CORPORATE SHAREHOLDING IN JAPAN

by

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Abstract

This dissertation investigates why a substantial number of common stocks is held by companies in many countries, especially in Japan. Chapter 1 gives an overview of historical and legal issues regarding corporate shareholding in Japan. Chapter 2 reviews how researchers have, theoretically and empirically, approached corporate shareholding issues.

Chapter 3 elaborates on a corporate shareholding model which incorporates a standard principal-agent model with Aoki's managerial risk sharing argument (Aoki, 1988). The model finds that a risk-averse manager of a firm invests in other firms if managerial reward is linked with the value of the firm she manages, and if the operating profits of investing and invested firms are negatively correlated. Corporate stock investment is larger if the invested (and/or investing) company's operating profit is less volatile and/or if the covariance in the operating profits of the companies is more strongly negative. Although a stronger link between corporate performance and managerial reward increases managers' incentive to exert efforts, it also increases the risk that managers must bear. If the risk is too high, managers would leave their companies. Corporate stock investment reduces the risk, and enables shareholders to offer a higher incentive to the managers and to earn a higher (expected) income.

Chapter 4 examines three major arguments concerning the rationale behind the practice of corporate shareholding: the competitive-effect, risk-sharing, and control-rights arguments. Predictions drawn from those arguments are tested using panel data of 186 Japanese corporate group firms from 1980 to 1988. The main findings of this study are as follows. (1) The competitive-effect argument is clearly supported by the data. Firms in the same industry do tend to invest more in one another. (2) The evidence in favor of the risk-sharing argument is weaker — although firms with less risky operating profits tend to attract more investment, the relationship between investment and the covariance in the firms' operating profits is ambiguous. (3) The strongest empirical support is given to the control-rights argument. Indeed, the evidence confirms that a firm is more likely to invest in other firms that hold more of its own shares.

Chapter 5 concludes this dissertation.
# Table of Contents

Abstract .................................................................................................................. ii
List of Tables ........................................................................................................... v
List of Figures .......................................................................................................... vi
Acknowledgements ............................................................................................... vii
Dedication ................................................................................................................ viii

CHAPTER 1 Introduction ......................................................................................... 1
  1.1 Definition of Corporate Groups in Japan ...................................................... 1
  1.2 A Brief History of Japanese Corporate Groups ............................................ 2
  1.3 Modern Japanese Corporate Groups ............................................................. 7
  1.4 Corporate Shareholding ............................................................................. 11
  1.5 Legal Issues on Corporate Shareholding .................................................... 13

CHAPTER 2 Review of the Literature ..................................................................... 22
  2.1 Theories ...................................................................................................... 23
  2.2 Empirical Studies ........................................................................................ 29
  2.3 Concluding Remarks ................................................................................. 32

CHAPTER 3 Corporate Shareholding and Agency Cost ......................................... 35
  3.1 Introduction ................................................................................................. 35
  3.2 P-A Model with Unilateral Stock Investment Opportunity ......................... 37
  3.3 P-A Model with Bilateral Stock Investment Opportunities ......................... 53
    3.3.1 The Model ............................................................................................. 53
    3.3.2 The Solution ........................................................................................ 55
  3.4 Concluding Remarks ................................................................................. 64

CHAPTER 4 Corporate shareholding in Japan: Empirical Testing ......................... 67
  4.1 Introduction ................................................................................................. 67
  4.2 Hypotheses ................................................................................................ 68
  4.3 Data ............................................................................................................. 80
    4.3.1 Raw Data .............................................................................................. 81
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.2</td>
<td>Constructed Variables I</td>
<td>84</td>
</tr>
<tr>
<td>4.3.3</td>
<td>Constructed Variables II: Control Rights Indices</td>
<td>86</td>
</tr>
<tr>
<td>4.3.4</td>
<td>Constructed Variables III: Portfolio Choice Indices</td>
<td>89</td>
</tr>
<tr>
<td>4.3.5</td>
<td>Summary Statistics for the Variables</td>
<td>94</td>
</tr>
<tr>
<td>4.4</td>
<td>Models and Tests</td>
<td>96</td>
</tr>
<tr>
<td>4.5</td>
<td>Empirical Results</td>
<td>99</td>
</tr>
<tr>
<td>4.6</td>
<td>Concluding Remarks</td>
<td>103</td>
</tr>
</tbody>
</table>

**CHAPTER 5** Conclusion ........................................................................... 120

Bibliography .................................................................................................. 124
List of Tables

Table 1.1 Intra-group Shareholding (Mitsui Group) ........................................... 20
Table 4.1 Comparative Static on Corporate Investment (\( \alpha^* \)) ......................... 108
Table 4.2 Data Items ............................................................................................... 109
Table 4.3 Constructed Variables in Estimations ...................................................... 109
Table 4.4 Summary Statistics of the Explanatory Variables ...................................... 110
Table 4.5 Summary Statistics of the Dependent Variables ...................................... 111
Table 4.6.1 Tobit Estimation Results: Control Rights Model (\( A_i \)) ...................... 112
Table 4.6.2 Tobit Estimation Results: Control Rights Model (\( B_i \)) ...................... 114
Table 4.6.3 Tobit Estimation Results: Portfolio Choice Model (\( PF_i \)) ..................... 116
Table 4.6.4 Tobit Estimation Results: Portfolio Choice Model (\( IPF_i \)) ................. 118
List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1</td>
<td>Number of Stocks by Holder in Japan</td>
<td>17</td>
</tr>
<tr>
<td>Figure 1.2</td>
<td>Firm's Asset (10 year Growth Rates from 1977 to 1986)</td>
<td>18</td>
</tr>
<tr>
<td>Figure 1.3</td>
<td>Distribution of 410 Japanese Firms in Cross Shareholding</td>
<td>19</td>
</tr>
<tr>
<td>Figure 1.4</td>
<td>Average Cross Shareholding by Group</td>
<td>21</td>
</tr>
<tr>
<td>Figure 3.1</td>
<td>( \lambda_1^* ) as Function of ( r_1 ): Model (1-1)</td>
<td>41</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>( w_1^* ) as Function of ( r_1 ): Model (1-1)</td>
<td>43</td>
</tr>
<tr>
<td>Figure 3.3</td>
<td>Shareholder's Expected Income as Function of ( r_1 ): Model (1-1)</td>
<td>43</td>
</tr>
<tr>
<td>Figure 3.4</td>
<td>Shareholder's Expected Income as Function of ( r_1 ): Comparison</td>
<td>52</td>
</tr>
<tr>
<td>Figure 3.5</td>
<td>Firm i's Reaction Function</td>
<td>58</td>
</tr>
<tr>
<td>Figure 3.6</td>
<td>( \alpha_{ij}^* ) as Function of ( \rho ) at Symmetric Equilibrium: Bilateral Model</td>
<td>60</td>
</tr>
<tr>
<td>Figure 3.7</td>
<td>( w_1^* ) as Function of ( r_1 ) at Symmetric Equilibrium: Comparison</td>
<td>62</td>
</tr>
</tbody>
</table>
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To Kazuko and Jiro
Chapter 1
Introduction

This dissertation addresses the issues of corporate shareholding, particularly among firms which belong to corporate groups in Japan. We first provide, in the rest of this chapter, some background regarding corporate groups and corporate shareholding structure in Japan. The second chapter reviews how researchers have approached Japanese corporate group issues, especially corporate shareholding. It is followed by the presentation of a corporate shareholding model with risk-sharing. In the fourth chapter, various motives, including the risk-sharing motive, for corporate shareholding are empirically examined. The last chapter concludes the dissertation.

1.1 Definition of Corporate Groups in Japan

To begin with, the notion of a “corporate group” used in the context of the Japanese economy must be clarified because issues of corporate shareholding and corporate groups are indivisible in Japan. Definitions for “corporate groups” vary between studies (Miwa, 1990). For the purpose of this dissertation, we will follow a conventional definition that a corporate group is a cluster of firms within which the presidents of those firms participate in a monthly presidents’ club meeting, so-called (shacho-kai).

This type of “corporate group” is sometimes called a financial keiretsu group, because financial institutions such as banks often play a central role. They are also referred to as “horizontal” keiretsu groups.

\[1\] The functions of the presidents’ club meetings will be discussed later.
Horizontal here means that each corporate group is usually made up of a representative from different industries and that members are mostly of the similar size. Note that there is another type of corporate group called “production” or “vertical” keiretsu, which consists of a major company and a number of its subsidiaries and/or parts suppliers. For example, Toyota belongs to a financial keiretsu, Mitsui group, but is also a leader of a vertical keiretsu, Toyota group. In this paper, the word “corporate group” will apply strictly to the financial keiretsu groups, unless otherwise noted.

The modern Japanese corporate groups were formed in the late 1940s and the early 1950s. Before the Second World War Japan had a different corporate group system. In the following part of this introduction, a brief history of both pre- and post-war corporate groups as well as the current situation of corporate shareholding in Japan is presented.

1.2 A Brief History of Japanese Corporate Groups

Most Japanese corporate groups originated in the early 1900s (Tamaki, 1976, p3). They were called zaibatsu groups (or concerns). In each of the zaibatsu groups, usually a family owned a holding company and, through the holding company, the family controlled the other members of the group. The members were from various industries and formed a conglomerate. A financial crisis which occurred in 1926 brought a restructuring of the bank

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2 Some firms in a “horizontal” keiretsu are subsidiaries and/or part suppliers of other member firms and have “vertical” trading relationships. The word, “horizontal” is sometimes misleading. Hence the author believes that the words, “financial” and “production” keiretsu, should be used to describe the types of different keiretsu.

3 This following brief history on zaibatsu is mostly based on the works of Arisawa (1976), Masamura (1985), and Tamaki (1976).
industry, and many smaller banks were merged into bigger ones. Until Sanwa Bank was established in 1933, Mitsui, Mitsubishi, Sumitomo, and Yasuda banks were the four largest banks (Arisawa ed., 1976, p30). The number of price and production cartels, backed up by the government, increased after the Great Depression. Mitsui and Mitsubishi groups were the largest among the corporate groups, and the group companies acquired and enjoyed their oligopolistic powers within various industries (Arisawa, pp66-71). This situation continued until the end of the Second World War.

After the war, the Supreme Commander for the Allied Powers (SCAP) in Japan implemented various policies to promote Japanese democratization. The dissolution of zaibatsu was one of them. As Zaibatsu groups, together with the Japanese military, were believed to have incited Japan to start the war, the General Head Quarters of Allied Power thought it important to break up the zaibatsu groups.

In 1946, the holding companies, their subsidiaries, and the owner families were ordered to sell the shares which they owned in their group companies to the Holding Companies Liquidation Commission (HCLC). The committee then resold the shares to the employees of those companies or to the public. The total value of shares subject to this order was 42% of total shares issued in Japan at the time (Tamaki, p453), and, as a consequence, approximately 70% of the total shares outstanding, in number, were owned by individuals. The holding companies were dissolved by the commission. Among all the zaibatsu companies, Mitsui & Company and Mitsubishi Corporation, were accused of playing crucial roles during the war and, as a result, were segmented into a few hundred small companies. However, banks
such as Mitsui and Mitsubishi Banks were not split and therefore retained their power within the Japanese economy. This was one of the reasons why the banks were positioned in the center of each corporate group after the war.

As a compensation for their shares sold to the HCLC, the owner zaibatsu families received government bonds with 10 years maturity. However, the families' financial powers were diminished by the series of orders and laws implemented after the war (Tamaki, p453). For example, through the Order of Purge from Public Positions in 1946 and Zaibatsu Family Power Elimination Law in 1948, most of the zaibatsu family members who worked as managers of major Japanese companies were forced to leave their positions. Eventually, they lost control of the zaibatsu companies and have never been able to regain their powers.

Along with the series of orders to dissolve zaibatsu, the Anti Monopoly Act and the Prevention of Excess Concentration of Economic Power Act were enforced. Most of the regulations tried to prevent firms from forming a zaibatsu-like corporate group. For example, each firm was limited to holding no more than one quarter of the total shares of other firms. Also, financial institutions were not allowed to hold more than 5% of shares in any other company and joint appointments of an executive to two or more companies were prohibited.

By 1949, most of the democratization policies had been implemented. However, the resurrection of “zaibatsu” had also begun at this time even though its ownership structure had totally changed after the war. The new type of groups are now called keiretsu groups. Some of the major characteristics of a keiretsu group are; provision of bank loans within
the group, shareholding of the borrowing companies by banks, and appointments of bank employees to the boards of those companies. The banks, which were not subject to the dissolution policies had already become the center of post-war zaibatsu. Underground meetings with the presidents of former zaibatsu companies had also begun. In 1949, the Anti Monopoly Act was revised to ease the restrictions on merger and corporate shareholding.

This revision was followed by a series of events which accelerated the formation of corporate groups, the keiretsu groups. When the San Francisco Peace Treaty between Japan and the Allies became effective in 1952, the orders issued by SCAP had expired. An order of 1948 which prohibited the use of zaibatsu names as part of a company name was one of them. Once this ban was lifted, many old group companies revived their pre-war names. The demands from the Korean war which broke out in 1950 helped the Japanese economy to recover faster. Most key industries were oligopolistic with members of former zaibatsu. They earned huge profits from demands of this war. The second revision of the Anti Monopoly Act in 1953 permitted some cartel, and lifted the limit on shareholding by non-financial institutions. The bank’s percentage limit on shareholding was relaxed from 5% of other firms’ shares to 10%, although it was reduced to 5% again in 1977. Other changes made in this revision included; the permission of joint appointment of executives, and the legalization of the price retail maintenance system for certain products. All of these events helped the old zaibatsu, now keiretsu, companies to regain strength.

The divided trading companies of former Mitsubishi and Mitsui & Co. were unified again in 1954 and in 1959, respectively. When Yowa Real Estate (now Mitsubishi Estate)
was threatened to be taken over, Mitsubishi group companies bought back the shares of the company from the potential raider. This was one of the first incidents where group firms fought against a threat of takeover. Mitsui, Mitsubishi, and Sumitomo were the first groups that emerged their post-war shapes. Fuji (Yasuda or Fuyo), Sanwa, and Dai-Ichi Kangyo had started forming their own groups later. They rapidly increased ties with their member firms during the 1950s, although the ties between the non-financial firms within these groups remain weak. This was the beginning of the current corporate groups in Japan.

In 1965 Japan’s capital market was opened to foreign investors. Because of the fear of being taken over by foreigners, many Japanese firms have started to make cross-shareholding arrangement (Okumura, 1992a, pp16–17). The stock investments were done crosswise because shareholding of its own were prohibited. The amount of corporate shareholding steadily increased until the first oil shock. A few years after the oil shock, banks’ shareholding started to increase again, and kept increasing throughout the 1980s. Shareholding by non-financial institutions, on the other hand, remains fairly constant in the late 1970s and the early 1980s.

In recent years, there were two important changes in Japan’s economy which have affected the corporate behavior towards investing in the stock market; the bubble economy and the BIS (the Bank for International Settlements) regulation.

Around 1986, Japan’s economy gradually moved towards the so-called “bubble economy.” As interest rates declined, asset prices such as land and stock prices began to soar.

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4 The name of banks are used to identify each group. Note that Fuji Bank is the main bank for Yasuda (or Fuyo) group.
These price increases were said to be more than the levels which were theoretically predicted from the decline in the interest rates (Noguchi 1992). The high priced stocks changed the firms' way of financing; many companies issued convertible bonds and stocks instead of borrowing money from banks. Financial institutions, including banks, were major buyers of those stocks (Suto, 1995). As a result, banks' shareholding kept increasing during the bubble period. The presence of foreign investors became noticeable in this period as well.

In the 1980s, the Bank for International Settlements (BIS) set a minimum requirement for \( \frac{\text{owner's equity-total assets value}}{\text{total asset value}} \) ratio for the banks which make international settlements. Since a part of unrealized profits, a difference between the book and current market values, of holding stocks are considered to be a part of owner's equity, banks had no trouble achieving the requirement when stock prices were steadily increasing. Banks were also able to keep the \( \frac{\text{owner's equity-total asset value}}{\text{total asset value}} \) ratio high through equity financing. However, once the stock market collapsed in 1990, it became a concern for many banks to achieve the BIS requirement. A new BIS regulation required banks to maintain the ratio at least 8% of its total asset value by the end of March 1993. Stocks obtained at a high price during the bubble period became a burden to many Japanese banks. Shareholding by banks, in terms of the number of shares, started declining in 1990.

1.3 Modern Japanese Corporate Groups

Mitsui, Mitsubishi, Sumitomo, Fuji, Sanwa, and Dai-Ichi Kangyo are the so-called six major corporate groups. The six major groups, excluding banks and insurance companies,
accounted for 3.79% of the number of employees, 11.89% of the total asset value, 13.27% of sales value, and 23.82% of net profits, of all the listed 2044 companies, again excluding banks and insurance companies, for the 1993 fiscal year (Kigyo Keiretsu Soran, Toyo Keizai Shinpo Sha, 1994).

As mentioned, a corporate group is defined as a cluster of firms within which their presidents participate in a monthly presidents’ club meeting. The function of the presidents’ clubs is controversial among academic and business people alike. See Okumura (1994, pp112–131) for example. Officially, the presidents’ club meetings are just informal socializing meetings and are not intended for any managerial decision-making. If this is true, being a member of a presidents’ club should not have any economic bearings for the companies involved. In reality, however, the participants of the meetings often do exchange managerial information and sometimes make managerial decisions, which could, as a result, have significant economic ramifications. An example of managerial decisions made at the presidents’ meetings is that, if any of the affiliate companies wants to use a trade name, say “Mitsubishi”, in the corporate name, permission is required at the presidents’ meeting. Having a big name such as “Mitsubishi” in the corporate name could bring various economic benefits to firms. For example, people already recognize the company and their beliefs on the reliability of the product would be favorable.

As explained before, in a Japanese corporate group, usually only one firm from each major industry is chosen as a member in order to cover the whole industry area. This is called one-set principle.
The Japanese financial corporate groups are often characterized by various economic ties between firms within the same group. The four major ties are; first, loans from the member financial institutions; second, interlocking shareholding; third, interlocking directorships; and fourth, trading relations.

Loans are provided to member companies of a corporate group by the central financial institutions, which are usually the so-called main banks. Although most major corporations borrow money also from financial institutions outside the group, the amount of loans provided inside the group is usually largest. One possible explanation for this phenomenon is that being members of the same presidents' club the financial institutions have better access to managerial information of the borrowing companies.

Many companies, especially financial institutions, of a group hold shares of other member companies. The investment relations are sometimes reciprocal and multiple, which creates a web type of shareholding relationships. As discussed in the later chapters, there are many possible reasons why companies in the same group invest within the members. This could be because firms have access to managerial inside information of member companies through personal connections at the presidents' meetings. Furthermore, some people claim that companies within a group implicitly agree to defend a member company against a take-over by outsiders, as mentioned earlier regarding the Yowa Real Estate case.

Along with these interlocking shareholding relationships, many major corporations often send representatives as directors to other member firms' boards. The sender companies have direct access to managerial information.
The forth major tie within members of a corporate group is said to be a trading tie. When a company has access to detailed information of product/services through connection at presidents’ meeting, it is natural for the company to procure goods/services from other member companies, especially if their prices are the same as those of other competitors outside the group. According to Lincoln, Gerlach, and Ahmadjian (1993), the proportion of a firm’s trade with firms in a group which accounts for the largest share of the firm’s trade is 25.8% on average for 87 Japanese financial corporate group firms and 23.5% on average for 110 other independent firms. Unfortunately, we do not know if these numbers are significantly different, one thing true is that having a complete set of firms, the one-set principle allows member companies to procure goods and services only from other member firms.

These ties are inter-related. Financial institutions may hold the shares in borrowing companies in order to better monitor the companies. If a company has a stock investment relationship with another member company, then the investing company has an incentive to increase trading ties with the invested company because a part of profits of the invested company will be paid out to the investing company.

The focus of this dissertation is on corporate shareholding. The following section explains the current situations of corporate shareholding and some significant issues surrounding them.

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5 In August 1997, Mitsui group decided to help a member company, Mitsui Construction, which is in a management crisis with large debts. One of the group’s restoration plans for the company in crisis is to procure more from the company (Kigyo Keiretsu Soran, Toyo Keizai Shinpo Sha, 1999).
1.4 Corporate Shareholding

Immediately after the dissolution *zaibatsu*, the amount of stocks held by private corporations in Japan was about 30%. The remaining 70% was owned by, mostly, individuals. A tiny fraction was owned by governments. Corporate shareholding, however, has steadily increased since then. By 1991, the figure for financial institutions and other business corporations had increased to 67%, while the amount owned by individuals had decreased to 23.2% of the total number of shares outstanding. The rest is owned by government sectors and foreign investors, which include individuals and other institutions. See figure 1.1. Micro data estimated by Hayashi and Inoue (1991) also show the strong trend of Japanese firms investing in other firms through stocks. The data used were on the average market values of various assets such as instruments, tools, land, inventory, or machineries of 687 Japanese manufacturing companies from 1977 to 1986. Japanese firms in the sample had increased financial assets, especially the stocks of affiliates, by 514.4% in value over the ten years period. See figure 1.2. In contrast, most of the other asset items only increased by 20-100% in value over the same time period. In 1986, 23.3% of the total assets value of an average firm was comprised of the stocks of affiliate companies.

A part of corporate shareholding, especially with affiliate companies, is in the form of cross (or mutual) shareholding. According to a survey cited in a Japanese Economic

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6 The same statistics are available for some other countries such as Korea, Taiwan, and the United States. For example, in Korea, 50.2% of stocks were owned by individuals in 1991 and this percentage is fairly stable since early 1970s (*Korea Statistical Yearbook*, National Statistical Office, Republic of Korea, various years). According to Aoki (1988), individuals in the United States owned 51.1% of total shares outstanding in the United States in 1980.
Planning Agency Annual Report (1992), 77.5% of 410 Japanese firms admitted that at least 10% of its shares were held crosswise by other firms and 51.5% of the firms are in the range between 10-40%.\(^7\) See figure 1.3. 18.7% of the firms say that more than 40% of their shares are owned in the form of cross-shareholding, while only 8% of the firms say none.\(^8\)

Table 1.1 shows an example of corporate shareholding in a Japanese corporate group, Mitsui group. There are a few prominent features to be observed in this table. First, a cross shareholding arrangement usually involves more than two firms which forms a "web" relation. Although each firm owns a relatively small portion of other participants' shares, the total amount held by other participants tends to be large. In the example given in table 1.4, the total percentage of shares held by affiliates amounts to about 20% in most firms which is consistent with earlier mentioned survey results. Secondly, there are various indirect ownership relations through the web structure. For instance, suppose firm 1 does not own any of firm 2. However, if firm 3 owns some shares in firm 2 and if firm 1 possesses firm 3's shares, then firm 1 owns a part of firm 2 indirectly. This indirect ownership issue will be addressed in detail later. The third observation is the so-called one-set principle — although there might be some overlap in their business fields or business relations such as a supplier-

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\(^7\) The definition of cross-shareholding used by the survey is unclear. The statistics are sensitive to the definition itself. A possible definition of the firm's rate of cross holding is the total percentage of shares held by other firms whose shares are owned by the firm.

\(^8\) Cross-shareholding has been practiced in some other countries. For example, Nyberg (1995) refers to a study done by Dsl (1986) which shows that in Sweden almost one-third of the firms with equity exceeding ten million Swedish Kronor have cross-shareholding relationships to some extent. According to the Asahi Newspaper (February 18, 1997), Japan's Fair Trade Committee claimed in a recently published report that a one directional circular type of corporate shareholding had drawn attentions because of the corporate control problems it has created in France.
buyer relationship with each other, few of the participants are in exactly the same industry. In other words, those participants in a group are, usually, not competing in the same product market.

Figure 1.4 presents the average fractions of shares held by other member firms in each of the six major groups from 1982 to 1992. In the Mitsubishi group, about 26-27% of a firm's shares are owned by the other member firms on average, which is highest among the six groups. Dai-Ichi Kangyo group exhibits lowest 11-12% on average. These averages are fairly stable over the time.

1.5 Legal Issues on Corporate Shareholding

Now let us examine some legal issues with regard to corporate shareholding. In many countries corporate shareholding is subject to regulation such as anti-trust laws. In Korea, cross shareholding has been prohibited since 1987 for 511 companies which belong to any one of 33 major company groups (Okumura, 1992b). In many European countries, mutual shareholding, at least direct mutual shareholding, is prohibited by law (Nyberg, 1995). In the United States cross shareholding is not illegal, but there does not seem to be any example of cross shareholding. In Japan, there are some restrictions on corporate shareholding, which indirectly result in regulating cross-shareholding. As stated earlier, banks are prohibited from owning more than 5% of a firm's share by Japan's anti-monopoly laws (Article 11). Non-financial institutions may possess other firms' shares over 5% with con-

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9 Banks in Japan can hold corporate shares on their own account, while banks in the United States cannot by the Glass-Steagall Act.
ditions that it will not reduce market competition and that, for the firm which is capitalized at more than 10 billion yen or owns net assets in excess of 30 billion yen, the value of the obtained shares will not exceed the maximum of either the net asset or capital of itself (Anti Monopoly Act, Article 10 and 9.2). The Fair Trade Committee is given the authority to judge whether or not a company’s stock investment would reduce the market competition. If the company’s practice is found to be illegal, the company and/or the executive(s) will be fined and/or imprisoned (Article 10, 91, and 95.2). If more than a half of firm 1’s shares are owned by firm 2, firm 1 is not allowed to obtain firm 2’s shares (Commercial Law Act, Article 211.2). If more than a quarter of firm 1’s shares are owned by firm 2 and/or firm 2’s subsidiaries, firm 1 is not allowed to exercise its voting rights in firm 2 even if firm 1 owns firm 2’s shares (Commercial Law Act, Article 241.3).

Why is cross shareholding restricted or even prohibited in many countries? Okumura (1992a, 1992b) provides one explanation. He believes cross shareholding creates a monitoring problem; that is, with a sufficient amount of cross-shareholding, the managers can do anything they want to by colluding with each other. Suppose both managers 1 and 2, the managers of firm 1 and 2, are not maximizing the values of the firms in their charge. If these two firms have a cross shareholding relation, manager 1 can support manager 2 in the decision making process, or, more precisely, approve the decisions made by manager 2.

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10 Until 1997, Japan’s Anti-monopoly Act prohibited the establishment of a shareholding company whose primary purpose is to control other firms through the shares they owned (Article 9). This prohibition is now removed.

11 Repurchasing of its own shares is also illegalized by the Commercial Law Act, Article 210.
at the shareholders meeting. In the stock market, manager 1 may not sell Firm 2's stocks to prevent manager 2 from being replaced with somebody else even if it is against the individual shareholders' interest. If manager 1 does not support manager 2, manager 2 will be replaced by some other manager who is considered to maximize the shareholders' interest. The new manager will find out that the value of shares in firm 1 can be increased by replacing manager 1 with some other efficient manager. In such a case, it is rational for manager 1 to support manager 2 because manager 1 is essentially supporting him/herself. If this happens, the shareholders' interests will be reduced.

Okumura's argument is ambiguous and is required to be worked out more rigorously. However, it is suggestive and seems to be consistent with some other observations. According to Kaplan (1994), the number of outside directors is only 0.86 out of a total, 22.29 directors, on average in Japanese firms.\(^{12}\) The same figure for US companies is 9.57 out of 14.88. Managers in the Japanese firms in which cross-shareholding is commonly practiced seem to have a free hand. It is doubtful that those directors in the Japanese firms are perfectly representing the shareholders' interests. Shareholders meetings in Japan are also believed to be distorted (See for example Higashi, 1993). More than 95% of the listed firms in Japan, conventionally, hold shareholders' meetings on the same day. This physically limits individual shareholders to attend more than one meeting. However, the managers of the

\(^{12}\) In this figure, some of the people who are sent from affiliated companies to the board of directors are counted as insiders. Considering them as outsiders, a study finds that 31% of directors of 1985 listed Japanese firms are outside directors in 1988 (Kigyo Keiretsu Soran, 1990). Implication of this study is two-fold. First, the number of outside directors in Japanese firms is smaller than in US firms even under a broader definition. Secondly, interlocking directorship is very common in Japanese companies.
companies with cross shareholding ties do often send their employees, as representatives of their companies, to other companies’ shareholders’ meetings. Since they have a number of employees, they dominate the shareholders’ meetings by numbers. Their role is, usually, to support the managers’ decisions at the meetings. It is believed that the managers in many companies also pay people called *sokai-ya* to be supportive of the managers at the shareholders’ meetings. Often, sokai-ya prevent other individual shareholders from asking unwanted questions to the managers’ side at the meetings. Payoffs to *sokai-ya* are prohibited by the Commercial Law Act, but is believed to be widely practiced in the Japanese firms. As a result, shareholders’ meetings take less than half an hour on average.

The next chapter discusses theoretical and empirical studies on corporate shareholding.

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13 *Sokai-ya* often threaten corporate managers that they will disrupt their shareholders’ meetings by asking embarrassing questions about company finances and/or scandals if the managers do not give some payoffs to them. Hence, *Sokai-ya* is sometimes translated as corporate extortionist or racketeer. Once a *sokai-ya* group receives some payoff, however, they will usually cooperate with the managers so that the shareholders’ meetings will go smoothly without any obstructions. See, for example, Okumura (1998, pp165–166).

14 For example, involvement of *sokai-ya* in Takashimaya, Ajinomoto, Dai-ichi Kangyo bank, and Nomura Security companies became public recently. The CEO of Dai-ichi Kangyo Bank, one of the world largest banks, had committed suicide after their case became public. See Okumura (1998, pp164–165).

15 These statistics are reported in most national papers every year. Japan must be the only country taking such detailed statistics on an annual basis.
Figure 1.1: Number of Stocks by Holder in Japan

Source: Nihon Ginko, Keizai Tokai Nenpo, various years.
Original Source: The National Conference of Stock Exchanges

- Thin Solid Line at Very Bottom: National and Local Government

- Individuals
- Financial Institutions (including Investment Trusts)
- Other Business Corporations
- Investment Trusts
- Security Companies
- Foreign Investors

Year

Figure 1.2: Firm's Asset (10 yr Growth Rates from 1977 to 1986)

Source: Hayashi and Inoue (1991)

Note: Hayashi and Inoue (1991) estimated the average market value of balance sheet items over 687 Japanese manufacturing firms. The growth rates shown here are calculated based on the estimated market value.
Figure 1.3: Distribution of 410 Japanese Firms in Cross Shareholding*

Source: Keizai Kikaku Cho (Economic Planning Agency), Keizai Hakusho (Economic Survey of Japan), 1992

*Note that the rate of "cross shareholding" is defined by the total percentage of shares held by other affiliates.
Table 1.1: Intra-group Shareholdings (Mitsui Group)

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*The observation is at the end of fiscal year 1992.
**The unit is percentage.
***The first row is the names of the investing companies, and the first column is of the invested companies.
Figure 1.4: Average Cross Shareholding by Group

Source: Kogyo Keiretsu Souran, various years

Note that the vertical axis is the total percentage of shares held by other group companies.
Chapter 2
Review of the Literature

Three major categories of the theoretical literature on corporate shareholding are (1) competitive effect arguments (Reynolds and Snapp, 1986; Flath, 1989, 1991; Reitman, 1994), (2) risk-sharing motive arguments (Aoki, 1988) and (3) controlling rights arguments (Perotti, 1992; Berglöf and Perotti, 1994; Nyberg, 1995; Osano, 1996). Besides these arguments, there is a separate argument of corporate shareholding specific to financial institutions—financial institutions hold the shares in borrowing companies in order to better monitor the companies (Nakatani, 1984; Sheard, 1989; Prowse, 1989, 1990). This is sometimes described as "main bank" argument. It, however, does not provide any insights for corporate shareholding between industrial firms. Hence this thesis focuses on the three major arguments.

The list of empirical research studies on the Japanese corporate groups is very long. Classical works by Caves and Uekusa (1976) and Nakatani (1984) are, still, the most frequently cited among the literature. The list, however, becomes short if it is only in regards to corporate shareholding.

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16 There are some other arguments as well. For example, Tanigawa (1986) shows that cross shareholding could benefit individual shareholders under the then Japan's tax system that companies need not pay corporate tax for received dividend, while dividend tax is levied on net dividend payment.

17 Hoshi, Kashyap, and Scharfstein (1990 and 1991) provide some positive supporting evidence for the argument. After the burst of the so-called bubble economy, however, the argument had also begun to receive a lot of questions. See for example Morck and Nakamura (1999).
The next two sections review the theoretical and empirical papers focusing on corporate shareholding.

2.1 Theories

Competitive Effect Argument

Reynolds and Snapp (1986) provided the first analytical model in regard to corporate shareholding between firms in the same industry. They argue that, under a Cournot model, a firm with shareholding in its rival reduces product market competition because the firm’s total profit is linked to that of the rival through dividend payments. As a consequence of this horizontal shareholding, the equilibrium price (or quantity) is higher (lower) than the competitive price (quantity). For example, if there are \( n \) identical firms in a market and if each firm owns \( \frac{1}{n} \) fraction of shares of every other firm, then the industry will produce the monopoly level of output in equilibrium. Under this circumstance, as the amount of corporate shareholding increases, the industry’s output moves from \( n \) firms’ oligopoly level to the monopoly level.\(^\text{18}\) Conventional market concentration ratios such as Herfindahl index do not properly reflect the true state of market competition.\(^\text{19}\)

\(^\text{18}\) This is true until the amount of investment reaches \( \frac{1}{n} \). In their symmetric example, if each invest more than \( \frac{1}{n} \), equilibrium output is less than the monopoly level. If investment is at the feasible maximum level, \( \frac{1}{(n - 1)} > \frac{1}{n} \), each firm produces nothing at equilibrium. This outcome can be changed if each firm’s payoff properly includes recursive effects of corporate shareholding on dividend payments. Chapter 4 discusses this issue a little more.

\(^\text{19}\) Example shown by them is as follows. If each of ten firms, with no shareholding ties, had a ten percent market share, a four firm concentration ratio would be 40%. However, if each had a ten percent interest in each of the other firms, then their model suggests that the industry would produce the monopoly level of output.
Flath (1991) questioned why there seem to be few examples of horizontal corporate shareholding even in Japan where corporate shareholding are common between the firms. He creates a two-firm two-stage Nash model, where each firm decides the amount of stock investment in the other firm in the first stage and the firms compete in product market in the second stage. According to the model, a firm actually invests into the other firms only if the firm knows that investment results in an increase of its own profits rather than the joint profits of the investing and invested firms. The first stage necessary condition can be decomposed into two effects; “strategic effect” and “direct effect”. The strategic effect is the effect on the investing firm’s profit of the stock investment through the change in the invested firm’s choices in the product market. The direct effect is the change in the investing firm’s profit by the stock investment through the change in its own choices in the product market. Flath says that, for both Cournot and Bertrand competition in the product market, the direct effect is negative because the firm has to give up a part of its own operating profit to obtain a partial ownership in the other firms. Hence the strategic effect has to be, at least, positive in order to have stock investment in equilibrium. Since the investment into the other firms makes the investing firm react softly, for the firm to make stock investment, choice variables in the product market have to be strategic complements (fat cat ploy). In other words, for the existence of a sub game perfect equilibrium, the product market competition cannot be Cournot competition, but could be Bertrand. Flath shows that, under Bertrand duopoly, there can be a Nash equilibrium with cross-shareholding, if the products of rivals

20 An important assumption is that the firms acquire the stocks of the rival through an efficient stock market where the stock prices reflect correct anticipation of the product market equilibrium.
are imperfect substitutes. If the products are perfect substitute, it would not be rational to acquire the shares of the other firm.

Using a conjectural variation model, Reitman (1994) shows that all of the firms in the industry do not necessarily agree to participate in a cross shareholding relationship at a Nash equilibrium. It may be rational for some firms to stay outside the cross shareholding arrangement because there is a positive externality for the firms which decide not to participate in the arrangement. Reitman finds that it is not rational for any firm to participate in any cross shareholding relation, if the number of firms in the industry is three and if they are competing in Cournot or less rivalrous way. On the other hand, if the firms are competing in more rivalrous than Cournot, such as Bertrand, there exists an individually rational cross shareholding arrangement.

Flath (1989) looks at the vertical shareholding ties, instead of horizontal ones, with \( n_u \) identical upper stream firms and \( n_d \) identical down stream firms. As Greenhut and Ohta (1979) find, there will be a double marginalization problem under a Cournot oligopoly if they are not vertically integrated. In such a case, the final good price that consumers face is higher than it would be if there were \( n_u \) or \( n_d \) integrated firms operating. A ramification of this is a belief that integration through increased shareholding would decrease the consumer price as well. Flath, however, shows that more stock investments by upstream firms in downstream firms will lower the consumer price, but more investments by downstream firms in upstream firms does not lower and may even raise the price. He says this asymmetry arises because upstream firms are the first movers. Upstream firms will reduce the price
to downstream firms if their ownership interests in the downstream firms are increased. If downstream firms increase their interests in upstream firms and if the upstream firm does not own any share in the downstream firm(s), the upstream firms will not change the sale price. If the upstream firms own some of shares in the downstream firm(s), the upstream firms may even increase the sale price.

**Risk Sharing Argument**

Aoki's (1988) argues that a firm which is exposed to idiosyncratic shocks can reduce risk by investing in other companies. With such investments, the investing company's profits, after receiving dividends, become less volatile. According to Aoki, those who most benefit from this type of inter-corporate stock investments are non-saleable stakeholders of companies such as employees. Individual shareholders, who are saleable stakeholders, can

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Aoki (1988) also provides a second argument—transactional risk-sharing arrangement between transacting partners. Suppose that there are two vertically related firms. The prices of a primary resource and the final product are assumed to be stochastic, while the price of the intermediate product is determined in a perfectly competitive market. If the two companies are risk averse, say in CARA class, then the two companies can write a profit sharing agreement in order to reduce risk. An example of the agreement is that the upstream (or downstream) firm receives a portion $\alpha$ (or $1 - \alpha$) of the joint profit plus (or minus) a fixed amount $\beta$. With this agreement, the companies choose the same level of operation as they would without the agreement because the intermediate product market is perfectly competitive. Although total profit is the same with or without the agreement, risk is reduced. Under certain regularity conditions, the share parameter $\alpha$ is determined by the companies' degree of absolute risk aversion. The transfer parameter $\beta$ is determined by the their relative bargaining powers. In the context of a "main bank" system, the upstream firm is the bank and the downstream is an affiliated company in the financial corporate group. If the bank is less risk averse, it should bear a large portion of the risk. The bank uses the fixed payment as compensation for risk bearing. In this example, the affiliated company enjoys less variable, but somewhat lower, profit.

Shareholding plays only a secondary role in this argument, although Aoki says that cross shareholding is required as a mutual monitoring device forcing each firm to comply with an arrangement that may not necessarily be in its short-term interest.
reduce their risk through corporate stock investment, but they do not necessarily rely on this mechanism to diversify their portfolio because they can directly invest in various companies. Workers in a company, on the other hand, accumulate their wealth in the company and part of their wealth is paid out as a retirement payment, which usually is neither portable nor marketable. In most Japanese firms, where quasi-life-time and seniority-payment systems prevail, workers bear human capital investment costs and receive low wages in the first years of their career, while they are compensated in later years. The wealth retained in a company in these forms depends on the performance of the company and there is no way for employees to diversify these holdings. Since managerial compensation is usually linked to the performance of the company, managers also hold non-saleable stakes in the company. For this reason employees and/or managers want the firm to hold the shares of other companies to reduce the volatility of the company’s performance.

An important assumption in the above two classes of arguments—the competitive-effect and risk-sharing arguments—is that obtaining stocks in a company only means acquiring rights to claim dividends. However, shareholders have rights to control the firm as well. They can typically exercise the rights at annual shareholders’ meetings. This is also an important characteristic of common stocks. Our final category, the controlling rights argument, sheds light on this aspect of stock investment.

**Control Rights Argument**

Perotti (1992) and Berglöf and Perotti (1994) say that cross shareholding is a sort of hostage exchange to support collaboration among managers. In their model, managers make
two decisions: collaborate or not; and exert effort or not. A manager's effort, say R & D effort, increases the profit, not only of her firm, but also of the other firms if those firms collaborate with each other, say in a R & D project. This externality does not exist if they do not collaborate. There is a certain range of payoffs for which the managers fall in a prisoner's dilemma when a cross shareholding arrangement does not exist. In a one shot game, they do not collaborate but exert effort for their own sake. In a repeated-game setting, a punishment for deviation is to end collaboration if there is no cross shareholding arrangement. The punishment, however, may not be strong enough to force the managers to collaborate. Their model suggests that if the firms exchange sufficient shares prior to the game, they might be able to attain a better equilibrium. With a cross shareholding arrangement, a manager who deviates will be ousted by the other managers, and this threat of job loss, which is a more severe punishment, can induce every manager to comply with the agreement. Hence profits are higher for the firms which participate in the cross shareholding arrangement.

Unlike Perotti (1992) and Berglöf and Perotti (1994), Nyberg (1995) introduced a potential raider outside a cross shareholding arrangement as a source of takeover threat. In his model, managers buy shares of other companies crosswise in order to protect themselves from a takeover.\textsuperscript{22} According to Nyberg, the managers' resistance to takeover induces a higher premium which can possibly benefit the individual shareholders if the takeover actually occurs. He also shows that, if the probability of takeover is high, a highly inten-

\textsuperscript{22}Note that shareholding ties in this model are not between corporations, but between managers.
sive cross shareholding arrangement may increase bargaining power of the managers and, thereby, the managerial rewards.

Osano (1996) shows that a manager, who would invest in a risk-free low-return project without a cross shareholding arrangement because of a threat of takeover, may invest in a high-risk high-return project with such an arrangement. Suppose that a manager’s utility is comprised of two parts; a fraction of total profit of the firm and some fixed value for staying with the firm. There is a potential raider who can better manage the risky project in a bad state than the incumbent manager can. The manager would choose the risk-free project if the threat of takeover is large enough. With a cross shareholding arrangement, however, the potential raider can be blocked, if the improvement which will be brought by the potential raider in a bad state is smaller, and if managers’ gains from staying with their firms are large compared to the value of stakes that the manager has in the firm. This means that raiders cannot improve the performance of the company in the bad state enough to make a tender offer. In such a case, the cross shareholding arrangement is sustainable and the managers will choose a high-risk high-return project.

The next section reviews the empirical literature on why companies hold shares in other companies.

2.2 Empirical Studies

A number of empirical studies address Japanese corporate group issues from various perspectives such as shareholding ties, debt ties, director ties, and trade ties. Much of the
literature stresses the existence of some “insurance” mechanism among the group affiliated companies.

For example, Nakatani (1984) finds, from a sample of 317 non-financial companies for the period of 1966-1974, that over-time fluctuation of business profit rates over total assets is smaller for group affiliated firms than for non-group firms. In addition to this lower volatility, Nakatani also finds that business profit rates are significantly lower in group firms than in non-group firms. He tries to explain these observations with a risk-sharing mechanism through interest payments: Under normal circumstances, a group firm pays a higher interest rate, a sort of “insurance premium”, to its main bank; once a downturn occurs, the main bank charges lower rates to its group firms so that they can get through the bad time; and, as a consequence, profit rates are lower but stable over time in group firms. Behind this argument is Cave and Uekusa’s (1976) discovery that the group firms, especially small peripheral firms, bear higher cost of interest to be paid to the “main bank(s)” of the group.

This insurance mechanism works only between banks and borrowers. On a broader basis, however, many studies indicate a negative correlation between corporate shareholding and volatility in companies’ profits. Among them are Caves and Uekusa (1976), Hoshi and Ito (1992), and Lincoln, Gerlach, and Ahmadjian (1996).

Based on a sample of 243 large manufacturing companies over the period of 1961–1970 in Japan, Caves and Uekusa find that rates of after-tax return on assets (ROA) of

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23 The growth rate of sales values is also found to be lower for the group firms than for non-group firms. Nakatani says the rate of growth of the firm’s output and of its total assets exhibit the same kind of results.
corporate group firms are negatively related to the amount of shares held by their affiliated companies. Hoshi and Ito (1992) replicate a similar result based on a sample of 178 group affiliated companies from 1978–1988. Lincoln, Gerlach, and Ahmadjian (1996) find, using a sample of 197 manufacturing companies over an extended period of 1967–1985, that a company with stronger shareholding ties, measured by the total amount of shares held by its affiliates, tends to earn a higher (lower) profit rate in the subsequent periods if it earned a lower (higher) profit rate in the previous periods.

Note that there are some studies which indicate no relation between corporate shareholding and volatility in companies' profits. Lincoln, Gerlach, and Ahmadjian states, in their study, that the overtime “redistribution” effect disappears in the late 1980s. Using a sample of 118 Japanese companies in 1989–90, Beason (1998) finds that more stock investment by other industrial companies or financial institutions does not imply a lower volatility if the volatility is measured by standard deviations in the invested company's stock prices. Based on the same volatility measurement, he also finds that affiliated companies do not necessarily exhibit a lower volatility.

Although it has nothing to do with the “insurance” argument, Flath's (1996) empirical research must be noted here because it looks at the determination of firms' stock invest-

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24 The explanatory variables used in the analysis are; market concentration rate in the main product of each firm, advertisement-sales ratio, total asset value, product specialization rate, sales growth rate, variance in sales values, the percentage of shares held by the affiliated companies and the corporate group dummies.

25 A distinctive feature of their study is that their indices for shareholding and directorship ties include both direct and indirect relations. The reason why they include indirect ties into their analysis is that direct ties ignore indirect relations such as a parent-grandchild relation of companies.
ments in other firms. This is a huge departure from the above class of literature. The purpose of his study is to find evidence that supports his argument that corporate shareholding in trading partners deters opportunistic behavior of the partners. Using a regression model, shareholding by each firm in other affiliates is explained by the characteristics of both investing and invested firms. Among the explanatory variables are proxies of trading relations between investing and invested companies. The percentage of investing (or invested) company’s industry’s purchases of intermediated inputs that are from invested (or investing) company’s industry are the proxies. It is found that stock investment is larger between companies with stronger trading ties.

In summary, although there are some exceptions, many empirical studies find that companies which are more closely tied together with corporate shareholding tend to exhibit lower but less volatile profit rates. This is often regarded as a “stylized” fact for corporate shareholding among Japanese companies.

2.3 Concluding Remarks

Aoki’s risk-sharing argument is an attempt to explain this “insurance” phenomena among group firms. In his stock-swap model, the value of shares owned by affiliates should be equal to the value of shares that a company owns in the affiliates. With dividend payments/receipts, the more a company invests in other companies, the less volatile the profit rates of the company. Aoki’s argument consistently provide an explanation for the lower volatility among group companies, as well as the “insurance” mechanism. His model, how-
ever, can not explain the lower profit rates of those companies. With respect to the “insurance” among group firms, the other theories provide no explanation, or even suggest the opposite. The competitive-effect argument predicts that the profits of the firms should be raised with reduced competition. Since those companies are in the same industry and their profit rates are likely to be correlated, risk reduction effect of such investment must be small, if any. The control-rights arguments, except Nyberg, also predict higher profit rates in firms with cross shareholding. Moreover, Osano’s model says that a cross shareholding arrangement allows precipitating firms to invest in a risk project, which cause more volatility in the companies’ *ex-post* profits. This contradicts the finding of most empirical researches.

In most of the empirical literature, the total fraction of shares held by other group members is the only variable to describe the shareholding structure. A firm’s stock investment in other firms, which determines the portfolio of the company, is not considered in those analyses. It also remains a mystery how shareholding by affiliates can reduce volatility of the firm’s profits.

The empirical studies discussed above are intended to describe functions of corporate groups, and are not designed to, specifically, test the theories of corporate shareholding, except Flath (1996). For example, we still do not know if there actually is corporate shareholding with the competitive-effect motive. In chapter 4, we try to find evidence which supports each of the three major arguments.
The next chapter is dedicated to a construction of a risk-sharing model with agency costs, which explains not only the lower volatility but also the lower level of profit rates in companies with corporate shareholding.
Chapter 3
Corporate Shareholding and Agency Cost

3.1 Introduction

Today a substantial amount of corporate stocks are held by other companies in many countries. There are many arguments for why companies invest in other companies.

As discussed in chapter 2, Aoki’s illustrative risk sharing model provides one of the insight (Aoki, 1988, pp.225-234). Suppose that there are two firms \((i = 1, 2)\) and their operating profits are subject to two independent states \((j = 1, 2)\). The operating profits for each firm at each state are given by \(\pi_i^j\) such that firm 1 performs better in state 1 and firm 2 does better in state 2; \(\pi_1^1 > \pi_1^2\) and \(\pi_2^2 > \pi_2^1\). If both firms could issue new shares and swap them with each other, each firm’s profit, after dividend payments and receipts, becomes less volatile. Aoki argues that non-saleable stakeholders of a company are the people who benefit from such exchanges of stocks because, otherwise, they cannot reduce their risks.

Examples of non-saleable stakeholders are employees and managers. Employees of a company accumulate their wealth in their company and part of their wealth is paid out as a retirement payment. Thus they have an incentive to support corporate shareholding. Managers also are often stakeholders of the firm they work for. As standard principal-agent models suggest, managerial compensation is usually linked to the performance of their company. Stock option is one way to link manager’s performance and rewards, although it was illegal in Japan until 1997. There are some other ways to link managerial reward to the
company's performance. In fact, Kaplan (1994) finds links between managerial rewards and firm's performance even among Japanese firms in which stock option has not been practiced. What is important is that managers are not only non-saleable stakeholders but also primal investment decision makers of their firms, while employees are not.

Models presented in this chapter combine the principle-agent issue with the risk-sharing argument. Suppose that a risk-neutral shareholder is the principle and a risk-averse manager the agent. Non-observable managerial effort is the primary input for a company. Managerial payment scheme consists of a performance-based reward and a fixed wage, where the performance of a company is measured by the value of that company. This performance-based payment scheme makes the managers non-saleable stakeholders of the company. A stronger link between the company's performance and the managerial reward works in two different directions. First, it increases the risk that the managers have to face, as is discussed in Aoki (1988). Secondly, it increases the manager's incentive to exert effort, as in any standard principle-agent model. Given the contract, managers try to maximize their expected utility by choosing the level of their effort and the amount of corporate stock investments. Shareholders, on the other hand, try to extract all the rent from the managers by choosing a payment scheme which will keep the managers in the company.

One of the purposes of this study is to see if our model can provide a consistent explanation for the "stylized" facts that, in Japan, companies which are more involved in intercorporate shareholding exhibit lower but less volatile profit rates measured by return on assets. Aoki's risk sharing argument suggests the lower volatility of profits, but not the lower
level of profits in companies with cross-shareholding. As discussed in chapter 2, none of other arguments seem to provide an explanation for the "stylized" facts.

The structure of this chapter is as follows. In the second section, the effects of unilateral stock investment under a standard principal-agent model will be considered. A simple model explains when and how a manager can reduce risk by investing in another company. In this model, the invested company is an entrepreneurial company—that is a firm without agency problem—and does not hold any shares in the investing company. The third section extends the model to bilateral investment models, by assuming that the invested company also has the same principle-agent problem. This adds new tiers to the model—managers (and shareholders) of the two companies interact strategically when they choose their variables. The fourth section draws conclusions from the second and third sections.

3.2 P-A Model with Unilateral Stock Investment Opportunity

Let us start with a standard principal-agent model. A firm, say firm 1, is owned by a risk-neutral individual shareholder and run by a risk-averse manager. The firm's profit, \( \pi_1 \), is generated by a manager's non-observable effort, \( e_1 \), with a disturbance, \( \epsilon_1 \):

\[
\pi_1 = e_1 + \epsilon_1
\]

Individual shareholders are assumed to be risk neutral, due to mainly a technical reason. If individual shareholders are risk averse, determination of stock price becomes extremely complicated because individual shareholders intervene the managers' investment decisions by affecting the stock price. Since the focus of this study is on the risk sharing behavior of non-saleable stakeholders (i.e. managers), individual shareholders, who can diversify their portfolio directly, are assumed to behave as if they were risk-neutral in this model.
where

\[ \epsilon_1 \sim N(0, \sigma^2_1). \]

There is a cost of effort to the manager, which is \( \frac{1}{2} \epsilon^2_1 \). The manager's net income is denoted by \( y_1 \) and the manager's utility function is \(-\exp(-r_1 y_1)\) where \( r_1 \) is the manager's degree of absolute risk aversion.

The timing of the game is as follows. In the first stage, the shareholder writes a contract. Since managerial effort is non-observable, the shareholder has to write a contract on observable variables. Managerial reward can be linked to either the operating profit or the value of the company. The shareholder can also pay a wage. If the wage is negative, it is a transfer payment from manager to shareholder. The manager's expected utility must be non-negative so that the manager will participate in the contract. In the second stage, given the contract, the manager decides on her effort. If opportunities to invest in other firms exist, the manager also decides on the firm's investment.\(^{27}\) Since firms in this model do not have any fund at this stage yet, only the decision is made in the this stage.\(^{28}\) Finally, the manager exerts effort, and the stochastic elements are revealed. Shares are transacted at the pre-determined price and quantity as decided in the second stage. Profits are distributed to the manager and the shareholder according to the managerial contract and the ownership structure.

\(^{27}\) In this case, it is assumed that the manager decides on the amount of investment and the level of effort simultaneously. This assumption is different from the one used in Flath (1991). In Flath, managers decides on the amount of investment and, then, makes their product market decision.

\(^{28}\) Bond financing could be included in the model. It, however, does not change the nature of our argument as long as the possibility of bankruptcy is not considered.
What follows shows that; (1) operating-profit-based and value-of-the-firm-based payment schemes in the incentive contract are equivalent for both individual shareholder and manager if there is no investment opportunity; (2) with the operating-profit-based payment scheme, a manager can never reduce risk in her income by investing in another company and; (3) with the firm-value-based payment scheme, a manager can reduce risk by investing in another company, which eventually benefits the shareholder.

(1-1) Operating-Profit-based Payment Scheme with No Investment Opportunity

Suppose that the managerial reward is a fraction $\lambda_1$ of the operating profit plus a wage $w_1$. Then the manager's net income, $y_1$, is $\lambda_1 \pi_1 + w_1 - e_1^2/2$. Given that the manager's utility function is $-\exp(-ny_1)$, the certainty equivalent income for the manager, $z_1$, is

$$z_1 = \lambda_1 E[y_1] - \frac{r_1}{2} Var[y_1]$$
$$= \lambda_1 e_1 + w_1 - \frac{1}{2} e_1^2 - \frac{1}{2} \lambda_1^2 \sigma_1^2.$$  \hspace{1cm} (3.1)

The last term is the risk premium.

In the second stage, the manager maximizes the certainty equivalent income, $z_1$, with respect to her own effort, $e_1$. Hence the optimal level of effort is $e_1^* = \lambda_1$. The manager exerts more effort when the managerial reward is more strongly linked to the operating profit of the firm. As you see in the above equation, a higher $\lambda_1$ increases not only managerial effort but also the degree of risk that the manager is exposed to.
Shareholder's net income, \( u_1 \), is \( (1 - \lambda_1)\pi_1 - w_1 \). Being risk neutral, the shareholder is concerned with his expected income, \( E[u_1] = (1 - \lambda_1)e_1 - w_1 \). In the first stage, the shareholder maximizes his expected income subject to the manager's participation constraint:

\[
\max_{\lambda_1, w_1} (1 - \lambda_1)E[\pi_1] - w_1 = \max_{\lambda_1, w_1} (1 - \lambda_1)\lambda_1 - w_1
\]  \hspace{1cm} (3.2)

subject to

\[
\lambda_1^2 + w_1 - \frac{1}{2} \lambda_1^2 - \frac{r_1}{2} \lambda_1^2 \sigma_1^2 \geq 0.
\]

Assuming that the participation constraint is binding, the solution is

\[
\lambda_1^* = \frac{1}{1 + r_1 \sigma_1^2}
\]  \hspace{1cm} (3.3)

and

\[
w_1^* = \frac{r_1 \sigma_1^2 - 1}{2(1 + r_1 \sigma_1^2)^2}.
\]  \hspace{1cm} (3.4)

If the manager is risk averse (i.e. \( r_1 > 0 \)), a higher link to the operating profit (i.e. larger \( \lambda_1 \)) assigns more risk to the manager. Although the shareholder himself is risk neutral, a large risk premium for the manager means that less can be extracted from the manager while keeping the manager in the firm. Hence the shareholder has to set \( \lambda_1 \) small at the expense of manager's incentive so that the risk premium for the manager will be small. See Figure 3.1. Note that \( \sigma_1 \) is assumed to be one in all of the figures in this chapter.
Figure 3.1: $\lambda_1^*$ as Function of $r_1$: Model (1-1)
Figure 3.2 shows that as the manager's degree of risk aversion rises, the wage increases, initially, and then decreases. The increasing part is associated with the gradual weight shift from a performance-based reward towards a fixed wage. As is shown above, when the manager's degree of risk aversion is small, the shareholder gives higher incentive to the manager. With the higher incentive, the expected profit of the company is large, and the shareholder asks the manager to pay a higher "franchise" fee (i.e. negative wage). The middle part of the function shows the case where, if the manager is moderately risk averse, the shareholder has to provide a positive wage to keep the manager in the company. If the manager is highly risk averse, the risk premium is high, but not so high because the managerial payment is weakly linked to the performance of the company by a lower $\lambda_1$ value. The wage can be lowered accordingly. This is shown in the decreasing part of the function.

In equilibrium, the shareholder's expected payoff is

$$E[u_t^*] = \frac{1}{2(1 + r_1\sigma_T^2)}.$$ (3.5)

Figure 3.3 depicts the shareholder's expected income, which decreases as the manager's degree of risk aversion increases.

This makes a benchmark case for the following argument.

(1-2) Value-of-the-Firm-Based Payment Scheme with No Investment Opportunity

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29 $w^*$ is increasing if $r\sigma^2 < 3$, while decreasing if $r\sigma^2 > 3$ because

$$\frac{d}{dr\sigma^2} \frac{r\sigma^2 - 1}{2(1 + r\sigma^2)^2} = \frac{3 - r\sigma^2}{2(1 + r\sigma^2)^3}.$$
Figure 3.2: $w_1^*$ as Function of $r_1$: Model (1-1)

Figure 3.3: Shareholder's Expected Income as Function of $r_1$: Model (1-1)
Suppose that everything is the same as in model 1-1, except that the managerial reward is a fraction $\lambda_1$ of the value of the firm plus a wage, $w_1$. The value of the firm, $v_1$, is defined after wage payment. It is, therefore, $\pi_1 - w_1$, if there is no outside investment opportunity. Then the manager’s income, $y_1$, is $\lambda_1 (\pi_1 - w_1) + w_1 - \frac{1}{2} \epsilon_1^2$, and the certainty equivalent income for the manager, $z_1$, is $\lambda_1 E[\pi_1 - w_1] + w_1 - \frac{1}{2} \epsilon_1^2 - \frac{1}{2} \lambda_1^2 \sigma_1^2$. The certainty equivalent income is maximized, as before, when $\epsilon_1^* = \lambda_1$.

The shareholder’s expected income is $(1 - \lambda_1) E[\pi_1 - w_1]$ in this setup. The shareholder’s maximization problem is
\[
\max_{\lambda_1, w_1} (1 - \lambda_1) E[\pi_1 - w_1] = \max_{\lambda_1, w_1} (1 - \lambda_1)(\lambda_1 - w_1)
\]
subject to
\[
\lambda_1 (\lambda_1 - w_1) + w_1 - \frac{1}{2} \lambda_1^2 - \frac{1}{2} \lambda_1^2 \sigma_1^2 \geq 0.
\]
This formula appears different from the previous model. However, assuming the participation constraint to bind and manipulating the expression to eliminate the wage, the reduced form of the maximization problem is the same in the two models. Thus, the optimal choices of $\lambda_1$, and hence the level of effort, is the same as in model 1-1: $\lambda_1^* = 1/(1 + r_1 \sigma_1^2)$. The wage is different,
\[
w_1^* = \frac{r_1 \sigma_1^2 - 1}{2(1 + r_1 \sigma_1^2)r_1 \sigma_1^2}, \tag{3.6}
\]
because the value of the firm is defined by the operating profit minus fixed wage. Despite
the change, \( w^*_1 \) has the same property as in the previous model—it is increasing in \( r_1 \) and \( \sigma \)
if both \( r_1 \) and \( \sigma \) are small, while decreasing if they are large.\(^{30}\)

Although \( w^*_1 \) is different, the shareholder's expected payoff is the same as in model 1-1.
\[
E[u^*_1] = \frac{1}{2(1 + r_1 \sigma^2_1)}.
\]
(3.7)
This is because the shareholder payoff is the operating profit minus the manager's cost of
effort minus the risk premium, which are all the same as in model 1-1.

This shows that the two payment schemes in models 1-1 and 1-2 are equivalent. The
following subsections show that the equivalency of the two payment schemes does not hold
when there is an outside investment opportunity.

(2-1) Operating-Profit-Based Payment Scheme with Investment Opportunity

Suppose that there is an entrepreneurial company, firm 2, which generates
\[
\pi_2 = \bar{e}_2 + \epsilon_2
\]
where \( \bar{e}_2 \) is a the first-best effort level which is fixed, while firm 1's operating profit is the
same, \( \pi_1 = e_1 + \epsilon_1 \).\(^{31}\) \( \epsilon_1 \) is a random variable with
\[
\epsilon \sim N(0, \Sigma) \text{ and } \Sigma = \begin{bmatrix}
\sigma_1 & \sigma_{12} \\
\sigma_{21} & \sigma_2
\end{bmatrix}.
\]
\(^{30}\) More precisely, \( w^* \) is increasing in \( r \) or \( \sigma \) if \( r\sigma^2 < 1 + \sqrt{2} \), while decreasing if \( r\sigma^2 > 1 + \sqrt{2} \) because
\[
\frac{dr\sigma^2}{dr\sigma^2} \frac{r\sigma^2 - 1}{2(1 + r\sigma^2)r\sigma^2} = \frac{1}{2} \frac{(r\sigma^2)^2 - 2r\sigma^2 - 1}{(1 + r\sigma^2)^2 (r\sigma^2)^2}.
\]
\(^{31}\) \( \bar{e}_2 \) does not have to be the first-best effort level for the following argument to hold.
From convention, \( \sigma_i \) stands for the standard deviation of shocks. \( \sigma_{ij} \) is the covariance between \( \epsilon_i \) and \( \epsilon_j \). Firm 1 is owned by an individual shareholder. The total number of shares is one for each firm.

Under this circumstance, firm 1 has an opportunity to invest in firm 2. Suppose that, in the second stage, firm 1 asks firm 2's owner to sell some fraction \( \alpha_1 \) of firm 2's shares. The value of the shares is \( \alpha_1 \pi_2 \) while the cost is \( \alpha_1 p_2 \) where \( p_2 \) is the share price. A risk-neutral owner, who originally had 100% of firm 2, is entitled to \( (1 - \alpha_1)\pi_2 \) after this transaction while receiving \( \alpha_1 p_2 \) in cash. The share price is determined by an "efficient market" (Flath, 1991). In an efficient market, the price of a share is equal to its expected value; \( p_2 = E[\pi_2] \).\(^{32}\)

What follows shows that nothing changes by the existence of outside investment opportunity, as long as the manager's reward is based on operating profits. Under an operating-profit-based payment scheme, the manager's net income, \( y_1 \), and hence the certainty equivalent income, \( z_1 \), is the same as in model 1-1 (equation 3.1). Therefore the manager's choice remains the same as well: \( e^*_1 = \lambda_1 \). Since \( z_1 \) is independent of \( \alpha_1 \), the amount of investment is indifferent to the manager.

Given the above, the payoff to firm 1's shareholder, \( u_1 \), is defined by firm 1's operating profit plus dividend income from firm 2 minus purchasing cost of firm 2's share minus managerial compensations: \( u_1 = \pi_1 + \alpha_1 \pi_2 - \alpha_1 \hat{\epsilon}_2 - \lambda_1 \pi_1 - w_1 \). Since \( E[\pi_1] = e^*_1 \) and \( E[\pi_2] = \hat{\epsilon}_2 \) in the equation, the expected payoff to the shareholder is \( E[u_1] = (1 - \lambda_1)e^*_1 - \)

\(^{32}\) Obviously this is a strong assumption because, for this to be true in general, everybody in stock market has to be risk neutral with no time preference. This assumption, however, allows us to single out the managerial risk sharing issue, which is the focus of our study.
$w_1$, which is the same as in model 1-1. Hence the shareholder’s maximization problem is identical with the one in model 1-1, as is the solution.

In sum, the existence of an investment opportunity does not change the equilibrium choices of both manager and shareholder if the managerial compensation is based on the operating profit of the firm.

(2-2) Value-of-the-Firm-Based Payment Scheme with Investment Opportunity

The next shows that, if the managerial reward is paid based on the value of the firm, introduction of outside investment opportunity benefits the shareholder.

When firm 1 holds a fraction $\alpha_1$ of firm 2, the value of firm 1 is,

$$v_1 = \pi_1 + \alpha_1 v_2 - \alpha_1 p_2 - w_1$$

where $v_2$ is the value of firm 2. The terms on the right hand side of the equation are; the operating profit of the firm; the market value of the shares purchased from an individual shareholder of firm 2; the money that is promised to be paid to the individual shareholder; and the fixed wage paid to the manager. These four items define the market value of firm 1. Since firm 2 does not own any firm’s shares, the value of firm 2 is simply equal to its operating profit: $v_2 = \pi_2$.

With a value-of-the-firm-based payment scheme, the manager's income is

$$y_1 = \lambda_1 v_1 + w_1 - \frac{1}{2} e_1^2.$$  

With the efficient market assumption (i.e. $p_2 = E[v_2]$), the expected value of the firm is equal to the level of effort minus wage paid to the manager, $E[v_1] = E[\pi_1 - w_1] = e_1 - w_1$.

Thus, certainty equivalent income for the manager, $z_1$, is
\[ z_1 = \lambda_1(e_1 - w_1) + w_1 - \frac{1}{2} e_1^2 - \frac{r_1 \lambda_1^2}{2} (r_1^2 + 2 \sigma_{12} \alpha_1 + \sigma_2^2 \alpha_1^2). \] (3.9)

Given the payment scheme, the manager in the second stage maximizes \( z_1 \) with respect to \( e_1 \) and \( \alpha_1 \) subject to \( 0 \leq \alpha_1 \leq 1 \). The solution is

\[ e_1^* = \lambda_1 \]

and

\[ \alpha_1^* = \begin{cases} 0 & \text{if } 0 \leq \sigma_{12} \leq 1 \\ = \frac{\sigma_{12}}{\sigma_2^2} & \text{if } -\sigma_2^2 \leq \sigma_{12} < 0 \\ = 1 & \text{if } \sigma_{12} < -\sigma_2^2. \end{cases} \] (3.10)

What is found here is as follows. First, \( \alpha_1^* \) is independent of the first stage choices, \( \lambda_1 \) and \( w_1 \). Secondly, the covariance must be negative for the optimal amount of investment to be positive. This is because cash, which is a risk-free asset, is promised in exchange for a profit claim in the outside project, which is a risky asset. A ramification of the second finding is that firm 1’s standard deviation, \( \sigma_1 \), has to be positive for the optimal amount investment to be positive, because the covariance is always zero if \( \sigma_1 \) is zero. This means that only a manager of a risky firm invests in other companies. Thirdly, in its interior, stock investment is larger if the covariance in operating profits is smaller (i.e. more strongly negative) and/or if the target company’s level of risk is smaller. The degree of risk that firm 1 originally faces (i.e. \( \sigma_1 > 0 \)) does not affect the equilibrium level of investment.\(^{33}\) Lastly,

\(^{33}\)The reason for this is, again, that cash is promised in exchange of another company’s stocks in our model and that investing firm’s decision is made solely based on the marginal cost and benefit of such an exchange.

48
if the invested company is very safe, the optimal level of investment reaches the boundary, 
\[ \alpha^*_1 = 1. \]

The manager’s participation constraint, and therefore the maximization problem in the first stage, depends on the managerial investment choice in the second stage. When there is no stock investment (i.e. \( \alpha^*_1 = 0 \)), the maximization problem, and the solution, is the same as in model 1-2. With positive investment, the participation constraint is

\[
\lambda_1(\lambda_1 - w_1) + w_1 - \frac{1}{2}\lambda_1^2 - \frac{r_1\lambda_1^2}{2}\sigma_1^2(1 - \frac{\sigma_{22}^2}{\sigma_1^2\sigma_2^2}) \geq 0 \quad \text{if } 0 < \alpha^*_1 < 1
\]

or

\[
\lambda_1(\lambda_1 - w_1) + w_1 - \frac{1}{2}\lambda_1^2 - \frac{r_1\lambda_1^2}{2}(\sigma_1^2 + 2\sigma_{12} + \sigma_2^2) \geq 0 \quad \text{if } \alpha^*_1 = 1,
\]

depending on the equilibrium level of investment.

In order to further analyze these two cases, let us define a function such that

\[
f_1(r_1, \sigma_1, \sigma_2, \sigma_{12}) = r_1\sigma_1^2(1 - \frac{\sigma_{22}^2}{\sigma_1^2\sigma_2^2}) \quad \text{if } -\sigma_2^2 \leq \sigma_{12} < 0
\]

\[
= r_1(\sigma_1^2 + 2\sigma_{12} + \sigma_2^2) \quad \text{if } \sigma_{12} \leq -\sigma_2^2.
\]

It is straightforward to show that \( f_1 \) is increasing in \( r_1, \sigma_1, \sigma_2, \) and \( \sigma_{12}, \) as long as \( \sigma_{12} < 0. \)

Since the risk premium is \( \lambda_1^2 f_1 / 2, \) this means that the risk premium increases as either the manager’s degree of risk aversion, the variances in investing or invested firm’s operating profit, or the covariance in operating profit increases. Note also that \( f_1 \) is positive as long as the parameters, \( r_1, \sigma_1, \sigma_2, \) and \( \sigma_{12}, \) stay in their feasible regions.\(^{34}\)

\(^{34}\) This can be easily shown, remembering the correlation coefficient, \( \rho, \) is always between minus one and one; \(-1 \leq \rho = \sigma_{ij} / \sigma_i\sigma_j \leq 1.\)

\((1) \) \( r\sigma_1^2(1 - \frac{\sigma_{12}^2}{\sigma_1^2\sigma_2^2}) \geq 0 \) since

\[
r\sigma_1^2(1 - \frac{\sigma_{12}^2}{\sigma_1^2\sigma_2^2}) = r\sigma_1^2(1 - \rho^2)
\]

and \( r, \sigma_1 \geq 0. \)
Suppose that the participation constraint is binding. Then a reduced form of the shareholder’s maximization problem is

\[
\max_{\lambda_1} (1 - \lambda_1) \lambda_1 + \lambda_1^2 - \frac{1}{2} \lambda_1^2 - \frac{1}{2} \lambda_1^2 f_1(r_1, \sigma_1, \sigma_2, \sigma_{12}).
\] (3.11)

The solution is

\[
\lambda_1^* = \frac{1}{1 + f_1}
\] (3.12)

and

\[
w_1^* = \frac{f_1 - 1}{2(1 + f_1)f_1}.
\] (3.13)

The shareholder’s expected payoff is

\[
E[u_1^*] = \frac{1}{2(1 + f_1)} = \frac{1}{2} \lambda_1^*.
\] (3.14)

The functional forms of \(\lambda_1^*\) and \(w_1^*\) in this model are the same as those shown in model 1-2. Replace \(f_1\) in the above equations with \(r_1 \sigma_1^2\) reproduces the solutions for model 1-2.\(^\text{35}\) Equation 3.12 shows that \(\lambda_1^*\) is decreasing in \(f_1\), while equation 3.13 shows that \(w_1^*\) is decreasing in \(f_1\).

\(^\text{35}\) In models, 1-2 and 2-2, the value-of-the-firm based payment scheme is employed. In model 1-1, on the other hand, the operating-profit-based payment scheme is used. This is why the wage function in model 1-1 is not comparable to the ones in models 1-2, 2-2 and the bilateral model in the next section.
increasing for a smaller value of $f_1$ and decreasing for a larger value. Applying the chain rule, we can study the comparative statics of $r_1, \sigma_1, \sigma_2$ and $\sigma_{12}$ on $\lambda_1^*$ and $w_1^*$. $\lambda_1^*$ is decreasing in all of these variables. As we have discussed, marginal effect of those variables on $w_1^*$ depends on the value of $f_1$: For a small $f_1$, $w_1^*$ is increasing in $r_1, \sigma_1, \sigma_2$ and $\sigma_{12}$, while for a large $f_1$, it is decreasing.

An important fact is that $f_1$ is always smaller than $r_1\sigma_2^2$ as long as the covariance is negative.\(^{36}\) This means that the shareholder would choose a larger $\lambda_1$ than he would without outside investment opportunity as in model 1-2. The high managerial incentive makes the shareholder better off as is shown in Figure 3.4. The upper line is with the investment opportunity (model 2-2), and the lower one is without it (model 1-2) when $\sigma_1 = \sigma_2$ and $\sigma_{12} = -0.5$.

This figure clearly shows that, with outside investment opportunity, the firm-value-based payment scheme improves the shareholder's expected income.

Up to this point, we only allowed one company to invest, unilaterally, in the other company. In the next section, we consider what happens if both companies can invest. It adds

\(^{36}\) The proof is as follows.

\[
(1) \quad r\sigma_1^2(1 - \frac{\sigma_{12}^2}{\sigma_1^2\sigma_2^2}) = r\sigma_1^2(1 - \rho^2) \leq r\sigma_1^2 \quad \text{since}
\]

\[r\sigma_1^2(1 - \frac{\sigma_{12}^2}{\sigma_1^2\sigma_2^2}) = r\sigma_1^2(1 - \rho^2) \]

and $-1 \leq \rho \leq 1$.

\[
(2) \quad r(\sigma_1^2 + 2\sigma_{12} + \sigma_2^2) \leq r\sigma_1^2 \quad \text{since}
\]

\[2\sigma_{12} + \sigma_2^2 < -2\sigma_2^2 + \sigma_2^2 \leq 0 \]

from $\sigma_{12} < -\sigma_2^2 < 0$. Q.E.D.
Figure 3.4: Shareholder's Expected Income as Function of $r_1$ : Comparison
new layers to the model, representing strategic interactions of managers and shareholders in two companies.

3.3 **P-A Model with Bilateral Stock Investment Opportunity**

3.3.1 **The Model**

Suppose that there are two firms, and one shareholder and one manager for each of the firms. In the first stage, each shareholder, independently, writes a managerial incentive contract. In measuring the performance of manager, the value-of-the-firm is employed. In the second stage, managers non-cooperatively decide on the amount of stock investment and the level of their effort.\(^{37}\) Corporate stock investments can be mutual.

The remaining assumptions are the same as before: Initially, there is no corporate shareholder in the economy and none of the individual shareholders holds the shares of more than one firm; the number of shares for each firm is equal to one; managers are risk-averse, while individual shareholders are risk-neutral.

The operating profit of firm \(i\) \((i = 1, 2)\) is

\[
\pi_i = e_i + \epsilon_i
\]

\(^{37}\) It may require some discussion whether managers in Japanese companies are cooperative or non-cooperative. For many of our eyes, they are seemingly cooperative. Various ties, including shareholding ties, between the companies may be used as “evidence” for their cooperative nature. However, the “evidence” could be simply the outcomes of individually rational behavior. One of the purposes of this chapter is to show that cross shareholding can happen even under non-cooperative environment.
where
\[ \epsilon \sim N(0, \Sigma). \]

The market value of firm \( i \) after corporate shareholding and wage payments is
\[ v_i = \pi_i + \alpha_i v_j - \alpha_i p_j - w_i \]
where \( \alpha_i \) is a fraction of firm \( j \)'s shares held by firm \( i \) and \( p_j \) is firm \( j \)'s share price. Solving the above equations for \( v_i \), we obtain
\[ v_i = \frac{1}{1 - \alpha_i \alpha_j} \left( \pi_i + \alpha_i \pi_j - \alpha_i p_j - \alpha_i \alpha_j p_i - \alpha_i w_j - w_i \right). \tag{3.15} \]

The value of the firm, \( v_i \), is distributed among the residual claimants; \( \lambda_i v_i \) to the manager, \( \alpha_j v_i \) to the corporate shareholder, and \( (1 - \lambda_i - \alpha_j) v_i \) to the individual shareholder of firm \( i \).

Under the efficient market assumption (i.e. \( p_i = E[v_i] \)), the expected value of the firm is equal to the level of effort minus the wage,
\[ E[v_i] = E[\pi_i] - w_i = e_i - w_i. \tag{3.16} \]

Hence manager \( i \)'s certainty equivalent income, under the value-of-the-firm based payment scheme, is
\[ z_i = \lambda_i (e_i - w_i) + w_i - \frac{1}{2} e_i^2 - \frac{r_i \lambda_i^2 (\sigma_i^2 + 2 \sigma_{ij} \alpha_i + \sigma_j^2 \alpha_i^2)}{2(1 - \alpha_i \alpha_j)^2}. \tag{3.17} \]

The risk premium is concave in the amount of the firm's investment, \( \alpha_i \). It is also a function of counter-investment, \( \alpha_j \). The counter-investment increases the risk premium as long as \( \alpha_i \) is positive. This is because, with higher counter-investment, more of firm \( i \)'s
investment into firm \( j \) is re-invested in firm \( i \), thereby reducing the effectiveness of firm \( i \)'s investment in firm \( j \).

We model the game as a two-stage game. In the first stage, shareholders \( i \) and \( j \) simultaneously choose their managers' compensation schemes by setting \((\lambda_i, w_i)\) and \((\lambda_j, w_j)\) respectively. In the second stage, manager \( i \) and \( j \) simultaneously choose their efforts levels, \( e_i \) and \( e_j \), and investment shares, \( \alpha_i \) and \( \alpha_j \). We solve for the subgame perfect equilibrium by working backwards from the second stage.

### 3.3.2 The Solution

**The Second Stage**

Manager \( i \)'s objective is to maximize its certainty equivalent income, \( z_i \), taken as given the strategy of manager \( j \). The constraints on its choices are (i) \( 0 \leq \alpha_i, \alpha_j \leq 1 \) and (ii) \( \alpha_i \alpha_j \neq 1 \). The last constraint excludes the case where \( \alpha_i \) and \( \alpha_j \) are both equal to 1, which would be the case if the risk premium is infinite. Without loss of generality, we can assume \( \sigma_i \geq \sigma_j \).

From the first order condition, the level of effort for manager \( i \) is

\[
e_i^* = \lambda_i.
\]

Manager \( i \)'s best reply to manager \( j \)'s investment choice is

\[
\alpha_i (\alpha_j) = \frac{\sigma_{ij} + \sigma_i^2 \alpha_j}{\sigma_j^2 + \alpha_j \sigma_{ij}},
\]

(3.18)
assuming an interior solution. The condition for \( \alpha_i \in (0, 1) \) for all values of \( \alpha_j \) is
\(-\sigma_j^2 < \sigma_{ij} < 0\). If the covariance is so small that \( \sigma_{ij} < -\sigma_j^2 \), the optimal value of \( \alpha_i \) is equal
to one for low values of \( \alpha_j \). If the covariance is positive, manager \( i \)'s best reply is not to
invest in firm \( j \). The above conditions are the same as those for the unilateral investment
model (i.e. model 2-2, hereafter) to have an interior solution. In the following analysis, we
assume that these conditions are satisfied for \( i = 1, 2 \).

The best reply functions for the investment choice in the bilateral model has several
interesting properties. First, \( \alpha_i \) is independent of the first stage choices, \( \lambda s \) and \( w s \). Each
shareholder in the first stage faces a simple optimization problem, that is, there is no strate­
gic interaction between shareholders. Secondly, \( \alpha_i \), is decreasing in the covariance, \( \sigma_{ij} \),
and in standard deviation, \( \sigma_j \). Third, \( \alpha_i \) is decreasing in \( \sigma_i > 0 \) as long as the counter
investment, \( \alpha_j \), is not zero. This is because, given other things constant, a part of firm

\[ \frac{\partial \alpha_i^*}{\partial \sigma_{ij}} = \frac{-\sigma_j^2 + \sigma_i^2 \alpha_j^2}{(\sigma_j^2 + \alpha_j \sigma_{ij})^2} \]

is negative since
\[-\sigma_j^2 + \sigma_i^2 \alpha_j^2 < -\sigma_j^2 + \sigma_i^2 \sigma_{ij}^{-2} \iff \alpha_j < -\frac{\sigma_{ij}}{\sigma_i^2} \]
\[ < 0 \iff -1 \leq \frac{\sigma_{ij}}{\sigma_i \sigma_{ij}} \leq 0. \]

\[ \frac{\partial \alpha_i^*}{\partial \sigma_i} = \frac{\partial \alpha_i^*}{\partial \sigma_j^2} \frac{\partial \sigma_j^2}{\partial \sigma_j} = \frac{\sigma_{ij} + \sigma_i^2 \alpha_j}{(\sigma_j^2 + \alpha_j \sigma_{ij})^2} * 2 \sigma_j \]

is negative since, for \( 0 < \alpha_j < 1, \sigma_{ij} + \sigma_i^2 \alpha_j < \sigma_{ij} + \sigma_i^2 (-\sigma_{ij}/\sigma_j^2) = 0. \]

Q.E.D.

\[ 40 \] The proof is;

56
$i$'s investment in firm $j$ returns to firm $i$ through recursiveness of cross shareholding and thereby, if firm $i$ is riskier, the stock investment in firm $j$ becomes less effective. Fourth, $\alpha_i$ is decreasing in the opponent's investment amount at an increasing rate (i.e. $\alpha_i$ and $\alpha_j$ are strategic substitutes). The intuition is that counter-investment decreases the marginal effectiveness of stock investment to reduce risks. For example, suppose we ignore the adjustment of a counter-investment by omitting $(1 - \alpha_i \alpha_j)^{-2}$ in computing the variance of the firm's value. Then firm $i$'s reaction function becomes $\alpha_i = -\sigma_{ij}/\sigma_j^2$. The investment level in this case is independent of the other company's choice, and is the same as in a unilateral investment model. This amount of investment always exceeds the amount with proper adjustment for the counter-investment, which is shown by equation 3.18. In other words, the stock investment under cross shareholding situation is not as effective as it is under non-cross shareholding.

Figure 3.5 a representative best reply function for manager $i$.

$$\frac{\partial \alpha_i^*}{\partial \sigma_i} = \frac{\partial \alpha_i^*}{\partial \sigma_j} = -\frac{\alpha_j}{\sigma_j^2 + \alpha_j \sigma_{ij}} \times 2\sigma_i$$

is negative since $\sigma_j^2 + \alpha_j \sigma_{ij} > \sigma_j^2 + (-\frac{\sigma_{ij}}{\sigma_i^2})\sigma_{ij} > 0$ for $\sigma_{ij} < 0$ as long as the counter investment stays interior (i.e. $0 < \alpha_j < -\frac{\sigma_{ij}}{\sigma_i^2}$).

Q.E.D.

The first order derivative,

$$\frac{\partial \alpha_i^* (\alpha_j)}{\partial \alpha_j} = -\frac{\sigma_{ij}^2 \sigma_j^2 + \sigma_{ij}^2}{(\sigma_j^2 + \alpha_j \sigma_{ij})^2}$$

is negative because $-1 < \rho = \sigma_{ij}/\sigma_i \sigma_j \iff \sigma_i^2 \sigma_j^2 > \sigma_{ij}^2 > 0$.

Similarly, the second order derivative,

$$\frac{\partial \alpha_i^{*2} (\alpha_j)}{\partial \alpha_j^2} = -2\sigma_{ij} \frac{-\sigma_i^2 \sigma_j^2 + \sigma_{ij}^2}{(\sigma_j^2 + \alpha_j \sigma_{ij})^3}$$

is negative for $\sigma_{ij} < 0$. 

57
Figure 3.5: Firm i’s Reaction Function
Note that $\alpha_i = -\sigma_{ij}/\sigma_j^2$, when $\alpha_j = 0$, and the risk premium for manager $i$ is smallest at $\frac{\lambda_i^2}{2} \sigma_i^2(1 - \sigma_{ij}^2/\sigma_i^2 \sigma_j^2)$, which is the same as the equilibrium risk premium under the unilateral model. The risk premium becomes larger as $\alpha_j$ increases. At the other boundary solution (i.e. when $\alpha_j = -\sigma_{ij}/\sigma_i^2$), $\alpha_i = 0$, and the risk premium is the largest at $\frac{\lambda_i^2}{2} \sigma_i^2$, which is the same as the equilibrium risk premium under models 1-1, 1-2, and 2-1. As will be discussed later, this has an important implication for the first stage outcome.

A Nash equilibrium to this second stage game is a pair $(\alpha_i^*, \alpha_j^*)$ which lies on both best reply functions. Interestingly, the best reply functions in this bilateral model coincide, which means that we have continuum of equilibria. This result does not require the firms to be symmetric, that is, $\sigma_i$ and $\sigma_j$ can differ. This phenomenon is due to our specific utility function, which generates a certainty equivalent income in a mean-variance form. Other types of utility function may produce a unique solution to this stage. Because of the existence of multiple equilibria, we have to impose an additional assumption to solve the first stage.

Before doing so, let us define a function, $f_i$, as we did in the previous section:

$$f_i = \frac{r_i(\sigma_i^2 + 2\sigma_{ij}\alpha_i^* + \sigma_j^2\alpha_i^{*2})}{(1 - \alpha_i^*\alpha_j^*)^2}.$$ 

This function always takes a non-negative value for $\alpha_i^*$ and $\alpha_j^* \in [0, 1)$, since

$$\sigma_i^2 + 2\sigma_{ij}\alpha_i^* + \sigma_j^2\alpha_i^{*2} = (\sigma_i - \sigma_j\alpha_i^*)^2 + 2\alpha_i^*(\sigma_{ij} + \sigma_i\sigma_j) \geq 0,$$

and $(1 - \alpha_i^*\alpha_j^*)^2 \geq 0$ and $r_i \geq 0$. Using this function, the risk premium becomes $\lambda_i^2 f_i/2$.

The First Stage
In order to solve the first stage, we need to select an equilibrium to the second stage game. Let us assume firms are symmetric (i.e. $\sigma_i = \sigma_j = \sigma$) and select a symmetric equilibrium for the second stage game (i.e. $\alpha_i^* = \alpha_j^* = \alpha^*$). The shareholders anticipate this equilibrium. From equation 3.18, such investment choices are,

$$\alpha^* = \left(-1 + \sqrt{1 - \frac{\sigma_{ij}^2}{\sigma^4}}\right) \frac{\sigma^2}{\sigma_{ij}} \text{ if } -1 < \frac{\sigma_{ij}}{\sigma^2} < 0.$$

The constraint on $\alpha^*$ binds if $\sigma_{ij}/\sigma^2 \geq 0$ or $\sigma_{ij}/\sigma^2 = -1$. Figure 3.6 shows the symmetric equilibrium investment as a function of the covariance, $\sigma_{ij}$, when $\sigma = 1$.

The $f_i$ function under this symmetric equilibrium is

$$f^*_i = \frac{r_i \sigma_i^2 (1 + 2 \sigma_{ij} \alpha^* + \alpha^{*2})}{(1 - \alpha^{*2})^2}.$$
As explained above, it is important to note that the risk premium in this case lies between the risk premiums in model 2-2 and in models 1-1, 1-2, and 2-1:

\[
\frac{r_i}{2} \lambda_i^2 \sigma^2 (1 - \frac{\sigma^2_{ij}}{\sigma^4_{ij}}) \leq \frac{\lambda_i^2}{2} f_i^s \leq \frac{r_i}{2} \lambda_i^2 \sigma^2. \tag{3.19}
\]

The shareholder's expected payoff is

\[
(1 - \lambda_i - \alpha^*)(e_i^* - w_i) + \alpha^* p_i.
\]

Remembering \( p_i = e_i - w_i \) and \( e_i^* = \lambda_i \) from the second stage, the shareholder's expected payoff can be simplified to \((1 - \lambda_i)(\lambda_i - w_i)\). The participation constraint in the first stage is

\[
\lambda_i (\lambda_i - w_i) + w_i - \frac{1}{2} \lambda_i^2 - \frac{r_i}{2} f_i^s \geq 0.
\]

Assuming a binding participation constraint, we can derive a reduced form of the shareholder's maximization problem similar to the one in model 2-2 (equation 3.11). The solution is

\[
\lambda_i^* = e_i^* = \frac{1}{1 + f_i^s}. \tag{3.20}
\]

The second order condition is satisfied.\textsuperscript{42} As before, applying the chain rule, it is easy to find that the optimal \( \lambda_i \) is decreasing in the manager's degree of risk aversion, \( r_i \), and the degree of risk, \( \sigma_i \), while increasing in the covariance, \( \sigma_{ij} \). The equilibrium level of effort is lower than in the unilateral investment model with outside investment, but higher than in the model without the investment opportunity. This can be easily proved because

\[
r_i \sigma^2_i (1 - \frac{\sigma^2_{ij}}{\sigma^4_{ij}}) \leq f_i^s \leq r_i \sigma^2 \text{ from equation 3.19.}
\]

\textsuperscript{42}The second order condition, \(-1 - f_i^s\), is negative for the domain since \( f_i^s \) is positive in the domain.
The optimal wage is

$$w_i^* = \frac{f_i^* - 1}{2(1 + f_i^*) f_i^*}. \quad (3.21)$$

Figure 3.7 shows the optimal wages as a function of the manager’s degree of risk aversion, $r$ for models 1-2, 2-2, and the bilateral investment model when $\sigma_1 = \sigma_2 = 1$ and $\sigma_{ij} = -0.8$. Note that the relative position of the functions totally changes depending on the parameters. For example, the function for model 2-2 can be located to the left of the function for model 1-2 if $|\sigma_{ij}|$ is small.

The shareholder’s expected payoff is

$$E[u_i^*] = \frac{1}{2(1 + f_i^*)}. \quad (3.22)$$
In figure 3.4, this shareholder's expected payoff is depicted as a function of $r$. It lies between the upper and lower lines, which, respectively, represents the expected payoff with the investment opportunity (model 2-2), and without it (model 1-1, 1-2, and 2-1). This is, again, simply because $r_i \sigma_i^2 (1 - \sigma_{ij}^2 / \sigma_i^2 \sigma_j^2) \leq f_i^* \leq r_i \sigma_i^2$ from equation 3.19. Hence it is true for any value of parameters, $\sigma_i = \sigma_j = \sigma$ and $\sigma_{ij}$, as long as those parameters keep the solution interior.

Now let us extend the above discussion. Suppose that the anticipated equilibrium investment choices are not symmetric (i.e. $\alpha_i^* \neq \alpha_j^*$) and the firms are not symmetric (i.e. $\sigma_i \neq \sigma_j$) either. In this case, shareholders' decision on $\lambda$s and $w$s are no longer the same: $\lambda_i^* \neq \lambda_j^*$ and $w_i^* \neq w_j^*$. Consequently shareholders' expected payoffs are different. However, the expected payoff for both shareholders is bounded by the two lines in figure 3.4 as long as the solution is interior. This is obvious since $r_i \sigma_i^2 (1 - \sigma_{ij}^2 / \sigma_i^2 \sigma_j^2) \leq f_i \leq r_i \sigma_i^2$ in general.

To conclude, shareholders benefit from the introduction of stock investment opportunity even if the managers and shareholders of the two companies strategically choose their own variables. The shareholder's benefit, however, is less compared to the situation where the investment is single sided. This is because, when it is mutual, the risk reduction effect of the stock investment declines. As a consequence, in order to obtain the participation of managers who face a greater uncertainty, the shareholders must weaken the link between the company's performance and managerial reward. The existence of outside investment opportunity itself, however, should still benefit the shareholders because such investment
reduces the risk premium. We must also bear in mind that this happens only when the incentive contract is based on value-of-the-firm and not on operating-profit.

3.4 Concluding Remarks

The models presented in this chapter incorporate the agency problem with the risk-sharing argument for corporate shareholding. They are different from Aoki's model in many respects. First, operating profits depend not only on stochastic events, but also on the level of effort which is endogenously determined by managers, given the incentive contract. Secondly, investment decisions are also made non-cooperatively in each firm. Unlike Aoki's swap model, the investment does not have to be reciprocal. Lastly, but most importantly, the degree of managerial reward's link to the company's performance, as well as a fixed wage, are endogenously determined by the shareholders, while these factors are not in Aoki's model.

With a unilateral investment model, we find that if manager's degree of risk aversion is small, shareholder offer high work incentives with a negative wage to the manager. In the extreme, if a manager is risk-neutral, the manager becomes the residual claimant and pays a high "franchise fee" (i.e. negative wage) to the shareholder. For managers with a medium degree of risk aversion, shareholders lower the rate of managerial reward which is linked to the firm's performance, and may have to pay a positive fixed wage to keep the managers in the company. If managers are highly risk averse, shareholders lower the link to the performance further. The risk premium remains high because the managers are highly risk averse, but is not so high because the managerial reward is linked weakly to
the performance of the company. Hence the wage does not have to be so high to keep the managers in the company. With such factors serving to lower incentive, the profit of the company with highly risk averse managers is low.

Conditions for a positive stock investment in the unilateral model are; (1) the manager is risk averse, (2) her managerial reward is linked with the value of the firm she manages, and (3) the operating profits of investing and invested companies is negatively correlated. Corporate investment is larger if the invested company’s operating profit is less volatile and/or if the covariance in the operating profits of the companies is more strongly negative.

With the bilateral investment decision model, we find—in addition to the above results—that corporate investment tends to be larger if the investing company’s operating profit is less volatile and/or if there is less counter investment from the invested firm to the investing firm. We also find that shareholders’ payoffs are lower than in the unilateral investment model, because the mutuality of investment reduces the risk reduction effect of stock investment in the bilateral investment model.

What is the relevance of these outcomes to the existing empirical literature?

According to Kaplan (1994), managerial compensation in many companies in Japan and the United States is linked more strongly to overall performance measures such as the rate of return on total assets or stock returns than to sales-performance measures such as the growth rate of sales. Our models in this chapter provide an explanation why the incentive contract is more likely to be based on overall performances which includes investment income, rather than sales performance which does not. The risk-sharing argument says that
corporate shareholding reduces the risk borne by managers compared to the case where no corporate shareholding is allowed. In our model, this benefits shareholders who extract all the rents from the managers. As we have seen, for this to happen, the performance payment must be based on the value of the firm rather than operating profit. If shareholders choose the operating-profit-based payment scheme instead, they must offer lower work incentives to managers and end up receiving lower payoffs.

Another ramification of our theoretical model is that companies with corporate stock investments exhibit lower but less volatile profits after dividends than companies without them. Aoki's model shows that profits after dividends are less volatile in the firms with stock investment. What is missing in his model is the link between corporate shareholding and performance of the company. In our model, a positive investment is an indication of risk-averse managers. The more risk-averse are the managers, the equilibrium level of effort, and hence the profit, is lower. In summary, compared to other arguments for corporate shareholding, the risk sharing model examined here provides a more consistent explanation for the "stylized" facts that companies which are more involved in inter-corporate shareholding exhibit lower but less volatile profit rates measured by return on assets.
Chapter 4
Corporate Shareholding in Japan: Empirical Testing

4.1 Introduction

There are various reasons why companies hold the shares of other companies. When a company tries to enter a new, especially risky, business, the company sometimes creates a subsidiary. Because of shareholders' limited liability, the parent company can, in this way, reduce the risk of the new business. Although this kind of investment contributes to the increase of corporate shareholding in Japan, this is not, strictly speaking, an investment in a different company because the subsidiary can be consolidated with the parent company. This chapter studies stock investment between different, in the strict sense of the word, companies. As we have discussed in chapter 2, three major arguments have been made in the literature concerning the rationale behind such corporate shareholding: the competitive-effect, risk-sharing, and control-rights arguments.

The purpose of this chapter is to test a number of hypotheses that have been drawn from these arguments, and to examine the extent to which their motives are supported by the data. More precisely, this chapter, first, discusses exogenous factors required for the arguments, and, then, studies how well the amount of stock investment between two companies is explained by those exogenous factors using a regression analysis. Depending on the purpose of stock investment, two different types of dependent variable, the portfolio-choice index and the control-rights index, are employed in the analysis.

67
Empirical tests in this chapter focus on Japanese firms because of the prevalence of this practice among Japanese corporations, as well as the availability of data. The sample used in this analysis is of 186 Japanese companies that belong to six major financial keiretsu groups during 1980s.\textsuperscript{43} The reason why only the keiretsu group companies are chosen is, again, due to the availability of data.

The following are the main results of this chapter. (1) The competitive-effect argument is reasonably supported by the data. (2) The evidence in favor of the risk-sharing argument is somewhat weaker — although firms with less risky operating profits tend to attract more investment, contrary to prediction, the relationship between investment and the covariance in the two firms' operating profits is ambiguous. (3) The strongest empirical support is given to the control-rights argument. Indeed, the evidence confirms that a firm is more likely to invest in other firms that hold more of its own shares. This mutuality is a necessary condition for the validity of the control-rights argument.

The structure of this chapter is as follows. The next section shows how the hypotheses are derived from existing literature. The third section presents the data used to test the hypotheses. In the forth section, the two models used in the analysis are presented. The fifth section covers the results obtained, which is then followed by some concluding remarks.

4.2 Hypotheses

The Competitive-Effect Motive

\textsuperscript{43} They are Mitsubishi, Mitsui, Sumitomo, Fuji (Fuyo or Yasuda), Sanwa, and Dai’ichi Kangyou groups.
The competitive-effect argument was introduced by Reynolds and Snapp (1986) and further developed by Flath (1991) and Reitman (1994). See chapter 2 for more detail. According to this class of literature, being in the same industry does not always lead to stock investments into other firms in the industry. In order to have corporate shareholding in equilibrium, the product market competition must be Bertland (Reitman, 1994), and products must be imperfect substitutes (Flath, 1991).

Some of the literature on the competitive-effect argument have a common problem in defining a firm’s profit after corporate shareholding. Reynolds and Snapp (1986) and Reitman (1994) define a firm’s profit after dividends by a simple linear combination of operating profits of firms. Firm \( i \)’s profit after dividends is defined, in their models, as:

\[
(1 - \alpha_2)\pi_1^{operating} + \alpha_1\pi_2^{operating},
\]

where \( \pi_i^{operating} \) is firm \( i \)'s operating profit and \( \alpha_i \) is the fraction of firm \( j \)'s shares held by firm \( i \).\(^{44}\) This specification puts too much weight on the rival’s operating profit and too little on its own operating profit. As a consequence, when making a production decision, a firm tends to produce less than what it would if profits after dividends were defined in the way to reflect the recursive structure of cross-holding.\(^{45}\) For example, if two firms mutually own 100% of the other’s shares (i.e. \( \alpha_1 = \alpha_2 = 1 \)), firms care only about their rivals, and neither of the firms produces anything under Cournot competition. The problem rises due to ignorance of the recursive structure of cross-shareholding. Tani-gawa (1986) presented a way to take the recursive structure of cross-shareholding into con-

\(^{44}\) For simplicity, cost of purchasing stocks are omitted in the following discussion.

\(^{45}\) For example, if two firms mutually own 100% of the other’s shares (i.e. \( \alpha_1 = \alpha_2 = 1 \)), firms care only about their rivals, and neither of the firms produces anything under Cournot competition.
sideration in defining firm's profit after dividend: \( \frac{1-\alpha_2}{1-\alpha_1\alpha_2} (\pi_1^{\text{operating}} + \alpha_1\pi_2^{\text{operating}}) \). This is also a standard formula used in adjustment for double counting which is involved in cross-shareholding (McDonald, 1989; French and Poterba, 1991 and; Fedenia, Hodder and Triantis, 1994). The formula reflects true ownership interests of the investing firm in the invested firm. With this specification, the above fully integrated firms should independently realize that "the best for me is the best for you" even under Nash conjecture—the total output should be equal to the monopoly level of output. This illustrates that, in Reitman, the external benefit of staying outside a cross shareholding arrangement is overstated because members in the arrangement cut their production too much under Cournot competition.

In sum, under some conditions, companies in the same industry can earn higher profits through integration by means of stock investments. A simple, but most important, hypothesis which can be drawn from this argument is,

CE-H1: A firm, ceteris paribus, tends to hold more ownership interest in other firms that belong to the same industry.

The literature on the competitive effects of corporate shareholding assumes that investing companies are "silent" stakeholders, who take an interest in the profit of the invested company but do not exercise their voting power as shareholders. The reduction of competition, if any, works through this profit sharing mechanism.

There is, however, another way to influence market competition — by holding the stocks of competing companies. With their voting rights, the shareholders of the company can affect managerial decisions on such issues as price, quantity, or sales locations. Accord-
ing to Okumura (1992a), before 1988 when the Securities and Exchange Law were revised, many Japanese companies held meetings with large shareholders prior to their annual general meetings of shareholders. This practice was abolished because it was considered to violate the new law which prohibits insider trading more strictly than before. Okumura claims that, even today, the presidents’ meetings (so-called shacho-kai) play the same role as the large shareholders meetings. In addition, there are many other chances for large corporate shareholders to meet the managers of the invested company and express their concerns to the managers. It is also common for investing firms to make their employees board members of the companies in which they have invested. With this practice, managerial decisions of a company tend to reflect the interests of its corporate shareholders more clearly. As a result of these informal institutions of decision making, annual general shareholder’s meetings of the Japanese firms usually have a ceremonial function only. Although the mechanism is different from profit sharing, this could be another reason for firms to invest in other corporations in the same industry.

The competitive-effect hypothesis has not yet been empirically researched. As far as the Japanese economy is concerned, there may be two reasons for this omission. One is that

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46 In Japanese corporate group companies, if a company owns 5% of other company's shares, the company is usually ranked as one of top ten shareholders and considered to be a “large” shareholder.

47 The managers usually solicit proxies from other investing companies, and vote for themselves. Japanese corporate shareholders seldom exercise their voting rights against the board’s decisions, or ask a question at the annual shareholders’ meetings.

48 Production keiretsu groups such as Toyota group or Hitachi group have firms from the same industry and have been studied extensively. Those companies are, however, usually subsidiaries of a parent company and do not have shareholding relation between the subsidiaries.
Japanese anti-monopoly laws prohibit corporate shareholding which reduces market competition. The Fair Trade Committee is given the authority to judge whether or not a company’s stock investment reduces market competition. Theoretically, if the company’s practice is deemed illegal, the company and/or its executive(s) will be fined and/or imprisoned.\textsuperscript{49} Secondly, Japanese financial corporate groups are said to employ the so-called \textit{one-set principle}. The one-set principle refers to the fact that each Japanese financial corporate group consists of a number of firms from the entire range of industries, such that, usually, only one firm from each industry participates in the group. Since most empirical research paid attention to within-group data, corporate shareholding within the same industry has not drawn much attention from researchers. The existence of laws, however, does not guarantee that there is no stock investment for the purpose of reducing competition. Rather, such investments could exist across different groups in spite of the one-set principle. Consequently, it is worth testing whether or not firms have a tendency to invest in other firms in the same industry.

\textbf{The Risk-Sharing Motive}

Aoki (1988, pp226–230) presents a model of risk-sharing through dividend payments. According to the model, a firm which is exposed to idiosyncratic shocks can reduce the after-dividend risk by investing in other companies. Non-saleable stakeholders of companies such as employees and managers benefit most from inter-corporate stock investment.

\textsuperscript{49} See Articles 10, 91, and 95.2 of the Anti-monopoly Act.
In chapter 3, we develop a risk-sharing model with principal-agent relations. With performance-based managerial rewards, managers are non-saleable stakeholders of their firms. They decide on their effort and corporate investment so as to maximize their utilities. Since shareholders can extract all the rent from managers with a properly designed payment scheme, shareholders are the ones who benefit from corporate shareholding in our model.

In regard to stock investment, our unilateral investment model yields a prediction that a firm tends to invest more in another firm with lower standard deviation and/or lower covariance in operating profits (equation 3.10 in chapter 3). See table 4.1. In addition to the prediction of the unilateral model, our bilateral investment model finds that, given the amount of counter investment, a firm with lower standard deviation in its operating profit tends to invest more in the other firm (equation 3.18). This is because, given other things constant, part of a firm's investment in the other firm returns to the investing firm through the recursive structure of cross shareholding and thereby, if the investing firm is riskier, the stock investment in the other firm becomes less effective. The model also finds that a firm is likely to invest more in another firm when the invested company owns fewer shares in the investing company. This reflects the fact that it is less effective, in terms of risk reduction, to invest in a firm which owns a large number of shares in the investing firm. This is also due to the recursiveness of cross shareholding.

The following hypotheses can be inferred from our theoretical models in chapter 3.

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50 The predictions may change if financing method is different from the one assumed in the model.
RS-H1: A firm, *ceteris paribus*, tends to invest more in other firms with a lower co-variance in operating profits.

RS-H2: A firm, *ceteris paribus*, with a lower standard deviation in its operating profit tends to be a target of more investment by other firms.

RS-H3: A firm, *ceteris paribus*, with a lower standard deviation in its operating profit has a tendency to invest more in other firms to reduce risk.

RS-H4: A firm, *ceteris paribus*, is likely to hold a larger portion of another firm’s stocks when the invested company owns fewer shares in the investing company.

In regard to the third hypothesis, there may be an opposite argument—a firm with a higher standard deviation in its operating profit has a stronger incentive to reduce risk, and hence to invest more into other firms. It is true that riskier firms have a stronger incentive for investment. The question is if such firms actually invest more or not. As explained above, our two-firm model finds, because of the recursive structure of cross shareholding, companies with high risk have difficulty investing in other companies if cash is promised in exchange of another firm’s stocks. In case of stock swaps, no firm wants become a partner of high risk companies. In sum, high riskiness gives high incentive for corporate investment, but it is also an obstacle for it.

The last hypothesis is not valid if two companies arrange to exchange each other’s shares without actual money transaction (swap or *kara-uri* transaction) as illustrated by Aoki. A swap transaction requires both companies to invest in each other and hence the
amounts of shares owned by each firm should be positively correlated.\textsuperscript{51} Stock swaps, however, are uncommon as a means of obtaining stocks among listed Japanese firms, although it may be practiced among small unlisted firms. On the other hand, allocation of new stocks to its affiliates is commonly practiced. In this case, the last hypothesis is still valid because cash is paid in to stock-issuing firms. Unfortunately, it is impossible to identify in our data which shares were obtained through a swap or other types of transaction such as market transaction and third party allocation.

**The Control-Rights Motive**

There are two types of the control-rights arguments in the literature, as shown in chapter 2.

Perotti (1992) and Bergløf and Perotti (1994) discuss the way in which corporate shareholding becomes a mutual monitoring/disciplinary device when the companies own each other's shares. The essence of their argument is as follows.\textsuperscript{52} Consider an R&D project which requires R & D efforts of its participating managers. A free-rider problem is involved in the project. None of the managers exerts her effort in a one-shot game, although a better payoff can be obtained for every manager when all the managers put their efforts (prisoner's dilemma). In a repeated game framework, managers can punish, by not putting their efforts in the future, a manager who did not exert her effort. It may lead to the better outcome (Folk theorem). However, if discount rates are large, the punishment may not

\textsuperscript{51} If a number of firms can make such a stock exchange arrangement, they could avoid to have a direct mutual investment relation and the hypothesis remains valid.

\textsuperscript{52} See chapter 2 for their original argument.
be strong enough to produce the desirable outcome. Whereas, with a cross shareholding arrangement, a deviating manager can be ousted by the other managers, and this threat of job loss, which is a more severe punishment, can induce every manager to comply with the agreement to always exert their efforts.

Nyberg (1995) and Osano (1996) focus on the fact that managers in a cross shareholding (CSH) arrangement can defend themselves against a takeover threat which comes from outside the arrangement. Nyberg argues that managers can buy the shares of other companies and ask the managers of those companies to support each other if threatened by a takeover. This means that the managers hold the shares of their own companies.\(^{53}\) Osano (1996) argues that a manager can act myopically due to the threat of a takeover. More specifically, when there are two projects, a risk-free low-return and a high-risk high-return project, managers might invest in the risk-free project if the return of the risky project in a bad state is very low and thus generates a high probability of a takeover. The managers, however, might invest in a risky project if they could establish a CSH relation and remove the threat of a takeover.

These arguments are not necessarily mutually exclusive. A minimum requirement for the arguments is that, in order to participate in a CSH relationship, a firm has to possess shares in at least one of the other CSH member firms, and, at the same time, has to be partially owned by at least one of the member firms.

\(^{53}\) Nyberg (1995) shows that both managers and individual shareholders can want a higher level of CSH. The managers' resistance to takeover will induce a higher premium which benefits the individual shareholders if the takeover actually occurs. On the other hand, if the probability of takeover is high, a higher rate of CSH can increase the bargaining power of the manager in the decision making process and, hence, the reward to the manager.
Various arrangements are possible for a CSH relationship with \( n > 2 \). Consider two examples with \( n \) symmetric firms forming a CSH group. In one example, a firm owns at least a fraction, \( 0.5/(n-1) \), of every other firms’ shares so that the total of shares in the former company, held by the latter \( n-1 \) firms, exceeds the majority needed to control that former company (or defend that firm from takeover by outsiders). In this case, every combination of firms in the group is involved in a mutual stock investment relationship. In the other example, the firms form a circle of stock investment relationships, and each firm owns a half of the shares of the firm sitting next to it. With this arrangement, there is no mutual or multiple shareholding relationship between the firms in a direct way, although there is indirectly.\(^5\) These are two extreme examples. Various other arrangements are possible and, in the real world, a combination of these two extreme scenarios is more likely to occur.

Whether directly, indirectly, or both, any CSH arrangement will lead to mutual and multiple shareholding. The first hypothesis is;

CR-H1: A firm, *ceteris paribus*, tends to invest more in firms which own more of the investing firm’s shares, directly and/or indirectly.

Note that this hypothesis mainly deals with the mutuality, but not the multiplicity of CSH arrangements. Although inclusion of indirect investment relationships reflects one of the features of multiplicity, the above hypothesis applies only to bilateral relationships. In the control-rights argument, it is important what fraction of shares is owned by the other

\(^5\) According to a report submitted to the Fair Trade Committee of Japan, this type of circular investment becomes a public concern in France. Although circular share investment relations can be virtually the same as direct cross shareholding, it is not considered to be illegal if laws prohibit only direct cross shareholding.
member firms collectively, but not individually. The greater the number of firms involved in a CSH relation, the smaller the fraction of shares each firm is required to own in the other firms in order to maintain the total amount of shares held as a CSH group. One problem is that we do not know how many companies and/or which specific companies are participating in a CSH relation.

One of the ways to deal with the multiplicity problem is to use proxy to identify the members of a CSH arrangement. As far as the Japanese economy is concerned, a corporate group can be used as the proxy. If the CSH arrangement is a corporate group, then we should expect control-rights investments among member firms regardless of the amount of direct counter investments from the firms to be invested in. Hence a hypothesis can be introduced such as;

CR-H2: A firm, *ceteris paribus*, is likely to invest in firms which belong to the same corporate group.

Although this hypothesis is not a perfect treatment of the multiplicity issue of CSH arrangements, it provides a supplementary test for the strength of the argument.

In Japan, most corporate shareholders are referred as “stable shareholders” which means that they keep holding shares as long as the invested firms perform reasonably. Osono(1996)'s argument implies that companies in a CSH arrangement are able to invest in a high-risk high-return project because the firms in the arrangement will not sell their shares and support managers even if a bad state occurs. The last hypothesis is;
CR-H3: Firms' stock investment decisions, \textit{ceteris paribus}, are not affected by short-term performance, such as sales growth rates or operating profit rates of target firms.

The following sections will examine which hypotheses are supported by the data. More concretely, the amount of stock investment between two companies is explained by characteristics of the companies, using a regression analysis.

There are two different aspects of common stocks; control rights and profit claims. Each of the above hypotheses is associated with one of these aspects. For example, the control-rights argument, obviously, is based on the former characteristic of common stocks, while the risk-sharing argument is rooted in the latter. Accordingly, two different types of dependent variable, the control-rights index and the portfolio-choice index, are employed in order to test these hypotheses.

Our analysis focuses on direct investment relations. We, however, present a way to include indirect investment relations in the analyses as well. Although firms primarily choose only their direct amount of investment in other firms, they may not determine only their own direct investment amount. Under cooperative environment, firms coordinate their investment among themselves. For example, a cross shareholding arrangement is formed as a collective decision. Even under non-cooperative environment, firms should, or at least try to, consider their true ownership interests, which can be correctly measured only by taking indirect investment relations into account. This is important for the competitive-effect and the risk-sharing arguments.
Although there is a statistical difficulty, as we describe later, to incorporate indirect investment relations into the analyses, one advantage of indirect investment indices is that they reveal covert investment relations between firms. For example, a one-directional circular type of "cross" shareholding arrangement cannot be detected only by looking at direct investment relations. Firms may invest indirectly for competitive-effect reason, but this is ignored if only direct investment indices are employed. In regard to the risk-sharing argument, the portfolio indices which consider indirect investment represent true allocations of firms' assets. Note that the degree of risk involved in a stock can only be calculated correctly with the use of both direct and indirect investment information.

Before presenting the models, the data used in the analysis is explained in the next section.

4.3 Data

The subjects of this analysis are 186 firms belonging to six major corporate groups in the 1980s. Twenty-nine of them are financial institutions such as banks, trust banks, and life or marine-fire insurance companies. The financial institutions employ different accounting methods and, often, do not provide comparable data. Furthermore, consistent data are not available for three of the non-financial institutions which were not listed at the beginning of the sample period. Due to these omissions, the analysis is based mostly on the observation of 154 non-financial companies. However, stockholding data of all 186

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55 Itoki Trading, Mitsubishi Auto, and Mitsubishi Construction.

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companies, including financial institutions, are used to identify indirect stock investment relation of the companies.

The following subsections explain the raw and constructed data used in the analysis. A single subscript $j$ signifies firm $j$, while double subscripts $ij$ means that it is a relational variable between firms $i$ and $j$. Superscript $f$ indicates variables which refer to both financial and non-financial institutions. All monetary variables are converted to real values using the Japanese wholesale price index for domestic products (1990 = 1.00). Most of the financial data on non-financial companies were directly drawn from the yearly *Kaisha Zaimu Karute*, published by Toyo Keizai Shinpo Sha. The shareholding information was retrieved from the annual publications of *Kigyo Keiretsu Soran* also by Toyo Keizai Shinpo Sha. References to other sources are provided throughout this chapter as the data are presented.

4.3.1 Raw Data

The raw data items are shown in table 4.2. The sample period extends from 1980 to 1988 for most of the data items. The values are as of the end of each company's accounting year, unless otherwise indicated. Fiscal year ends at the end of March for a majority of the sample firms, the timing of which is consistent with that of our stock investment data.

$ASSET_j$ (total asset value, or *soshisan*) is the sum of equity and debt taken from the balance sheet of each company.

$EMP_j$ is the number of employees.

$SALE_j$ represents sales revenues in million yen.
SGROW\textsubscript{j} (sales growth rate) is the annual rate of growth in sales revenue from the previous year; this year's sales revenues minus the previous year's sales revenues divided by the previous year's sales revenues.

\(AD\textsubscript{j}\) and \(RD\textsubscript{j}\) are advertising and R & D expenditures, respectively, as they appear in the official financial statement of each company.\textsuperscript{56} In the analysis, these data have been normalized by dividing by the sales revenue: \(AD\textsubscript{j}/SALE\textsubscript{j}\), and \(RD\textsubscript{j}/SALE\textsubscript{j}\).

\(KL\textsubscript{j}\), capital-to-labor ratio, is provided as tangible fixed asset value minus construction prepayment divided by the number of employees and executives. A brief definition of the tangible asset is; asset which are used for production, for example, buildings, land, vehicles, and production facilities. The prepayment made for construction in process is included as a part of the tangible asset value in accounting. In order to measure the size of tangible assets which are currently used for production, construction prepayments are subtracted. In computing this variable, the yearly data book uses the averages of each of the above components at the beginning and the end of the accounting year. Although we should use the end-of-year values for consistency, unfortunately, they are not available.

\(OPE\textsubscript{j}\) (Operating profit rate, \textit{uriagedaka eigyo rieki ritsu}) is defined as operating profits divided by sales revenues times 100, where the operating profits (\textit{eigyo rieki ritsu}) are defined as sales revenues minus input costs minus sales costs minus management costs.\textsuperscript{57}

\textsuperscript{56} A well known drawback of these data items is that some of the companies do not report these expenditure figures in the official financial statement since they are not required to do so by law.

\textsuperscript{57} The sample period of this data item starts from 1978. The data before 1980 have been obtained from the issues of \textit{Japan Company Handbook}, Toyo Keizai Shinpo Sha, from various years. These data have been used in calculating standard deviations and correlations,
$YEAR_j$ is each company’s year of establishment. These data are obtained from *Kaisha Sikiho* (1994, fall), Toyo Keizai Shinpo Sha. The company’s date of establishment has been used to assess the age of the company.

The following three variables are characteristics of each firm that remain constant over the years.

$FDUM_j$ is a financial institution dummy. Value 1 has been assigned to financial institutions such as banks, trust banks, life and non-life insurance companies, and 0 has been assigned to the others.\(^58\)

$G1 - G6$ are group (*shacho-kai*) dummies for each of the six major corporate groups, Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa, and Dai-Ichi Kangyo. Six firms belong to two different groups at the same time.

$SIC_j$ is a 3 digit industry code for each firm provided by *Gyoshu-betsu Rankingu*, Toyo Keizai Shinpo Sha. According to their classification, the 186 sample firms have been categorized into 53 different industries.\(^59\)

$A_{ij}$ is the fraction of firm $j$’s shares which are directly held by firm $i$ at the end of March in respective years.\(^60\) For instance, $A_{12} = 0.1$ means firm 1 holds 10% of firm 2’s outstanding shares. Hence $A_{ij}$ is the amount of control-rights that firm $i$ holds directly in

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\(^{58}\) This is used to identify financial institutions.

\(^{59}\) This classification seems to be appropriate for the purpose of our analysis. A broader classification such as 2 digit code might include companies who produce totally different products, while a narrower classification exclude companies who produces competitive products, but not as their main products.

\(^{60}\) This is $\alpha_i$ in our theoretical models, or $\alpha_{ij}$ in table 4.1. For consistency of notations with the other variables, $A_{ij}$ is used in this chapter.
firm \( j \). *Kigyo Keiretsu Soran*, which is published annually by Toyo Keizai Shinpo Sha, provides the stock investments between companies (i.e. \( A_{ij} \)) in a matrix form for each of six individual corporate groups. Although the matrices do not contain the information on the percentage stock investment between companies in two different groups, the book includes lists of names and percentage shares of the top 20 largest shareholders for every listed company. From the lists, information on the stock investment between companies in two different groups have been retrieved for five years (1980, 82, 84, 86 and 88). In most previous studies of Japanese corporate shareholding, only the original information provided in matrix form in *Kigyo Keiretsu Soran* has been used. Our data present the advantage of including stock investments between firms in two different groups.

### 4.3.2 Constructed Variables I

Table 4.3 shows constructed independent variables used in the analysis.

\( SGRPDU_{ij} \) is the same group dummy, which is equal to 1 if both investing and invested firms are in the same group, and 0 otherwise.

\( SICDUM_{ij} \) is the same industry dummy, which is 1 if both investing and invested firms are in the same industry and 0 otherwise.

\( AGE_j \) is the age of firm \( j \), which is calculated from the year of establishment, \( EYEAR \). Note that some of the younger firms in our sample were created as subsidiaries or joint ventures of the existing companies.
Before calculating the variance and between-firm covariance of operating profits, an adjusted operating profit rate, $DOPE_j$, needs to be introduced. First, we calculated weighted average operating profit rates for each year, $\overline{OPE_t}$, by adding the operating profits, weighted by the sales value, of $n$-firms, and dividing it by the number of firms, $n$. Secondly, we created new operating profit rates for each firm by subtracting the economy’s yearly average from the original operating profit rates.

$$DOPE_{j,t} = OPE_{j,t} - \overline{OPE_t}$$

where $OPE_{j,t}$ is the operating profit rate of firm $j$ at time $t$. The reason why we used $DOPE_j$ is because $OPE_j$ may include the effect of shocks to the whole economy. According to the risk sharing argument, through stock investments in other firms in the economy, the investing firm can protect itself from company-specific shocks but not from the shocks to the economy as a whole. For this reason, firms must be concerned with the variance and covariance of the firm-specific shocks when they make stock investment decisions. This is also the reason why operating profit rate has been chosen instead of other indicators for profit rates, such as return on assets, which includes investment incomes.

The standard deviations of firm $j$’s operating profit rates, $DSDOPE_j$, over previous years have been calculated based on all of the previous observations of $DOPE_j$. For example, $DSDOPE_j$ at 1982 is computed with $DOPE_j$ from 1978 to 1981. The standard deviations indicate the degree of risk faced by a company.

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61 The estimation results with the use of simple averages are qualitatively the same as the ones shown in this paper.
The covariance of the operating profit rates of two firms, firm $i$ and $j$, have also been calculated from past observations of $DOPE_i$ and $DOPE_j$, which is denoted as $DCOVOPE_{ij}$.

For the purpose of the analysis, we are interested in direct, as well as indirect, measures of the fraction of firm $j$'s shares held by firm $i$ (control rights indices) and the fraction of firm $i$'s shareholding invested into firm $j$ (portfolio-choice indices). The following sections explain the way to construct those indices.

4.3.3 Constructed Variables II: Control Rights Indices

As explained in the previous section, $A_{ij}$ measures the fraction of firm $j$'s shares directly held by firm $i$ and can be used to measure firm $i$'s direct control over firm $j$. However, companies sometimes control other companies indirectly. Suppose that firms 1 and 2, respectively, hold 0% and 10% of firm 3's shares, while firm 1 owns 50% of firm 3's shares indirectly through its subsidiary. With the direct investment measure, the amount of firm 1's control rights over firm 3 is regarded as 0 although firm 1 seems to be able to control firm 3 with the indirect investment. This may be an extreme case. What if both firms 1 and 2 directly own 10% of firm 3's shares, while firm 1's subsidiary owns 50% of firm 3's shares? The direct investment measure ranks the amounts of control rights in firm 3 held by firms 1 and 2 as the same. It, however, should be natural to think that firm 1 has more
influence in firm 3 than firm 2 does. Ito and Hoshi (1992) introduce a way to construct an index which includes indirect ownerships as follows.

First, consider an $n \times n$ matrix, $A$, which shows direct ownership relations among $n$ firms. The element in row $i$ and column $j$ of this matrix is $A_{ij}$. A simple example is used in order to explain the construction of control-rights indices which include indirect control. Suppose firm 1 owns two-thirds of firm 2's shares, firm 2 owns one-third of firm 3's shares, and firm 3 owns one-third of firm 1's shares. This ownership structure between the firms is represented by

$$A = \begin{bmatrix} 0 & 2/3 & 0 \\ 0 & 0 & 1/3 \\ 1/3 & 0 & 0 \end{bmatrix}.$$  

Firm 1 owns two-thirds of firm 2's control-rights directly. firm 2 and 3, respectively, owns one-third of firm 3's and firm 1's control-rights directly. In this case, it can be said that firm 1 indirectly owns a fraction of firm 3's shares through firm 2 and that the amount of ownership is given by $A_{12}A_{23} = (2/3)(1/3) = 2/9$. Let us call it second order indirect investment. $A^2$ represents the second order indirect investment relationships of all the firms. In general, $k$th order indirect investments can be expressed by $A^k$. Hence, a new matrix

$$B = A + A^2 + A^3 + \cdots = A[I - A]^{-1}$$

The readers may wonder how the investing company can influence the management of the invested company indirectly if the amount of shares held by the investing company is not large. Obviously, it cannot be done at general meetings of the shareholders. However, as mentioned before, corporate shareholders could be informally involved in the decision making of invested companies. Through this mechanism, corporate shareholders can affect indirectly-invested companies.
can be defined to include all the direct (first order) and indirect (second or higher order) ownership relations. The element in row $i$ and column $j$ of this matrix is denoted $B_{ij}$.

This is the index which indicates the amount of control-rights in firm $j$ held, directly and/or indirectly, by firm $i$. In order to save space, let us call this, simply, the indirect control-rights index, although the index actually takes both direct and indirect investments into account.

With our numerical example,


Matrix $B$ generally has the following three properties. First, every element in matrix $B$ is greater than or equal to its counterpart in matrix $A$ because of its additive construction. Secondly, the diagonal elements of matrix $B$ are no longer necessarily zero, which means that firms could indirectly own some of their own shares. The third property is that the sum of the elements in each column can never be greater than 1 in matrix $A$, but may exceed 1 in matrix $B$. This is because matrix $B$ does not cancel out mutual ownership relations through shareholding and is closely related with the first property.

It can be said that the control rights indices, $A_{ij}$ and $B_{ij}$, measure the degree of firm $i$'s influence in firm $j$. With these indices, holding 50% of shares in a large—in terms of value—firm and a small firm are treated as the same. They may not be, however, equivalent.

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63 Futatsugi (1982 and 1984) is the first who studied the effects of indirect shareholding by an operation of shareholding matrices. Ito and Hoshi (1992) discuss the relation between Futatsugi's measure and theirs. Flath (1992) proposes another measure of indirect shareholding based on $(I - A)^{-1}$. His measure, however, does not exhaust all of the possible routes of the indirect investment.
in terms of the values. The next subsection explains derivation of portfolio choice indices which represent allocation of a firm's stock investments according to their values.

4.3.4 Constructed Variables III: Portfolio Choice Indices

Portfolio choice indices represent a relative degree of ownership interest in other companies. The word "relative" has two meanings. Unlike the control rights index, the portfolio indices distinguish the investments in a large and a small firm, since investments are measured by value, not by a fraction. The portfolio indices also treat the same value of investment in a company from two different size companies differently. The index is smaller for the investment from a larger company.

Portfolio choice indices are calculated using a matrix introduced by Tanigawa (1986). Derivation of a portfolio choice index with only direct investment is, first, shown, which is followed by derivation of a portfolio choice index with both direct and indirect investment. The numerical example of the previous section is presented to illustrate the intuition behind the indices.

Let \( s_i \) denote the (market) value of firm \( i \)'s operating assets where \( i = \{1, \ldots, n\} \). This value may vary with a stochastic element. In the context of risk-sharing argument, this is the source of uncertainty.

Construct a diagonal matrix, \( A^f \), such that \( l'(A^f + A) = l' \) where \( l \) is a vector of ones. The \( i \)th diagonal element of \( A^f \) is the portion of firm \( i \)'s shares directly held by the
individual shareholders of firm \( i \). In our example,

\[
A^I = \begin{bmatrix}
2/3 & 0 & 0 \\
0 & 1/3 & 0 \\
0 & 0 & 2/3
\end{bmatrix}
\]

The first diagonal element, for example, is two-thirds because one-third of firm 1's shares are owned by firm 3 and, hence, the rest, two-thirds, are owned by individual shareholders of firm 1.

By adding \( A \) and \( A^I \), the entire direct ownership structure is represented. Denote this new matrix as matrix \( C \). The \( i \)th column of matrix \( C \) shows the decomposition of ownership of firm \( i \), while the \( i \)th row shows firm \( i \)'s stock investment portfolio. Note that, by its construction, matrix \( C \) has a property that the sum of the elements in each column is always equal to one.

In our example, the matrix is given by

\[
C = A + A^I = \begin{bmatrix}
2/3 & 2/3 & 0 \\
0 & 1/3 & 1/3 \\
1/3 & 0 & 2/3
\end{bmatrix}
\]

The first column can be read that two-thirds of firm 1's shares is owned by individual shareholders of firm 1 and one-third of them is owned by firm 3. Hence, ignoring indirect investments, two-thirds of the firm 1's operating asset belongs to the individual while one-third of it belongs to firm 3, according to the ownership structure. On the other hand, the first row of this matrix indicates that firm 1's total asset consists of two-third of firm 1's operating asset and two-third of firm 2's operating asset. None is from firm 3 since firm 1 does not own any shares of firm 3.
An index for direct portfolio choice, \( PF_{ij} \), is defined by the firm \( i \)'s direct investment value in firm \( j \) divided by the total direct investment value of firm \( i \).

\[
PF_{ij} = \frac{C_{ij} \cdot ASSET_j}{\sum_{k=1}^{n} (C_{ik} \cdot ASSET_k)}
\]

Market values of firms' total assets are used as the weights since we do not have data on the operating assets. As will become clear later, the (expected) value of a firm's operating asset is equal to the (expected) value of the firm's total assets, if the price of every firm's stocks is equal to the (expected) values of the firm.\(^{64}\)

In our example, firm 1's total investment is \( 2/3 \cdot s_1 + 2/3 \cdot s_2 + 0 \cdot s_3 \). If the values of the operating assets are the same across the firms (i.e. \( s_1 = s_2 = s_3 \)), then \( PF_{11} = (2/3)/(2/3 + 2/3 + 0) = \frac{1}{2} \), \( PF_{12} = (2/3)/(2/3 + 2/3 + 0) = \frac{1}{2} \) and \( PF_{13} = (0)/(2/3 + 2/3 + 0) = 0 \).

The following shows the calculation of an index for the portfolio-choice model that includes indirect investments. \( C_{ij} \) does not offset the stock investments which are, directly and/or indirectly, made by firm \( j \) in firm \( i \). In order to compensate for this shortcoming, some additional steps are required.

Using matrix \( A \), the market value of firm \( i \) with corporate shareholding is expressed by the \( i \)th factor of vector \( u \):

\[
u = s - Ap + Au
\]

\(^{64}\) If there is no uncertainty, the price of shares must be equal to the (market) value of the firm. In this case, the (market) value of the firm is also the same as the value operating assets. With uncertainty, however, these relations may not hold because of risk premiums.
where $p$ is a vector of the prices per fraction of shares. The first terms in the right hand side of the equation are the operating assets of firm $i$ minus the purchasing cost of shares in other firms. The second term is the (market) values of those shares held by the company. Solving the above equation for $u$, we obtain

$$u = [I - A]^{-1}[s - Ap].$$

(4.1)

It is well-known that aggregate market capitalization is inflated because of double counting problem which is involved in corporate shareholding. See for example, McDonald (1989), French and Poterba (1991) and Fedenia, Hodder, and Triantis (1994). Tanigawa (1986) seems to be the first who realized this fact. He multiplied $u$ from its left hand side by $A^I$ to derive a true capitalization of the firms:

$$A^I[I - A]^{-1}[s - Ap].$$

This is what is called outside value of the firms.

Therefore firms’ true portfolio choices are represented by a new matrix,

$$D = A^I[I - A]^{-1}.$$

This matrix, $D$, takes into account both the indirect investment effects and the offsetting effects of mutual investment. A portfolio index defined by Fedenia, Hodder, and Triantis (1994) is based on matrix $[I - A]^{-1}$ instead of $A^I[I - A]^{-1}$. It is, however, essentially the same as our index because $A^I_{ii}$ which appears on both numerator and denominator cancels out in our index.
$ij$ element of matrix $D$, $D_{ij}$, represents the fraction of firm $j$'s operating profit that goes to firm $i$; and the sum of elements in each column is always equal to one. In matrix $D$, not only the indirectness but also the canceling-out effect of cross-shareholding are taken in consideration. Hence, a new portfolio index which includes indirect investments, $IPF_{ij}$, can be obtained as before:

$$IPF_{ij} = \frac{D_{ij} \cdot ASSET_j}{\sum_{k=1}^{n} (D_{ik} \cdot ASSET_k)}$$

In our example,


and, if the operating asset is the same across the firms, $IPF_{11} = (18/25)/(18/25+12/25+4/25) = \frac{9}{17}$, $IPF_{12} = \frac{6}{17}$ and $IPF_{13} = \frac{2}{17}$. $IPF_{12}$ is smaller while $IPF_{11}$ and $IPF_{13}$ are bigger compared to the PF indices.

In constructing actual indices used in our analysis, one additional step is required in order to deal with the 29 financial institutions and the 3 manufacturing companies mentioned before, whose shareholding information is available but financial data are not. First, a 186-by-186 $A$ matrix, which contains shareholding information of all 186 firm, is used to construct matrices $B$, $C$ and $D$. After the construction of these matrices, the entries for the financial institutions and the manufacturing companies are removed from the matrices so that each of them is reduced to 154-by-154 matrices. Then $B_{ij}$, $C_{ij}$, $PF_{ij}$ and $IPF_{ij}$ are derived, as described above, based on those smaller matrices. As a result, a firm's invest-

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67 The proof for the latter statement is: $l^\prime (A^l + A) = l^\prime$ by definition. Multiplying both side of this equation by $(I - A)^{-1}$ from the right, $l^\prime (A^l (I - A)^{-1} + A(I - A)^{-1}) = l^\prime (I - A)^{-1}$. Moving $l^\prime A(I - A)^{-1}$ to the right hand side, $l^\prime A^l(I - A)^{-1} = l^\prime$. Q.E.D.
ment into those omitted corporations are not in the denominator when calculating \( PF_{ij} \) and \( IPF_{ij} \).

Alternatively, a 154-by-154 \( A \) matrix can be directly used to derive the indices. In such a case, the derived \( B_{ij} \) and \( PF_{ij} \) are the same as the ones obtained by the above procedures, but \( C_{ij} \) and \( IPF_{ij} \) are different. There is an important reason for the use of the 184-by-186, instead of the 154-by-154, matrix. Most financial institutions in Japan hold a substantial amount of shares in companies across groups. Therefore the large matrix is not block diagonal by groups. Because of this, most companies are, at least indirectly, inter-connected even if they are not in the same group. If the small matrix is used, this important fact is omitted.

### 4.3.5 Summary Statistics for the Variables

Tables 4.4 and 4.5 provide summary statistics for the variables used in the estimations. The number of observation is \( 23562 (= 154 \times 153) \) for relational variables (i.e. variables with Subscript \( ij \)) when financial institutions and the three companies which are mentioned before are excluded, otherwise \( 34410 (= 186 \times 185) \). Several important characteristics of our data are as follows:

\( SGRP \) shows that about 19.8\% of the 23562 \( i-j \) bilateral relations are between firms in the same group. The mean of \( SICDUM_{ij} \) indicates that 3.13\% of the relations are between firms in the same industry. Notice that, since the sample firms are from 43

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68 The statistics in table 4.3 are calculated from data used in the pooled model specification which will be discussed later.
different industries, there is a probability of $1/43 = 2.33\%$ of any two firms belonging to
the same industry, assuming an equal distribution.

The companies used in our analysis are old, large companies. The average corporate
age was 55.39 years, which means that many of the firms have their historical roots in the
period before the Second World War. The youngest company is 20 years old and the oldest
107. The number of employees varies from 258 to 77981, with an average of 8724.1.

In table 4.5, the mean of $A_{ij}$ (or $A_{ji}$) indicates that the fraction of a firm's shares held
directly by another firm is, on average, small. For example, it was only 0.06926\% in 1980.
In other words, $10.60\% = 0.06926\% \times 153$ of each company's shares are owned by the
other 153 firms on average. Although it is not shown in the table, by adding the shares
held by financial institutions in the same group, the amount rises to about 30\% for most
companies. The mean of $A_{ij}$ declines slightly over the sample period. Because $B_{ij}$ includes
indirect investments by its construction, the mean of $B_{ij}$ is higher than that of $A_{ij}$.

The mean of $PF_{ij}$ should indicate what fraction, on average, of a firm's portfolio is
allocated to another company's shares. This was 0.07047\% in 1980, for example. This
means that, in 1980, $10.78\% = 0.07047\% \times 153$ of a firm's total asset value is held in the
form of other firms's shares, while the rest, 89.22\%, is in other forms of assets.\footnote{This is fairly consistent with micro data provided by Hayashi and Inoue (1990). According to the data, about 10-20\% of total asset value in an average Japanese firm during 1977–1986 consists of affiliated companies' stocks. However, if non-affiliated companies' stocks are added, the figure should be bigger.} $IPF_{ij}$
accounts for indirect investments and their netting-out effects. As shown in the example

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calculation, \( PF_{ij} \) can be either greater or smaller than \( IPF_{ij} \). Therefore, the average of \( PF_{ij} \) can be as well.

By including indirect investment relations, the number of non-limit observations in both control-rights and portfolio indices drastically increases. Only about 4% of i-j combinations in our data have direct investment relations. With indirect investments, about 70% of the combinations have some investment relations. The inclusion of financial institutions in computing indirect indices largely contributed to this change.

### 4.4 Models and Tests

As explained, common stocks have two distinctive characteristics as control-rights and profit-claims, and each of the hypotheses is related to one of them. Hence the models used in the estimations have been designed in order to correspond to these two features: the control-rights models and portfolio-choice models, respectively. In the control-rights models, the fraction of firm j's shares held by firm i is explained by the characteristics of the invested (including zero-invested) and investing firms. The portfolio-choice models, focus on the fraction of firm i's stock investments in firm j.

With the reasons given before, we estimate the indirect investment models, as well as the direct investment models. The dependent variable is \( A_{ij} \), or \( B_{ij} \) for the control rights model, and \( PF_{ij} \), or \( IPF_{ij} \) for the portfolio choice model.

Caution must be taken, however, to interpret the outcomes from the indirect investment models because we have a statistical difficulty to measure the indirect investment relations.
Our indirect investment indices are constructed by taking the inverse of matrix \((I - A)\). As a result, the disturbances are, to some extent, correlated with one another.\(^{70}\) This is an inevitable problem because no one can observe \(B_{ij}\) or \(IPF_{ij}\), only \(A_{ij}\). Ironically, this is why \(B_{ij}\) and \(IPF_{ij}\) are called "indirect" indices.

Many of the dependent variables are zeros, especially when indirect investments are not accounted for. In order to deal with this limited dependent variable issue, a Tobit model is employed. With the use of a latent variable, the Tobit model is defined as follows:

\[
y^*_{ij} = \beta X + \epsilon_{ij}
\]

and

\[
y_{ij} = \begin{cases} y^*_{ij} & \text{if } y^*_{ij} > 0 \\ 0 & \text{if } y^*_{ij} \leq 0 \end{cases}
\]

The dependent variable, \(y_{ij}\), is \(A_{ij}, B_{ij}, PF_{ij}\), or \(IPF_{ij}\). Three categories of dependent variables, \(X\), are employed; (1) relational variables \((SGRPDUM_{ij}, SICDUM_{ij}, DCOVOPE_{ij})\), and either one of the counter stock investment measures, \(A_{ji}, B_{ji}\) and \(D_{ji}\), depending on the dependent variable); (2) characteristics of the invested company \((\log AG_E_j, \log KL_j, \log EMP_j, SGROW_j, AD_j/SALE_j, RD_j/SALE_j, DOPE_j, and DSDOPE_j)\) and; (3) characteristics of investing company \((\log AG_E_i, \log KL_i, \log EMP_i, SGROW_i, AD_i/SALE_i, RD_i/SALE_i, DOPE_i, and DSDOPE_i)\).\(^{71}\)

\(^{70}\) The estimates are considered to be consistent but has no statistical inference.

Strictly speaking, the direct investment measurement, \(A_{ij}\), and therefore \(PF_{ij}\), are also correlated one another because \(i\) is the same for different \(j\). This problem is, however, different from the one discussed in the above.

\(^{71}\) Flath (1996) presents a similar Tobit estimation model, in which the fraction of firm
The sample period of the dependent variables is every two years from 1980 to 1988, since data on $A_{ij}$ are only available for those years. Because of the use of the lagged variables, yearly estimations are conducted for 1982, 84, 86 and 88. Pooled estimation models, which allow only the constant term to be different by year, are examined as well.

A Hausman test, proposed by Smith and Blundell (1986), is conducted to check if any of the explanatory variables are endogenous, and it is found that $SGROW_{ij}$ and $DOPE_{ij}$ are endogenous. As a remedy for this problem, lagged values for these variables are employed in the analyses. Subscript -2 is used to denote lagged variables. Besides these, lagged variables are used for the counter stock investment measures in order to avoid a simultaneity problem.

Tables 4.6.1 to 4.6.4 report the estimated coefficients in the Tobit for both control-rights and portfolio choice models with and without indirect investments. A LR test is conducted to examine the validity of pooling the yearly data sets into a single equation. The pooled estimations, which are viewed as restricted models of the separate yearly estimations, are rejected for all the models.

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$j$'s shares held by firm $i$, that is our $A_{ij}$, is explained by proxy variables for intermediate input transaction relationships between the two firms and some other control variables. Besides the difference in the purpose of studies, there are a few major differences to our studies. First, neither indirect investment nor portfolio choice model is not considered in his model. Secondly, his data set consists of a single year observation which does not include investment information across groups.
4.5 Empirical Results

The following reports details of the estimation outcomes for each argument. Note that, because of the correlation problem in the indirect investment models, significance levels are noted only in the direct investment models.

The Competitive-effect Argument

The coefficient on $SICDUM$ is significantly positive at 1 or 5% level in most of the direct investment models (tables 4.6.1 and 4.6.3). This indicates that companies have a tendency to invest more, in terms of both control-rights and portfolio-choice indices, in other companies in the same industry. The indirect investment models provide a similar outcome for $SICDUM$ in both portfolio-choice and control-rights models (tables 4.6.2 and 4.6.4).

The competitive argument through control-rights is clearly supported by the data despite the fact that companies in our data set are subject to the one-set principle.

The Risk-Sharing Argument

The coefficient on $DCOVOPE_{ij}$ is statistically insignificant (table 4.6.3). This contradicts one of the predictions of the risk-sharing model—that the relationships between the amount of investment and the covariance of operating profits should be negative (RS-H1).

According to the risk-sharing argument, firms with lower standard deviations in operating profits should attract more investment by other firms (RS-H2). This hypothesis is supported by the data. The coefficient on $DSDOPE_j$ is negative and significant at 1%.  

\footnote{When indirect investments are considered, the coefficient is mostly negative, but which may not be significant (table 4.6.4).}
level in all of the direct portfolio-choice model (table 4.6.3). It is negative in the indirect investment model estimations (table 4.6.4). This implies that firms with lower standard deviations in operating profits do attract more investment by other firms. This is consistent with the empirical finding of Caves and Uekusa (1976) and Nakatani (1984) that firms which attract more investment by other firms tend to exhibit lower volatilities in their profit rates.

The coefficient on $DSDOPE_i$ is negative and significant at 1% level in all of the direct portfolio-choice model (table 4.6.3). This is consistent with the third hypothesis of the risk-sharing argument (RS-H3).

The estimated coefficients of the counter investment, $A_{ij}$, is significantly positive (table 4.6.3). This result contradicts one of the predictions of the risk-sharing model—that firms invest less in other firms which own large portions of the investing firms (RS-H4).

The outcomes for the risk-sharing argument are mixed. Two out of four possible hypotheses are not supported. In sum, we cannot conclude that the data provide enough evidence to support the risk-sharing argument.73

**The Control-Rights Argument**

The coefficient on $A_{ij}$ in the estimations indicates that a firm has a tendency to invest more in firms which directly own more of the investing firm’s shares (table 4.6.1). This supports the hypothesis regarding mutuality of investment relationships required in control-rights argument (CR-H1).

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73 This is consistent with Beason (1998).
The coefficient on $SGRPDUM_{ij}$ in the estimations clearly shows that a firm has a tendency to invest more in the firms which belong to the same group as the investing firm (table 4.6.1).\textsuperscript{74} This is not a surprising result, which just reconfirms that members of a presidents' meeting are the participants of a cross-shareholding arrangement.

The sign coefficients on the variable of growth rate in sales values, $SGROW_j$, varies from year to year. The coefficients are mostly insignificant. This tells us that corporate stock investment is not responsive to the sales performance of target companies, which is consistent with the "stable shareholders" hypothesis (CR-H3). The coefficient on operating profit rates, $DOPE_j$, is significantly negative except in year 1982 (table 4.6.1). This is the only outcome which is against the third hypothesis of the control-rights argument.

Given all these outcomes, we can conclude that the data provide evidence to support the control-rights argument.

**Some Other Results**

General results regarding the characteristics of invested firms are as follows. Younger firms are likely to attract more investment. One possibility for this outcome is that the age factor may capture the future prospect of company. The result may also reflect the fact that

\textsuperscript{74} In general, this implies that, against its "official" view, the presidents' meetings are not just informal socializing functions. On the contrary, they must have some significant economic meaning with respect to stock investment decisions. Although the formation of cross-shareholding arrangements seems to be the most important cause of this outcome, there are some other possible causes. For example, in a widely accepted view, the participants of the presidents' meetings exchange some managerial information and sometimes reach managerial decisions together. This leads to the hypothesis that firms tend to invest in other member firms of the same presidents' club because investing firms have private access to the managerial information of the invested firms through personal connections.
some of the firms in the sample are subsidiaries of another company. Companies with lower advertisement and/or R & D expenditures are also invested in more.

Regarding the characteristics of investing firms, our data find that capital intensive firms with large number of workers tend to hold a larger fraction of shares in other companies. The large number of employees indicates that the investing firms are large. The size of investing companies should affect their investment amounts, especially when the amounts are measured by the fraction of an invested firm’s shares held by the investing firm (i.e. $A_{ij}$). Companies with lower advertisement and/or R & D expenditures also invest more. The operating profit rate, as well as its standard deviation, tend to be smaller in heavily investing firms.

The negative coefficients on advertisement expenditures for both investing and invested firms are consistent with the finding of Flath (1996). In light of his argument that trading partners should invest more in each other, companies with small advertisement expenditures are considered to be manufacturers of intermediate products rather than final consumer products. Their products are traded between firms.
4.6 Concluding Remarks

There are several features of this study that distinguish it from previous empirical research.

First of all, many previous empirical studies of Japanese corporate groups used a “cross shareholding” index, which is the fraction of a company’s shares that are owned by other members of the same corporate group, in order to examine how the corporate shareholding structure can be related with the profit rate of a company (see for example, Cave and Uekusa, 1976; Nakatani, 1986 and; Itoh and Hoshi, 1992). In other words, the shareholding structure was treated as exogenous. In contrast, this chapter looked at endogenized shareholding relations and examined the determinants of corporate shareholding.

Secondly, in dealing with corporate stock investment, this paper considered two significant factors of corporate shareholding; inter-group investment and indirect investment. First, in this analysis, the shareholding matrices for each group were expanded to a large matrix to accommodate shareholding across companies in different groups. Second, with some matrix operations, we presented a way to take indirect investment relations into consideration. Although analyses on indirect investment were limited by a data availability, these two features enable us to find interesting results. For example, the competitive-effect argument may not be supported if intra-group investments are only considered, because few companies in a group belong to the same industry. In addition, any covert relationship through indirect investment between firms can be, theoretically, captured in analyses.
Our study suggests that competitive-effect arguments need to be researched more. Perhaps influenced by a strong belief in the one-set principle, and in the effectiveness of anti-monopoly laws, the competitive-effect motive of corporate shareholding has not drawn much attention from researchers of the Japanese economy. Consequently, the possibility of distortions in market competition through corporate shareholding has not been studied. The data have shown that there exists stock investment relations between companies within the same industry. It will be interesting to study the degree of distortion which might be possibly caused by such stock investments. Remember that conventional market concentration ratios such as Herfindahl index do not properly reflect the true state of market competition under a cross shareholding situation. See chapter 2 for more detail.

With respect to the risk-sharing argument, the coefficient on the covariance in operating profits is insignificantly positive except in one year. There are two possible reasons for this result.

First, as mentioned above, the data cannot distinguish vertical investment relations from others. Suppose there is a final demand shock. It is very unlikely that either upstream or downstream firms absorb all the shock. For example, if new entries are not allowed, the

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75 Examples of such investment can be found in automobile, synthetic fiber, paper and pulp, and electronics industries (Kigyo Keiretsu Soran, 1983). Toyota owned 12.75% of Daihatsu in 1982. Toyota gradually increased its ownership in Daihatsu and finally made Daihatsu as its subsidiary. In synthetic fiber industry, Nissinbo owned 33.92% of Toho Rayon, and Teijin owned 3.42% of Nissinbo in 1982. In paper and pulp industry, Shin Oji Seishi owned 1.05% and 0.96% of Honshu Seishi and Nihon Seishi, respectively. Shin Oji Seishi eventually merged Honshu Seishi in October 1996. In electronics industry, "Mitsubishi Electronics-Oki", "Hitachi-Nihon Columbia", "Fujitsu-Hitachi" had investment relations in 1982. Note that many of these investment relations are between the firms in different financial keiretsu groups.
final demand shock affects both upstream and downstream firms. In this case, operating profits are highly correlated. If we could control this factor, the estimation result may change in favor of the risk-sharing argument.

Secondly, if two companies arrange to exchange each other’s shares without actual money transactions (swap transaction), such “stock investments” reduce the volatility of final profit unless operating profits of the firms are perfectly correlated—that is even if they are positively correlated. Although swap transactions do not seem to be so common, the data, again, cannot distinguish whether the shares are obtained by a swap or not. The inclusion of such investment relations may have shifted our estimated coefficient on the covariance to the positive side.

The lack of evidence for the risk-sharing argument may also simply mean that most firms do not, or cannot, efficiently use the information on target firms in order to diversify themselves. While it is common that investors only have limited information on firms, corporate shareholding makes it more difficult to correctly estimate the risk involved in each share. Under this circumstance, it is naive to think that stock prices carry correct risk information because it requires everybody in the market to correctly estimate the risks. Having partial information is sometimes equivalent to having no information at all and some managers may simply invest in a market index. If there are many managers who diversify their companies’ assets in such a way, our estimate may fail to produce clear evidence for

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76 See Fedenia, Hodder, and Triantis (1994).
77 In fact, judging from the Japanese companies’ typical portfolios—a small fraction of shares in a number of companies—many managers appear to be acting as if they have no information and are simply investing in a market index.
the risk-sharing argument. Remember that this is not a denial of the risk-sharing argument, because managers are still considered to be trying to reduce their risk, just in a less efficient way.

The strongest empirical support is given to the control-rights argument in this analysis. However, many empirical studies of Japanese corporate groups such as Caves and Uekusa (1976) and Nakatani (1986) have found a contradiction to the prediction of the control-rights argument—that firms which are invested more by other group members tend to have lower profit rates. In the framework of this paper, this discrepancy could not be addressed. This issue needs to be investigated in the future.

Financial institutions are not included in our analysis because financial institutions and non-financial institutions provide the data in totally different ways. What if comparable data are available for financial institutions? Financial institutions must have many different motives for stock investment as discussed in the main bank argument. Those factors must be controlled in order to include financial institutions in the analysis. For example, the supply of loans from a bank to each company should be added as an explanatory variable. Suppose that such adjustments were made. Would our results be affected by the inclusion of financial institutions? The competitive-effect argument may be supported more strongly because many banks hold shares in trust banks. Evidence to support the risk-sharing argument may be still weak because the extent of financial institutions' investment diversification is great. The effect of the inclusion of financial institutions on the control-rights argument is ambiguous. Within a group, apparently financial institutions are the centre of stock

78 If included, it is likely to introduce a large distortion in our estimates.
investment relations. Many mutual investment relations are added into the sample. On the other hand, financial institutions invest in companies in other groups too. Those invested companies seldom invest back in the financial institutions.

A direction of future research is to expand the data set and to test the robustness of the results in this study. It would be interesting if independent companies which do not belong to any of the six corporate groups are added to our data set. International comparison may also provide further insight.
Table 4.1: Comparative Statics on Corporate Investment ($\alpha_{ij}^*$)

<table>
<thead>
<tr>
<th></th>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\alpha_{ij}^* = -\frac{\sigma_{ij}}{\sigma_j^2}$</td>
<td>$\alpha_{ij}^* = -\frac{\sigma_{ij} + \sigma_i^2\alpha_{ij}}{\sigma_j^2 + \sigma_{ij}\alpha_j}$</td>
</tr>
</tbody>
</table>

| Covariance in operating profit rates ($\sigma_{ij}$) | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_{ij}} < 0$ | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_{ij}} < 0$ |
| St. Deviation in $j$’s operating profit rates ($\sigma_j$) | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_j} | \sigma_{ij} < 0 < 0$ | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_j} | \sigma_{ij} < 0 < 0$ |
| St. Deviation in $i$’s operating profit rates ($\sigma_i$) | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_i} | \sigma_i \neq 0 < 0$ | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_i} < 0$ |
| Counter Investment ($\alpha_{ji}$) | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_{ji}} < 0$ | $\frac{\partial \alpha_{ij}^*}{\partial \sigma_{ji}} < 0$ |

* These are predictions drawn from the risk-sharing models in chapter 3.
** $i$ and $j$ stand for investing and invested firms, respectively.
*** $\alpha_{ij}$ is the fraction of firm $j$’s shares held by firm $i$ (i.e. $\alpha_i$ in chapter 3).
### Table 4.2: Data Items

<table>
<thead>
<tr>
<th>Variables</th>
<th>Period</th>
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<tbody>
<tr>
<td>ASSET</td>
<td>total asset value (million yen in 1990 value)</td>
</tr>
<tr>
<td>EMP</td>
<td>number of employees</td>
</tr>
<tr>
<td>SALE</td>
<td>sales (million yen in 1990 value)</td>
</tr>
<tr>
<td>SGROW</td>
<td>sales growth from previous year (1 = 100 %)</td>
</tr>
<tr>
<td>AD</td>
<td>advertising expenditure (million yen in 1990 value)</td>
</tr>
<tr>
<td>KL</td>
<td>capital-labor ratio (thousand yen in 1990 value/per person)</td>
</tr>
<tr>
<td>OPE</td>
<td>operating profit rate (%)</td>
</tr>
<tr>
<td>EYEARf</td>
<td>year of establishment of each firm</td>
</tr>
<tr>
<td>FDUMf</td>
<td>financial institution dummy (one for a financial institution)</td>
</tr>
<tr>
<td>G1-G6</td>
<td>group dummy for each of six major corporate groups</td>
</tr>
<tr>
<td>SICf</td>
<td>industry code (3 digit)</td>
</tr>
<tr>
<td>Aij</td>
<td>a fraction of firm j’s shares held by firm i</td>
</tr>
</tbody>
</table>

* Superscript f indicates that the data of the financial institutions are available.

* The observation period is annual at the end of accounting year.

### Table 4.3: Constructed Variables in Estimations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>SGRPDUMfij</td>
<td>same group dummy (one if firms i and j are in the same group)</td>
</tr>
<tr>
<td>SICDUMtij</td>
<td>same industry dummy (one if firms i and j are in the same industry)</td>
</tr>
<tr>
<td>AGEj</td>
<td>age of firm j</td>
</tr>
<tr>
<td>DOPEij</td>
<td>adjusted operating profit (deviation from the year weighted average)</td>
</tr>
<tr>
<td>SDDOPEij</td>
<td>standard deviation in DOPEi for each firm in the past</td>
</tr>
<tr>
<td>DCOVOPejij</td>
<td>covariance of DOPEi and DOPEj in the past</td>
</tr>
<tr>
<td>Bij</td>
<td>control- rights index constructed from Aij, includes indirect investments</td>
</tr>
<tr>
<td>PFij</td>
<td>portfolio-choice index constructed from Cij</td>
</tr>
<tr>
<td>IPFij</td>
<td>portfolio-choice index constructed from Dij, includes indirect investments</td>
</tr>
<tr>
<td>Dij</td>
<td>a fraction of firm j’s operating profits contributed to the firm i’s final profit</td>
</tr>
</tbody>
</table>

* Superscript f indicates that the data of the financial institutions for the item are available.
Table 4.4: Summary Statistics for Explanatory Variables

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<th>St. Dev</th>
<th>Min</th>
<th>Max</th>
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<td>258</td>
<td>77981</td>
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<td>SGR_j</td>
<td>0.0479</td>
<td>0.2191</td>
<td>-0.7794</td>
<td>4.028</td>
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<td>AD_j/S_j</td>
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<td>0.0115</td>
<td>0.0000</td>
<td>0.0886</td>
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<tr>
<td>RD_j/S_j</td>
<td>0.0133</td>
<td>0.0536</td>
<td>0.0000</td>
<td>0.7438</td>
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<td>KL_j</td>
<td>21758</td>
<td>39800</td>
<td>1194</td>
<td>436270</td>
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<td>DOPE_j</td>
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<td>5.2044</td>
<td>-18.919</td>
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<td>1.0000</td>
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<td>0.3987</td>
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<td>0.3946</td>
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<td>0.1742</td>
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<td>18.64</td>
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<td>DSDOPE_j</td>
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<td>1.2976</td>
<td>0.0292</td>
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<td>54.502</td>
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* Superscript f indicates that the reported values were derived from the data including the financial institutions.
Table 4.5: Summary Statistics of the Dependent Variables

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<td>$A_{ij}$ (1980)</td>
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<td>0.0000</td>
<td>0.5899</td>
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<tr>
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<tr>
<td>$A_{ij}$ (1984)</td>
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<tr>
<td>$A_{ij}$ (1986)</td>
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<td>0.009451</td>
<td>0.0000</td>
<td>0.5597</td>
<td>0.0482</td>
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<tr>
<td>$A_{ij}$ (1988)</td>
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<td>0.009139</td>
<td>0.0000</td>
<td>0.5569</td>
<td>0.0420</td>
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</thead>
<tbody>
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<td>$B_{ij}$ (1980)</td>
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<td>0.01069</td>
<td>0.0000</td>
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<tr>
<td>$B_{ij}$ (1982)</td>
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<td>0.0000</td>
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<td>0.6885</td>
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<tr>
<td>$B_{ij}$ (1984)</td>
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<td>0.009352</td>
<td>0.0000</td>
<td>0.5593</td>
<td>0.7079</td>
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<table>
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</tr>
</thead>
<tbody>
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<td>$PF_{ij}$ (1980)</td>
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<td>0.007433</td>
<td>0.0000</td>
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<tr>
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<td>0.7079</td>
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<tr>
<td>$IPF_{ij}$ (1988)</td>
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<td>0.005167</td>
<td>0.0000</td>
<td>0.3063</td>
<td>0.7079</td>
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</table>

*The variables are in the form of fraction.

**Financial institutions are included to compute the adjusted value for inclusion of indirect shareholding, although the reported values are of 154 non-financial companies.

***The total number of observation is 23562.
## TABLE 4.6.1: Tobit Estimation Results: Control Rights Model
(Direct Investments: $A_{ij}$)

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<td><strong>YEAR</strong></td>
<td>1982</td>
<td>1984</td>
<td>1986</td>
<td>1988</td>
<td>POOL (rejected)</td>
<td>S I G N</td>
<td>EXPECTED</td>
<td>ESTIMATED</td>
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<td><strong>Relational (ij)</strong></td>
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<tr>
<td>SGRP DUM$_{ij}$</td>
<td>1.590</td>
<td>1.745</td>
<td>1.765</td>
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<td>+ (CR)</td>
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<td></td>
<td>36.96</td>
<td>38.10</td>
<td>37.98</td>
<td>35.76</td>
<td>76.09</td>
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<td>SICDUM$_{ij}$</td>
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<td>0.255</td>
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<td>0.237</td>
<td>+ (CE)</td>
<td>+</td>
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<td>2.495</td>
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<td>DCOVOPE$_{ij}$</td>
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<td>0.011</td>
<td>0.006</td>
<td>0.007</td>
<td>0.009</td>
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<tr>
<td></td>
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<td>5.500</td>
<td>+ (CR)</td>
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<td><strong>Invested Firm (j)</strong></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>logAGE$_j$</td>
<td>-0.153</td>
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<td>-0.132</td>
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<td>0 (CR)</td>
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<td>logEMP$_j$</td>
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(continues to the next page)
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<th>Investing Firm (i)</th>
<th>logAGE$_i$</th>
<th>logKL$_i$</th>
<th>logEMP$_i$</th>
<th>SGROW$_{i,2}$</th>
<th>AD$_i$/SALE$_i$</th>
<th>RD$_i$/SALE$_i$</th>
<th>DOPE$_{i,2}$</th>
<th>DSDOPE$_i$</th>
<th>Others</th>
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*CR and CE stands for control-rights and competitive-effect argument, respectively.

** For each variable, the above is the coefficients normalized by the standard deviation of $e_{ij}$.

The below is the asymptotic T-ratio.

*** is the squared correlation between observe and expected value.
TABLE 4.6.2: Tobit Estimation Results: Control Rights Model
(Direct and Indirect Investments: \( B_{ij} \))

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<tr>
<td>( SGRPDUM_{ij} )</td>
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<td>0.217</td>
<td>0.241</td>
<td>+ (CR)</td>
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<tr>
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<tr>
<td>( \log \text{AGE}_{j} )</td>
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<td>-0.034</td>
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<td>0.005</td>
<td>0 (CR)</td>
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<td>( \text{RD}<em>{j}/\text{SALE}</em>{j} )</td>
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<td>( \text{DOPE}_{j,i} )</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.001</td>
<td>-0.000</td>
<td>-0.001</td>
<td>0 (CR)</td>
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<td>0.000</td>
<td>0.000</td>
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(continues to the next page)
TABLE 4.6.2: Tobit Estimation Results: Control Rights Model (continued)
(Direct and Indirect Investments: $B_{ij}$)

<table>
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<tr>
<th>Investing Firm (i)</th>
<th>logAGE_{ij}</th>
<th>-0.004</th>
<th>0.069</th>
<th>0.050</th>
<th>0.032</th>
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<td>0.191</td>
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<td>17.74</td>
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<td>0.163</td>
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<td>-21.43</td>
<td>-17.65</td>
<td>-18.81</td>
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<td>-21.59</td>
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<td>RDi/SALE_{ij}</td>
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<td>-0.010</td>
<td>-0.023</td>
<td>-0.021</td>
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<td>-5.810</td>
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<td>-22.32</td>
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<td>DSDOPE_{ij}</td>
<td>-0.016</td>
<td>-0.110</td>
<td>-0.052</td>
<td>-0.064</td>
<td>-0.060</td>
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</table>

| Others             |            |        |       |       |       |
| CONSTANT           | -2.682      | -2.557 | -2.547 | -2.501 |       |
|                    | -13.71      | -13.11 | -12.28 | -11.97 |       |
| Y82                | -2.496      |        |        |        |       |
|                    | -25.48      |        |        |        |       |
| Y84                | -2.499      |        |        |        |       |
|                    | -25.21      |        |        |        |       |
| Y86                | -2.495      |        |        |        |       |
|                    | -24.94      |        |        |        |       |
| Y88                | -2.529      |        |        |        |       |
|                    | -24.85      |        |        |        |       |

| Standard Error     | 0.0121      | 0.0119 | 0.0114 | 0.0111 | 0.0116 |
| Loglikelihood      | 44778       | 45558 | 47231  | 47742  | 185084 |
| Sq'd Corr.***      | 0.0189      | 0.0200 | 0.0184 | 0.0145 | 0.0177 |
| Frac. of non-limit obs. | 0.6885 | 0.6949 | 0.7079 | 0.7079 | 0.6998 |

*CR and CE stands for control-rights and competitive-effect argument, respectively.
** For each variable, the above is the coefficients normalized by the standard deviation of $e_{ij}$.
*** The below is the asymptotic T-ratio.
**** is the squared correlation between observe and expected value.
TABLE 4.6.3: Tobit Estimation Results: Portfolio Choice Model  
(Direct Investments: $PF_{ij}$)

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<th>YEAR</th>
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<th>1984</th>
<th>1986</th>
<th>1988</th>
<th>POOL (rejected)</th>
<th>SICDUM$_i$</th>
<th>SGRPDUM$_j$</th>
<th>DCOVOPE$_{ij}$</th>
<th>$A_{ij-2}$</th>
<th>Invested Firm (j)</th>
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<td></td>
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<td>1.587 1.753 1.779 1.752 1.695</td>
<td>0.011 0.007 -0.010 0.007 0.008</td>
<td>6.870 7.334 7.764 7.211 7.489</td>
<td>logAGE$_j$ -0.126 -0.100 -0.100 -0.103 -0.133</td>
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<td>1.765 1.604 1.990 1.608 3.012</td>
<td>1.501 0.677 -0.968 0.966 2.151</td>
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<td>10.01 10.15 10.58 9.472 20.77</td>
<td>logKL$_j$ 0.066 0.160 0.169 0.150 0.128</td>
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<td>2.579 6.419 6.524 5.567 10.38</td>
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<td></td>
<td>logEMP$_j$ 0.015 0.069 0.046 0.057 0.041</td>
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<td>SGRW$_{ij}$ 0.243 -0.104 1.308 -0.254 0.113</td>
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<td>AD$_j$/SALE$_j$ -14.18 -8.819 -9.319 -5.664 -10.02</td>
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<td>RD$_j$/SALE$_j$ -7.841 -2.305 -1.662 -0.810 -1.852</td>
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<td>DOPE$_{ij}$ -0.005 -0.020 -0.023 -0.013 -0.017</td>
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<td>DSDOPE$_j$ -0.045 -0.081 -0.042 -0.076 -0.057</td>
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TABLE 4.6.3: Tobit Estimation Results: Portfolio Choice Model (continued)
(Direct Investments: PF_{ij})

<table>
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<tr>
<th>Investing Firm (i)</th>
<th>logAGE_{ij}</th>
<th>logKL_{ij}</th>
<th>logEMP_{ij}</th>
<th>SGROW_{ij}</th>
<th>AD_{ij}/SALE_{ij}</th>
<th>RD_{ij}/SALE_{ij}</th>
<th>DOPE_{ij}</th>
<th>DSDOPE_{ij}</th>
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<td>-19.97</td>
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</table>

Standard Error    | 0.0493      | 0.0449     | 0.0416     | 0.0448     | 0.0461 | 0.0449 | 0.0416 | 0.0448 | 0.0461 |
Loglikelihood      | -34.40      | 216.02     | 307.05     | 126.84     | 519.75 | 216.02 | 307.05 | 126.84 | 519.75 |
Sq'd Corr.*        | 0.0254      | 0.0295     | 0.0385     | 0.0279     | 0.0297 | 0.0254 | 0.0295 | 0.0385 | 0.0279 |
Frac. of non-limit obs. | 0.0396 | 0.0432 | 0.0429 | 0.0389 | 0.0411 |

* CE and RS stands for, respectively, competitive-effect, and risk-sharing argument.
** For each variable, the above is the coefficients normalized by the standard deviation of $e_{ij}$.
The below is the asymptotic T-ratio.
*** is the squared correlation between observe and expected value.
### TABLE 4.6.4: Tobit Estimation Results: Portfolio Choice Model
(Direct and Indirect Investments: IPF<sub>ij</sub>)

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<td>SGRPDUM&lt;sub&gt;ij&lt;/sub&gt;</td>
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<td>0.245</td>
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<td>0.243</td>
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<td>0.012</td>
<td>0.057</td>
<td>+ (CE)</td>
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TABLE 4.6.4: Tobit Estimation Results: Portfolio Choice Model (continued)
(Direct and Indirect Investments: IPF\textsubscript{ij})

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<th>Investing Firm (i)</th>
<th>logAGE\textsubscript{i}</th>
<th>logKL\textsubscript{i}</th>
<th>logEMP\textsubscript{i}</th>
<th>SGROW\textsubscript{i,2}</th>
<th>AD\textsubscript{i}/SALE\textsubscript{i}</th>
<th>RD\textsubscript{i}/SALE\textsubscript{i}</th>
<th>DOPE\textsubscript{i,2}</th>
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Others

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Standard Error

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Loglikelihood

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Sq'd Corr.***

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Frac. of non-limit obs.

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* CE and RS stands for, respectively, competitive-effect, and risk-sharing argument.

** For each variable, the above is the coefficients normalized by the standard deviation of \( y \).

The below is the asymptotic T-ratio.

*** is the squared correlation between observe and expected value.
Chapter 5
Conclusion

This thesis focuses on corporate shareholding issues surrounding Japanese companies. After the so-called bubble economy, Japan's economy has been undergoing tremendous changes. As mentioned in the Introduction, banks started to sell some of other companies' shares they owned. In order to finance business losses, many companies in other industries also had to liquidate the shares they owned. These are the factors which reduce the amount of corporate shareholding in Japan. On the other hand, some companies have issued new stocks in order to increase their equity position, and most of the stocks are allocated to affiliated or non-affiliated financial institutions. As a part of a restructuring process, some companies started creating joint companies. With a revision of the Anti-Monopoly Act in 1997, the ban on shareholding companies was lifted. These factors contribute to an increase of corporate shareholding. The net effect of these economic changes on the corporate shareholding structure is yet to be studied.

Along with these changes, corporate shareholding across groups appears to be increasing in Japan. Furthermore, corporate shareholding is becoming more and more international. For example, Goodyear Tire and Rubber and Sumitomo Rubber Industry (known as Dunlop) agreed to have Goodyear hold 10% of Sumitomo's shares, while Sumitomo also invests the same amount value in Goodyear (Asahi Shinbun, February 3, 1999). Their combined share in the world market will be the largest at 20%. Bridgestone and Michelin become the second and the third, respectively, in terms of the world share.
Motors announced the issue of new shares which are allocated to Renault. As a result, Renault will have 36.75% ownership interests in Nissan (Asahi Shinbun, March 16, 1999). These kinds of events imply that any analysis on corporate shareholding should not be restricted to companies within the same group. In this sense, our use of a large shareholding matrix which includes investment relations across groups is a move in the right direction.

The empirical analysis in chapter 4 presented supporting evidence for the competitive-effect argument. The examples given above are also clear cases which support this argument. Governmental anti-trust agencies can monitor corporate shareholding between domestic companies in the same industry. Their authorities are, however, limited against international corporate shareholding. In the Nissan and Renault case, the announcement was only additional to the already complex ownership structure in the automobile industry. Some companies are partially integrated by means of corporate shareholding: Nissan owns 4.2% of Fuji Heavy Industry (known as Subaru); Ford owns 33.4% of Mazda; Toyota owns 51.2% of Daihatsu; and General Motors owns 37.5% of Isuzu. Some others are directly integrated: Chrysler and Daimler-Benz merged in 1998; and Ford purchased Volvo’s passenger vehicle division in 1999. It will be interesting to study how market competition is altered with this structural change.

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80 Nikkei Kaisha Joho (Spring 1999).

81 It is not necessarily straightforward to find out a prediction because there are usually many factors involved in this kind of, partial and/or direct, integrations. Closures of some factories and shares of distribution channels are common factors, which change the cost functions of the integrating firms. Furthermore, products are, generally, not perfect substitutes.
As Fedenia, Hodder, and Triantis (1994) point out, corporate shareholding introduces various potential estimation difficulties. For example, it distorts standard market return and risk measurement when using observed returns and market capitalization in an economy. Japan is not the only country which encounters this problem. Companies in many countries, especially in Europe, hold a substantial fraction of shares in other companies (Nyberg, 1994; Fedenia, et al., 1994). Purchasing a Renault share means purchasing some ownership interests in Nissan, Fuji Heavy Industry's and many other companies. Therefore, investors must know shareholding structures of all these companies in order to correctly estimate the risk involved in the Renault's share. Such information is, however, not currently available, at least in an accessible manner. As people start recognizing these possible problems, the demand for disclosure of shareholding structure information will be stronger.

Although our empirical study does not find enough evidence to support the risk-sharing argument, there are a few reasons to believe that the risk sharing argument is yet to become important. As discussed in chapter 4’s conclusion, the lack of evidence may be a consequence of the fact that, without full information on corporate shareholding structure, managers’ investment decisions are also distorted. Once full shareholding information becomes available, managers should be able to correctly estimate the risks involved in each share and, as a result, more evidences to support the risk-sharing argument may arise.

Stock options, as a part of managerial rewards, were illegal until 1997 in Japan. After the legalization of stock option in 1997, many companies are gradually introducing the system in Japan (Asahi Shinbun, June 22, 1998). This is the second reason to believe the
importance of the risk-sharing argument. Although Kaplan (1994) already suggested the existence of performance-based payment schemes in Japan during 1980s, the introduction of stock option should reinforce the connection between managerial rewards and a company's performance, and hence the basis for the risk-sharing argument.

The control-rights argument is clearly supported by our data. However, in the course of current economic changes, the future of this argument is uncertain. Disintegration of groups seems to be an inevitable trend for many Japanese corporate groups. The trend is stronger especially in Dai-Ichi Kangin, Fuji (Yasuda or Fuyo), and Sanwa groups (e.g. Kigyo Keiretsu Soran, Toyo Keizai Shipo Sha, 1994, p28).  

As mentioned above, some companies are selling the shares they owned. Intergroup, as well as international, investments are becoming common. According to a prediction of the arguments, as groups started to disintegrate, more take-overs should occur. We need to continuously watch if this happens.

\[\text{82 On August 20, 1999, Dai-Ichi Kangin, Fuji, and the Industrial Bank of Japan had announced their future integration (Asahi Shinbun, August 21, 1999). According to their plan, they will create a holding company at the end September, 2000, and integrate their business by Spring 2002.} \]

The impact of this integration on their keiretsu group companies has yet to be studied.
BIBLIOGRAPHY


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