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5 Characteristics of Japanese Industrial Groups and Their Potential Impact on U.S.-Japanese Trade

K. C. Fung

5.1 Introduction

Given the economic importance of the two nations, the economic relationship between the United States and Japan is perhaps the most significant bilateral economic linkage in the world economy today. Unfortunately, the dominant feature of the relationship in recent years has been disputes about trade. The core of the problem is undoubtedly the persistent trade imbalance between the two nations.

The magnitude of the trade imbalance remains large. The United States ran a merchandise trade deficit of over $118.5 billion in 1988, and $109 billion in 1989. Japan had a global trade surplus of $78.3 billion in 1988 and $65 billion in 1989. On a bilateral level, the trade imbalance between the United States and Japan was $51.8 billion in 1988 and $49 billions in 1989.

U.S.-Japanese bilateral trade disputes have several important facets. The first element is the set of overall macroeconomic factors. Many economists have pointed out that the large U.S. government budget deficit, the low U.S. savings rate, and the high value of the dollar in the early 1980s provide the fundamental environment that sustains the trade deficit. In 1985, the high U.S. exchange rate began to reverse itself. But the rise of the Japanese yen failed to affect the U.S. trade balance significantly.[1]

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1. This has created some new puzzles and has stimulated further research on the relationship between changes in the exchange rates and the trade balance. For important studies, see Krugman and Baldwin (1987) and Dixit (1989).

A second important dimension of the U.S.-Japan trade problem centers on alleged policies carried out by the Japanese government to promote Japan's industries. Johnson (1982) and Scott and Lodge (1985) highlight how Japanese trade and industrial policies have contributed to the success of Japan's exports in the world market. However, Krugman (1984) and Saxonhouse (1983a, 1983b) dispute the effectiveness of such industrial targeting. The alleged government policies include subsidies, tax incentives for investment, subsidized loans, government-sponsored cooperative research and development projects, and protection of infant industries.

The third important aspect of the U.S.-Japan trade problem is the structure of industry in Japan and how its unique organization can affect the trade balance, the so-called structural impediments to trade. The areas of scrutiny involve banking-industry relationships, the manufacturer-supplier relationships, the alliances between various business concerns, and the behavior of the distributors. It is often alleged that the cooperative Japanese *keiretsu* (industrial groups) and the complex and inefficient Japanese distribution network constitute invisible barriers to trade. For example, it has been pointed out that firms belonging to the same group often purchase from one another rather than from foreign sources.[2] Foreign producers also complain that they cannot find appropriate distributors to carry their products in Japan.

As long as the U.S.-Japan trade imbalances continue to be significant, these elements will be widely discussed. Recent events have focused attention on the last facet—the structure of Japanese industries. In May 1989, the U.S. government, invoking a provision of the 1988 Omnibus Trade Act (the Super 301) singled out Japan and two other countries for maintaining a pattern of unfair trade barriers that are harmful to U.S. exports. Negotiations are being conducted to improve U.S. trade balance with Japan. In April 1990, the United States and Japan reached accords to expand sales of American wood products, satellites, and supercomputers to Japanese markets. Since these agreements, no new formal trade complaints have been launched against Japan. Nevertheless, broad-scale talks are continuing that are aimed at modifying the economic structures of Japan, talks meant to remove Japan's "major structural barriers to imports." One such major area of discussion is the phenomenon and conduct of Japanese industrial groupings.

In this paper I present an analysis of the relationship between the Japanese *keiretsu* and U.S.-Japanese industry trade balances. Although there is a consensus that the aggregate trade deficit is best explained by macroeconomic factors, it is often alleged that the Japanese *keiretsu* interfere with trade at an industry level because of their extensive intragroup dealings. In the next section, I present some summary statistics and institutional background concerning Japan's corporate groups. In section 5.4 I construct an oligopolistic model of how Japan's *keiretsu* can affect both U.S. and Japanese exports. Based on

2. For an interesting case study, see Kreinin (1988).

this model, I conduct some simple empirical tests of whether Japan's *keiretsu* is a factor in U.S.-Japan trade. Some concluding remarks are given in the last section.

5.2 The Japanese *Keiretsu*

5.2.1 Classification of Industrial Groups

A Japanese industrial group consists of a group of firms that are related economically. Group members are interconnected in a variety of ways, including cross-holding of shares; intragroup financing by nucleus banks; existence of general trading firms (*sogo shosha*) as trading arms and as organizers of various projects; formation of clubs (*shacho-kai*) where presidents of member companies meet and exchange information; mutual appointment of directors, officers and other key personnel; and joint investment by group members in new industries.[3]

There are three types of industrial groups.[4] One is the descendant of the prewar *zaibatsu* (giant business combines), a second is the bank group (consisting of firms that center on major banks), while the third group is composed of one or more large independent industrial manufacturers, their subsidiaries, affiliates, and suppliers. Unlike the first two groups, which deal with a wide range of products, this last group tends to concentrate in particular industries.

In this paper we will focus on the leading sixteen industrial groups.[5] Three of these groups—Mitsubishi, Matsui, and Sumitomo—are of *zaibatsu* origin. The prewar *zaibatsu* were groups of companies partly owned and controlled by a family holding company. Each family *zaibatsu* included a bank, a trust company, an insurance company, and a trading company to buy and sell goods on behalf of the member firms. Until World War II, the Japanese economy was heavily influenced by ten major *zaibatsu,* which accounted for approximately 35 percent of the aggregate paid-up capital of all Japanese companies in 1946. After the war, all the major *zaibatsu* were dissolved. However, gradually some splinter companies reestablished their former associations, exchanging shares with other firms bearing the common *zaibatsu* name and doing business with one another through the trading companies. They exchanged directors and set up clubs where company presidents could meet. In this way there was a revival between 1952 and 1965 of the industrial groups with prewar connections. Mitsubishi Shôji (currently Mitsubishi Corporation), which was split into 140 companies, was reestablished in 1954. Through a merger of three split companies Mitsubishi Heavy Industries was revived in 1964. It should

3. Not all groups engage in all these joint activities.

4. In some classifications, the last type (prime manufacturer-supplier) is subsumed under the previous two.

5. Again, under other classification schemes, the focus is on six groups rather than sixteen. The six are Mitsubishi, Mitsui, Sumitomo, Fuyo, DKB, and Sanwa.

be noted, however, that the postwar *zaibatsu* groups are much more loosely connected than their prewar counterparts, which involved a vertical hierarchy in which the family holding company held majority or near majority shares of all group companies and exercised vertical control. However, holding companies were outlawed in postwar Japan under the antimonopoly law and the shares of companies of a *zaibatsu* group were distributed among the member companies.

The second type of industrial group centers on a principal bank. Examples of this type include Fuyo, DKB, Sanwa, Takai, and IBJ. For most of Japan's modern history (until perhaps the late 1970s), capital and foreign exchange have been in relatively short supply. The formation of these financial keiretsu during the 1950s and 1960s probably came in response to the banks' ability to finance firm operation and investment. The various members, though typically all indebted to the group bank, need not be particularly closely associated with one another. Transactions among group companies are never exclusive, and affiliated firms often engage in transactions with outsiders. As table 5.1 shows, in 1985 bank financing of affiliated companies ranged from 12.1 percent to 27.7 percent of all financing. The remaining finance came from sources that were not members of the same group. The bank groups are expected to be less and less cohesive over time, since other sources of financing, including the domestic stock market, issuance of bonds, and borrowing from foreign banks, are becoming relatively more important.[6]

The last type of industrial group is formed around a prime manufacturing company (*motouke*). This type includes, among others, the Toyota and Nissan groups in the auto industry, the Nippon Steel group in the iron and steel industry, the Hitachi, Matsushita, and Toshiba-IHI groups in the electrical and electronic industry. It is made up of a cluster of subsidiaries, affiliates, supplies, and subcontractors, with the major manufacturer at the apex.

There will be dozens and even hundreds of smaller suppliers and sales companies around the major company and its important affiliates. One or more of the group companies or affiliates will hold shares of the smaller members. Member companies will be engaged in a range of interrelated activities. This type of group resembles a vertical hierarchy with large and stable leaders at the top and firms of decreasing size and skill level beneath them. Besides shareholding, the linkages are maintained by extension of credit and subcontracting. These manufacturing groups are formed by a combination of two processes. One is the consolidation into groups of small firms that for various reasons come to depend on large group members for customers, while the second process is the spinning off of specialized divisions from main manufacturers.

As an example of the manufacturer-supplier relationship, according to a

6. Note, however, that many main banks are involved as underwriters in the issuance of bonds abroad.

Table 5.1 **Intragroup Financing**

Six Major Groups	Share of Total Financing
Mitsui	21.2%
Mitsubishi	22.4
Sumitomo	27.7
Sanwa	20.3
Fuyo	18.4
DKB	12.1

Source: Oriental Economist (Kigyu Keiretsu Soran) 1987.

survey conducted in 1977 (Japanese Agency for Small and Medium-sized Enterprises 1977), an unnamed Japanese auto manufacturer (believed to be Toyota) had direct relations with 122 first-tier suppliers and indirect relationships with 5,437 second-tier suppliers and 41,703 third-tier subcontractors. Between 1973 and 1984 only 3 firms exited from the association of first-tier Toyota suppliers while 21 firms entered. This example shows that typically the main manufacturer is at the top of a pyramid of a large number of stratified smaller firms.

Unlike the bank *keiretsu*, the manufacturer-subcontractor grouping seems to be increasing in importance. Large firms rely more and more on subcontracting to perform a variety of activities. According to the survey just mentioned, the proportion of subcontractors in the manufacturing sector has increased from 53.1 percent in 1966 to 65.5 percent in 1981. For the electric and electronics industry, the figure is even higher. In 1981, 85.3 percent of the small and medium-sized firms in that industry were subcontractors to larger firms.

5.2.2 The Importance of Industrial Groups

In this section, we provide some summary statistics concerning the importance of the industrial groups in Japan. Among the sixteen groups that this paper highlights, Mitsubishi, Mitsui, Sumitomo, Fuyo, DKB, and Sanwa are the most important and are sometimes categorized separately in the following tables. The number of companies, number of employees, annual sales, and net profit as a percentage of all nonfinancial Japanese companies for each group in 1980 are given in table 5.2. In 1980, the sixteen industrial groups accounted for 920 companies, 2.8 million employees, 194,401 billion yen in sales and their net profits were 2,176 billion yen.

As a percentage of all nonfinancial Japanese companies, about 0.06 percent of Japanese firms and 9.9 percent of Japanese employees are members of industrial groups. In terms of sales and net profits, the sixteen groups accounted for 23.7 percent and 23.6 percent, respectively, of the totals for nonfinancial companies.

How do these Japanese groups compare with corporations abroad? In terms

Table 5.2 Importance of Industrial Groups

Industrial Group	No. of Companies	Sales as Share of Total Sales of Nonfinancial Companies	Employment as Share of Total Employment of Nonfinancial Companies	Profits as Share of Total Profits of Nonfinancial Companies
Six major groups:				
Mitsubishi	139	3.9	1.4 (0.69)	3.2 (3.07)
Mitsui	108	2.9	0.7 (0.69)	1.5 (5.07)
Sumitomo	117	3.0	1.2 (0.38)	3.4 (1.42)
Fuyo	110	2.7	0.9 (0.96)	2.5 (3.59)
DKB	64	2.9	0.8 (1.92)	1.1 (3.03)
Sanwa	84	2.4	0.8 (1.16)	1.1 (3.03)
Other ten industrial Groups:				
Tokai	25	0.6	0.1	0.3
IBJ	23	0.3	0.1	0.2
Nippon Steel	40	0.9	0.5	1.3
Hitachi	38	0.6	0.5	1.4
Nissan	27	0.7	0.5	1.3
Toyota	38	1.4	0.7	2.8
Matsushita	25	0.7	0.4	1.8
Toshiba-IHI	40	0.4	0.5	0.7
Tokyu	19	0.2	0.2	0.2
Seibu	22	0.2	0.2	0.1
Total	919	23.7	9.9	23.6

Note: The percentages in parentheses are for the year 1985. However, they do not come from the same source as the data for 1980.

Source: Dodwell Marketing Consultants *Industrial Groupings in Japan*, rev. 1982–83, *Oriental Economist (Kigyo Keiretsu Soran)*, 1987; *Japan Economic Journal (Nihon Keizai Shimbun)*, 1 January 1980.

of annual sales, each of the six leading industrial groups is larger than most major multinationals. The Mitsubishi Group, the largest industrial group in Japan, is about twice as large as Royal Dutch/Shell. The DKB group, the Mitsui group and the Fuyo group are each almost equivalent to Exxon, the largest company in the world in 1980. In table 5.3, we compare the sales of six major Japanese groups with those of other leading multinationals.

5.2.3 Linkages Between Group Members

One important linkage among affiliated companies is through share cross-holding. In table 5.4 I present some statistics of the extent of intragroup cross shareholding by the major groups. The cross-holding ratio is defined as the total value of members' shares held by all group members as a percentage of the total value of all paid-up capital of the entire group companies listed on the stock exchange.

Another important linkage among group members is their relationships

Table 5.3 **Comparison of Six Major Japanese Groups with Multinationals**

	Country	1980 sales (US $ million)	Index (Mitsubishi Group = 100)
Mitsubishi Group	Japan	144,900	100
Sumitomo	Japan	111,300	77
DKB	Japan	107,800	74
Mitsui	Japan	106,600	74
Fuyo	Japan	100,800	70
Sanwa	Japan	90,400	62
Exxon	USA	103,100	71
Royal Dutch/Shell	Neth/UK	77,100	53
GM	USA	57,700	40
Ford Motor	USA	37,100	26
IBM	USA	26,200	18
Fiat	Italy	25,200	17
GE	USA	25,000	17
US Steel	USA	12,500	9
Procter & Gamble	USA	10,800	7

Source: Dodwell Marketing Consultants, *Industrial Groupings in Japan*, rev. ed. (1982–83).

Table 5.4 **Crossholding of Shares in Six Major Groups**

	1971	1974	1980	1985
Mitsubishi	27.6	30.6	20.7	25.2
Mitsui	14.3	17.4	17.7	17.9
Sumitomo	24.7	27.9	21.4	25.0
Fuyo	20.5	17.4	16.4	15.8
DKB	18.6	21.2	14.1	13.3
Sanwa	14.1	16.0	13.6	16.8

Sources: Japanese Fair Trade Commission, *Second Report on the Operations of the General Trading Companies*, 1975; Dodwell Marketing Consultants, *Industrial Groupings in Japan* (1982–83). rev. ed. (1990), *Oriental Economist (Kigyo Keiretsu Soran), 1987.*

with general trading companies. General trading companies (*Sogo shosha*) are important trading arms of seven major industrial groups: Mitsubishi, Mitsui, Sumitomo, Fuyo, DKB, Sanwa, and Tokai. The activities of these companies are quite diverse. They trade in more than twenty thousand different commodities on a commission basis, invest in domestic and overseas markets, and extend credit to affiliated companies and customers. They also coordinate the setting up of joint ventures overseas. Their functions include marketing/distribution, financing, project organizing, and information gathering. The nine leading general trading companies and their affiliations are listed in table 5.5.

The existence of group-affiliated general trading companies is important in our context because of their significant involvement in international trade. In 1980, the value of exports handled by the nine Sogo shosha amounted to $66

Table 5.5 **Affiliations of Leading General Trading Companies**

General Trading Companies	Industrial Group
Mitsubishi Corp.	Mitsubishi
Mitsui & Co.	Mitsui
Sumitomo Corp.	Sumitomo
Maruberi Corp.	Fuyo
C. Itoh & Co.	DKB[a]
Nissho-Iwai	Sanwa
Toyo Menka	Tokai[a]
Karematsu-Gosho	DKB
Nichimen Corp.	Sanwa

Sources: Dodwell Marketing Consultants, *Industrial Groupings in Japan,* rev. ed (1982–83). M. Y. Yoshino and T. Lifson, *The Invisible Link: Japan's Sogo Shosha and the Organization of Trade* (Cambridge, Mass.: MIT Press, 1988).

[a]These are primary affiliations. C. Itoh & Co. is also related to Sumitomo and Toyo Menka is related also to Mitsui.

billion and the value of imports was $80 billion. These amounts accounted for roughly half of Japan's export and import activities (table 5.6).

The major exports of the general trading companies are machinery and iron and steel. Their main imports are fuels, foodstuffs, and ferrous and nonferrous metals. The general trading companies are also active in extending financial assistance in the form of business credits, loans, and payment guarantees to their affiliated group members.

These statistics indicate that the Japanese *keiretsu* constitute a fairly significant portion of the Japanese economy. The extent of interconnectedness varies from group to group, as do the forms of linkages. Group affiliations, however, almost never translate into exclusive dealings. For example, group companies borrow from nonmember banks and affiliated suppliers supply to nonmember consuming corporations. With the liberalization of the Japanese economy, it is expected that Japanese groups will diminish in importance. Nonetheless, existing group behavior may still have an impact on U.S.-Japanese trade.

5.2.4 Comparison of Japanese Groups with U.S. Institutions

When we compare the features of Japanese groups with U.S. industry characteristics and institutions, the picture becomes more complex and there are both differences and similarities.[7]

The existence of long-term manufacturer-supplier relationships is not unique to Japan. For example, Cole and Yakushiji (1984) estimated that in 1983 General Motors purchased 40 percent of its parts, components, and materials from its suppliers; for Ford and Chrysler, the respective figures were 50

7. Intercorporate ties are also found in West Germany, with banks and some holding companies playing a key role. See Scherer and Ross (1990, chap. 3).

Table 5.6 Trade of Nine General Trading Companies

	Exports		Imports	
	Nine General Trading Companies (Billion Yen)	Share of Total Exports	Nine General Trading Companies (Billion Yen)	Share of Total Imports
1977	10,860	49.8%	9,204	49.7%
1978	9,604	48.1	8,730	51.2
1979	11,798	48.2	15,055	54.5
1980	14,640	48.2	17,624	56.0

Note: Exports are in FOB value, while imports are in CIF.
Source: Dodwell Marketing Consultants, *Industrial Groupings in Japan*, rev. ed. (1982–83).

and 60 percent. However, auto firms in Japan do seem to procure a relatively greater portion of the parts from their subcontractors, relying less on in-house production. On average, it is estimated that 55 percent of a U.S. car's purchased value is provided by external suppliers. For a Japanese car, estimate that 75 percent of its value is supplied by outside subcontractors. (Cole and Yakushiji 1984)

In terms of bank groups there are some legal differences. U.S. banks are not permitted to hold stock of other nonfinancial companies on their own account.[8] In contrast, the antimonopoly law in Japan allows banks to hold up to 5 percent of a particular nonfinancial corporation.[9] As a stockholder of the company, the main bank often sends its representative to the company's board of directors. The main bank is periodically briefed about the company's general business and also often functions as financial rescuer of last resort. If a member company is on the verge of bankruptcy, it is often the main bank that organizes the rescue package to try to save the company. For instance, when Tōyō Kōgyō, the maker of Mazda automobiles, was on the brink of bankruptcy in 1979–80, its main bank, Sumitomo Bank, coordinated the rescue activities. The entire Sumitomo group switched its auto purchases to Mazda. It is estimated that the group members purchased eighteen thousand vehicles over six years (Pascale and Rohlen 1983). Overall, it seems that main banks in Japan play a more significant role in the activities of corporations than do U.S. banks.

5.3 An Oligopolistic Model of Japanese Keiretsu

The U.S. Trade Representative (1985) (USTR) cites three aspects of the oligopolistic behavior that affects U.S.-Japanese trade. First, the government

8. Trust departments of banks do manage pension and trust funds and invest in the stock market. At least legally, the funds are managed on behalf of owners of pension and trust funds, not of the banks.

9. The limit until 1987 was 10 percent of the total stock of any single company.

allows "recession cartels" designed to protect declining industries. As an example, the USTR cites the paper industry, where cartels have existed to cope with the problem of high energy and raw material costs. Second, it is alleged that the Japanese distribution system is a close-knit network of financial and input-output arrangements linking distributors, customers, and suppliers in such a way that nonmembers are excluded. Third, the USTR argues that the *keiretsu* conglomerates of manufacturers, banks and general trading companies, by supporting each others' activities, effectively preclude opportunities for non-*keiretsu* firms.[10]

One prominent industry where U.S. producers charge that oligopoly in Japan restricts imports is semiconductors. In June 1985 the U.S. Semiconductor Industry Association petitioned the president to act under section 301 of the Trade Act of 1974, arguing that the Japanese protected semiconductors through reciprocal buying arrangements among the six large electronics firms. It was alleged that Japanese firms buy their semiconductors needs primarily from each other. The Semiconductor Industry Association requested that the Japanese government force its firms to purchase more U.S. chips to offset the discrimination.

Conceptually, there are two views in the literature of the Japanese groups with very different welfare implications. The first approach focuses on their potential exploitation of joint market power, which tends to be welfare reducing. The second views Japanese groups as a mechanism for risk sharing, which tends to be Pareto improving. In this paper, we will concentrate on a *positive* analysis of how the behavior of groups affects U.S. net exports.[11]

I construct a model of international oligopoly to highlight how members of the Japanese groups may affect industry trade balance. The model is meant to set up some hypothesis for my later empirical work. Following the approach of Brander and Krugman (1983), I assume that the international firms compete both at home and abroad.[12] I start with the competition between a Japanese firm J_1 and an American firm A in the Japanese product market. The analysis for the competition in the U.S. market will be exactly symmetrical. The respective Japanese and U.S. profit functions π^{J_1} and π^A are

$$\pi^{J_1} = P^{J_1}(x,y)x - C^{J_1}(x,P_m,w^{J_1}), \tag{1}$$

$$\pi^A = P^A(x,y)y - C^A(y,w^A,t^A). \tag{2}$$

10. This line of argument is really pointing to barriers to entry, whether the potential entrants are foreign or domestic.

11. Note, however, that it is possible for the groups (either due to joint monopoly or risk sharing) to improve the welfare of group members, while reducing the welfare of the Japanese consumers and/or nonmembers, including foreign producers.

12. Brander and Krugman's (1983) original framework focuses on homogeneous products. However, the approach will remain valid if the products are differentiated; see Fung (1991). Furthermore, since the outputs by the international firms are substitutes, the Cournot-Nash setting adopted here is arguably more appropriate because if the firms can choose price setting versus quantity setting, they will endogenously choose the Cournot-Nash strategies; see Singh and Vives (1984).

P^{J_1} and P^A are the product prices; x is the output produced by the Japanese firm, while y is the output produced by the U.S. firm in the Japanese market. The two products are assumed to be imperfect substitutes. C^{J_1} and C^A are the respective cost functions, with w^{J_1} and w^A the labor costs in each country, P_m the price of some material input produced by another member of the same Japanese group (J_2) to which J_1 belongs, and t^A is the transparent trade barriers that the U.S. firms face in Japan.

The model is characterized as a two-stage game with the timing described as follows: J_2 moves first, naming P_m, taking the impact of P_m on the derived demand for m into account. Taking P_m as given, J_1 then sets x, while firm A simultaneously sets y. The equilibrium is subgame perfect.[13] Profit maximization of the international Cournot-Nash firms yields

$$\pi^{J_1}_x = P^{J_1} + xP^{J_1}_x - C^{J_1}_x = 0, \tag{3}$$

$$\pi^A_y = P^A + yP^A_y - C^A_y = 0, \tag{4}$$

$$\pi^{J_1}_{xx} < 0 \quad \pi^A_{yy} < 0. \tag{5}$$

Given P_m, w^A, w^{J_1}, and t^A, the equilibrium market shares and product prices are implicitly determined by (3) and (4) and the inverse demands. The value of U.S. exports to Japan in this industry is given by the equilibrium value of P^Ay.

Let us now introduce the member of the same Japanese *keiretsu*, J_2, that produces the input m. Being a member of the same group, J_2 will take the interest of the J_1 into account when setting the price P_m. This may be because it holds shares of J_1, has joint investment in projects, or has directors on its board from J_1. To reflect this economic interaction, the profit function of J_2 can be written

$$\pi^{J_2} = (P_m m - km) + g\pi^{J_1} - F^{J_2}, \tag{6}$$

where m is the quantity of the material input produced, k is the marginal cost of producing m, and g is the degree of J_2's group affiliation to J_1. More concretely, g can be interpreted as J_2's extent of shareholding over J_1.[14] Maximization of (6) implies

13. The model assumes that there are barriers to entry to these oligopolistic industries; thus entry by other firms is not considered.

14. We can easily accommodate the phenomenon of intragroup cross shareholding if g is interpreted as the extent of shareholding of J_2 over J_1. Let g^* be the extent of sharing of J_1 over J_2. Then

$$\pi^{J_1} = (1 - g)(P^{J_1}x - C^{J_1}(\cdot)) + g^*(P_m m - km - F^{J_2})$$

and

$$\pi^{J_2} = (1 - g^*)(P_m m - km - F^{J_2}) + g(P^{J_1}_x - C^{J_1}(\cdot)).$$

Under the same two-stage game framework, J_2 moves first to set P_m in the first stage. In the second stage, J_1 sets x, given P_m. The analysis proceeds similarly as in the text and yields similar results.

(7) $$\frac{\delta\pi^{J_2}}{\delta P_m} \equiv \pi^{J_2}_{P_m} = m + P_m \frac{\delta m}{\delta P_m} - k\frac{\delta m}{\delta P_m} + g\frac{\delta\pi^{J_1}}{\delta P_m} = 0,$$

(8) $$\pi^{J_2}_{P_mP_m} < 0.$$

Given an exogenous g, the optimal price P_m that J_2 will charge is implicitly defined in (7). From (1)–(8), the equilibrium output and equilibrium price of the U.S. export can be written

(9) $$y = y(w^{J_1},w^A,t^A,P_m(g)),$$

(10) $$P^A = P^A(x,y),$$

where $x = x(w^{J_1},w^A,t^A,P_m(g))$.

To obtain some hypothesis concerning the signs of U.S. export level and export value with respect to their arguments, totally differentiate (3) and (4) to obtain

(11) $$\frac{\delta x}{\delta w^{J_1}} = \frac{-\pi^{J_1}_{xwJ_1}\pi^{J_2}_{yy}}{\Delta} < 0,$$

(12) $$\frac{\delta y}{\delta w^{J_1}} = \frac{\pi^{J_1}_{xwJ_1}\pi^{J_2}_{yx}}{\Delta} > 0,$$

where $\pi^{J_1}_{xwJ_1} = -\delta l/\delta x < 0$ and $\Delta = \pi^{J_1}_{xx}\pi^{J_2}_{yy} - \pi^{J_1}_{xy}\pi^{J_2}_{yx} > 0$ is the standard stability condition for Cournot firms. Equations (11) and (12) tell us that a rise of the wage rate in Japan will raise U.S. export volume but lower Japanese domestic output. The impact on the value of U.S. exports is

(13) $$\frac{\delta(yP^A)}{\delta w^{J_1}} = yP^A_x \frac{\delta x}{\delta w^{J_1}} + C^A_y \frac{\delta y}{\delta w^{J_1}} > 0$$

Thus a rise of Japanese wage rate will raise the value of U.S. exports.

Similar calculations show that the U.S. export value is negatively related to the wage in the U.S. and the tariff in Japan, that is, $\delta(yP^A)/\delta w^A < 0$, $\delta(yP^A)/\delta t^A < 0$. To obtain the effect of the strength of the group affiliation, totally differentiate (7),

$$\pi^{J_2}_{P_mP_m} dP_m + \pi^{J_2}_{P_mg}dg = 0,$$

(14) $$\frac{dP_m}{dg} = -\frac{\pi^{J_2}_{P_mg}}{\pi^{J_2}_{P_mP_m}} = -\frac{\left[\frac{d\pi^{J_1}}{dP_m}\right]}{\pi^{J_2}_{P_mP_m}},$$

where $d\pi^{J_1}/dP_m = (xP^{J_1}_y)(dy/dP_m) - m < 0$ and $P^{J_1}_y < 0$. Substituting into (14), we obtain $\delta P_m/\delta g < 0$. The impact of g on the value of Japan's import is:

(15) $$\frac{d(yP^A)}{dg} = \left[\frac{d(yP^A)}{dP_m}\right]\left[\frac{dP_m}{dg}\right] < 0$$

where the sign of $(d(yP^A)/dP_m)$ can be obtained in a similar fashion as in (13). A higher degree of Japanese group affiliation will lead to a smaller amount of U.S. exports. The reduced form of our model for U.S. export can be written

(16) $$yP^A = yP^A(w^{J_1}, w^A, t^A, P_m^{J_2}(g))$$

with

$$\frac{\delta(yP^A)}{\delta w^{J_1}} > 0, \quad \frac{\delta(yP^A)}{\delta w^A} < 0, \quad \frac{\delta(yP^A)}{\delta t^A} < 0, \quad \frac{\delta(yP^A)}{\delta g} < 0.$$

Thus the value of U.S. exports to Japan will rise with a higher Japanese wage, a lower U.S. wage rate, lower overt trade barriers in Japan, and lower degree of group affiliation.

For the U.S. market, J_1 exports x_1 and A produces y_1 domestically.[15] Japanese exports are subjected to overt trade barriers t^{J_1}. Group member J_2 supplies quantity of materials m_1 to J_1. Using similar reasoning as before, the analysis of the impact of w^{J_1}, w^A, t^{J_1}, and g on U.S. imports from Japan $x_1P_1^{J_1}$ can be expressed as $\delta(x_1P_1^{J_1})/\delta w^{J_1} < 0$, $\delta(x_1P_1^{J_1})/\delta w^A > 0$, $\delta(x_1P_1^{J_1})/\delta t^{J_1} < 0$, and $\delta(x_1P_1^{J_1})/\delta g > 0$. The last comparative static term shows that group affiliation in our model not only restricts U.S. imports but also promotes exports. The reduced form of U.S. net exports $TB = (yP^A - x_1P_1^{J_1})$ can be written as

(17) $$TB = TB(w^{J_1}, w^A, t^A, t^{J_1}, g),$$

where $\delta TB/\delta w^{J_1} > 0$, $\delta TB/\delta w^A < 0$, $\delta TB/\delta t^A < 0$, $\delta TB/\delta t^{J_1} > 0$, $\delta TB/\delta g < 0$. U.S. net exports depend on the wage rate in the United States and Japan, the overt trade barriers in both countries, and the intensity of Japanese group affiliation. U.S. industry trade balance is higher with a higher Japanese wage rate, a lower U.S. wage rate, lower extent of Japanese overt trade barriers, higher extent of U.S. overt trade barriers, and a lower degree of Japanese group affiliation.

5.4 Econometric Analysis

The basic econometric equation to be estimated is based on equation (17), which identifies the equilibrium level of U.S. net export value as a function of the wage costs in Japan and the United States, the overt trade barriers (tariffs and tariff-equivalent nontariff trade barriers) in Japan and the United States, and the intensity of group affiliation. The model is meant to explain the inter-industry variation of the value of U.S. industry trade balance with Japan. A linear specification of (17) gives

15. Following Brander and Krugman (1983), I have assumed that the profit functions in the United States and Japan are separable.

$$(18) \quad TB_i = \alpha + \beta_1 USW_i + \beta_2 JW_i + \beta_3 USTQ_i + \beta_4 JTQ_i + \beta_5 g_i + \mu,$$

where USW_i and JW_i are the U.S. and Japanese unit labor costs for industry i, $USTQ_i$ and JTQ_i are the level of overt protection through tariffs and nontariff trade barriers in the United States and Japan for industry i, and g_i is the group affiliation intensity for industry i; μ is the disturbance term. Because some values of TB_i are negative, a log-linear specification in this instance is not appropriate. From previous discussions of this model, it is predicted that $\beta_1 < 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 < 0$, and $\beta_5 < 0$. For the purposes of this paper, the main coefficient of interest is β_5.

Like Petri (1990) and Yamawaki and Audretch (1988), my approach departs from the traditional emphasis of factor-intensity approach and focuses on oligopolistic interactions as a determinant of U.S.-Japanese trade. Furthermore, unlike earlier literature on the studies of determinants of trade but in accord with Yamawaki and Audretch (1988) and Petri (1990), I have not confined the explanatory variables to only characteristics of the U.S. industries. Instead, I have explicitly included features of Japanese industries in our equation.

The sources and the method of construction of the variables are given in the appendix. The variable that is most constraining on our choice of industries is the group intensity variable g_i. Due to the availability of g_i, we confine ourselves to the year 1980 for twenty-two industries (compared with twenty-four industries in Yamawaki and Audretch and forty-nine in Petri).[16]

The dependent variable TB_i is the trade balance between the United States and Japan for industry i in 1980. JTQ_i and $USTQ_i$ are the sum of tariffs and tariff-equivalent nontariff barriers for Japan and the United States, respectively, for industry i in 1980. $JULC_i$ and $USULC_i$ represent unit labor costs in Japan and the United States. As a proxy, I follow the literature (e.g., Yamawaki and Audretch 1988) and use the nominal wage divided by value added per worker in each industry. It thus approximates labor costs adjusted by a measure of labor productivity.[17]

Finally, the group intensity variable is given by two proxies. The first is the sales of group-affiliated companies as a percentage of total industry sale (gS_i) and the second is the share of employment accounted for by group-affiliated corporations in industry i (gE_i).[18]

Table 5.7 presents the estimation result of the regression equations based on (17). Equation (A) uses the group affiliation variable gS (percentage of total industry sales); equation (A_1) employs the group affiliation variable gE (percentage of total employment). All equations are estimated by the ordinary least squares method.

Table 5.7 indicates that the extent of group affiliations, either measured by

16. The industries, two-digit and three-digit SIC industries, are listed in the Appendix.

Table 5.7 Regressions with U.S. Trade Balance

	Eq. (A)	Eq. (A_1)
Constant	9.5001***	9.6204***
	(2.9746)	(3.0283)
Group affiliation	−12.605***	−12.117***
	(−3.9531)	(−4.0177)
U.S. tariffs and quotas	−5.6687	−6.2251
	(−0.27620)	(−0.30598)
Japanese tariffs and quotas	0.26146	2.6678
	(0.31848×10^{-1})	(0.33025)
Japanese unit labor cost	−16.804*	−19.071*
	(−1.7467)	(−1.9391)
U.S. unit labor cost	1.3657	1.1635
	(0.13709)	(0.11799)
R^2	0.540497	0.547856
$\bar{R}^2$	0.396902	0.406562
F	3.76404	3.87740

Note: t-statistics in parentheses.
*Significant at 10 percent level (two-tailed test).
***Significant at 1 percent level (two-tailed test).

sales or by employment, has the expected negative sign and is significant at the 1 percent level. The only other variable (other than the constant) that is significant (at the 10 percent level) is the Japanese unit labor cost. But contrary to our theory, Japan's unit labor costs are negatively related to U.S. net exports to Japan. There can be several potential explanations for this unexpected sign. In studying characteristics of group-affiliated firms, Nakatani (1984) found Japanese group-affiliated firms pay higher wages than independent firms. Thus both group affiliation and high wages in Japan may worsen U.S. net exports to Japan. Alternately, both Yamawaki and Audretch (1988) and Petri (1990) found that Japan's technology intensity and expenditure on research and development are positively related to Japan's exports. It may be that Japan's high wages partly serve as proxies for these variables, and in industries where Japan's wages are high (due to more scientists and engineers), the U.S. trade balance is worse. Other variables such as the overt trade barriers and the U.S. unit labor cost have signs contrary to our model, but they are all insignificant. Using the coefficients of the group affiliation variables in equations (A) and (A_1), we can further estimate the percentage decline in U.S. industry net exports due to the Japanese keiretsu. The results are presented in the Appendix, which shows that the industries most affected by Japanese groups are leather and leather products, nonferrous metal and products, shipbuilding, and rubber products. The industries that are typically of the most concern to the U.S. are affected only a relatively small amount. For example, for food and kindred products, the drop in trade balance due to Japanese groups is only 0.301 percent. For such other industries as chemical and allied products, general machinery, and scientific and optical instruments, the impacts are 3.10 percent, 1.19 percent, and 1.17 percent, respectively.

5.5 Further Empirical Analysis

In the last section, I obtained some evidence that Japanese group strength is negatively correlated with U.S. net exports. To test the sensitivity of the results, I conduct several sets of variations of the basic empirical tests. First, I use instrumental variable estimation to correct for biases that may arise if the Japanese group-strength variables are endogenous. I will also estimate the basic equations with the addition of potentially relevant variables, such as transport costs, advertising intensity (as a proxy for product differentiation), and the number of firms in each industry. Lastly I run modified regressions with U.S. gross exports to Japan and the world's trade balance with Japan as the dependent variables.

5.5.1 Instrumental Variable Estimation

In the basic estimation equation I provide estimates of the effects of the Japanese group strengths on U.S. net exports, assuming that g is an independent variable. However, arguments can be made to treat g as endogenous.[19] In this subsection I provide an instrumental variable estimation to correct for potential biases due to the endogenity of group strengths.

The instruments that I have selected are average firm profits in each Japanese industry (JFP_i), proportion of temporary employees in each Japanese industry (JTE_i), proportion of individual proprietorship in each Japanese industry (JIP_i), and percentage of firms with more than three hundred employees in each Japanese industry (JLF_i). If Japanese groups coordinate in their activities, group strengths should be correlated with average profits.[20] Group-affiliated firms with long-term suppliers may use fewer temporary employees. Small subcontractors are also more likely to be individually owned. Finally, suppliers of parts are likely to have smaller numbers of employees.[21] Thus these instruments should be highly correlated with the intensity of group strengths.

17. Since unit labor costs capture differences in productivities, the use of these variables in both countries will partly reflect comparative advantage due to technological differences.

18. Measures of gS_i and gE_i for various industries are constructed from Dodwell Marketing Consultants (1982–83), and Ministry of International Trade and Industry (1981).

19. For example, if Japanese groups are formed for risk sharing, group strength will be determined by how risky a particular industry is.

20. Caves and Uekusa (1976), Nakatani (1984), and Roehl (1983) found that contrary to the view that keiretsu collude, group-affiliated nonfinancial companies did not realize as high an average rate of profits as comparable independent firms for the period 1961–75.

21. Legally, a subcontractor is defined as a firm with three hundred or fewer employees, or with one hundred million yen or less paid-in capital and has a contractual relation with a larger firm for supplying a part, processed product, or material.

Table 5.8 **Regressions with Predicted Values of Group Strengths**

	Eq. (Â)	Eq. ($\hat{A}_1$)
Constant	12.5708***	11.10643***
	(3.7885)	(3.4686)
Group affiliation	−16.556***	−13.9195***
	(−4.5630)	(−4.3818)
U.S. tariffs and	−14.9038	−13.3667
quotas	(−0.7863)	(−0.6895)
Japanese tariffs	2.4406	1.4447
and quotas	(0.3228)	(0.18632)
Japanese unit	−16.4802	−15.1560
labor cost	(−1.8949)	(1.72504)
U.S. unit labor	−3.5000	−4.5982
cost	(−0.3908)	(−0.5037)
R^2	0.605187	−0.587011
$\bar{R}^2$	0.481808	0.457951
F	4.90511	4.54838

Notes: Eq. (Â) uses the predicted values of gS and eq. ($\hat{A}_1$) the predicted values of gE as the group affiliation variables. The values in parentheses are t-statistics.

***Significant at 1 percent level (two-tailed test).

Table 5.8 shows the regression of U.S. net exports with the group variables adjusted by instrumental variables.[22] The group strength variables, both measured by sales and employment, are still significant at 1 percent level. The adjusted R^2 improves from around 0.4 in table 5.7 to 0.48 and 0.45 in table 5.8. Overall, the instrumental variable estimations yield similar results as those with the simple OLS estimations. The degree of Japanese group affiliations remains statistically significant.

5.5.2 Transport Costs as an Explanatory Variable

One interesting variation on the basic regression equation is the addition of transport costs. Lawrence (1987), Saxonhouse (1985), and Balassa (1986) highlight the importance of the cost of transportation as a determinant of the pattern of Japanese trade. In table 5.9, I present results from regressions based on (17) with transport costs TC added. As a representation of TC, I use the unit freight charge calculated by Clark (1981). This proxy pertains only to charges of ocean shipments and does not include costs of air freight.

22. As described in the text, first-stage regressions are run with group strengths as dependent variables. The explanatory variables are *JFP, JTE, JIP,* and *JLF.* When group strength is measured by sales, only the intercept is statistically significant at the 1 percent level (adjusted $R^2 = 0.54145$; F-statistic = 7.199177). When the group strength is measured by employment, the intercept is significant at the 1 percent level. In addition, *JFP* is significant at 5 percent level (adjusted $R^2 = 0.66225$; F-statistic = 11.29396). The predicted values of the group strengths are then used as explanatory variables in the second-stage regressions.

Table 5.9 **Regressions with Transport Cost**

	Eq. (B)	Eq. (B_1)
Constant	9.6394**	9.9912**
	(2.5693)	(2.6556)
Group affiliation	−12.691***	−12.347***
	(−3.6539)	(−3.7254)
U.S. tariffs and quotas	−5.3564	−5.4204
	(−0.24833)	(−0.25371)
Japanese tariffs and quotas	0.80564×10^{-1}	2.2410
	(0.91634×10^{-2})	(0.26059)
Japanese unit labor cost	−17.043	−19.759*
	(−1.6389)	(−1.8453)
U.S. unit labor cost	1.4643	1.4286
	(0.14128)	(0.13929)
Transport cost	−0.53057	−1.36715
	$(-0.77873 \times 10^{-1})$	(−0.20052)
R^2	0.540682	0.549605
$\bar{R}^2$	0.356955	0.368691
F	2.94285	3.04404

Notes: Eq. (B) uses gS and eq. (B_1) gE as the group affiliation variables. The values in parentheses are t-statistics.

*Significant at 10 percent level (two-tailed test).

**Significant at 5 percent level (two-tailed test).

***Significant at 1 percent level (two-tailed test).

The transport costs variable is insignificant in both cases. However, adding TC does not affect the results of the previous basic regression equations. The group affiliation variables (both in terms of sales in eq. [B] or in terms of employment in eq. [B_1]) still have the negative sign and are significant at the 1 percent level. One explanation of the insignificance of the added variable is that transport costs reduce U.S. exports as well as U.S. imports. The net impact of the U.S. industry trade balance is thus ambiguous. With net exports as the dependent variable, TC does not seem to be an appropriate explanatory variable.

5.5.3 Advertising Intensity and Number of Firms as Explanatory Variables

Adhering to the theoretical model, the only explanatory variables that should be included are USW_i, JW_i, $USTQ_i$, JTQ_i and g_i. However, if we relax our model for empirical implementation and contrast, other relevant variables can reasonably be included. For example, one variable may be the intensity of advertising expenditures in industry i in the United States and Japan. Advertising is an instrument of international oligopolistic rivalry that alters demand for a firm's product. Alternatively, the intensity of advertising can be used as a proxy for the degree of product differentiation between goods sold by the United States and Japan. It is expected that other things being equal, a high advertising intensity by the United States will be positively related to the United States trade balance, while a high advertising intensity by Japan is negatively related to *TB*. In other words, advertising intensity can be interpreted as a proxy for comparative advantage due to product differentiation. As a measure of advertising intensity, we will use the industry advertising expenditure per dollar sale in each country (USD_i and JD_i).

Another variable that may reasonably be included is the number of firms in industry *i* in the United States and Japan. Based on the theoretical literature of Dixit (1984), Eaton and Grossman (1986), Brander and Krugman (1983), and Fung (1987, 1989), we can expect that the number of firms will affect the equilibrium outcome. In particular, increasing the number of firms of a country under symmetry will raise market share and thus exports of that country. Thus with identical firms, the number of U.S. firms in industry *i* should be positively related to the U.S. trade balance, while the reverse sign is expected with respect to the number of firms in Japan.

The results of these expanded regressions are given in tables 5.10 and 5.11. For the regressions that include the number of firms as an explanatory variable, the equations with the group affiliation variable *gE* are not significant overall and are not presented (although the variable *gE* is itself significant).

Equations (C)-(E) essentially confirm the result that in a variety of regres-

Table 5.10 Regressions with Advertising Intensity

	Eq. (C)	Eq. (C_1)
Constant	8.6437**	9.3676**
	(2.3758)	(2.5035)
Group affiliation	−10.519**	−11.388**
	(−2.1126)	(−2.2353)
Japanese tariff and quota	3.1051	4.8146
	(0.35580)	(0.57343)
U.S. tariff and quota	−7.3530	−6.4017
	(−0.34673)	(−0.30559)
Japanese unit labor cost	−14.184	−19.574
	(−1.0746)	(−1.3412)
U.S. unit labor cost	−1.2885	0.52659
	(−0.11092)	(0.44769×10^{-1})
Japanese advertising intensity	−92.491	−8.2067
	(−0.36888)	(-0.30340×10^{-1})
U.S. advertising intensity	38.777	42.432
	(1.2010)	(1.3378)
R^2	0.587881	0.599451
$\bar{R}^2$	0.381822	0.399177
F	2.85297	2.99315

Note: Eq. (C) uses *gS* and eq. (C_1) *gE* as the group affiliation variables. The values in parentheses are *t*-statistics.

**Significant at 5 percent level (two-tailed test).

Table 5.11 Regressions with Number of Firms

	Eq. (D)	Eq. (E)
Constant	9.6805**	9.7642**
	(2.6710)	(2.5361)
Group affiliation (gS)	−12.984***	−12.399**
	(−3.4545)	(−2.3947)
Japanese tariff and quota	−2.6445	−1.2303
	(−0.29950)	(−0.14031)
U.S. tariff and quota	−13.439	−15.470
	(−0.58524)	(−0.69753)
Japanese unit labor cost	−18.031*	−19.424
	(−1.8292)	(−1.4971)
U.S. unit labor cost	3.6948	3.5263
	(0.35987)	(0.30911)
Japanese advertising intensity		−15.497
		(−0.64509 × 10^{-1})
U.S. advertising intensity		60.670*
		(1.8237)
No. of Japanese firms	0.63930 × 10^{-4}	0.85472 × 10^{-4}
	(1.0629)	(1.4468)
No. of U.S. firms	−0.83034 × 10^{-4}	−0.12730 × 10^{-3}*
	(−1.2367)	(−1.8281)
R^2	0.587363	0.678098
$\bar{R}^2$	0.381045	0.436671
F	2.84688	2.80871

Note: Eq. (D) regresses gS on the basic equation with variables of numbers of firms. Eq. (E) regresses gS on the basic equation with both numbers of firms and advertising intensifies. The values in parentheses are t-statistics.

*Significant at 10 percent level (two-tailed test).

**Significant at 5 percent level (two-tailed test).

***Significant at 1 percent level (two-tailed test).

sions based on equation (17) of our model, the intensity of Japanese groupings is negatively related to the U.S. balance of trade with Japan on an industry basis. Of all the explanatory variables employed, group affiliation is the most consistently significant one.

There are some variables that are significant in one equation but not in others.[23] For example, in (E) the U.S. advertising intensity is found to be positively related to U.S. net exports to Japan. This probably reflects the strategic effect of advertising, which can expand demand as well as shift demand from the firm's rivals. More generally, the advertising to sales ratio may reflect comparative advantage due to product differentiation. Equation (E) then tells

23. Note that in eq. (E) the variable representing number of U.S. firms has the wrong sign and is significant at the 10 percent level. This may be because the assumption of symmetric firms does not hold. If the number of firms can alter the equilibrium solutions (e.g., see Fung 1987), then a smaller number of U.S. firms may increase exports.

us that the more distinctive the U.S. products are, the better the U.S. industry trade balance. Across equations, the degree of explanatory power is fairly consistent and satisfactory, with the adjusted R^2 for all regressions about 0.4.

5.5.4 U.S. Exports as the Dependent Variable

According to (16), an alternative implication of our model is that U.S. exports alone ($USXC_i$) are also negatively related to the degree of Japanese group affiliations. Instead of industry trade balance, I rerun the regressions using U.S. industry exports to Japan as the dependent variable. To adjust for the size of the industries, I divide the exports by Japanese consumption of that industry.

Since Japanese exports to the United States are now excluded, the variable representing U.S. overt trade barriers becomes irrelevant and is omitted. Furthermore, the transport cost variable should be included since its coefficient now has an unambiguous predicted negative sign, unlike the situation where the trade balance is the dependent variable. I have run regressions for both the linear and the log-linear versions, but the linear version performs much better; the results are reported in table 5.12.

Estimates from equations (F) and (F_1) show that the basic results obtained previously are robust with respect to a change of dependent variables. With adjusted U.S. exports to Japan on the left-hand side, the group affiliation variables *gS* and *gE* still have the expected negative signs and are significant at the 1 percent level. But as in the trade balance equations, the unit labor costs again have the wrong signs, indicating that again they may act as proxies for other variables such as research and development intensities.[24] The transport cost variable has the expected negative sign but is not significant in either equation.

5.5.5 World Net Exports as the Dependent Variable

A further additional regression analysis uses the world trade balance with Japan (WTB_i) as the dependent variable. The idea is to find out if Japanese group affiliations are also negatively correlated with industry trade balances of countries other than just the United States. World trade balance is defined as the exports from the rest of the world to Japan minus Japan's exports to the rest of the world. To make the analysis meaningful, I omit all variables that pertain to the United States, since these are not necessarily representative of the characteristics of the world. Again, since there are negative values in WTB_i, the log version will not be appropriate. The results, reported in table 5.13, show that Japanese group affiliation is negatively correlated not only with U.S. trade balance but also with the world's trade balance. In this instance, the U.S. data are not unique.[25] Japanese group intensities adversely

24. Note further that Japanese advertising intensity also has the wrong sign.

25. But I also ran similar regressions with world exports adjusted by consumption as the dependent variable. Generally they are not significant. The results are not presented here.

Table 5.12 Regressions with U.S. Exports

	Eq. (F)	Eq. (F_1)
Constant	0.18915	0.22628*
	(1.6792)	(1.8630)
Group affiliation	−0.44453***	−0.47427***
	(−3.1740)	(−3.1808)
Japanese tariffs and quotas	−0.10193	0.44104×10^{-1}
	(−0.53593)	(0.24447)
Japanese unit labor cost	−0.65638	−0.86965*
	(−1.7597)	(−2.0224)
U.S. unit labor cost	0.51807	0.58306*
	(1.7307)	(1.8606)
Japanese advertising intensity	25.274***	27.650***
	(3.8795)	(3.9123)
U.S. advertising intensity	0.98993	1.0229
	(1.1006)	(1.1369)
No. of Japanese firms	-0.21596×10^{-6}	-0.13213×10^{-5}
	(−0.14541)	(−0.89037)
No. of U.S. firms	-0.41369×10^{-6}	-0.14102×10^{-5}
	(0.22246)	(0.79283)
Transport cost	-0.57358×10^{-1}	-0.82762×10^{-1}
	(−0.32851)	(−0.46711)
R^2	0.692007	0.692608
$\bar{R}^2$	0.461013	0.462063
F	2.99577	3.00423

Note: Eq. (F) uses gS and eq. (F_1) uses gE as the group affiliation variables. The values in parentheses are t-statistics.

*Significant at 10 percent level (two-tailed test).

***Significant at 1 percent level (two-tailed test).

affect U.S. net exports as well as world net exports to Japan. The variable representing the number of firms in Japan has the expected significant negative sign. A larger number of Japanese firms increase Japan's market share and thus reduce the world's trade balance with Japan.[26]

To summarize, I have estimated here a variety of equations generated by my theoretical model. In general, not all the coefficients conform to our predictions. However, there is fairly consistent evidence that the Japanese keiretsu is a factor in U.S.-Japanese trade. This basic conclusion remains robust with alternative specifications of our equation, with different proxies of Japanese group affiliations, and with correction for the possible endogenity of the group-strength variable.[27]

26. As before, the variable representing Japan unit labor costs has the significant sign that is contrary to our model.

27. In addition, alternative functional forms of the regression have also been tested. The results concerning the linear as well as log-linear forms are discussed in the text. To detect the effects of nonlinearities, I also attempted to add the square term of each explanatory variable in turn to the basic equation. The regression results remain qualitatively similar to those of the linear version. The significance of the group-strength variables remain robust.

Table 5.13 Regressions with World Trade Balance

	Eq. (K)	Eq. (K_t)
Constant	94.167***	108.61***
	(5.6799)	(7.7224)
Group affiliation	−76.191***	−89.651***
	(−4.5125)	(−6.4039)
Japanese tariffs and quotas	0.89182	19.192
	(0.34071 × 10⁻¹)	(0.91172)
Japanese unit labor cost	−172.63***	−212.50***
	(−5.1220)	(−7.1304)
Japanese advertising intensity	417.67	1005.5
	(0.47717)	(1.3855)
No. of Japanese firms	−0.39438 × 10⁻³***	−0.51409 × 10⁻³***
	(−2.3291)	(−3.6743)
R^2	0.700389	0.80889
$\bar{R}^2$	0.606761	0.749180
F	7.48052	13.5451

Note: Eq. (K) uses gS and eq. (K_t) uses gE as the group affiliation variables. The values in parentheses are t-statistics.

**Significant at 5 percent level (two-tailed test).

***Significant at 1 percent level (two-tailed test).

5.6 Conclusion

This paper offers an analysis of the role of Japanese *keiretsu* as a potential determinant of U.S.-Japanese trade. Industrial groups in Japan can be classified into three types: those with prewar *zaibatsu* origin, those centered on major banks, and those centered on a prime manufacturer. The Japanese groups are linked economically through many channels. They include cross-holding of shares, intragroup financing by the main banks, subcontracting, regular meeting of presidents of important member firms, and the joint use of general trading companies as agents of imports and exports.

In general, *keiretsu* are still an important component of the Japanese economy, though they are nowhere nearly as powerful as the prewar *zaibatsu*. The links between member firms are also much looser. Perhaps as a way to enhance bargaining power, member corporations do not deal exclusively with other member firms or banks. Even subcontractors, particularly those among the first tier, supply firms other than the prime manufacturer. In the long run, there is a general expectation that *keiretsu* will decline in importance as the Japanese economy becomes more internationalized. One exception, however, is the prime manufacturer-subcontractor relationship, which seems to be increasing in importance over time.

To investigate the impact of *keiretsu* on Japanese-U.S. trade, an oligopoly model of the U.S. and Japanese firms was constructed. It was hypothesized according to this model that a higher degree of Japanese group affiliation will lead to a lower U.S. industry trade balance with Japan. I estimated the focal equation generated by this model and showed that overall there is some evidence that the extent of Japanese *keiretsu* is negatively related to the U.S. trade balance by industry. I estimated similar equations with alternative specifications and different proxies. Furthermore, I also estimated equations where the intensity of group strength was corrected for endogenity. In general, I conclude that the phenomenon of Japanese industrial groups as a factor in U.S.-Japanese trade seems to remain robust.

Since this paper is among the first direct studies of the effects of Japanese *keiretsu,* one must be cautious in drawing policy implications. There are two things to keep in mind, Japanese *keiretsu* may be an important variable explaining the variations of industry-level trade, but they are unlikely to be determinants of overall U.S. trade imbalances. On the aggregate level, macroeconomic conditions remain the most important factors that need to be changed in order for the U.S. trade balances to improve. In addition, the theoretical model as well as the empirical estimations are exercises of *positive* analysis. The model does not tell us what welfare changes may occur if indeed there are changes in the Japanese industrial structures.

Appendix

Industries in the Sample and Percentage Drop of Industry Trade Balance Due to Groups

	Using Eq. (A)(%)	Using Eq. $(A)_1$(%)
1. Food and kindred products	0.301	0.11
2. Fibers and textiles	4.51	3.14
3. Pulp and paper products	3.86	1.99
4. Chemical and allied products	3.10	3.94
5. Petroleum and coal products	2.30	2.07
6. Rubber products	15.44	10.51
7. Iron and steel	2.60	2.52
8. Nonferrous metal and products	16.79	16.38
9. Fabricated metal products	0.85	0.34
10. General machinery	1.19	0.71
11. Electronic and electrical equipment	1.91	1.52
12. Shipbuilding	16.20	11.45
13. Auto parts and components	4.54	3.63
14. Automobile and equipment	1.15	1.13
15. Aircraft and parts	2.54	1.80
16. Watches, clocks and parts	3.71	1.57
17. Scientific and optical instruments	1.17	0.49
18. Stone, clay and glass products	8.64	4.30
19. Lumber and plywood products	0.19	0.04
20. Printing and publishing	0.31	0.22
21. Furniture and fixtures	13.55	6.10
22. Leather and leather products	29.39	30.08

Note: Equation (A) measures the percentage drop of U.S. net exports due to the Japanese groups using the estimated coefficient of the group affiliation measured by sales. Equation (A_1) estimates the same percentage drop using the estimated coefficient of the group affiliation measured by employment.

Definitions of Variables

TB U.S. exports to Japan minus U.S. imports from Japan, 1980.

gS Sales of group affiliated companies as a percentage of total industry sale, 1980.

gE Employment of group affiliated companies as a percentage of total industry employment, 1980.

USULC U.S. nominal wage rate/value added per worker, 1980.

JULC Japanese nominal wage rate/value added per worker, 1980.

JTQ Sum of Japanese tariffs and Japanese tariff-equivalent nontariff barriers, 1989.

USTQ Sum of U.S. tariffs and U.S. tariff-equivalent nontariff barriers, 1989.

USAD U.S. advertising expenditure/total sales, 1980.

JAD Japanese advertising expenditure/total sales, 1980.

USF	Number of U.S. firms, 1980.
JF	Number of Japanese firms, 1980.
TC	Ocean shipments freight charges/f.a.s. import unit values, 1977
USXC	U.S. exports to Japan/consumption of Japan, 1980
WTB	World's exports to Japan minus Japan's exports to the world, 1980
JFP	Value of products minus cost of materials and total wages and salaries in Japan/number of firms in Japan, 1980.
JTE	Number of temporary employees as a percentage of total industry employment in Japan, 1980.
JIP	Number of individually owned firms as a percentage of total number of firms in Japan, 1980.
JLF	Number of firms with more than 300 regular employees as a percentage of total number of firms in Japan, 1980.

Sources of Data

Degrees of group affiliations *gS* and *gE:* constructed from Dodwell Marketing Consultants (1990) and Ministry of International Trade and Industry (1981).

Japanese unit labor costs and number of firms: constructed from Ministry of International Trade and Industry (1981).

U.S. trade balance: U.S. Bureau of the Census, *U.S. Exports: Domestic Merchandise SIC-based Products by World Areas,* Publication FT610 (Washington, D.C., 1980); ibid., *U.S. Imports: Consumption and General SIC-based Products by World Areas,* Publication FT210 (Washington, D.C., 1980).

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U.S. and Japanese tariffs and nontariff trade barriers: constructed from Saxonhouse and Stern (1989) and Ray (1990).

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World trade balance: constructed from Japan Tariff Association, *Japan Exports and Imports, Commodity by Country* (Tokyo, 1980).

Japanese average industry profits, percentage of firms with more than 300 employees, percentage of temporary employees, and proportion of individual proprietorship: constructed from Ministry of International Trade and Industry, *Japan Census of Manufactures: Report by Industries* (Tokyo, 1980) and *Japan Census of Manufactures: Report by Enterprises* (Tokyo, 1980).

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Comment Robert Z. Lawrence

Fung presents an informative summary of *keiretsu* groups, an oligopolistic model of how *keiretsu* could affect net exports, and some empirical tests. My overall impression was that although this is an important topic, the research presented here remains in a very preliminary phase, particularly if it is to be useful to policymakers.

I enjoyed the first section and will not comment on it. I will, however, comment on the theory, the empirical work, and its relevance for the policy debate.

Theory

The strategy in this paper is to come up with a very simple model of the group that allows us to test its effects on trade flows. The methodology is appropriate if the model captures the essential features of the group's behavior, allowing us to place fairly tight constraints on the estimation parameters, and thus to accept or reject the model.

My feeling was, however, that the model fails to capture many of the key questions relating to the existence of groups. The model emphasizes the links between an input supplier and a final producer. The key here is that the supplier holds stock in the firm producing the final product. We know that there can be gains from vertical integration when a supplier has monopoly power. Without vertical integration, when a monopolist supplier raises input prices, his customers are induced to substitute other inputs. A vertically integrated firm, on the other hand, can use shadow prices that reflect marginal cost and thus produce more efficiently and earn higher profits.

Of course, if this is the source of the price advantage given to the Japanese final product producer from exchanging securities with its supplier, it could readily be emulated by vertical integration in the United States. Indeed, as noted by Cline and Bergsten, "Oligopoly behavior in its most intense form will replicate the decisions of a single large firm."[1] So the relationship as captured here does not really *explain* the existence of groups. It assumes them. Moreover, it is not really clear why we should expect Japan to derive a competitive advantage from these groups, unless we make the additional assumption that in the United States there is some constraint on vertical integration.

But it seems to me that the reasons for the existence of groups could go far beyond the effects of cross-holding modeled here. On the one hand, they may

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1. C. F. Bergsten and W. R. Cline, *The United States–Japan Economic Problem* (Washington, D.C.: Institute for International Economics, 1985).

simply reflect increased monopoly power. On the other, they could enhance efficiency by achieving the benefits of closer vertical integration while avoiding some of the costs. These benefits relate to the potential gains from reducing risk, improving information flows and perhaps certain economies of scope. There may also be benefits in preserving greater flexibility than full vertical integration would require. In particular, in a system where core firms provide lifetime employment guarantees, they may prefer closely tied suppliers who can lay off their workers to vertical integration. But Fung's model fails to deal with these questions, which could have an important influence on the qualitative nature of the results he obtains.

Finally, let me note that what Fung has modeled is competition in the market for the final product market. The Japanese firm has a *keiretsu* association with its input supplier that gives it access to these inputs more cheaply because it has a share in final product. What many Americans are complaining about, however, is competition in the inputs market. The dispute involves not only the link he models where the supplier has shares in the final producer, but the reverse, where the final buyer has shares in the suppliers who are local.

Empirical Tests

The dependent variable in the test is the bilateral net trade balance. Relying on his model, Fung argues the effects of the group act symmetrically in export competition and in competition within Japan. His model is one where the group allows the Japanese producer access to cheaper raw materials. This allows the final goods producer to charge lower prices at home and abroad, so this mechanism fits his formulation quite naturally. But there are other effects which one might believe are more powerful *in* Japan than they are outside. If the group providing the loans insists on purchases from other group members, for example, indeed this might make a positive contribution to the group share within Japan but hurt export sales abroad. So I would like to see specifications of the dependent variable as imports (or import shares) of particular products.

A second problem with the dependent variable, if I understand it, is surely heteroskedasticity. This means we probably have an equation giving huge weight to autos and electronics.

The dependent variable, unit labor costs, is not clearly defined. How was it derived? What data sources were used? I am not sure the discussion of the variable which implies that it captures *absolute* differences in costs is really justified. Since this is a cross-sectional analysis, you need a purchasing-power parity estimate for each two-digit industry to define these units. How was this done? I missed an explanation in the text, and it is surely critical. Indeed, I suspect that what is really being captured here is the share of labor in overall income. If this is the case, it might help explain the empirical result, but not through the mechanism laid out in the model. In particular, the equation may be telling us of a relationship between trade performance and labor intensity rather than unit costs.

Fung *assumes* the conditions required for a quota to have a negative effect on the (exporters') trade balance. But in theory, of course, the effect is ambiguous. There are higher prices and lower quantities, and when you have imperfect competition, the price response hinges on the demand elasticity. This might explain why the empirical results of the quota are poor. It might simply reflect the fact that his assumption is unwarranted, rather than providing a good test of the effect of groups.

Policy Implications

Simply finding that *keiretsu* has a positive effect on trade fails to sort out the most important dilemma for policy. Are *keiretsu* allowing for an increase in *efficiency* or an increase in *monopoly* power in the domestic market? Either could boost the trade balance, but the welfare effects for the United States and Japan could be very different. This is the key issue on which policymakers need help.

The official U.S. contention in the current negotiations in the Structural Impediments Initiative is, of course, that there are *inefficiencies* due to these groups. These result precisely from the effects on restraining trade. Even if the trade balance is improved, welfare could be reduced, since the groups practices could hurt Japanese consumers and U.S. producers. The perplexing thing to an economist is how such a situation could persist. Why does competition not force some producers to buy cheaper and better foreign goods and thus drive those relying on an inefficient *keiretsu* system out of business? Indeed, the evidence on price differentials between Japan and the rest of the world do seem to suggest such practices exist.

My suspicion is that the groups result in both efficiency gains and losses. In the auto industry, group affiliations seem to have provided benefits. But in other cases, there are suggestions of inefficiency. It is worth recalling, for example, that in an early study, Caves and Uekusa found: "After controlling for other determinants of profitability, we found that profits . . . were if anything negatively related to group affiliation. . . . It remains distinctly possible that rents yielded by group affiliation are consumed in technical inefficiency."[2]

Indeed, it seems to me, one way to sort this out would be to examine performance in third markets rather than in the bilateral balance. We would like to know if given the performance in third markets, the United States tends to do worse in Japan in sectors where there is a *keiretsu* presence.

2. Richard Caves and Masu Uekusa, *Industrial Organization in Japan* (Washington, D.C.: Brookings Institution, 1976).