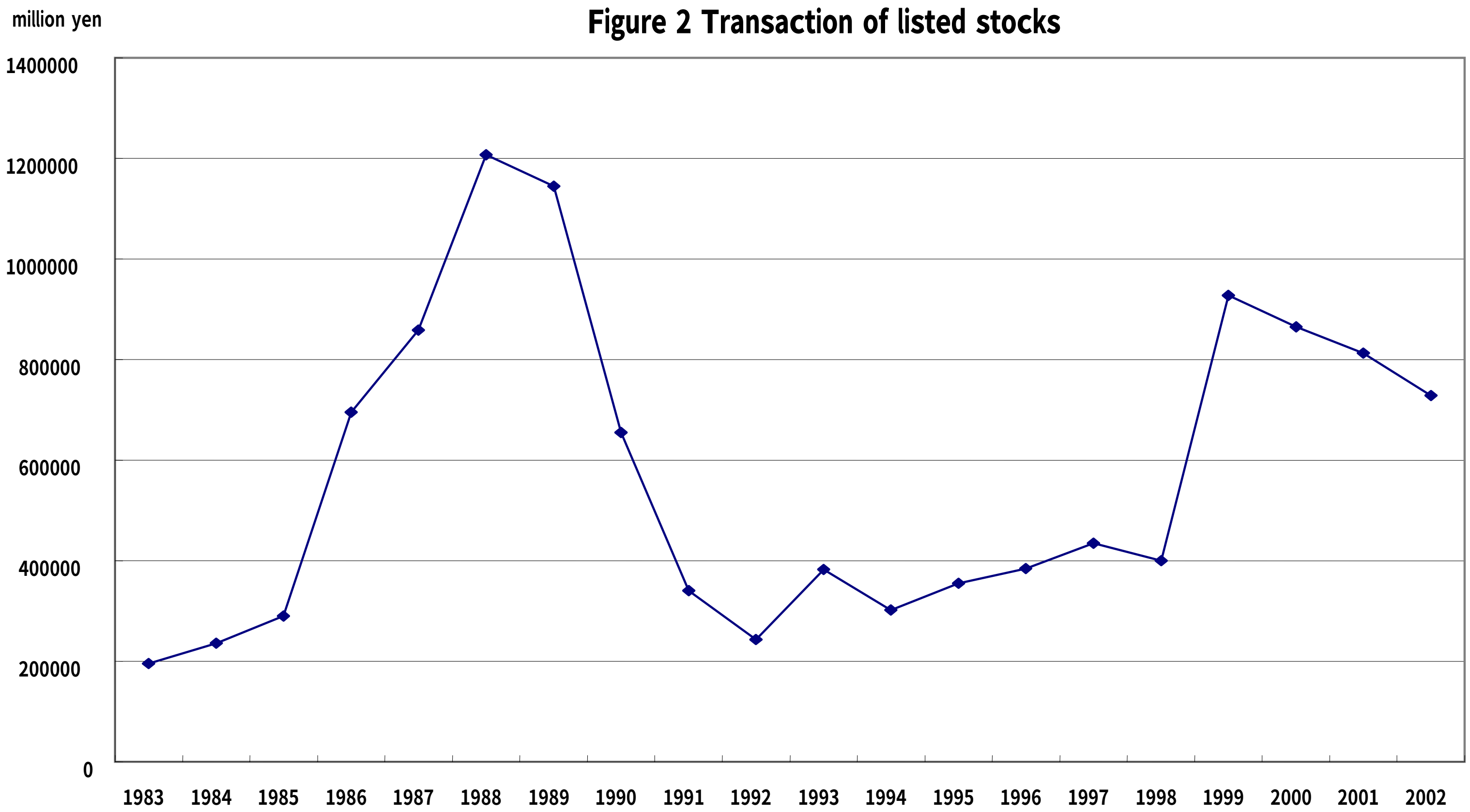
is estimated by OLS estimation. See notes to Table 3.

Figure 1 Issues of corporate bonds



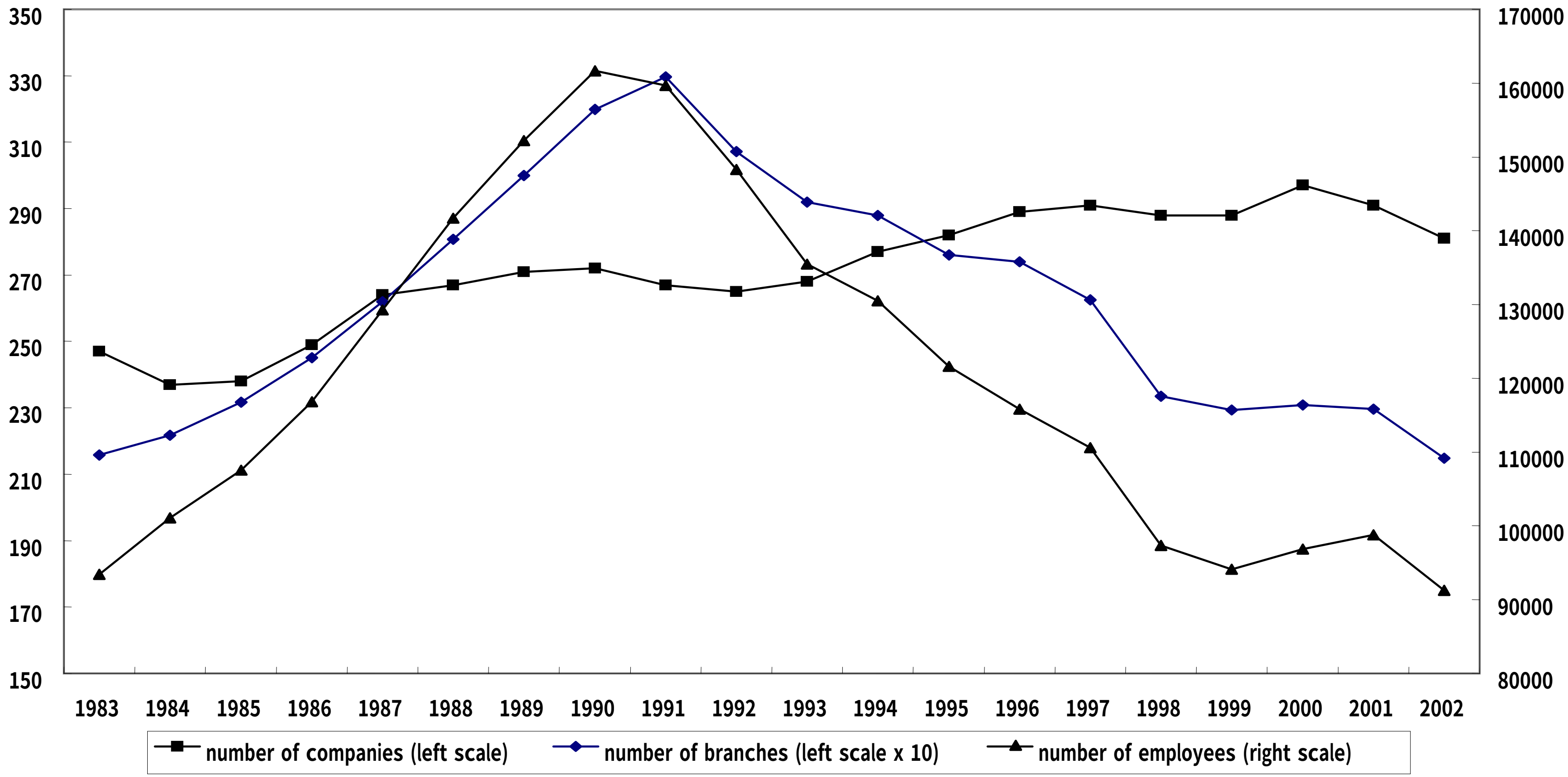
Note: Issues of private corporate bonds are shown from fiscal 1983 to 2002. They are measured in hundred million yen. The corporate bond is defined as the amount excluding those issued by nine electric power companies, Nippon Telegraph and Telephone Corporation and Japan Railway Companies. Data source is Nikkei NEEDS Macro Data File.

Figure 2 Transaction of listed stocks



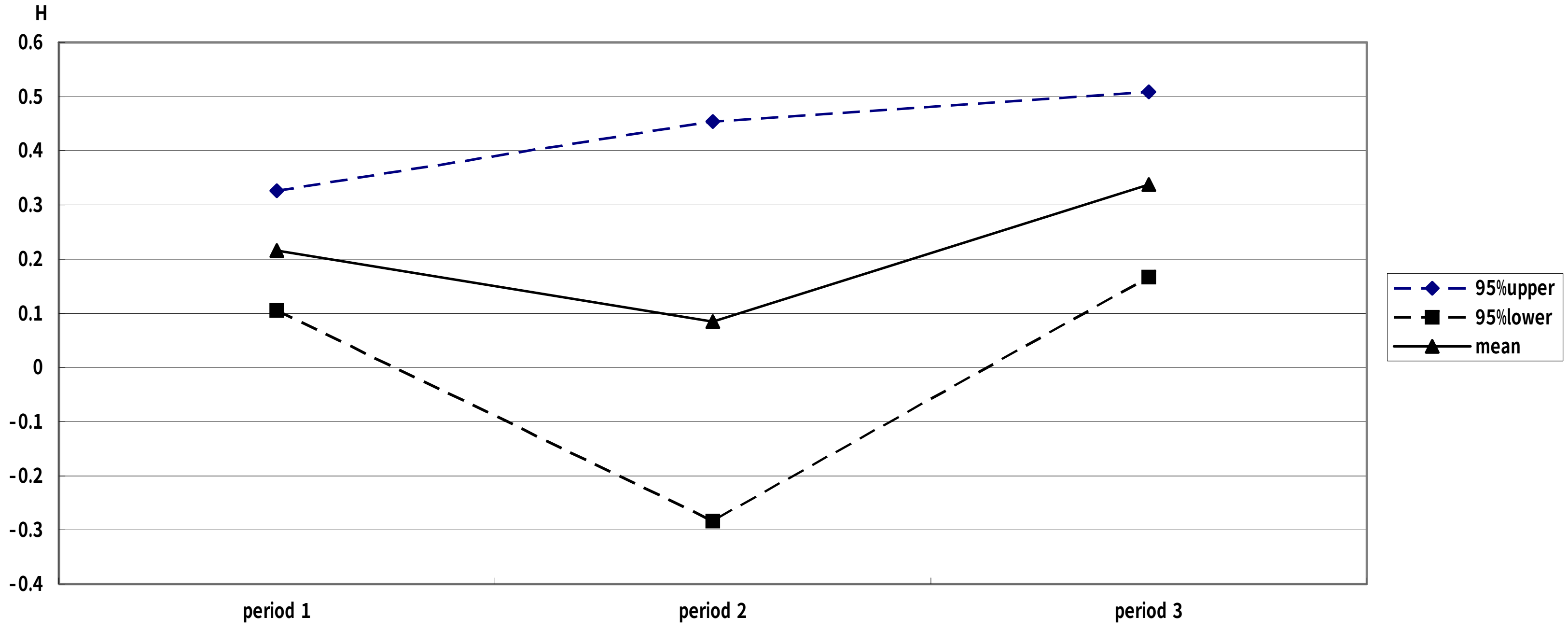
Note: Amount of stock transactions of stocks listed in the first section of Tokyo Stock Exchange is shown from 1983 to 2002. They are measured in million yen. Data source is Nikkei NEEDS Macro Data File.

Figure 3 Number of firms, branches and employees



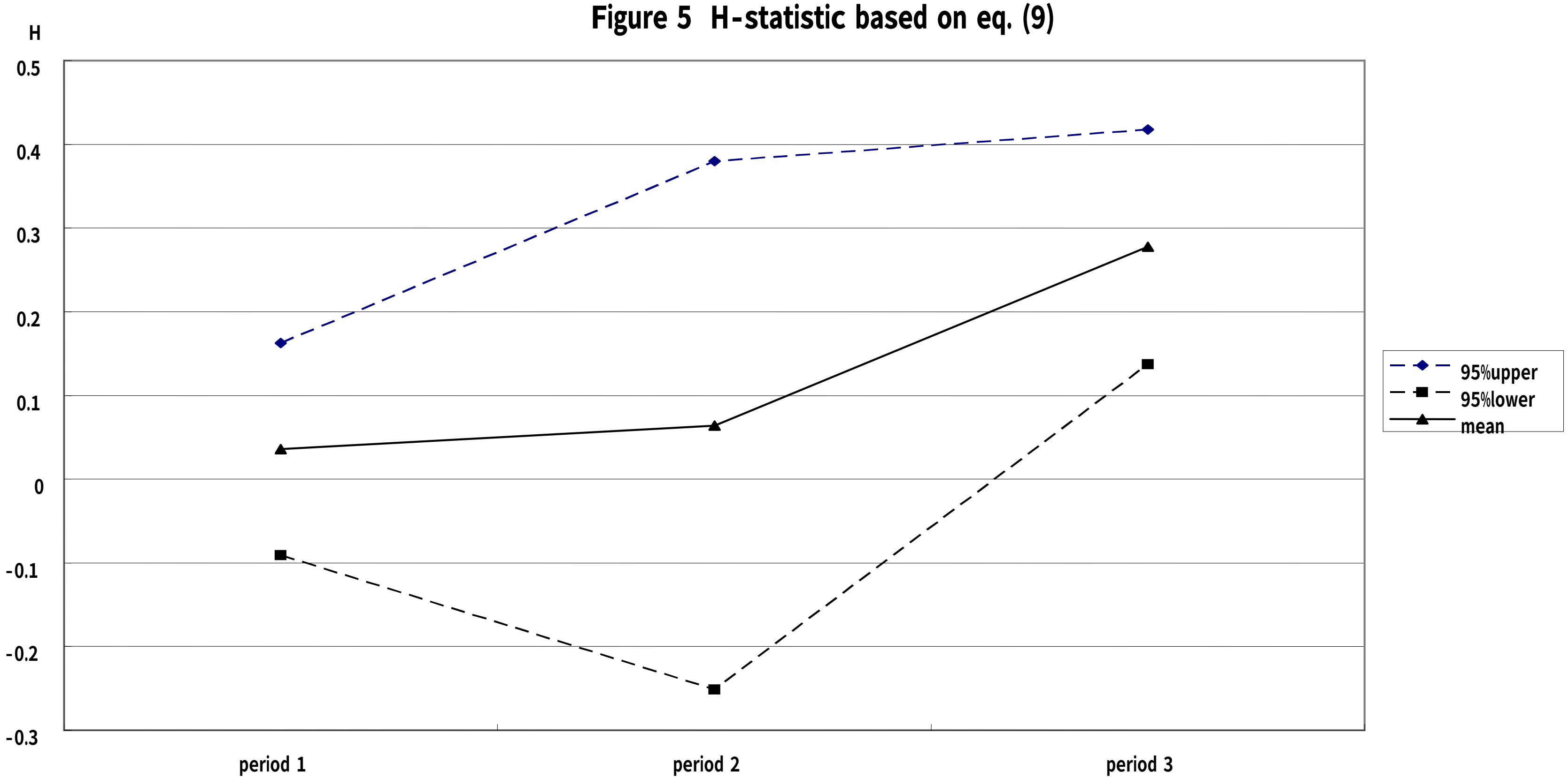
Note: The number of securities firms (left scale), number of their branches (left scale x 10), and number of their employees (right scale) are shown. Data source is Nikkei NEEDS Macro Data File.

Figure 4 H-statistic based on eq. (4)



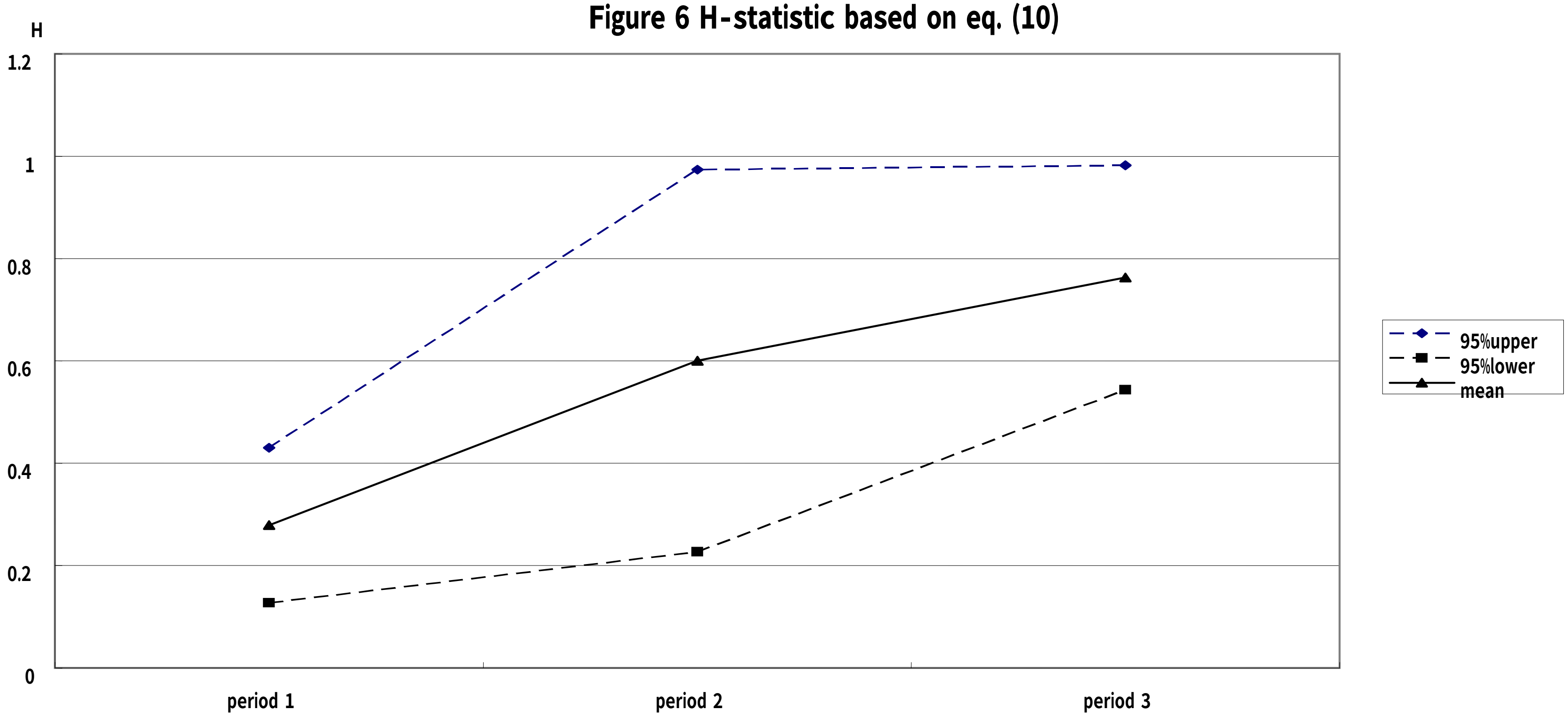
Notes: H-statistic, which is based on the estimation of eq. (4) $\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{ASSET_{i,t}} + a_5 \frac{DISTR_{i,t}}{ASSET_{i,t}} + a_6 \frac{MARGIN_{i,t}}{ASSET_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t}$ is shown with its 95% confidence interval.

Figure 5 H-statistic based on eq. (9)



Notes: H-statistic. which is based on the estimation of eq. (9) $\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 BROKER_{i,t} + a_5 DISTR_{i,t}$ $+ a_6 MARGIN_{i,t} + a_7 \ln ASSET_{i,t} + u_{i,t}$ is shown with its 95% confidence interval.

Figure 6 H-statistic based on eq. (10)



Notes: H-statistic, which is based on the estimation of eq. (10) $\ln R_{i,t} = a_0 + a_1 \ln r_{i,t} + a_2 \ln w_{i,t} + a_3 \ln k_{i,t} + a_4 \frac{BROKER_{i,t}}{REV_{i,t}} + a_5 \frac{DISTR_{i,t}}{REV_{i,t}}$

$+ a_6 \frac{MARGIN_{i,t}}{REV_{i,t}} + a_7 \ln ASSET_{i,t} + u_{i,t}$ is shown with its 95% confidence interval.