KOBE

ECONOMIC & BUSINESS

REVIEW

42nd

ANNUAL VOLUME

RESEARCH INSTITUTE FOR ECONOMICS
AND BUSINESS ADMINISTRATION
KOBE UNIVERSITY

1997

KOBE ECONOMIC & BUSINESS REVIEW

42nd

ANNUAL VOLUME

RESEARCH INSTITUTE FOR ECONOMICS
AND BUSINESS ADMINISTRATION
KOBE UNIVERSITY

1997

CONTENTS

KOBE ECONOMIC & BUSINESS REVIEW, 42 (1997), 1-9

A SIMPLE MODEL OF TECHNOLOGY TRANSFERS IN THE NORTH AND SOUTH ECONOMIES; TECHNOLOGY AS INTERMEDIARY GOODS

KAZUHIRO IGAWA **Kobe University**

Abstract

Using a simple model of H-O-S with an intermediary product, technology transfers by licensing, FDI, and R&D, are investigates. It is shown that the three alternatives can be treated in a model, but with specific interpretations respectively. This model is useful when a service of technology is contained in the intermediary goods.
JEL classification: O33
Keywords: Technology transfer; Licensing; FDI; R & D; Intermediary product

1. Introduction

It is interesting to investigate changes of international trade patterns, when international transfers of production technology are taking into account. In this paper, international trade patterns are investigated for different types of production technology transfer and innovation. A production technology becomes available for a country where domestic R & D activities develop it or transfers of technology from abroad through licenses or FDI are accepted. Depending on the three types of technology acquirement, the country might show different trade patterns in the case of an introduction of new production processes, using the technology.

In this paper I will show a way to explain the difference of trade patterns, when technologies services are intermediary products and the technologies are necessary for production of goods or services. There are many roles of technologies in production; one of them is a role as intermediary inputs, that is, services of technologies are combined with other fundamental factors for production. Cal-

Corresponding Address:
Kazuhiro Igawa
Research Institute for Economics and Business Administration, Kobe University
2-1 Rokkodai-cho, Nada-ku, Kobe 657-8501, Japan
E-mail: igawa@rieb.kobe-u.ac.jp
Fax: (81)-78-803-0391

culating factors inputs to reproduce the services of the technologies, it will be possible to treat the services of a technology to be an intermediary product, which is produced using the fundamental factors for production. I will construct a very simple model, which explains important features of technology transfers or technology developments, treating a technology as an intermediary product.

In the following section, a simple model is introduced to show how production and consumption, and thus international trade export and import, are determined when technology is contained in intermediary goods. In section 3, a technology transfer through licenses will be introduced. Using a similar model as in the case of intermediary goods, properties of technology transfers through licenses are investigated. Properties in the case of FDI are investigated in section 4. Differences in the case of technology acquirement through R&D innovation will be investigated in section 5 and dynamic aspects of R&D technology innovation will be discussed.

2. Technology as Intermediary Goods

A typical North and South economies, developed and developing countries, are modeled as follows. Starting from production of a labor intensive product X, the developing country (country B) plans to produce more capital intensive product Y, which requires a specific technology service M at a fixed proportion to a quantity of Y. It is assumed that fundamental production factors are a labor and a capital. The product M (services of technology M) is produced using the labor and the capital. It is also assumed that M is more capital intensive than Y (excluding the inputs of M), and Y is more capital intensive (excluding inputs of M) than X. For simplicity the capital labor ratios are assumed to be fixed.

Without international transaction, developed country (country A) produces both products X and Y, using intermediate goods M (and thus technology M). This implies that unit value iso-quants of outputs X, Y (excluding the input value of M), and M, on the diagram of labor and capital, tangent to a common unit cost line. See the figure in Appendix. This is the case when all the tree markets are perfectly competitive. The slope of the line shows relative price of two factors. Adding input vectors of Y (excluding intermediary inputs) and M, a factor contents vector of Y (including intermediary inputs M) will be constructed, which is called F. Combine the factor contents vectors of X and F, production quantities of X and F (and thus Y and M) are determined to attain the full use of factors endowment of the developed country.

Demands for X and Y (and thus also for M) are determined by relative prices of X to Y, and GNP (factor income) of the country. If demands for X and Y are

different from the products supply, relative prices will change, and thus unite value iso-quants will shift away or toward the origin. These adjustment processes will stop when markets for X and Y are cleared, demand is equal to supply in each market.

Now let us introduce international trade between a developed country A and a developing country B. Country B is assumed to be producing only commodity X, because of a luck of technology M. By opening trade, demand for Y from developing country will rise the relative price of Y, And this will reduce demand for Y in developed country. Country A exports Y, exchanging imports X from country B.

Production of Y will become possible when the developing country accumulates capital and if intermediary goods of technology M is importable. The cases of production of Y through license contracts of M or through FDI or own development of technology of M, will be discussed in the following sections.

When a factor endowment ratio of country B is less capital intensive than the capital intensity of X, country B will specialize in X and labor will be unemployed. The production of Y becomes possible when the ratio of endowment is more than the capital intensity of X, and full employment will be attained. The productions of X and Y are determined at the full employment of the both endowments of capital and lacor in country B. GNP of the country B is an aggregate of factor incomes and this is less than the value of products X and Y by the value of imported intermediary products M.

On the part of country A, factor inputs of intermediary exports of M are adjusted from factor endowments for producing X and Y. The production of Y will be reduced and production of X will be increased when an export of M increases, and when M is most capital intensive (Rybczynski Theorem). This implies that the export of Y and import of X decreases and export of M increases in country A, as a capital accumulation increases in country B and it produces more Y using more imports of M. When a production of Y is small enough in country B, an export of X is large. However an increase in production of Y may change trade patterns. Country B may export Y and may import both X and M.

3. License for a Technology

Consider the case that a developing country B can make use of a license of producing services of technology M and can produce Y. Inputs of factors for producing the services is assumed to be the same for M in the previous section. Now production factors of the developing country are also used for production of M. Then the situation is similar to the familiar H-O-S model of factor inputs vectors

F (for products Y) and X in both country A and country B. However the difference here is a license fee, and it will be the difference in a value of income between GDP with license and GNP without license.

When a capital endowment is scarce and capital endowment ratio is less than the intencity ratio of X in country B, the country B will specialize in producing X and will export X exchange for import of Y. Capital accumulation in country B will make efficient to produce both X and Y, by paying a license fee. Determination of production pattern is a familiar one explained by H-O-S theory, as mentioned above. Demand pattern will be different from the case of intermediary input M is imported, by the effects of transfer of the license fee. The value of license fee will be the difference of factor incomes with and without the license, when the technology is monopolized by a firm in country A. The value of incomes are evaluated at the prices when the license is used. The prices will change toward better terms of trade for country B. Therefore gains from trade in this case come from the improvement of terms of trade in country B. Gains are transfer of license fee plus negative effects of terms of trade change, in country A.

Comparing with the case of import of intermediary input in the previous section, it seems that the country B is worse in the case of licenses. However, it must be aware that competitive conditions of the two cases are different. In the case of licenses, it is assumed that the technology is monopolized and in the case of import of intermediary input, it is assumed that the market of intermediary goods is competitive, and thus profit of products M industry is zero. If the market of intermediary goods of technology services is monopolized, price of M will exceeds marginal cost of factor inputs of producing M. That is, a positive profit will exist. This profit will correspond to the license fee. If the license fee par one unit of production of M is the same as a mark up rate in pricing of intermediary goods M, the two cases of the technology license and the import of intermediary input of technology services will be same.

It is impossible to make license contracts when the technology is not divisible as one entity. Even if it is divisible, costs of transaction should be low to make license contracts. An evaluation of technology is very difficult in many aspects, and thus transaction costs will be very high, in general. The main difficulty comes from asymmetry of information about technologies. A technology is valuable in the market when it is unknown or at least known incompletely. A supply side, which has advantage in knowledge about a technology, does not show all the information about the technology. A demand side always has uncertainty about the technology and also about effects of using it. Therefore price levels they offer scarcely coincide. Another difficulty might be risks of reveal or spillover of the technology after the license contracts.

A license contract is possible when transaction costs is not prohibitively large and if the cost to cheat the contract is very large. Furthermore, a licenser should have merits to use the technological advantage in the form of license. This depends on situations of alternative use of the advantage. An own use for production may not efficient because of higher factor costs to manage the technology and because of opportunities of more productive use of scarce factors in the firm. To protect from the potential rivals to appear, increase of supply by licensing might be a strategy of a firm. Licensing to the firm in developing country might be better strategy for licenser firm in developed country. In this case, the possibility of a licensee become competitor of the licenser, in production technology developments in future, may be small.

4. Technology Transfer by FDI

Instead of licensing a technology, it might be more profitable to keep the technology inside the firm (organization) and use it in a form of FDI activities. In the case of FDI from country A to country B, a profit of FDI belongs to country A. An equilibrium in the case of FDI of the M industry, can be shown explicitly in the same diagram of iso-quant as in the case of licensing. Producing both output X and output Y competitively in country B, unit value iso-quant of X and unit value iso-quant of Y (excluding inputs value of M) and also iso-quant of $(1+m)$ value of M should tangent the same unit cost line, where m is a mark up rate in price of M. See the figure in Appendix. The price of M is a competitive market price when technology services are produced and are traded as intermediary goods.

In the case of FDI of jointly producing Y and M, the price of M is not a market price, but a price for internal trade in the organization, within the FDI firm. It is important in this case that the FDI firm is a monopolist in the market of Y. And thus the profit of M is reflected in the pricing of product Y.

An important aspect of FDI is an existence of headquarters in home country. This case is extensively investigated in Helpman & Krugman (1985). The case that services of technology M are produced in headquarters in country A and FDI firm produces Y in country B will correspond to the case of import of intermediary input M, in section 2. Instead of jointly producing M in country B, the FDI company produce Y using intra-firm trade of M. The firm producing Y in country B is owned by the firm of the country where headquarters have located, here in country A. The firm gets profits as a monopolist of M and can use transfer pricing in the intra-firm trade.

It is well known that OLI elements are important as determinants of FDI.

Ownership advantage in the above model is technology owned by a firm in country A. Locational advantage might be a low factor price in the developing country B before FDI (it may disappear after FDI). Internalization is the choice of controls of production of M (when a separation of M is possible) and of Y.

The technology advantage of a firm, in developed country, might disappear when rival firms, in developed country or in developing country, develop the same or more advanced technology. Once some technology is developed in a firm, risks and costs of R&D for similar technologies will be reduced. The possibility of those potential rival firms enter the market will be reduced by expanding production of the products using the technology. The rival firm in developing country will have more competitiveness when FDI to developing country is more profitable than production activities in developed country. In this case incentives to make FDI will be large to get profits and to protect an entry of rival firms.

There are many disadvantages to make economic activities in foreign countries. FDI should compensate those disadvantages with other advantages. The advantages might be lower factor prices, easier access to resources, and close to markets, and protection policies, and others. Advantages of FDI may be different depending on production processes and products. In the case that production processes of final goods and technology embodied intermediary goods can be separable, it will be a matter which production process should be transferred to a foreign country. If protections of technology spillover are difficult in the foreign country and/or a production of the technology embodied intermediary goods costs more, only FDI of the final process will be taken, as in the headquarters case discussed above. There is a case that only the process of technology embodied intermediary goods is put into a foreign country as FDI and local firm take the process of final products. Some recent trends of FDI of R&D activities in developing countries will be explained by locational advantages.

It is often true that technology advantages are sources of competitiveness of a firm. In this case use of the technology should be kept inside the firm and accesses to the technology should be limited within members of the firm. Here is a reason why a licensing (alternative way to FDI) is not used, as mentioned in the previous section. The selection of ways for transaction, that is, transactions through market (arms length transactions) or through organizations (intra-organization transaction) is extensively investigated by Williamson (1975) and the followers. The arguments for intra-organization transaction, compared to alternative forms of activities in foreign countries, are applicable to the argument for FDI.

5. Development of Technology by R&D

In the case of developing a new technology in the developing country, production factors should be invested in R&D. The newly developed technology is put into use for production of Y when all costs of R&D for developing technologies and the cost to make use of the services of technology are expected to be covered with sales of Y and M. The profit over time should be nonnegative, and will be zero when competitions prevail in R&D activities. If the developing and managing costs of technology in country B are same as in the developed country A, previous model of intermediary input of M, in section 2, can be used to explain the situation of R&D of the technology. If the factor inputs vector of M is the previous sections is interpreted as R&D costs per period, then the relation of factor costs and price of M can be interpreted as profit condition, on average per period, for developing the technology. In the case of R&D, costs exceed in the early stages and which are covered by positive profits in the later stages of a lifetime of technology. Therefore a dynamic treatment of R&D is more appropriate. However, simple investigations of important aspects of R&D are still possible by using average figures per period. The decision weather or not to develop the technology by own R&D activities depend on overtime net profits, and thus average net profits per period, if there are no liquidity constraints.

If processes of R&D and changes of production patterns (and also trade patterns) though life cycles of new products are issue, dynamic approaches should be taken. Using endogenous growth theory, Grossman & Helpman has shown an analytical framework of the product cycle theory developed by Vernon (1966). Decisions of R&D investments depend on the probability of success in getting new technologies and on the profitable uses of the technologies. In which country to use the technologies for production or for license, depends on the differences in the time profiles of factor prices. Timing of FDI or of import substitution will depend on abilities to imitate the technology in developing countries and ability of innovation in developed countries.

Consider a case that developing country depend on its own R&D activities for obtaining new technologies. Investments for R&D activities should be financed with savings, income minus expenditure. This happens in a gestation period of R&D, and the country will import the products until it succeeds in imitating of the technology for the products. When the country has competitiveness of the products using advantages of the country, import substitution will change to export to developed countries. In the mean time, R&D activities in the developed countries will introduce new technologies or new products. Depending on the innovation speed in the developed countries and catching up (imitating) speed in

the developing countries, different life cycles of products will be found and different movements of gaps of factor prices between developed and developing countries will be found. On the part of developed countries matters are a decision of volume of investment to R&D and a decision of timing of technology transfer by licenses or FDI, taking into account of in the speed of imitation in developing countries and speed of innovation in developed countries.

6. Final Remarks

A technology is an important factor for firms to have competitiveness, and a transfer of technology is crucial for developments of South countries. It is shown the effects of the behavior of the firms in North countries, depending on the patterns of technologies transfer. Depending on the behavior, production, consumption and trade patterns in South countries are investigated. However, an attention is paid mostly on the aspects of technology as intermediary goods, and effects are investigated in the context of technology transfers. There are other types of technologies, one embodied in capital goods, and another embodied as human capital, and another one of know-how to improve production.

In the case of capital goods embodied technology, it is possible to investigate in a similar way as in the case of intermediary goods. The difference will be durability of the capital and analytical concepts of average per period, used in the previous section will be effective. In the case of human embodied technology, an international mobility of labor determines the way of use of technology. To internalize a human technology, the firm might pay more than the market price (wage rate), or the technology are changed specific to the firm. Education or training will be the ways of technology transfer, when labor is immobile internationally.

Some know-how is difficult to put into a manual. Then a transfer of technology is difficult, except totally imitating the way of production. However some know-how can be put into a blue print. A blue print has specific properties for market transactions. The copy can easily be made. The situation is similar to the case of license contracts with higher possibility of spill over. Furthermore, it is easy for the firm with the blue print to increase the services of technology with very small marginal costs. These make the firm profitable to use the blue print itself.

The limitation of static analyses of R & D here will be relaxed with costs of complexity.

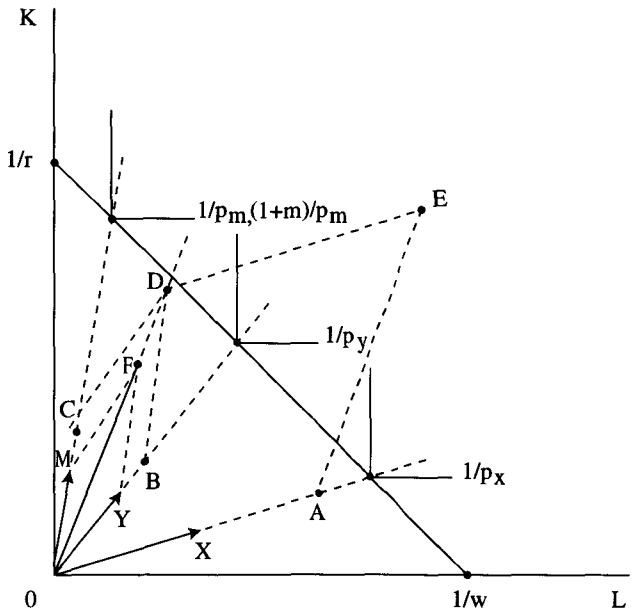
References

R. Vernon, "International Investment and International Trade in the Product Cycle", *Quarterly Journal of Economics,* 80, 1966

O. E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications,* the Free Press, 1975
E. Helpman and P. R. Krugman, *Market Structure and Foreign Trade,* MIT Press, 1985
G. M. Grossman and E. Helpman, *Innovation and Growth in the Global Economy,* MIT press, 1993

Appendix: A presentation of equilibrium in production side

The following figure shows an equilibrium situation of production of X and Y and M, in the country whose factor endowment point is point E. The horizontal line indicates volumes of labor and the vertical line indicates volumes of capital. A factor intensity of X is shown in vector X from origin O and the one of M is shown in vector M from the origin. A factor intensity of Y (excluding input of M) is shown in vector Y from point O. The factor contents of Y, including the one of M, which is an addition of vectors M and Y, is shown in the vector F from the origin. Unit value iso-quants of X, Y (excluding the costs of M), and M are shown in L shaped production level curves of 1/Px, 1/Py, and 1/Pm, respectively. The line tangent to those iso-quants is a unit cost curve, which passes through 1/w (on horizontal line) and 1/r (on vertical line). Here w is a wage rate for labor and r is a rental rate for capital. Full employment of factors is attained by producing OA of X, and OB of Y, and OC of M. The factor contents in the products of Y (including intermediary inputs M) is shown in OD. The line OD is parallel to the line AE and the lengths of these lines are same. The iso-quant level in the case of monopoly of product M is shown as $(1+m)$/Pm.



Figure

KOBE ECONOMIC & BUSINESS REVIEW, 42 (1997), 11-54

TRADE AND INVESTMENT RELATIONS OF JAPAN AND ASEAN IN A CHANGING GLOBAL ECONOMIC ENVIRONMENT*

SHIGEYUKI ABE **Kobe University**

Abstract

This paper analyzes the patterns of trade and investment of Japan with ASEAN in the 1980's and early 1990's. The development of the region was brought by positive foreign direct investment and trade activities of Japan in particular. Trade structures have changed, reflecting the relative cost performances and the development of international production/distribution networks. ASEAN now engages in intra industry trade with Japan but it is still one sided. Japan is expected to transfer technology, management skills, and capital substantially to this region. With the emergence of economic powers such as China and Indochina countries, which turn out to be very strong in labor intensive products, ASEAN faces a challenge to upgrade their industries and to this end Japan should play a positive role from the standpoint of harmonious growth of the region.

JEL Classification: F14; F21; O14; O53

Keywords: Intra-industry trade; Flying geese pattern; FDI; ASEAN

Corresponding Address:
Shigeyuki Abe
Research Institute for Economics and Business Administration, Kobe University
2-1 Rokkodai-cho, Nada-ku, Kobe 657-8501, Japan
E-mail: abe@rieb.kobe-u.ac.jp
Fax: (81)-78-803-0397

* This paper was originally presented at the conference, "AFTA and Beyond: An ASEAN Perspective," Bangkok, Thailand, April 25-26, 1995. At the time of the conference, ASEAN had been enjoying high economic growth led by export expansion. The world environment has changed substantially since then. Particularly in 1997 the Thai baht devaluation triggered the Asian foreign exchange crisis and that affected not only Asia but the world. The immediate cause of the crisis was the burst of bubble and the withdrawal of foreign short term capital; but the real cause should be slow and lagged adjustments of their economies to advanced industrial structure and the continued large gap between actual and real exchange rates. This paper is old but is suggestive enough to what ASEAN and Japan should do in the future. In fact, this paper recommended upgrading their industrial structures in their high time of economic miracle. The author would like to thank Miss Kaori Kiyohara and Mrs. Mika Yoshida for data collection and preparation.

1. Introduction

This paper addresses the role of Japan and East Asia in the world trading system in light of the 1993 conclusion of the Uruguay Round, successive APEC meetings and trends toward a more regional trading system centering around the World Trade Organization (WTO). To do so, we analyze the patterns of trade and investment of Japan with the ASEAN countries for the past decade or so and project the direction of future relations of Japan and ASEAN in the context of the global trading system.

Japan faced an acute *yendaka* or high yen situation after the Plaza Agreement in 1985; The yen rate rose from 240 to 150 yen/dollar in nine months. By mid 1995 the yen appreciated again to 80 yen/dollar[1]. Trade structures have been changing, reflecting the relative cost performances and the development of international production/distribution networks. Neighboring Asian countries have been pursuing export-oriented policy and encouraging foreign direct investments(FDI). FDI contributes to the international transfer of technology, management skills, and capital. Accordingly, such FDI enabled host developing countries to expand production and exports of capital and technology intensive goods, which changed comparative advantage structures. As a result, Japan became a significant importer of manufactured goods from the world. To ASEAN, Japan, however, remained to be a big exporter; this is because ASEAN was still at an intermediate stage of development, which requires large imports of intermediate and capital goods.

Structures of comparative advantage, thus, was transformed substantially in Asia and the Pacific and intra-industry trade sharply increased in this region. With the emergence of economic powers such as China and Indochina countries, which turned out to be very strong in labor intensive products, ASEAN now faces a challenge to upgrade their industries and to this end Japan is expected to play a positive role.

Japan should support the ASEAN countries in their industry upgrading efforts through financial and technical cooperation. It is important to have a viewpoint that this effort is part of Japan's process of establishing an internationally harmonious industrial structure. *Full Set Industrialism for Japan*[2] should be changed to *Full Set Industrialism in the region or in the world.* AFTA, although its scale is

---

1 In terms of effective exchange rates this appreciation was no smaller than the former one. Currently the yen depreciated to 130 yen/dollar. This paper analyses this situation upto 1995.

2 *Full set industrialism* means the production within Japan of virtually all consumer, intermediate, and capital goods used in Japan, as had been the case in the 1970's.

quite limited, has and will have an impact which leads Japan to move in this direction.

In this paper the issue of structural change in ASEAN and Japan and their relation is analyzed in a focused manner by reorganizing and aggregating the extensive data available on trade flows. First, we will review the status of Japan and ASEAN in world trade in terms of shares, growth rate, trade intensities, and revealed comparative advantage (*RCA*). Second, the Japanese trade pattern will be analyzed in more detail. The main objective here is to show the development of intra-industry trade (*IIT*). To see the real specialization, however, our aggregation is not satisfactory. We will go into more detailed classification, that is, to the SITC 5 digit level to examine the division of labor between Japan and the ASEAN countries. Thirdly, we will review the development of direct foreign investment in this region, which prompted the above changes in the trade relationship. Fourthly, the prospect of further cooperation in trade and investment will be discussed in reference to the recent regionalism; i.e. APEC, NAFTA, and AFTA. The last section gives a conclusion.

2. Importance of ASEAN as Trade Partner of Japan

The average real growth rates of East Asia were much higher than those of OECD countries. Despite the slowdown in the world economy, East Asia in the 1990's has maintained relatively high growth rates. The real economic growth rates of selected countries in the region for the years 1988 through 1990 were as follows: Thailand, 11.7%; Malaysia, 9.2%; Indonesia, 6.7%; Philippines, 2.8%; Korea, 8.0%; Taiwan, 6.7%; Hong Kong, 4.7%; Singapore, 8.8%; China, 6.8%; and Japan, 4.2%[3].

In addition, this region's importance is self evident if we take into account the size factor, i.e., population and GDP. There is no doubt that East Asia had been a growth pole in the world economy during the 1980's and in the early 1990's. The U.S. and Japan are beginning to regard the Asia Pacific strategically indispensable. The economic performance of the Asian NIEs (ANIEs), ASEAN, and China contributed to this recognition. China is now a strong rival of ASEAN in attracting foreign capital and exports of labor intensive products.

Trade Shares and High Trade Intensities: 10% vs. 20% Trade Importance

Table 1 gives a world trade matrix for 1980 and 1991 with Japan and ASEAN being a focus. According to this table, the share of ASEAN's trade expanded

3 World Bank, *World Table,* 1993.

from 3.5% in 1980 to over 4.5% of the world trade in 1991. This size was roughly half of the Japanese world trade share. The same table shows the importance of ASEAN as a Japanese trade partner; its relative importance increased in exports (from 10% to 12%) while it decreased in imports (from 17% to 14%). Although the share was greater in Japanese imports, the main items were non-manufactures. The trade of ASEAN and ANIEs combined expanded almost 5 percentage point in the world trade share. To this development the United States contributed mainly in expanding imports while Japan mainly in expanding exports; Asian NIEs increased both exports and imports. China increased its trade share with the region most of all, the growth rate of trade being 16.1 percent. Asian NIEs contributed far more than Japan to this development; in fact, Japan and ASEAN4 contributed less than the world average. China is by far the fast trade expanding country in the Asia-Pacific region. China's exports to ASEAN4, in fact, increased by 24 percentage point.

Table 1 World Trade Matrix

Trade Matrix: 1980 (million of US$)

	World	USA	Japan	HK	Korea	Taiwan	China	Sing.	Mal.	Thai.	Indo.	Phil.	Brunei	ROW	ASEAN6	ASEAN5
World	1,895,500	239,562	123,667	22,057	19,376	19,733	17,830	25,787	10,761	8,644	11,039	8,186	566	1,388,292	64,983	39,196
USA	220,781	0	20,790	2,688	4,685	4,673	0	3,033	1,337	1,263	1,545	1,999	70	178,698	9,247	6,214
Japan	130,435	31,910	0	4,784	5,393	5,353	5,109	3,929	2,070	1,925	3,476	1,692	89	64,704	13,181	9,252
Hong Kong	19,720	5,157	909	0	227	250	1,249	863	176	213	617	328	10	9,721	2,207	1,344
Korea	17,439	4,624	3,039	823	0	209	0	267	184	165	366	153	0	7,609	1,134	868
Taiwan	19,811	6,760	2,173	1,551	267	0	0	545	170	176	478	195	4	7,491	1,568	1,023
China	18,139	983	4,032	4,353	0	0	0	421	184	312	21	258	0	7,576	1,196	775
Singapore	19,377	2,424	1,560	1,496	289	222	307	0	2,909	844	0	273	277	8,776	4,303	4,303
Malaysia	12,960	2,119	2,958	244	262	425	217	2,480	0	188	34	198	23	3,812	2,923	444
Thailand	6,501	823	982	330	49	90	124	503	292	0	237	23	9	3,039	1,064	562
Indonesia	21,909	4,303	10,793	152	0	540	0	2,484	60	35	0	181	0	3,362	2,760	276
Phillipinnes	5,787	1,594	1,540	192	203	117	45	113	94	63	107	0	3	1,716	380	268
Brunei	4,589	395	3,253	1	0	75	0	301	44	189	0	51	0	282	585	284
ROW	1,398,052	178,471	71,638	5,444	8,001	7,780	10,779	10,849	3,240	3,271	4,158	2,835	80	1,091,505	24,434	13,584
ASEAN6	71,123	11,657	21,085	2,414	803	1,468	693	5,879	3,400	1,319	378	727	313	20,987	12,016	6,136
ASEAN5	51,746	9,233	19,525	918	514	1,246	386	5,879	491	475	378	454	36	12,211	7,713	1,833

Trade Matrix: 1991 (million of US$)

	World	USA	Japan	HK	Korea	Taiwan	China	Sing.	Mal.	Thai.	Indo.	Phil.	Brunei	ROW	ASEAN6	ASEAN5
World	3,454,400	490,741	213,095	97,715	70,765	54,716	62,795	61,975	32,343	33,636	19,236	12,864	1,690	2,302,829	161,744	99,769
USA	421,755	0	48,147	8,141	15,518	12,612	0	8,808	3,902	3,758	1,892	2,269	162	316,547	20,791	11,983
Japan	314,892	92,200	0	16,337	20,088	16,069	8,605	12,228	7,649	9,446	5,618	2,663	129	123,861	37,732	25,504
Hong Kong	98,579	22,391	5,308	0	2,111	1,446	26,736	2,688	711	1,073	705	916	21	34,473	6,115	3,427
Korea	69,489	18,311	12,195	4,641	0	1,344	307	2,434	1,117	1,350	1,048	632	2	26,110	6,583	4,148
Taiwan	67,214	21,746	8,346	8,556	1,213	0	0	2,204	1,104	1,424	1,246	811	2	20,563	6,790	4,587
China	71,986	6,192	10,265	32,111	2,177	0	0	2,013	527	847	481	253	11	17,109	4,132	2,119
Singapore	59,188	11,674	5,133	4,260	1,393	1,406	858	0	8,800	3,706	0	681	553	20,724	13,740	13,740
Malaysia	34,405	5,808	5,458	1,152	1,514	1,003	639	8,020	0	1,098	503	301	117	8,793	10,037	2,018
Thailand	27,824	6,016	5,104	1,297	468	448	419	2,164	610	0	145	96	30	11,028	3,044	880
Indonesia	29,142	3,509	10,767	703	0	922	1,191	2,410	342	267	0	168	0	8,864	3,187	777
Phillipinnes	8,840	3,151	1,771	392	228	236	128	229	123	221	42	0	1	2,317	617	387
Brunei	2,597	26	1,365	6	256	90	2	168	1	189	0	89	0	405	448	280
ROW	2,248,489	299,717	99,236	20,120	25,800	19,140	23,911	18,609	7,457	10,259	7,557	3,985	661	1,712,035	48,529	29,920
ASEAN6	161,996	30,184	29,599	7,810	3,858	4,105	3,236	12,991	9,876	5,480	690	1,334	702	52,131	31,073	18,081
ASEAN5	102,808	18,510	24,466	3,550	2,466	2,699	2,378	12,991	1,076	1,774	690	653	148	31,406	17,333	4,342

Source: Calculated based upon IMF *Direction of Trade* .

On the other hand, for ASEAN, Japan has been the largest trading partner. As an ASEAN's export partner, Japan's share was 30% in 1980, dropping to 18% in 1991, which corresponds with the above observation. Japan increased its importance as ASEAN's import partner from 20 % in 1980 to 23% in 1991.

Although these development occurred over the past decade, Japan regards ASEAN as roughly a 10% trade partner while ASEAN regards Japan as a 20% trade partner. Japan's importance to ASEAN is twice as large as that of ASEAN to Japan in their trade relationship.

Another way to see the trade dependence is by trade intensity[4]. Table 2 gives these figures. This intensity shows how different particular bilateral trade relation is compared with the world average. Japan-ASEAN trade intensity dropped from 2.95 in 1980 to 2.56 in 1991. (ASEAN-Japan figure, i.e., ASEAN's exports to Japan, changed from 4.54 to 2.96.) The corresponding figure for the U.S.-ASEAN changed from 1.22 to 1.05. Thus, although the intensity dropped, Japan was more strongly tied with ASEAN in trade than the case of the United States. Among ASEAN countries, Japan had the largest trade intensity with Indonesia (3.20), followed by Thailand (3.08), Malaysia (2.59), Philippines (2.27), and Singapore (2.16). The intensity with Korea and Taiwan was at the similar level as with Indonesia. Asian NIEs also dropped their intensities with Japan between 1980 to 1991.

One possible explanation of this result is the following. The two successive oil shocks and various trade frictions taught a lesson to this region about the importance of diversification. Japan and Asian NIEs diversified trade of oil away from Indonesia and Malaysia; Indonesia and Malaysia did not intend to diversify but there was no other choice. Thus, the trade intensity indices of this region did not rise during this period although the intensity levels were already high.

Another interesting finding is that although ASEAN6's intensity was 4.10, ASEAN5's one is much lower, 1.46, in 1991[5]. This is because Singapore and Malaysia showed very high trade intensities with Brunei, 19.11 and 6.96 respectively.

In sum, although the absolute trade volume of ASEAN grew rapidly, the rela-

---

4 The direction of trade for the Asia-Pacific countries is prepared from the *IMF Direction of Trade statistics and a direct source of Taiwan, Statistical Yearbook of the Republic of China.* The compiled table is an export based one for 1980 and 1991. For some countries 1991 figures are not available at present time. In such cases 1990 figures are used instead (Taiwan); for some countries figures are not available at all(USSR). In such cases trade partners' import data are used without any modification. The difference between CIF and FOB should be duely considered. However, this amendment has been done for less than 5% of the data and for minor countries only.

5 ASEAN6 consists of Indonesia, Malaysia, Singapore, Philippines, Thailand, and Brunei. ASEAN5 excludes Brunei from ASEAN6.

tive share and trade intensity with Japan dropped for the period between 1980 and 1991.

Table 2 Trade Intensity Index

1980

	USA	Japan	HK	Korea	Taiwan	China	Sing.	Mal.	Thai.	Indo.	Phil.	Brunei	ROW	ASEAN6	ASEAN5
USA	0.00	1.44	1.05	2.08	2.03	0.00	1.01	1.07	1.25	1.20	2.10	1.06	1.11	1.22	1.36
Japan	1.94	0.00	3.15	4.04	3.94	4.16	2.21	2.80	3.24	4.58	3.00	2.28	0.68	2.95	3.43
Hong Kong	2.07	0.71	0.00	1.13	1.22	6.73	3.22	1.57	2.37	5.37	3.85	1.70	0.67	3.26	3.29
Korea	2.10	2.67	4.06	0.00	1.15	0.00	1.12	1.86	2.08	3.60	2.03	0.04	0.60	1.90	2.41
Taiwan	2.70	1.68	6.73	1.32	0.00	0.00	2.02	1.51	1.95	4.14	2.28	0.67	0.52	2.31	2.50
China	0.43	3.41	20.62	0.00	0.00	0.00	1.71	1.79	3.77	0.20	3.29	0.00	0.57	1.92	2.07
Singapore	0.99	1.23	6.63	1.46	1.10	1.69	0.00	26.44	9.55	0.00	3.27	47.91	0.62	6.48	10.74
Malaysia	1.29	3.50	1.61	1.98	3.15	1.78	14.06	0.00	3.19	0.45	3.53	5.99	0.40	6.58	1.66
Thailand	1.00	2.31	4.36	0.74	1.33	2.02	5.68	7.92	0.00	6.25	0.84	4.79	0.64	4.78	4.18
Indonesia	1.55	7.55	0.60	0.00	2.37	0.00	8.33	0.48	0.35	0.00	1.92	0.00	0.21	3.67	0.61
Phillipinnes	2.18	4.08	2.85	3.43	1.95	0.83	1.43	2.87	2.39	3.18	0.00	1.85	0.40	1.92	2.24
Brunei	0.68	10.86	0.02	0.00	1.56	0.00	4.81	1.70	9.01	0.00	2.58	0.00	0.08	3.72	2.99
ROW	1.01	0.79	0.33	0.56	0.53	0.82	0.57	0.41	0.51	0.51	0.47	0.19	1.07	0.51	0.47
ASEAN6	1.30	4.54	2.92	1.10	1.98	1.04	6.08	8.42	4.07	0.91	2.37	14.73	0.40	4.93	4.17
ASEAN5	1.41	5.78	1.52	0.97	2.31	0.79	8.35	1.67	2.01	1.25	2.03	2.31	0.32	4.35	1.71

1991

	USA	Japan	HK	Korea	Taiwan	China	Sing.	Mal.	Thai.	Indo.	Phil.	Brunei	ROW	ASEAN6	ASEAN5
USA	0.00	1.85	0.68	1.80	1.89	0.00	1.16	0.99	0.91	0.81	1.44	0.79	1.13	1.05	0.98
Japan	2.06	0.00	1.83	3.11	3.22	1.50	2.16	2.59	3.08	3.20	2.27	0.84	0.59	2.56	2.80
Hong Kong	1.60	0.87	0.00	1.05	0.93	14.92	1.52	0.77	1.12	1.28	2.50	0.44	0.52	1.32	1.20
Korea	1.85	2.84	2.36	0.00	1.22	0.24	1.95	1.72	1.99	2.71	2.44	0.05	0.56	2.02	2.07
Taiwan	2.28	2.01	4.50	0.88	0.00	0.00	1.83	1.75	2.18	3.33	3.24	0.07	0.46	2.16	2.36
China	0.61	2.31	15.77	1.48	0.00	0.00	1.56	0.78	1.21	1.20	0.94	0.31	0.36	1.23	1.02
Singapore	1.39	1.41	2.54	1.15	1.50	0.80	0.00	15.88	6.43	0.00	3.09	19.11	0.53	4.96	8.04
Malaysia	1.19	2.57	1.18	2.15	1.84	1.02	12.99	0.00	3.28	2.62	2.35	6.96	0.38	6.23	2.03
Thailand	1.52	2.97	1.65	0.82	1.02	0.83	4.34	2.34	0.00	0.94	0.92	2.20	0.59	2.34	1.10
Indonesia	0.85	5.99	0.85	0.00	2.00	2.25	4.61	1.25	0.94	0.00	1.55	0.00	0.46	2.34	0.92
Phillipinnes	2.51	3.25	1.57	1.26	1.69	0.80	1.45	1.49	2.57	0.85	0.00	0.23	0.39	1.49	1.52
Brunei	0.07	8.52	0.09	4.80	2.19	0.04	3.61	0.06	7.46	0.02	9.24	0.00	0.23	3.68	3.73
ROW	0.94	0.72	0.32	0.56	0.54	0.58	0.46	0.35	0.47	0.60	0.48	0.60	1.14	0.46	0.46
ASEAN6	1.31	2.96	1.70	1.16	1.60	1.10	4.47	6.51	3.47	0.76	2.21	8.85	0.48	4.10	3.86
ASEAN5	1.27	3.86	1.22	1.17	1.66	1.27	7.04	1.12	1.77	1.21	1.71	2.95	0.46	3.60	1.46

Source: Calculated based upon IMF *Direction of Trade*.

Drastic Changes in Trade Structures

The above treated simply gross trade nelationships and we will now turn to product breakdowns. Asia's increasing trade shares accompanied rapid and drastic structural changes. One way to examine these changes is to look at the revealed comparative advantage (*RCA*) index[6]. In Table 3 the *RCA* indices were shown for Japan, the United States, Singapore, Hong Kong, Thailand, and Indonesia. This table only lists the highest 15 *RCA* industries both for 1980 and 1988.

In Japan, while iron related products and woven textiles lost *RCA*, electronics related machines and various other machines gained *RCA*. The changes of the *RCA* structure of the United States were not substantial except the coal and petroleum industry, which gained *RCA* drastically. For the developed countries like the United States and Japan the *RCA* structures change at a slower pace. The rankings of *RCA* for 1980 and 1988 are not much different, i.e., most of the top 15 industries in 1980 ranked within the top 15 in 1988. This is more true for the United States.

Singapore gained *RCA* in office machines, nickel, coin, and office supplies while she lost *RCA* in special transactions, crude materials excluding fuels, clothing, watches and clocks. The *RCA* index for machinery increased in Singapore. Hong Kong's *RCA* structure seemingly did not change much in terms of rankings but when we closely look at the values of *RCA*, Hong Kong lost *RCA* in watches, clocks, toys, clothes, and cinema films, all the labor intensive products. Thailand gained *RCA* in leather manufactures, gold, silverware, jewelry, clothing, travel goods, footwear, toys, pottery, electric distributing machinery and domestic electric equipment. Most of the top listed industries in 1988 were new ones in Thailand. This shows how drastic the change of the trade structure was. Accordingly, Thailand lost *RCA* in silver, platinum, crude materials, zoo animals, pets, woven textile, cutlery, and some of the parts industry. For Indonesia substantial *RCA* rises were found in veneers, lace, ribbons, wood manufactures, woven cotton fabrics, aluminum, and iron in primary forms. Indonesia lost *RCA* in developed cinema film, beverages and tobacco, and some electrical machinery. The pattern of

---

6 The revealed comparative advantage (*RCA*) is a useful concept to see directly in which products one country has a relative strength in exporting. The *RCA* measures the relative strength as is revealed in the actual exports data. It is the ratio of the strength of that product of this country to the world average strength of it. The formula of the *RCA* is:

$$RCA_{ij} = \frac{(X_{ij}/X_{.j})}{(X_{iw}/X_{.w})}$$

where subscripts mean the following.

i: commodity *i*, .: all the commodities, *j*: country *j*, and *w*: the world.

The RCA is a good proxy of international competitiveness. To calculate RCA we used SITC 3 digit data for 5 to 9 categories and one digit for 0 to 4 categories. This is because we weigh more on manufactured products. The most recent data available is 1988, which is compared with 1980 figures.

Indonesia was similar to Thailand but the change of Thailand was more impressive.

With the limited observation as above we can see the rapid changes in the rankings of *RCA* in ASEAN countries. For developed countries more technology intensive products gained *RCA,* NIEs gained *RCA* in less sophisticated products, and developing ASEAN gained in more labor intensive products. The speed of the change, however, is remarkable. This is indicative of the existence of *Flying Geese Pattern of Development* in Asia. Japanese strong *RCA* industries in the past became the strong *RCA* industries of ANIEs, and ANIEs' strong *RCA* industries became the strong *RCA* industries of ASEAN now.

Japan-ASEAN Trade Relationships

Let us, next, look specifically at the trade relationship between Japan and ASEAN countries by regrouping detailed trade data into manageable size of industry categories. This is to project how ASEAN might develop in the future by referring to the current Japan-ANIEs and Japan-U.S. trade relationships.

Regarding the exports to Asian NIEs, machinery, semiconductor, and industrial machinery expanded drastically. In particular when Japanese FDI expanded to Asian NIEs, machinery exports increased. Japanese export items consisted of automobile parts, electronic parts, industrial machinery, steel, and non-ferrous metal. As was true for the ANIEs, Japan proved to be a supplier of capital goods as well as intermediate goods. In the area of machinery ASEAN increasingly raised the dependence on Japan since the latter half of the 1980's. Japan still imported petroleum and other raw materials from ASEAN. Since 1988, however, drastic increases were found in miscellaneous manufactures such as clothing, bags, and footwear; since 1989 machinery such as parts of office machines, computer, audio-video equipment expanded to a large degree. The share of non-manufacturing products in Japanese imports from ASEAN decreased to less than 70 percent and the ratio of machines increased to almost 10 percent in the early 1990's.

Table 5 investigates 10 major traded items out of 47 commodity categories[7]. It is surprising to find out that just 10 major commodities trade accounted for more than 85% of exports and 75% of imports. Regarding the exports from Japan to the U.S./Canada, Japan's exports of commodity categories 29, 40, 42, and 41, totaled 74% in 1990. This pattern was true for any other sub-regions of the Asia-Pacific. For imports, Japan's imports of non manufactures (*NM*) was the largest category from all the regions. This was followed by categories 40, 42, 43, 41, and 29. As far as we can see, there exists a possibility of *IIT* in the four manufactured goods which appeared twice above.

---

7 Table 4 gives the 47 categories. These categories are further aggregated to four manufacture groupings. This typology is similar to Krauss (1988).

Table 3 RCA of Selected Countries

Japan

Order of 1980 RCA	1980		1988		Order of 1988 RCA	1980		1988	
	RCA	rank	RCA	rank		RCA	rank	RCA	rank
891--Sound recorders,produ	6.10	1	3.99	1	891--Sound recorders,produc	6.10	1	3.99	1
735--Ships and boats	4.11	2	2.01	9	724--Telecommunications eq	3.54	4	2.45	2
678--Iron,stl tubes,pipes,etc	4.09	3	1.81	12	729--Electrical machinery ne	1.66	29	2.24	3
724--Telecommunications eq	3.54	4	2.45	2	732--Road motor vehicles	2.99	8	2.22	4
674--Irn,stl univ,plate,sheet	3.44	5	2.09	8	862--Photo,cinema supplies	1.82	25	2.21	5
666--Pottery	3.06	6	1.47	18	861--Instruments,apparatus	2.86	9	2.21	6
864--Watches and clocks	2.99	7	1.63	17	715--Metalworking machinery	1.89	24	2.20	7
732--Road motor vehicles	2.99	8	2.22	4	674--Irn,stl univ,plate,sheet	3.44	5	2.09	8
861--Instruments,apparatus	2.86	9	2.21	6	735--Ships and boats	4.11	2	2.01	9
696--Cutlery	2.66	10	1.30	22	717--Textile,leather machnry	1.68	27	1.86	10
673--Iron and steel shapes	2.65	11	1.00	31	895--Office supplies nes	1.96	19	1.85	11
672--Iron,stl primary forms	2.51	12	0.87	36	678--Iron,stl tubes,pipes,etc	4.09	3	1.81	12
653--Woven textiles noncotto	2.36	13	0.90	35	714--Office machines	1.19	40	1.81	13
694--Stl,coppr nails,nuts,etc	2.24	14	1.36	21	726--Electro-medcl,xray equi	0.93	50	1.77	14
723--Electr distributing mach	2.21	15	1.07	27	722--Elec pwr mach,switchge	1.72	26	1.75	15

USA

	1980		1988			1980		1988	
	RCA	rank	RCA	rank		RCA	rank	RCA	rank
840--UN special code	7.18	1	0.00	111	951--War firearms,ammunitio	3.96	4	3.50	1
688--Uranium,thorium,alloys	7.16	2	2.39	4	734--Aircraft	4.03	3	3.36	2
734--Aircraft	4.03	3	3.36	2	931--Special transactions	1.33	24	3.31	3
951--War firearms,ammunitio	3.96	4	3.50	1	688--Uranium,thorium,alloys	7.16	2	2.39	4
896--Works of art etc	3.88	5	1.96	7	515--Radioactive etc material	1.81	16	2.08	5
714--Office machines	2.63	6	1.76	11	561--Fertilizers manufactured	2.03	12	2.04	6
726--Electro-medcl,xray equi	2.32	7	1.82	9	896--Works of art etc	3.88	5	1.96	7
689--Non-fer base metals ne	2.16	8	1.77	10	521--Coal,petroleum etc che	0.17	105	1.89	8
711--Power machinery non-e	2.15	9	1.67	12	726--Electro-medcl,xray equi	2.32	7	1.82	9
863--Developed cinema film	2.12	10	0.99	32	689--Non-fer base metals ne	2.16	8	1.77	10
718--Machs for spcl industry	2.08	11	1.18	22	714--Office machines	2.63	6	1.76	11
561--Fertilizers manufacture	2.03	12	2.04	6	711--Power machinery non-el	2.15	9	1.67	12
729--Electrical machinery ne	2.00	13	1.54	13	729--Electrical machinery ne	2.00	13	1.54	13
712--Agricultural machinery	1.97	14	1.29	19	2--Crude matls excl fuels	1.74	17	1.44	14
862--Photo,cinema supplies	1.89	15	1.14	25	514--Othr inorganic chemical	1.68	18	1.39	15

Singapore

	1980		1988			1980		1988	
	RCA	rank	RCA	rank		RCA	rank	RCA	rank
521--Coal,petroleum etc che	21.54	1	6.60	2	687--Tin	6.73	3	9.99	1
931--Special transactions	7.42	2	0.49	55	521--Coal,petroleum etc che	21.54	1	6.60	2
687--Tin	6.73	3	9.99	1	714--Office machines	0.53	39	3.89	3
4--Animal,vegetable oil,fat	4.34	4	3.36	5	724--Telecommunications eq	3.65	6	3.68	4
631--Veneers,plywood,etc	3.73	5	1.81	10	4--Animal,vegetable oil,fat	4.34	4	3.36	5
724--Telecommunications eq	3.65	6	3.68	4	3--Mineral fuels etc	1.29	12	2.53	6
729--Electrical machinery ne	3.10	7	2.38	7	729--Electrical machinery ne	3.10	7	2.38	7
735--Ships and boats	2.56	8	1.34	14	891--Sound recorders,produc	1.49	11	2.32	8
2--Crude matls excl fuels	1.85	9	0.84	29	683--Nickel	0.11	97	2.26	9
911--Mail not classed by kind	1.49	10	1.03	20	631--Veneers,plywood,etc	3.73	5	1.81	10
891--Sound recorders,produ	1.49	11	2.32	8	961--Coin nongold,noncurren	0.05	103	1.69	11
3--Mineral fuels etc	1.29	12	2.53	6	895--Office supplies nes	0.54	37	1.64	12
725--Domestic electric equip	1.21	13	1.16	15	722--Elec pwr mach,switchge	1.05	16	1.64	13
864--Watches and clocks	1.20	14	0.96	21	735--Ships and boats	2.56	8	1.34	14
841--Clothing not of fur	1.10	15	1.04	18	725--Domestic electric equip	1.21	13	1.16	15

Table 3 RCA of Selected Countries (concluded)

Hong Kong

	1980		1988			1980		1988	
	RCA	rank	RCA	rank		RCA	rank	RCA	rank
961--Coin nongold,noncurren	23.89	1	2.41	21	675--Iron,steel hoop,strip	0.12	88	27.61	1
864--Watches and clocks	19.09	2	9.34	3	831--Travel goods,handbags	10.78	6	9.57	2
894--Toys,sporting goods,etc	13.03	3	8.88	4	864--Watches and clocks	19.09	2	9.34	3
841--Clothing not of fur	12.10	4	6.24	6	894--Toys,sporting goods,etc	13.03	3	8.88	4
842--Fur etc clothes,prod	11.33	5	8.07	5	842--Fur etc clothes,prod	11.33	5	8.07	5
831--Travel goods,handbags	10.78	6	9.57	2	841--Clothing not of fur	12.10	4	6.24	6
899--Other manufactured go	8.96	7	5.33	7	899--Other manufactured go	8.96	7	5.33	7
652--Cotton fabrics,woven	7.57	8	5.08	8	652--Cotton fabrics,woven	7.57	8	5.08	8
656--Textile etc products nes	6.50	9	2.38	22	696--Cutlery	2.74	18	3.74	9
863--Developed cinema film	6.01	10	2.81	18	653--Woven textiles noncotto	2.30	21	3.64	10
911--Mail not classed by kind	4.70	11	3.02	15	697--Base mtl household equ	4.63	12	3.38	11
697--Base mtl household eq	4.63	12	3.38	11	897--Gold,silver ware,jewelry	4.32	14	3.27	12
725--Domestic electric equip	4.42	13	3.08	14	613--Fur skins tanned,dresse	0.68	50	3.17	13
897--Gold,silver ware,jewelry	4.32	14	3.27	12	725--Domestic electric equip	4.42	13	3.08	14
571--Explosives,pyrotech pro	3.72	15	2.36	23	911--Mail not classed by kind	4.70	11	3.02	15

Thailand

	1980		1988			1980		1988	
	RCA	rank	RCA	rank		RCA	rank	RCA	rank
687--Tin	46.28	1	10.00	1	687--Tin	46.28	1	10.00	1
0--Food and live animals	4.74	2	4.28	4	612--Leather etc manufactur	0.21	43	8.46	2
931--Special transactions	4.14	3	0.42	50	897--Gold,silver ware,jewelry	1.54	14	6.05	3
632--Wood manufactures ne	3.82	4	2.80	9	0--Food and live animals	4.74	2	4.28	4
656--Textile etc products nes	3.71	5	2.51	12	841--Clothing not of fur	2.04	12	4.11	5
722--Elec pwr mach,switchge	3.39	6	0.40	52	831--Travel goods,handbags	1.32	17	3.93	6
681--Silver,platinum,etc	2.65	7	0.01	100	667--Pearl,prec-,semi-p ston	2.48	8	3.93	7
667--Pearl,prec-,semi-p ston	2.48	8	3.93	7	851--Footwear	0.38	33	3.10	8
652--Cotton fabrics,woven	2.48	9	1.48	17	632--Wood manufactures ne	3.82	4	2.80	9
2--Crude matls excl fuels	2.33	10	1.40	18	899--Other manufactured go	1.32	18	2.54	10
941--Zoo animals,pets	2.29	11	1.10	29	894--Toys,sporting goods,etc	0.10	60	2.53	11
841--Clothing not of fur	2.04	12	4.11	5	656--Textile etc products nes	3.71	5	2.51	12
653--Woven textiles noncotto	1.93	13	1.36	20	666--Pottery	0.22	42	1.99	13
897--Gold,silver ware,jewelry	1.54	14	6.05	3	723--Electr distributing mach	0.16	47	1.74	14
696--Cutlery	1.49	15	0.51	43	725--Domestic electric equip	0.05	74	1.65	15

Indoneisa

	1980		1988			1980		1988	
	RCA	rank	RCA	rank		RCA	rank	RCA	rank
687--Tin	10.49	1	23.44	2	631--Veneers,plywood,etc	0.97	6	35.44	1
3--Mineral fuels etc	3.66	2	6.75	3	687--Tin	10.49	1	23.44	2
2--Crude matls excl fuels	2.65	3	2.49	8	3--Mineral fuels etc	3.66	2	6.75	3
4--Animal,vegetable oil,fat	2.13	4	6.01	4	4--Animal,vegetable oil,fat	2.13	4	6.01	4
551--Essentl oil,perfume,etc	1.02	5	1.28	16	654--Lace,ribbons,tulle,etc	0.08	23	4.56	5
631--Veneers,plywood,etc	0.97	6	35.44	1	661--Cement etc building pro	0.48	9	2.90	6
863--Developed cinema film	0.92	7	0.00	107	632--Wood manufactures ne	0.11	21	2.50	7
0--Food and live animals	0.63	8	1.20	18	2--Crude matls excl fuels	2.65	3	2.49	8
661--Cement etc building pro	0.48	9	2.90	6	561--Fertilizers manufactured	0.31	11	1.96	9
532--Dyes nes,tanning prods	0.39	10	0.98	22	841--Clothing not of fur	0.22	13	1.78	10
561--Fertilizers manufacture	0.31	11	1.96	9	652--Cotton fabrics,woven	0.03	35	1.62	11
1--Beverages and tobacco	0.28	12	0.47	37	653--Woven textiles noncotto	0.14	19	1.55	12
841--Clothing not of fur	0.22	13	1.78	10	684--Aluminium	0.01	48	1.54	13
671--Pig iron etc	0.21	14	1.47	14	671--Pig iron etc	0.21	14	1.47	14
729--Electrical machinery ne	0.18	15	0.08	62	672--Iron,stl primary forms	0.00	97	1.34	15

Source: Calculated based upon OECD trade data.

Table 4 Classification of Traded Goods

	SITC Rev. 1	SITC Rev. 2	SITC Rev.3
Natural Resource Intensive (NR)			
1 Leather	61	61	61
2 Wood	63	63	63
3 Mineral manufactures	661-3	661-3	661-3
4 Precious stones	667	667	667
5 Pig iron	671	671	671
6 Nonferrous metals	68	68	68
Unskilled Labor Intensive (UL)			
7 Texitles	65	65	65
8 Glass and pottery	664-6	664-6	664-6
9 Ships	735	793	793
10 Sanitary, plumbing, heating and lighting fi	81	81	81
11 Furniture	82	82	82
12 Travel goods	83	83	83
13 Apparel	84	84	84
14 Footwear	85	85	85
15 Plastic articles	893	893	893
16 Toys	894	894	894
17 Office supplies	895	895	895
18 Manufactured articles, n.e.c.	899	899	899
Human Capital Intensive (HC)			
19 Paints	53	53	53
20 Perfume	55	55	55
21 Rubber	62	62	62
22 Paper	64	64	64
23 Steel	672-9	672-9	672-9
24 Metal manufactures	69	69	69
25 Television receivers	7241	761	761
26 Radios	7242	762	762
27 Phonographss, recorders	89111	763	763
28 Household-type electrical machinery	725	775	775
29 Road vehicles	732-733	78	78
30 Railway vehicles	731	791	791
31 Watches	864	885	885
32 Printed matter	892	892	892
33 Antiques and jewelry	896-7	896-7	896-7
34 Musical instruments	898	898	898
Technology Intensive (TC)			
35 chemical elements	51	51	51
36 other chemicals	52,57,59	52,57,59	52,57,59
37 medicine	54	54	54
38 fertilizer(chemical)	56	56	56
39 plastics	58	58	58
40 nonelectrical machineray	71	71-5	71-5
41 telecommunication equipment	724	764	764
42 electrical machinery other than 775	724,-725)	77(-775)	77(-775)
43 aircraft	734	792	792
44 scientific instruments	861-3	87	87
45 photographic goods	861-3	881-4	881-4
Others (OT)	9	9	9
Non-Manufactures (NM)	0-4	0-4	0-4

Table 5 Major Traded Goods: 45 Categories

Sectors	Exports in mil. US dollars 1985	1990	Growth Rate 85-90	Share in Trade 1990	Sectors	Imports in mil. US dollars 1985	1990	Growth Rate 85-90	Share in Trade 1990
USA and Canada					*USA and Canada*				
29	25,464	32,581	5.05	33.47	*SITC0-4*	15,532	26,546	11.32	43.83
40	12,439	24,688	14.69	25.36	*40*	2,854	6,841	19.11	11.30
42	4,452	8,773	14.53	9.01	*42*	1,464	3,651	20.06	6.03
41	3,497	5,197	8.24	5.34	*SITC9*	1,131	3,254	23.55	5.37
SITC9	3,461	4,629	5.99	4.76	*43*	1,452	2,961	15.31	4.89
27	5,316	3,357	-8.78	3.45	*36*	1,442	2,545	12.03	4.20
45	1,669	2,413	7.66	2.48	*6*	668	2,002	24.53	3.31
23	2,943	2,243	-5.29	2.30	*44*	919	1,913	15.79	3.16
44	905	1,995	17.14	2.05	*35*	886	1,251	7.14	2.07
24	1,295	1,374	1.20	1.41	*29*	114	990	53.97	1.63
sub total	61,439	87,250	7.27	89.64	*sub total*	26,463	51,953	14.44	85.78
ASEAN					*ASEAN*				
40	887	5,557	44.35	31.44	*SITC0-4*	15,086	18,205	4	78
29	1,059	3,855	29.47	21.81	*2*	79	1,077	69	5
42	557	2,379	33.71	13.46	*6*	596	547	-2	2
23	869	1,802	15.70	10.20	*40*	50	543	61	2
41	216	682	25.89	3.86	*SITC9*	102	514	38	2
36	83	472	41.67	2.67	*42*	57	368	45	2
SITC9	110	353	26.28	2.00	*4*	45	296	46	1
24	150	325	16.75	1.84	*13*	5	250	116	1
35	75	314	33.32	1.78	*11*	0	220	na	1
SITC0-4	79	256	26.52	1.45	*41*	0	158	na	1
sub total	4,084	15,995	31.40	90.51	*sub total*	16,019	22,177	6.72	95.62
ANIES					*ANIES*				
40	3,918	12,198	25	23	*SITC0-4*	3,935	6,743	11	28
42	3,380	9,871	24	19	*13*	935	3,280	29	13
SITC9	1,361	3,316	19	6	*SITC9*	874	2,418	23	10
23	1,715	3,048	12	6	*23*	529	1,572	24	6
29	1,054	2,844	22	5	*42*	427	1,446	28	6
41	827	2,235	22	4	*40*	235	1,411	43	6
SITC0-4	637	1,987	26	4	*7*	387	707	13	3
36	181	1,865	59	4	*16*	161	707	34	3
7	1,194	1,792	8	3	*14*	227	703	25	3
35	524	1,588	25	3	*41*	125	638	38	3
sub total	14,791	40,744	22.46	77.46	*sub total*	7,836	19,625	20.16	80.14
World					*World*				
29	42,122	64,298	9	25	*SITC0-4*	87,589	115,092	6	52
40	28,430	61,518	17	24	*SITC9*	3,085	12,705	33	6
42	12,786	28,310	17	11	*40*	3,934	12,209	25	5
41	6,745	14,241	16	5	*6*	3,680	9,381	21	4
SITC9	7,226	12,518	12	5	*13*	1,484	7,832	39	4
23	11,995	10,068	-3	4	*29*	728	7,244	58	3
27	8,512	8,933	1	3	*42*	2,199	6,456	24	3
45	3,408	6,302	13	2	*33*	312	5,141	75	2
9	5,820	5,430	-1	2	*36*	2,245	4,621	16	2
44	2,028	4,226	16	2	*35*	1,883	3,579	14	2
sub total	129,071	215,846	10.83	83.26	*sub total*	107,139	184,260	11.45	82.57

Out of 47 categories of goods, sector 29, automobiles, and sector 40, non-electrical machinery, shared roughly 25% each and sector 42, electric machinery except home electronics shared 11% in Japanese exports to the world. The growth rates of sectors 40 and 42 were more than 16.5%. Only a few selected items more or less monopolize the export trade scene; this is a characteristic of the Japanese trade.

As far as imports are concerned, the major portion of imports went to non-manufactures, 36.1% in 1990. The rapidly growing items were SITC 9 (*OT*) and sector 40, non-electric machinery, sector 6, non-ferrous metal, sector 13, apparel, and sector 29, road vehicles. The rate of growth was very rapid, more than 20 % per annum; in the case of sector 29, the growth rate recorded was 58% per annum.

In the same table we showed Japan-ASEAN trade relationships for 47 categories of goods. As is observed for ASEAN as a region, the trade is a one-sided game, i.e., Japan exported most of the technology intensive and capital intensive goods in large amount while ASEAN exported to Japan natural resources and labor intensive goods constantly and high tech and capital intensive products only recently. Indonesia and the Philippines began exporting even labor intensive products only in recent years.

This is roughly the picture of the Japan-ASEAN trade in the past.

We will analyze in more detail, i.e., at the SITC 5 digit level, to see if there are differences between Japan's trade with selected Asia-Pacific countries, i.e., the U.S., Korea, Taiwan, Hong Kong, Singapore, Malaysia, Thailand, Philippines, Indonesia, and China. We included non-ASEAN countries to see if how ASEAN will evolve in the future to follow the *Flying Geese Pattern.* As was examined in the former sections, intra-industry trade was found in sectors 28 (household type electric machinery), 29 (road vehicles), 40 (non-electrical machinery), 41 (tele-communication equipment), and 42 (electrical machinery other than household type). We will investigate and verify the trend of intra-industry trade in these sectors for selected countries in 1990.

Table 6 reveals the following. For home type electric appliances, Japan engaged in exports solely with Malaysia, Singapore, Indonesia, and China. Japan imported these goods from more than exported to Korea and Thailand. Quite a development of intra-industry trade was observed with Taiwan, followed by the U.S. and Hong Kong. Taiwan exported to Japan electric space heating units; refrigerators were more or less traded both ways in comparable value. Korea's case is probably an exception where Japan exported only parts and imported refrigerators and cooking utensils. In 1990 the data show that no imports from ASEAN took place but in recent years we observe quite a development in ASEAN's ex-

ports to Japan in this category of goods.

Table 6 Intra-Industry Trade of Selected Sectors and Countries

Home Appliances (Sector 28)

SITC	Explanation	Trade Specialization index	mil $	%	SITC	Explanation	mil $	%
USA		0.78						
77586	ovens and cookers, cooking plates, etc.		121,248	44.40	77571	vacuum cleaners	17351	51.70
77587	electro-theramic domestic appliances, n.e.s.		73,262	26.83	77588	electric heating resistors	9609	28.63
77589	parts of the electro-theramic appliances of 7758		27,886	10.21	77573	other electro-mechanical, domestic appliances	6598	19.66
total			273,077	100.00			33558	100.00
Thailand		-0.38						
77589	parts of the electro-theramic appliances of 7758		8,043	100.00	77521	refrigerators	9935	56.02
					77583		7801	43.98
total			8,043	100.00			17736	100.00
Malaysia		1.00						
77511	washing machines		6,693	100.00				
total			6,693	100.00				
Singapore		1.00						
77521	refrigerators		13,689	45.41				
77511	washing machines		10,172	33.74				
77586	ovens and cookers, cooking plates, etc.		6,287	20.85				
total			30,148	100.00				
Indonesia		1.00						
77521	refrigerators		6,125	100.00				
total			6,125	100.00				
China		1.00						
77586	ovens and cookers, cooking plates, etc.		11,090	44.78				
77571	vacuum cleaners		7,676	30.99				
77521	refrigerators		6,001	24.23				
total			24,767	100.00				
Korea		-0.45						
77589	parts of the electro-theramic appliances of 7758		13,056	100.00	77521	refrigerators	22404	65.50
					77586	ovens and cookers, cooking plates, etc.	11802	34.50
total			13,056	100.00			34206	100.00
Taiwan		0.69						
77587	electro-theramic domestic appliances, n.e.s.		39,597	35.87	77582	electric space and soil heating apparatus	8242	40.19
77511	washing machines		23,196	21.01	77521	refrigerators	6744	32.89
77521	refrigerators		14,938	13.53	77587	electro-theramic domestic appliances, n.e.s.	5521	26.92
total			110,387	100.00			20507	100.00
Hong Kong		0.88						
77587	electro-theramic domestic appliances, n.e.s.		22,175	28.67	77587	electro-theramic domestic appliances, n.e.s.	5118	100.00
77521	refrigerators		19,668	25.42				
77586	ovens and cookers, cooking plates, etc.		14,251	18.42				
77511	washing machines		12,839	16.60				
total			77,359	100.00			5118	100.00

Table 6 Intra-Industry Trade of Selected Sectors and Countries (continued)

Road Vehicles (Sector 19)

SITC	Explanation	Trade Specialization index	mil $	%	SITC	Explanation	mil $	%
USA		0.93						
78120	motor vehicles for the transport of persons		21,225,693	71.99	78120	motor vehicles for the transport of persons	602915	59.19
78219	motor vehicles fo rthe transport of goods, n.e.s.		2,060,194	6.99	78439	other parts and accessories	94898	9.32
78439	other parts and accessories		1,712,664	5.81	78432	other parts and accessories of bodies	73459	7.21
78432	other parts and accessories of bodies		1,492,315	5.06	78211	dumpers designed for off-highway use	43613	4.28
total			29,486,044	100.00			1018620	100.00
Thailand		1.00						
78219	motor vehicles fo rthe transport of goods, n.e.s.		604,072	34.98				
78410	chassis fitted with engines, for 722, 781, 782 and		270,224	15.65				
78439	other parts and accessories		256,998	14.88				
78120	motor vehicles for the transport of persons		214,723	12.43				
total			1,726,790	100.00				
Malaysia		1.00						
78120	motor vehicles for the transport of persons		170,829	28.25				
78439	other parts and accessories		104,687	17.31				
78219	motor vehicles fo rthe transport of goods, n.e.s.		96,603	15.98				
78511	motorcycles below 50 cc		63,956	10.58				
total			604,701	100.00				
Indonesia		1.00						
78439	other parts and accessories		237,173	27.94				
78120	motor vehicles for the transport of persons		172,024	20.26				
78410	chassis fitted with engines, for 722, 781, 782 and		78,208	9.21				
78432	other parts and accessories of bodies		76,602	9.02				
			848,964	100.00				
Philippines		0.96						
78120	motor vehicles for the transport of persons		187,202	41.48	78439	other parts and accessories	10301	100.00
78219	motor vehicles fo rthe transport of goods, n.e.s.		121,233	26.86				0.00
78439	other parts and accessories		41,288	9.15				0.00
78513	motorcycles over 50 cc but not 250 cc		23,412	5.19				0.00
			451,339	100.00			10301	100.00
China		0.95						
78219	motor vehicles fo rthe transport of goods, n.e.s.		78,008	33.53	78537	parts and accessories of other vehicles of 785	5869	100.00
78120	motor vehicles for the transport of persons		33,635	14.46				0.00
78439	other parts and accessories		25,411	10.92				0.00
			232,631	100.00			5869	100.00
Korea		0.73						
78439	other parts and accessories		155,681	36.21	78630	containers specially designed for carriage	24972	37.52
78434	gear boxes		84,755	19.71	78439	other parts and accessories	12435	18.68
78432	other parts and accessories of bodies		45,608	10.61	78120	motor vehicles for the transport of persons	8302	12.47
78227	concrete-mixer lorries		41,768	9.71	78432	other parts and accessories of bodies	8289	12.45
			429,981	100.00			66562	100.00

Table 6 Intra-Industry Trade of Selected Sectors and Countries (continued)

Taiwan	0.79						
78537	parts and accessories of other vehicles of 785	280,608	25.22	78439	other parts and accessories	42849	32.62
78432	other parts and accessories of bodies	184,385	16.57	78520	bicycles and other cycles, not motorized	42790	32.57
78219	motor vehicles fo rthe transport of goods, n.e.s.	179,670	16.15	78537	parts and accessories of other vehicles of 785	32645	24.85
78439	other parts and accessories	155,204	13.95	78685	vehicles, not mechanically propelled, n.e.s.	7715	5.87
		1,112,617	100.00			131369	100.00
Hong Kong	0.99						
78120	motor vehicles for the transport of persons	330,548	47.46	78517	motorcycles over 800 cc	5079	100.00
78219	motor vehicles fo rthe transport of goods, n.e.s.	125,483	18.02				0.00
78513	motorcycles over 50 cc but not 250 cc	93,694	13.45				0.00
		696,545	100.00			5079	100.00

Machinery (Sector 40)

SITC	Explanation	Trade Specialization index	mil $	%	SITC	Explanation	mil $	%
USA		0.55						
75997	parts and accessories of the machines of group 7		3,929,380	16.70	75997	parts and accessories of calculating machines	1402764	20.58
75260	input or output units		2,806,399	11.93	75230	digital processing units	1286282	18.87
75270	storage units		1,900,306	8.08	71491	parts of turbo-jets or turbo-propellers	512681	7.52
71322	reciprocating piston engines not over 1000cc		1,133,135	4.82	75270	storage units	398997	5.85
			23,522,939	100.00			6814920	100.00
Thailand		0.76						
72322	mechanical shovels		200,941	7.99	74610	ball bearings	116843	33.94
71323	compression-ignition engines		162,248	6.45	75997	parts and accessories of calculating machines	97765	28.40
72849	machinery having individual functions, n.e.s.		118,088	4.69	75270	storage units	35898	10.43
71391	parts for the internal combustion piston engines		100,461	3.99	71610	electric motors of an output not exceeding 37.5	25085	7.29
			2,515,217	100.00			344238	100.00
Malaysia		0.85						
72849	machinery having individual functions, n.e.s.		139,448	13.29	75997	parts and accessories of calculating machines	38497	45.83
72842	machinery for working rubber or plastics		65,355	6.23	75121	electronic calculators	24401	29.05
72322	mechanical shovels		63,951	6.09	74151	air conditioning machines	13690	16.30
71391	parts for the internal combustion piston engines		58,451	5.57	72849	machinery having individual functions, n.e.s.	7407	8.82
			1,049,367	100.00			83995	100.00
Singapore		0.71						
71610	electric motors of an output not exceeding 37.5 w		204,551	9.05	75270	storage units	165175	43.55
75260	input or output units		178,540	7.90	75997	parts and accessories of calculating machines	51545	13.59
72849	machinery having individual functions, n.e.s.		149,220	6.60	71610	electric motors of an output not exceeding 37.5	37233	9.82
75997	parts and accessories of the machines of group 7		122,117	5.40	74610	ball bearings	33419	8.81
			2,260,950	100.00			379319	100.00
Indonesia		1.00						
72443	textile spinning, doubling or twisting machines		164,256	9.66				
71323	compression-ignition engines		122,972	7.23				
72451	weaving machines (looms)		105,287	6.19				

Table 6 Intra-Industry Trade of Selected Sectors and Countries (continued)

	71391 parts for the internal combustion piston engines	97,708	5.75				
		1,700,337	100.00				
Philippines	0.32						
	75997 parts and accessories of the machines of group 7	53,452	18.32	75270 storage units		65996	43.63
	71323 compression-ignition engines	28,265	9.69	75997 parts and accessories of calculating machines		48445	32.03
	72849 machinery having individual functions, n.e.s.	21,113	7.24				0.00
	71392 parts for the internal combustion piston engines	19,248	6.60				0.00
		291,730	100.00			151267	100.00
China	0.77						
	72849 machinery having individual functions, n.e.s.	81,950	10.83	71610 electric motors of an output not exceeding 37.5		74895	76.12
	72435 other sewing machines	32,791	4.33	75121 electronic calculators		11931	12.13
	72443 textile spinning, doubling or twisting machines	32,680	4.32	75122 other calculating machines		5891	5.99
	71391 parts for the internal combustion piston engines	31,909	4.21	74780 taps, cocks, valves and similar appliances, n.e.s.		5676	5.77
Korea	0.85						
	72849 machinery having individual functions, n.e.s.	359,976	7.18	75997 parts and accessories of calculating machines		127536	31.40
	75997 parts and accessories of the machines of group 7	145,572	2.90	72344 other boring and sinking machinery, not self-prop		44490	10.95
	72451 weaving machines (looms)	129,224	2.58	74918 injection or compression moulds for rubber or pla		36453	8.97
	72443 textile spinning, doubling or twisting machines	106,304	2.12	71610 electric motors of an output not exceeding 37.5		34743	8.55
		5,014,991	100.00			406189	100.00
Taiwan	0.72						
	75270 storage units	198,131	6.18	71610 electric motors of an output not exceeding 37.5		89820	17.14
	72849 machinery having individual functions, n.e.s.	186,322	5.81	75997 parts and accessories of calculating machines		67683	12.92
	75997 parts and accessories of the machines of group 7	177,302	5.53	72433 sewing machines of the household type		53237	10.16
	72322 mechanical shovels	124,682	3.89	75230 digital processing units		47910	9.14
		3,204,340	100.00			523955	100.00
Hong Kong	0.89						
	75997 parts and accessories of the machines of group 7	189,286	11.02	75997 parts and accessories of calculating machines		61896	60.86
	72435 other sewing machines	143,537	8.36	75995 parts & accessories of calculating machines of 7		19934	19.60
	75270 storage units	121,414	7.07	75910 parts and accessories of the photo-copying appa		11368	11.18
	75260 input or output units	117,911	6.87	71610 electric motors of an output not exceeding 37.5		8505	8.36
		1,717,246	100.00			101703	100.00

Telecommunication Equipments (Sector 41)

SITC	Explanation	Trade Specialization index	mil $	%	SITC	Explanation	mil $	%
USA		0.69						
76482	television cameras		1,920,321	39.57	76493	parts & accessories of TV, radio, transmission et	203629	22.82
76419	other telephonic or telegraphic apparatus		720,364	14.84	76491	parts & accessories of telephony or telegraph	152792	17.12
76432	transmission apparatus incorporating reception		411,384	8.48	76432	transmission apparatus incorporating reception	144730	16.22
76493	parts & accessories of TV, radio, transmission etc		396,205	8.16	76415	telephonic or telegraphic switching apparatus	130438	14.62
			4,853,014	100.00			892321	100.00
Thailand		0.58						
76415	telephonic or telegraphic switching apparatus		98,717	30.89	76499	parts & accessories of sound recorders or reprod	54381	64.41
76499	parts & accessories of sound recorders or reprod		88,806	27.79	76411	telephone sets	12132	14.37
76432	transmission apparatus incorporating reception		27,458	8.59	76415	telephonic or telegraphic switching apparatus	6169	7.31
76493	parts & accessories of TV, radio, transmission etc		26,915	8.42	76423	loudspeakers, not mounted in their enclosures	5970	7.07
			319,550	100.00			84430	100.00

Table 6 Intra-Industry Trade of Selected Sectors and Countries (continued)

Malaysia	0.72						
76499	parts & accessories of sound recorders or reprod	120,957	43.27	76493	parts & accessories of TV, radio, transmission et	25653	55.86
76493	parts & accessories of TV, radio, transmission etc	61,508	22.01	76499	parts & accessories of sound recorders or reprod	20269	44.14
76417	other apparatus for carrier-current line systems	25,008	8.95				0.00
76432	transmission apparatus incorporating reception	22,717	8.13				0.00
		279,517	100.00			45922	100.00
Singapore	0.84						
76499	parts & accessories of sound recorders or reprod	185,300	29.07	76499	parts & accessories of sound recorders or reprod	37706	69.83
76493	parts & accessories of TV, radio, transmission etc	97,192	15.25	76493	parts & accessories of TV, radio, transmission et	8299	15.37
76482	television cameras	96,159	15.08	76432	transmission apparatus incorporating reception	7989	14.80
76419	other telephonic or telegraphic apparatus	53,828	8.44				0.00
		637,501	100.00			53994	100.00
Indonesia	0.50						
76411	telephone sets	15,236	18.33	76499	parts & accessories of sound recorders or reprod	22572	80.53
76432	transmission apparatus incorporating reception	11,135	13.40	76491	parts & accessories of telephony or telegraph	5459	19.47
76493	parts & accessories of TV, radio, transmission etc	9,055	10.90				0.00
76499	parts & accessories of sound recorders or reprod	8,728	10.50				0.00
		83,104	100.00			28031	100.00
China	0.49						
76415	telephonic or telegraphic switching apparatus	43,897	27.14	76493	parts & accessories of TV, radio, transmission et	19675	33.92
76499	parts & accessories of sound recorders or reprod	35,411	21.89	76499	parts & accessories of sound recorders or reprod	10642	18.35
76432	transmission apparatus incorporating reception	22,282	13.78	76411	telephone sets	9882	17.04
76493	parts & accessories of TV, radio, transmission etc	18,399	11.38	76424	headphones, earphones	6276	10.82
76419	other telephonic or telegraphic apparatus	18,115	11.20	76423	loudspeakers, not mounted in their enclosures	6248	10.77
		161,745	100.00			57996	100.00
Korea	0.10						
76499	parts & accessories of sound recorders or reprod	176,691	43.87	76499	parts & accessories of sound recorders or reprod	142096	43.15
76493	parts & accessories of TV, radio, transmission etc	131,672	32.69	76493	parts & accessories of TV, radio, transmission et	68408	20.77
76491	parts & accessories of telephony or telegraph	23,023	5.72	76423	loudspeakers, not mounted in their enclosures	40149	12.19
76432	transmission apparatus incorporating reception	18,829	4.67	76424	headphones, earphones	39612	12.03
		402,779	100.00			329335	100.00
Taiwan	0.35						
76499	parts & accessories of sound recorders or reprod	123,698	28.82	76493	parts & accessories of TV, radio, transmission et	55058	26.41
76493	parts & accessories of TV, radio, transmission etc	55,850	13.01	76411	telephone sets	37712	18.09
76419	other telephonic or telegraphic apparatus	50,332	11.73	76422	loudspeakers, mounted in their enclosures	30169	14.47
76491	parts & accessories of telephony or telegraph	42,638	9.93	76499	parts & accessories of sound recorders or reprod	27299	13.10
		429,258	100.00			208451	100.00
Hong Kong	0.90						
76482	television cameras	150,049	19.61	76432	transmission apparatus incorporating reception	20556	50.55
76432	transmission apparatus incorporating reception	136,812	17.88	76411	telephone sets	11882	29.22
76499	parts & accessories of sound recorders or reprod	136,316	17.82	76491	parts & accessories of telephony or telegraph	8229	20.24
76419	other telephonic or telegraphic apparatus	65,038	8.50				0.00
		765,034	100.00			40667	100.00

Table 6 Intra-Industry Trade of Selected Sectors and Countries (continued)

Electric Machinery (Sector 42)

SITC	Explanation	Trade Specialization index	mil $	%	SITC	Explanation	mil $	%
USA		0.40						
77641	digital monolithic integrated units		2,438,439	29.28	77641	digital monolithic integrated units	1479854	41.43
77878	other electrical machines and apparatus		475,993	5.71	77878	other electrical machines and apparatus	480476	13.45
77831	electrical ignition or starting equipment		327,778	3.94	77643	non-digital monolithic integrated units	289569	8.11
77812			266,165	3.20	77259	other elecrical switching circuits over 1000 v	121690	3.41
			8,329,160	100.00			3572043	0.00
Thailand		0.83						
77641	digital monolithic integrated units		63,971	8.13				
77643	non-digital monolithic integrated units		57,885	7.36	77314	other electric conductors below 80 v	12278	16.48
77261	boards, panels, consoles, etc. below 1000 v		51,955	6.61	77259	other elecrical switching circuits over 1000 v	8789	11.79
77831	electrical ignition or starting equipment		48,604	6.18	77121	static converters	7409	9.94
			786,597	100.00			74518	100.00
Malaysia		0.71						
77641	digital monolithic integrated units		280,746	26.12	77641	digital monolithic integrated units	69013	37.64
77689	parts of ICs and microassemblies		184,443	17.16	77681	piezo-electric crystals, mounted	29583	16.13
77611	television picture tubes, cathode ray: color		74,562	6.94	77119	electric transformers	21966	11.98
77643	non-digital monolithic integrated units		56,124	5.22	77121	static converters	20016	10.92
			1,074,744	100.00			183358	100.00
Singapore		0.87						
77641	digital monolithic integrated units		733,722	32.75	77641	digital monolithic integrated units	40856	25.66
77643	non-digital monolithic integrated units		155,287	6.93	77259	other elecrical switching circuits over 1000 v	35148	22.08
77259	switching or protecting circuits over 1000 volts		73,922	3.30	77121	static converters, rectifiers and rectigying appara	20362	12.79
77689	parts of ICs and microassemblies		68,602	3.06	77611	television picture tubes, cathode ray: color	15630	9.82
			2,240,580	100.00			159218	100.00
Indonesia		0.93						
77831	electrical ignition or starting equipment		40,923	25.81	77811	primary cells and batteries, and parts thereof, ne	6170	100.00
77261	boards, panels, consoles, etc. below 1000 v		18,634	11.75				0.00
77834	electrical lighting equipment, windscreen wipers,		17,382	10.96				0.00
77886	carbon electrodes, brushes, lamp & battery carbo		12,510	7.89				0.00
			158,558	100.00			6170	100.00
Philippines		0.59						
77641	digital monolithic integrated units		107,864	31.93	77313	insulated electric wire , cabels, bars, strip and th	51965	60.30
77689	parts of ICs and microassemblies		47,067	13.93	77631	diodes, transistors and similar semi-conductor	14113	16.38
77259	switching or protecting circuits over 1000 volts		26,666	7.89	77125	electric transformers, static converters	13148	15.26
77328	insulating fittings for electrical machines, etc.		25,073	7.42	77119	electric transformers	6954	8.07
			337,841	100.00			86180	100.00
China		0.59						
77611	television picture tubes, cathode ray: color		77,353	18.85	77119	electric transformers	53156	50.57
77629	parts of tubes and valves of TV tubes etc.		70,529	17.19	77125	electric transformers, static converters	16798	15.98
77261	boards, panels, consoles, etc. below 1000 v		35,204	8.58	77255	appartatus for making and breaking electrical circ	16099	15.31
77421	apparatus based on the use of x-rays		25,753	6.28	77315	insulated electric wire , cabels, bars, strip and th	8394	7.99
			410,348	100.00			105122	100.00

Table 6 Intra-Industry Trade of Selected Sectors and Countries (concluded)

Korea	0.63						
77641	digital monolithic integrated units	406,192	14.63	77641	digital monolithic integrated units	97112	15.25
77643	non-digital monolithic integrated units	259,260	9.34	77643	non-digital monolithic integrated units	93809	14.73
77623	other cathode ray tubes	178,440	6.43	77119	electric transformers	92267	14.49
77261	boards, panels, consoles, etc. below 1000 v	151,111	5.44	77611	television picture tubes, cathode ray	44067	6.92
		2,775,759	100.00			636737	100.00
Taiwan	0.66						
77641	digital monolithic integrated units	460,241	16.58	77627	othe electronic volves and tubes	79970	13.88
77623	other cathode ray tubes	446,255	16.08	77643	non-digital monolithic integrated units	58791	10.20
77629	parts of tubes and valves of TV tubes etc.	160,819	5.79	77121	static converters, rectifiers and rectigying appara	55643	9.66
77643	non-digital monolithic integrated units	109,497	3.94	77641	digital monolithic integrated units	46103	8.00
		2,775,995	100.00			576153	100.00
Hong Kong	0.99						
77641	digital monolithic integrated units	467,967	25.33	77643	non-digital monolithic integrated units	8135	58.42
77643	non-digital monolithic integrated units	155,239	8.40	77884	electrical capacitors, fixed or variable	5790	41.58
		1,847,635	100.00			13925	100.00

Regarding road vehicles, trade with selected countries was all one sided as was exemplified by intra-industry trade index (*IIT* was larger than 0.70, mostly larger than 0.90); i.e., Japan exported most of the part and imported none or only marginally, except the cases with the U.S. and Korea. Japan traded with the U.S. on an equal basis, but with other countries, Japan imported only parts and low-end vehicles such as bicycles and motor cycles. It is evident that Japan imported parts from ANIEs and nothing from ASEAN in 1990.

For machinery, Japan engaged in fairly large intra-industry trade with the U.S. in data processing parts and machinery. Parts which require advanced technology were mutually traded. Intra-industry trade index for the U.S. was 0.55, the lowest among all, suggesting large intra-industry trade. Traded items were different in the case of ASEAN from that of the U.S., while they were more or less similar in the case of ANIEs. Japan's trade was in general one sided. Japan exported, for instance, roughly 200 items while she imported only 100 items; In terms of value, Japan exported to ASEAN and ANIES more than 10 times than she imported from them. Japan imported ball bearings to an amazing degree from Thailand; this, of course, is a reflection of Japanese FDI by Minebear.

Sector 40, non-electrical machinery, gives a good example. In 1990 Japan exported to Malaysia 101 billion US dollars while Malaysia imported from Japan by the amount of 126 billion US dollars. Intra-industry trade index must be 0.15.

For tele-communication equipment (Category 41), intensified intra-industry trade was observed. Surprisingly order of intra-industry trade index was Korea,

Taiwan, China, Indonesia, Thailand, the U.S., Malaysia, Singapore, and Hong Kong.

Electric machinery (Category 42) shows a case where fairly extensive intra-industry trade took place with the U.S. while one sided trade took place in value terms with ASEAN and ANIEs.

The value of the exports of Japan to these countries, in most cases, was more than ten times larger than the value of the imports from these countries. Intra-industry trade in a number of products emerged but a great asymmetry existed between the level of Japanese exports and imports; this asymmetry will decrease only gradually in the future. Japan exported many of and imported very little of high-end products such as various machinery and key components of TV, video recorders, central processing units, and electrical ignition equipment.

As far as Thailand is concerned, Japanese exports of machinery were overwhelming in value. Even when they have intra-industry trade in the SITC 5 digit level such as parts and accessories suitable for use in televisions and so on, the value of exports of Japan to Thailand is 33 million dollars while the value of imports is 2 million dollars. The same is true for Indonesia. Japan's imports of miscellaneous parts are small compared with Japan's exports to Indonesia. Singapore imported video recording apparatus in large volume. One interesting finding is that Singapore exported black and white television receivers at the same time she imported more than ten times as much. Singapore also exported digital automatic data processing machines and digital processing units which are high end technology products. The problem is that they were relatively small in amount. For Hong Kong the same is true. Hong Kong started to export high end goods but in small amount. Hong Kong imported video recording apparatus, black and white television receivers, television cameras and other essential parts of manufacturing and exports electric motors, and calculators, which are more toward the low end of the technology spectrum.

Although intra-industry trade has been emphasized in the Asia-Pacific region, the trade between Japan and these Asian countries remain mostly one sided, i.e., dominated by Japanese exports.

3. Development of Foreign Direct Investments

Japanese FDI expanded rapidly since the 1985 when acute yendaka started. By 1990 to 1992 the accumulated or single year Japanese investment reached 25% to 35% of the total FDI in ASEAN countries; Japan had become the largest investor to ASEAN (Table 7).

Table 7 Largest Investors to ASEAN

Indonesia (mil. of US$)

	1992	%	1967-1992	%
Japan	1,502	14.59	12,907	22.01
Hong Kong	1,018	9.89	5,231	8.92
U.K.	978	9.50	2,397	4.09
U.S.A.	923	8.97	3,419	5.83
South Korea	617	5.99	2,846	4.85
Taiwan	563	5.47	3,938	6.72
Singapore	448	4.35	2,027	3.46
total	10,292	100.00	58,643	100.00

Source: Investment Coordinating Board, Indonesia (BKPM)

Malaysia (mil. of M$)

	1990	%	1991	%
Japan	1,777	28.53	1,161	20.91
Taiwan	2,353	37.78	1,573	28.33
Singapore	321	5.15	368	6.63
Hong Kong	136	2.18	315	5.67
S. Korea	164	2.63	376	6.77
U.S.	187	3.00	438	7.89
U.K.	315	5.06	184	3.31
total	6,228	100.00	5,553	100.00

Source: Malaysian Industrial Development Authority (MIDA)

Philippines(mil. peso)

	1991	%	1992	%
Japan	5,773	26.99	1,847	25.47
U.S.A.	2,281	10.66	1,570	21.65
S.Korea	1,223	5.72	1,084	14.95
UK	7,809	36.51	741	10.22
Hong Kong	229	1.07	323	4.46
Netherland	489	2.29	293	4.04
Taiwan	330	1.54	232	3.20
Singapore	83	0.39	118	1.63
toal	21389.3	100.00	7250.4	100.00

Source: Board of Investment (BOI)

Thailand(mil. Baht)

	1960-1986		1960-1991	
Japan	48883	20.48	277382	32.69
U.S.	45542	19.08	105220	12.40
U.K.	12759	5.35	65129	7.68
Taiwan	14742	6.18	60460	7.13
Hong Kong	7652	3.21	47282	5.57
Singapore	6646	2.78	40418	4.76
Others	102469	42.93	252540	29.77
total	238693	100.00	848431	100.00

Source: Board of Investment (BOI), Thailand

Singapore (mil. S$)

	-1985		-1989	
U.S.	4656	35.38	7143	33.24
Japan	2943	22.36	6600	30.71
EC	4172	31.70	6172	28.72
others	1389	10.55	1575	7.33
total	13160	100.00	21490	100.00

Source: Economic Development Board, Singapore

ASEAN attracted around 10% of the total Japanese FDI (Table 8). That is, from ASEAN countries Japan was the biggest investment partner while from the Japanese point of view ASEAN has just one quarter importance compared with North America. Another feature is that FDI to ASEAN on average is on a smaller scale than that to North America.

Table 8 Japan's Overseas Direct Investment by Region (fiscal year, mil. of US$)

Region	*1992*	*%*	*951-199*	*%*
North America	14,572	42.69	169,580	43.87
Central and South Am	2,726	7.99	46,547	12.04
Asia	6,425	18.82	59,880	15.49
ASEAN	3,867	11.33	35,000	9.05
Brunei Darussalam	0	0.00	109	0.03
Indonesia	1,676	4.91	14,409	3.73
Malaysia	704	2.06	4,815	1.25
Philippines	160	0.47	1,943	0.50
Singapore	670	1.96	7,837	2.03
Thailand	657	1.92	5,887	1.52
Middle East	709	2.08	4,231	1.09
Europe	7,061	20.68	75,697	19.58
Africa	238	0.70	6,813	1.76
Oceania	2,406	7.05	23,782	6.15
Total	34,138	100.00	386,530	100.00

Source: Ministry of Finance, Japan

What can we tell about the industrial composition of Japanese FDI? The FDI to Asia is different from that to the world in the following aspects. Manufacturing shares were almost twice as much as the world average and they showed an increasing trend, with a strong contribution being found in food and beverage, textile, chemical, steel and non-ferrous metal, general machinery, and electric machinery. In terms of regional FDI intensity figures (Table 9), textile recorded 2.96, followed by chemicals 1.9. This implies that Japanese FDI contributed to the expansion of production and exports of Asian host countries more than other countries.

Table 9 Japanese FDI by Direction and by Industry (as of 1992 since 1955)

	(a) Value in million yen					(b) FDI Intensity				
	total	*Asia*	*NAmerica*	*LAmerica*	*Others*	*total*	*Asia*	*NAmerica*	*LAmerica*	*Others*
Manufacturing	103,981	24,691	50,367	6,913	22,010	1.00	1.53	1.16	0.55	0.69
food & bevarages	5,234	1,396	2,587	268	983	1.00	1.72	1.19	0.43	0.61
textile	5,043	2,312	1,058	484	1,189	1.00	2.96	0.50	0.80	0.77
lumber & pulp	3,711	611	2,508	243	349	1.00	1.06	1.62	0.54	0.31
chemicals	14,558	4,282	5,923	868	3,485	1.00	1.90	0.98	0.50	0.78
steel & non-ferrous metal products	12,040	3,310	5,027	2,142	1,561	1.00	1.77	1.00	1.48	0.42
machinery	10,320	2,117	4,723	483	2,997	1.00	1.32	1.10	0.39	0.94
electrical machinery, equipment & sup	24,473	5,587	12,707	764	5,415	1.00	1.47	1.25	0.26	0.72
transportation equipment	14,065	2,061	6,312	1,479	4,213	1.00	0.95	1.08	0.87	0.97
others	14,537	3,061	9,524	181	1,771	1.00	1.36	1.57	0.10	0.40
Non-manufacturing	243,294	22,839	110,631	35,869	73,955	1.00	0.61	1.09	1.22	0.99
commerce	40,268	5,259	21,074	2,537	11,398	1.00	0.84	1.26	0.52	0.92
finance & insurance	74,869	5,711	22,661	15,735	30,762	1.00	0.49	0.73	1.75	1.33
services	46,610	6,731	27,801	2,688	9,390	1.00	0.93	1.43	0.48	0.65
transportation	21,652	1,530	769	14,667	4,686	1.00	0.46	0.09	5.63	0.70
real estates	59,895	3,608	38,326	242	17,719	1.00	0.39	1.54	0.03	0.96
Others	39,255	12,350	8,582	3,756	14,567	1.00	2.03	0.52	0.79	1.20
Total	386,530	59,880	160,998	46,547	119,105	1.00	1.00	1.00	1.00	1.00

	(c) Share in total industry FDI to the world					(d) share in total regional FDI				
	total	*Asia*	*NAmerica*	*LAmerica*	*Others*	*total*	*Asia*	*NAmerica*	*LAmerica*	*Others*
Manufacturing	100.00	24	48	7	21	26.90	41.23	31.28	14.85	18.48
food & bevarages	100.00	27	49	5	19	1.35	2.33	1.61	0.58	0.83
textile	100.00	46	21	10	24	1.30	3.86	0.66	1.04	1.00
lumber & pulp	100.00	16	68	7	9	0.96	1.02	1.56	0.52	0.29
chemicals	100.00	29	41	6	24	3.77	7.15	3.68	1.86	2.93
steel & non-ferrous metal products	100.00	27	42	18	13	3.11	5.53	3.12	4.60	1.31
machinery	100.00	21	46	5	29	2.67	3.54	2.93	1.04	2.52
electrical machinery, equipment & sup	100.00	23	52	3	22	6.33	9.33	7.89	1.64	4.55
transportation equipment	100.00	15	45	11	30	3.64	3.44	3.92	3.18	3.54
others	100.00	21	66	1	12	3.76	5.11	5.92	0.39	1.49
Non-manufacturing	100.00	9	45	15	30	62.94	38.14	68.72	77.06	62.09
commerce	100.00	13	52	6	28	10.42	8.78	13.09	5.45	9.57
finance & insurance	100.00	8	30	21	41	19.37	9.54	14.08	33.80	25.83
services	100.00	14	60	6	20	12.06	11.24	17.27	5.77	7.88
transportation	100.00	7	4	68	22	5.60	2.56	0.48	31.51	3.93
real estates	100.00	6	64	0	30	15.50	6.03	23.81	0.52	14.88
Others	100.00	31	22	10	37	10.16	20.62	5.33	8.07	12.23
Total	100.00	15	42	12	31	100.00	100.00	100.00	100.00	100.00

More country specific data can be found in General Survey of Japanese Affiliates Abroad *(Kaigai Shinshutsu Kigyo Soran)* of Toyo Keizai. Based upon this questionnaire study, Table 10 summarizes these flows. For Thailand, Japanese investment was largest in industrial machinery, transportation, shipbuilding, electric machinery in terms of capital invested. For Malaysia, electronic machinery and transportation represented around 15% each of capital invested. With heavy electronics also having an 8% share, the concentration in electronics and transportation equipment is obvious. Indonesia still attracted FDI from Japan in agriculture and forestry, unlike Malaysia and Thailand, and food had a large share, 12% in capital and 25% in employment. Other important sectors were metal products, 8%, and shipbuilding, 10%. In the case of the Philippines, leading sectors were shipbuilding (17%), cement (12%), metal products (11%), home electronics and parts (10%), pharmaceuticals (10%), and food (7%).

As we discussed in the former sections, the *RCA* and *IIT* were closely linked with the development of Japanese FDI activities. Although we cannot provide rigorous statistical tests, we see apparent correspondence between the FDI concentrated industries and industries of trade expansion.

We should look more closely how Japanese firms were motivated to perform FDI. The objectives of these Japanese FDI are given in Table 11. The most common objective was to secure local market. Nothing surpassed this objective; in fact, Japanese firms primalily consider ASEAN as a production base for a growing domestic market, which can be shown by low percentage of objectives G and H in Table 11. Rather, Japanese firms started to regard the production network important, which can be verified by high percentage of objectives D. Of course, all these were different from one country to another. Export base objective was stronger in Thailand and Malaysia than the Philippines and Indonesia. The objectre of royalty and information gathering was also important.

The interest to construct production networks has an important implication for the AFTA scheme. Let us discuss it further in detail next since AFTA might simplify the establishment of a production scheme which covers the whole ASEAN area.

Table 10 Japanese FDI in ASEAN

Thailand

				Share			Objectives																
	(1)	(2)	(3)	(1)	(2)	(3)	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	1	2	3
Agriculture, Forestry, Fisher	53	15	5380	9.19%	7.32%	3.72%	2	10	6	4	1	32	1	3	1	0	13	0	1	0	3	17	2	6
Mining	26	7	6622	4.51%	3.41%	4.57%	10	4	1	8	1	7	3	6	0	0	3	1	2	1	1	3	0	2
Food	12	5	8402	2.08%	2.44%	5.80%	0	5	2	2	0	3	0	3	0	0	3	0	0	0	0	3	2	3
Textile	15	1	7230	2.60%	0.49%	4.99%	0	7	1	5	0	5	0	3	0	0	1	0	0	0	0	5	1	1
Apparel	4	0	1747	0.69%	0.00%	1.21%	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Wood, Furniture	3	1	303	0.52%	0.49%	0.21%	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0
Chemicals	1	0	88	0.17%	0.00%	0.06%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Medicine	20	9	2712	3.47%	4.39%	1.87%	0	2	3	6	1	8	1	1	0	0	2	0	0	0	1	3	2	0
Paints	4	1	783	0.69%	0.49%	0.54%	0	3	1	1	0	2	0	0	0	0	1	1	0	0	0	1	1	0
Other Chemical	5	1	579	0.87%	0.49%	0.40%	0	3	1	3	0	3	0	0	0	0	1	0	0	0	0	2	1	1
Petrolium and Coal	4	0	310	0.69%	0.00%	0.21%	0	1	2	1	0	1	0	0	0	0	1	0	0	0	1	3	1	0
Rubber Products	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leather Products	9	2	3311	1.56%	0.98%	2.29%	1	3	2	2	0	2	0	1	0	0	0	0	0	0	0	0	0	1
Ceramics	15	3	2206	2.60%	1.46%	1.52%	0	3	2	3	0	5	3	2	1	0	2	0	0	1	0	6	0	0
Glass	4	1	990	0.69%	0.49%	0.68%	0	1	0	1	0	4	1	0	0	0	2	1	0	0	0	2	0	0
Cement	3	6	1583	0.52%	2.93%	1.09%	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
China and Porcelain	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-ferous Metals	12	5	1592	2.08%	2.44%	1.10%	0	6	2	1	1	6	1	0	0	0	1	0	0	1	0	3	1	1
Metals	22	15	9773	3.81%	7.32%	6.75%	1	10	7	4	0	13	4	3	1	1	4	0	0	0	0	4	1	0
Machinery	15	4	2783	2.60%	1.95%	1.92%	0	2	1	3	0	5	3	2	0	1	1	0	0	0	0	5	1	0
Industrial Machinery	22	22	6810	3.81%	10.73%	4.70%	0	10	4	6	2	8	3	4	1	1	2	0	1	0	0	5	2	3
Electric Machinery	5	1	373	0.87%	0.49%	0.26%	0	1	1	2	1	2	1	1	0	0	0	0	0	1	0	1	0	0
Heavy Electric Machinery	21	9	8923	3.64%	4.39%	6.16%	0	9	5	8	0	13	4	3	2	0	0	0	0	0	0	9	0	3
Telecommunication	1	0	120	0.17%	0.00%	0.08%	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Consumer Electronics and	2	0	507	0.35%	0.00%	0.35%	0	2	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	2
Electronics	19	19	13211	3.29%	9.27%	9.12%	0	5	4	5	0	3	1	2	1	0	0	0	0	0	0	2	0	0
Transportation Equipments	14	25	15554	2.43%	12.20%	10.74%	0	11	6	1	1	2	2	4	1	0	0	0	0	0	1	3	2	1
Automobile and Parts	9	3	4054	1.56%	1.46%	2.80%	0	5	3	2	0	6	1	2	2	0	1	0	0	0	1	3	0	0
Shipbuilding	33	14	16240	5.72%	6.83%	11.22%	0	8	12	10	1	13	1	1	1	0	1	0	0	1	0	16	2	3
Precision Instruments	7	7	4049	1.21%	3.41%	2.80%	0	6	2	2	0	2	0	0	0	1	0	0	0	0	0	2	0	0
Other Manufacturing	17	3	4185	2.95%	1.46%	2.89%	1	8	4	1	0	4	3	2	0	0	0	0	0	0	0	3	1	1
Service	200	26	14359	34.66%	12.68%	9.92%	1	15	6	8	23	87	17	9	3	4	40	10	5	1	11	43	16	14
Total	577	205	144779	00.00%	00.00%	00.00%	19	142	79	89	32	239	51	52	14	8	80	13	9	7	19	146	38	42

Malaysia

				Share			Objectives																
	(1)	(2)	(3)	(1)	(2)	(3)	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	1	2	3
Agriculture, Forestry, Fisher	43	5	2538	10.41%	2.54%	2.15%	3	5	7	4	1	24	0	1	2	1	15	3	0	1	3	13	4	5
Mining	4	2	479	0.97%	1.02%	0.40%	1	1	2	0	0	2	1	1	0	0	0	0	0	0	0	1	0	0
Food	11	9	6174	2.66%	4.57%	5.22%	0	7	5	5	0	3	3	1	0	0	0	0	0	0	0	8	0	0
Textile	2	0	954	0.48%	0.00%	0.81%	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Apparel	10	2	2285	2.42%	1.02%	1.93%	8	6	2	3	0	0	1	2	0	0	0	0	0	0	0	0	2	1
Wood, Furniture	1	0	40	0.24%	0.00%	0.03%	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Chemicals	1	0	219	0.24%	0.00%	0.19%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Medicine	21	8	2105	5.08%	4.06%	1.78%	6	5	9	6	1	7	2	0	0	0	3	1	0	1	1	2	0	3
Paints	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Chemical	5	1	404	1.21%	0.51%	0.34%	0	0	0	2	0	2	1	0	0	0	2	0	0	0	0	2	0	2
Petrolium and Coal	1	0	166	0.24%	0.00%	0.14%	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0
Rubber Products	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leather Products	7	1	1274	1.69%	0.51%	1.08%	4	5	4	0	1	0	0	3	0	0	0	0	0	0	0	0	2	1
Ceramics	7	4	1348	1.69%	2.03%	1.14%	0	3	1	3	0	2	2	1	2	0	1	0	0	0	0	2	0	0
Glass	7	1	1232	1.69%	0.51%	1.04%	1	2	3	2	0	5	1	0	0	0	2	0	0	0	1	2	0	1
Cement	3	2	1221	0.73%	1.02%	1.03%	1	1	1	3	1	3	0	0	0	0	1	0	0	0	0	1	0	0

Table 10 Japanese FDI in ASEAN (continued)

China and Porcelain	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel	2	1	699	0.48%	0.51%	0.59%	0	1	0	2	0	1	2	1	1	0	0	0	0	0	0	2	0	0
Non-ferous Metals	10	10	1748	2.42%	5.08%	1.48%	0	3	5	0	0	6	0	0	0	0	0	0	0	0	0	3	0	0
Metals	21	10	3902	5.08%	5.08%	3.30%	1	9	5	3	0	12	1	1	3	0	3	0	0	0	0	3	1	5
Machinery	15	4	1463	3.63%	2.03%	1.24%	0	4	7	7	1	9	4	1	1	2	1	0	1	1	1	4	3	1
Industrial Machinery	10	1	626	2.42%	0.51%	0.53%	0	3	2	3	0	3	0	2	0	2	1	0	0	0	0	1	4	1
Electric Machinery	2	0	41	0.48%	0.00%	0.03%	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1
Heavy Electric Machinery	26	15	18769	6.30%	7.61%	15.87%	0	15	10	8	2	11	6	3	3	0	0	0	1	1	2	6	2	5
Telecommunication	1	0	45	0.24%	0.00%	0.04%	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
Consumer Electronics and	5	1	801	1.21%	0.51%	0.68%	0	3	2	3	0	1	1	1	0	0	0	0	0	0	0	0	1	0
Electronics	26	29	16424	6.30%	14.72%	13.88%	0	10	3	2	0	8	2	1	1	0	1	0	1	1	0	4	1	4
Transportation Equipments	31	27	25285	7.51%	13.71%	21.37%	0	19	11	11	1	13	7	4	1	0	0	0	0	0	0	7	0	2
Automobile and Parts	6	2	1391	1.45%	1.02%	1.18%	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Shipbuilding	11	13	4240	2.66%	6.60%	3.58%	1	3	4	4	1	2	1	1	3	0	0	2	0	0	0	2	1	2
Precision Instruments	8	4	7705	1.94%	2.03%	6.51%	0	2	2	3	0	1	1	0	1	0	0	0	0	0	0	1	0	1
Other Manufacturing	7	1	1427	1.69%	0.51%	1.21%	0	3	2	1	0	3	1	1	0	0	0	0	1	0	0	1	0	1
Service	109	44	13294	26.39%	22.34%	11.24%	2	1	5	2	11	45	4	4	1	0	22	2	1	1	8	20	12	2
Total	413	197	118299	00.00%	00.00%	00.00%	28	114	94	79	22	169	42	30	20	5	53	8	5	6	16	87	35	38

Indonesia

				Share			Objectives																	
	(1)	(2)	(3)	(1)	(2)	(3)	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	1	2	3
Agriculture, Forestry, Fisher	17	24	4214	17.35%	47.06%	11.13%	3	6	6	1	0	7	0	0	0	0	3	0	0	0	1	8	0	0
Mining	1	0	70	1.02%	0.00%	0.18%	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Food	9	6	9507	9.18%	11.76%	25.11%	0	7	3	1	0	8	0	0	1	0	3	0	0	0	0	8	0	0
Textile	2	0	1635	2.04%	0.00%	4.32%	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
Apparel	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood, Furniture	1	0	185	1.02%	0.00%	0.49%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chemicals	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medicine	3	0	281	3.06%	0.00%	0.74%	1	0	0	0	0	2	1	0	0	1	1	0	0	0	0	1	1	0
Paints	3	0	1233	3.06%	0.00%	3.26%	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Other Chemical	1	0	50	1.02%	0.00%	0.13%	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Petrolium and Coal	1	0	1355	1.02%	0.00%	3.58%	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rubber Products	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leather Products	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceramics	1	0	225	1.02%	0.00%	0.59%	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Glass	3	2	1670	3.06%	3.92%	4.41%	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1
Cement	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China and Porcelain	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-ferous Metals	*5*	*1*	*746*	*5.10%*	*1.96%*	*1.97%*	*0*	*1*	*3*	*1*	*0*	*1*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*
Metals	3	4	2866	3.06%	7.84%	7.57%	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
Machinery	3	0	344	3.06%	0.00%	0.91%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial Machinery	6	1	1622	6.12%	1.96%	4.28%	0	1	2	0	0	4	0	0	0	0	1	0	0	0	1	2	0	0
Electric Machinery	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Electric Machinery	5	1	624	5.10%	1.96%	1.65%	0	1	1	1	0	2	0	0	1	0	1	0	0	0	0	2	0	0
Telecommunication	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumer Electronics and	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electronics	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipments	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Automobile and Parts	5	1	1397	5.10%	1.96%	3.69%	0	1	1	1	0	3	0	0	0	0	3	0	0	2	0	1	0	0
Shipbuilding	11	5	7624	11.22%	9.80%	20.14%	1	2	5	4	0	6	0	1	0	0	1	0	0	0	1	5	1	0
Precision Instruments	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Manufacturing	2	0	476	2.04%	0.00%	1.26%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Service	16	6	1734	16.33%	11.76%	4.58%	1	4	2	3	0	7	3	2	1	0	1	0	1	0	1	2	1	0
Total	98	51	37858	00.00%	00.00%	00.00%	8	26	27	13	0	49	5	4	5	1	16	0	1	2	6	34	3	1

Table 10 Japanese FDI in ASEAN (concluded)

Philippines

				Share			Objectives																
	(1)	(2)	(3)	(1)	(2)	(3)	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	1	2	3
Agriculture, Forestry, Fisher	26	1	3628	21.67%	2.44%	8.34%	5	10	1	5	1	9	0	3	0	0	3	1	0	0	1	6	2	1
Mining	2	1	1326	1.67%	2.44%	3.05%	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
Food	3	3	1537	2.50%	7.32%	3.53%	0	3	2	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1
Textile	1	0	1200	0.83%	0.00%	2.76%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apparel	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood, Furniture	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemicals	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medicine	5	4	755	4.17%	9.76%	1.73%	4	2	3	4	0	1	0	1	0	0	0	0	0	0	0	2	0	0
Paints	2	0	102	1.67%	0.00%	0.23%	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Other Chemical	2	0	81	1.67%	0.00%	0.19%	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	0	1
Petrolium and Coal	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rubber Products	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leather Products	1	0	266	0.83%	0.00%	0.61%	0	1	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
Ceramics	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glass	1	0	180	0.83%	0.00%	0.41%	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1
Cement	1	5	850	0.83%	12.20%	1.95%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China and Porcelain	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel	1	0	466	0.83%	0.00%	1.07%	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Non-ferous Metals	1	2	605	0.83%	4.88%	1.39%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Metals	5	4	4586	4.17%	9.76%	10.54%	2	3	1	3	0	2	1	0	1	0	1	0	0	0	0	2	1	0
Machinery	2	0	143	1.67%	0.00%	0.33%	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0
Industrial Machinery	3	0	92	2.50%	0.00%	0.21%	0	2	1	1	0	2	1	1	0	0	0	0	0	0	0	2	0	0
Electric Machinery	1	0	90	0.83%	0.00%	0.21%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heavy Electric Machinery	4	0	517	3.33%	0.00%	1.19%	0	1	1	2	0	1	0	0	1	0	0	0	0	0	0	3	0	0
Telecommunication	0	0	0	0.00%	0.00%	0.00%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumer Electronics and	2	4	3223	1.67%	9.76%	7.40%	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0
Electronics	1	0	3135	0.83%	0.00%	7.20%	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Transportation Equipments	4	2	3022	3.33%	4.88%	6.94%	0	3	1	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0
Automobile and Parts	1	0	86	0.83%	0.00%	0.20%	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Shipbuilding	10	7	6407	8.33%	17.07%	14.72%	0	6	6	3	0	3	2	2	0	0	0	0	0	0	0	5	0	1
Precision Instruments	1	0	250	0.83%	0.00%	0.57%	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Manufacturing	1	0	130	0.83%	0.00%	0.30%	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Service	39	8	10848	32.50%	19.51%	24.92%	0	8	2	2	2	22	1	1	0	1	9	1	1	0	2	10	3	4
Total	120	41	43525	00.00%	00.00%	00.00%	12	43	20	23	4	52	8	13	2	1	15	3	1	1	3	36	8	9

Source: Compiled based upon Toyo Keizai, Kaigai Shinshutsu Kigyo Soran (General Directory of Japanese Firms Abroad), 1993.

Note: (1) Number of firms (2) Capital invest (3) Numober of employment

Table 11 Objectives of Japanese Firms in ASEAN

	No. of Firms	Capital	Employment
Thailand	577	205	144779
Malaysia	413	197	118299
Indonesia	98	51	37858
Philippines	120	41	43525

Number of responses

	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	1	2	3
Thailand	19	142	79	89	32	239	51	52	14	8	80	13	9	7	19	146	38	42
Malaysia	28	114	94	79	22	169	42	30	20	5	53	8	5	6	16	87	35	38
Indonesia	8	26	27	13	0	49	5	4	5	1	16	0	1	2	6	34	3	1
Philippines	12	43	20	23	4	52	8	13	2	1	15	3	1	1	3	36	8	9

Ratio to F (%)

	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	1	2	3
Thailand	8	59	33	37	13	100	21	22	6	3	33	5	4	3	8	61	16	18
Malaysia	17	67	56	47	13	100	25	18	12	3	31	5	3	4	9	51	21	22
Indonesia	16	53	55	27	0	100	10	8	10	2	33	0	2	4	12	69	6	2
Philippines	23	83	38	44	8	100	15	25	4	2	29	6	2	2	6	69	15	17

Objectives

A	to secure materials	I	to accompany group firms or affiliated firms
B	to use cheap labor	J	to finance and to avoid exchange rate risk
C	DFI promotion policy of local govern	K	to aquire royalty and information gathering
D	international production network	L	development and planning of goods internationally sold
E	international distribution netwrok	M	new business
F	to secure local markets	O	trade frictions
G	to export third countries	P	others
H	to export to Japan		
		1	profit
		2	in balance
		3	loss

Source: Same as Table 10.

Development of an International Network of Japanese Private Enterprises

The Twenty Second Survey on Japanese Business Activities Abroad gives some hints regarding the recent development of international networks. This survey covers all the firms, where Japanese capital involvement is more than 10%, except finance, insurance, and real estate. Based upon Table 12, Japanese firms abroad generally marketed their products more than three quarters in local markets. There is no distinct trend for the entire period but for the past few years it seems that exports and networking became more important than before.

This is more evident in terms of purchases of Japanese firms. More than half of purchases was from other markets and amazingly large proportion was from Japan (42.4%) in 1991. The local content in all regions remained around 48% since 1989. The Japanese imports content dropped, particularly, it dropped in North America, from 62.3% in 1986 to 47.1% in 1991, while the local content increased steadily from 32.3% to 47.1% during the same period. Imports from third countries to total input recovered in all the regions from 5.3% in 1988 to 9.5% in 1991, comparable to 9.3% in 1983.

In the case of Asia, the proportion of exports in total sales was twice as large (45.5%), with this share increasing. The export to sales ratio of Japanese affiliated companies in Asia was four times higher than that of the U.S. Japanese affiliated companies. This simply shows the fact that Japanese affiliated companies in Asia were more export-oriented.

What is noteworthy is that imports by Asian affiliates from countries other than Japan recovered from 11.5% in 1988 to 16.7%. The local content in Asia, however, showed a decline from 53.7% in 1987 to 44.5% in 1991.

Thus, FDI towards Asia was motivated not only by the yen appreciation but also by export-oriented policies of the host countries. Thus, we see these policies enhanced and expanded international network activities.

Table 12 Trade of Japanese Firms Abroad (Manufacturing)

Sales

	1983	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
World Total							
Local Sales	75.2	81.1	79.3	81.7	84	81.4	76.2
Exports	24.8	18.9	20.7	18.3	16	18.6	23.8
Japan	11.6	7.8	9.1	7.1	7.9	5.8	8.4
other countries	13.2	11.1	11.6	11.2	8.1	12.8	15.4
North America							
Local Sales	87.2	92.8	92.8	93.8	93.1	90.1	89.4
Exports	12.8	7.2	7.2	6.2	6.9	9.9	10.6
Japan	7.7	3.3	4.8	4	4.5	3.3	4.1
other countries	5.1	3.9	2.4	2.2	2.4	6.6	6.5
Asia							
Local Sales	66.9	54.7	59	59.8	63.9	59.6	54.5
Exports	33.1	45.3	41	40.2	36.1	40.4	45.5
Japan	10.8	15.8	16.7	13.7	15.8	11.8	15.5
North America	8.2	10.2	8	8.7	6	7.6	8.5
Asia	8.2	12.8	11.1	11.4	9.7	12.6	15.6
Europe	3.1	4.6	3.5	4.5	3.3	6.1	4.3
other countries	2.8	1.9	1.7	1.9	1.3	2.3	1.6

Purchases

	1983	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
World Total							
Local Purchases	40.3	40.1	48.5	41.8	48.1	47.9	48.1
Imports	59.7	59.9	51.5	58.2	51.9	52.1	51.9
Japan	50.4	53	44.5	52.9	45.7	44.8	42.4
other countries	9.3	6.9	7	5.3	6.2	7.3	9.5
North America							
Local Purchases	28.5	32.3	44.3	36.9	47.1	42.8	47.1
Imports	71.5	67.7	55.7	63.1	52.9	57.2	52.9
Japan	68.7	62.3	52.9	60.8	49.2	52.6	47.1
other countries	2.8	5.4	2.8	2.3	3.7	4.6	5.8
Asia							
Local Purchases	44.7	42.2	53.7	47.2	49.8	48.5	44.5
Imports	55.3	57.8	46.3	52.8	50.2	51.5	55.5
Japan	38.4	45.3	33.6	41.3	38.9	38.8	38.8
other countries	16.9	12.5	12.7	11.5	11.3	12.7	16.7

Source: MITI, *22nd Survey of Japanese Affliates Activities Abroad (Dai 22 Kai* WagakuniKigyo no Kaigai Jigyo Katsudo)

4. Prospects of Trade and Investment Relationship between Japan and ASEAN

In former sections we made it clear that trade shares of ASEAN, ANIEs, and Japan expanded in the past and this area became a growth pole. Although the trade intensity somewhat decreased, it still remained at very high level. We have also seen a development of diversification of trade by direction and by products. Japanese FDI has a special characteristic in ASEAN; the share of manufactures is far greater than the world average. This implies that Japanese FDI to this region helps expand production more than other cases. It is also pointed out that there seems to be a positive correspondence between Japanese FDI and changing comparative advantage structures of ASEAN countries.

To visualize future prospects we should consider the following aspects. All the questions are not mutually exclusive.

1. Can ASEAN have a higher trade intensity? Can ASEAN have higher trade shares?
2. Can ASEAN upgrade its production in the face of the emergence of China and South Asia as a supplier of labor intensive goods?
3. Can ASEAN create new Japanese markets for their products at a time when U.S. demand is growing less rapidly and countries like Mexico are granted a preferential access?
4. What are the prospects of increased intra-industry trade?
5. Can ASEAN invite more FDI from Japan? Or might FDI intensity rise?

Higher Trade Share and Intensity?

For the first question of trade share, it might grow a little further but the trade intensity might drop because of the emergence of new markets. Recent Japanese investment in China and South Asia is indicative that the trade share of China and South Asia will grow, which has a negative impact to ASEAN's trade share.

AFTA might speed up in lowering tariffs, and more importantly non-tariff barriers, and this might increase regional as well as non-regional trade. It is indeed important how their import competing industries are protected by tariffs and other barriers. Economic theory suggests that the more countries are protecting their import competing industries, the greater the trade creation effect of the formation of a free trade will be. Since the tariff levels of the U.S. and Japan are already low, the problem is with ASEAN and Asian NIEs. Except for Singapore, where the trade weighted-average tariffs are low (i.e., about one percent), tariffs in East Asian countries are substantially higher than those of Japan and the U.S. In particular those in Indonesia and in the Philippines are high at around twenty percent, while those in Japan and the U.S. are less than four percent. Thus, as is

often the case in most developing countries, the degree of tariff protection in East Asia is also fairly high[9]. AFTA was created to reduce tariffs within ASEAN but member countries are encouraged to continue unilateral trade liberalization. Thus, the prospect of trade creation is rosy. The tariff rate increases according to the degree of processing, thus consumer goods have the highest tariff rate, and primary goods the lowest. It should be noted that in Indonesia and Malaysia the tariff rates for consumer goods are as high as sixty percent. In addition to tariffs, imports by East Asian countries heavily protected by non-tariff barriers (NTBs), such as quotas, restrictive licensing and import prohibition. These are also the target of reduction of the recent AFTA endeavor. Considering this, if AFTA succeeds in lifting tariffs and non-tariff barriers and in coordinating trade and investment policies, we can expect a rosy scenario for further trade expansion.

Another important aspect related to trade expansion is that the current Japanese FDI expansion is still at an early stage and the real trade of products of multinational companies is expected to expand in the near future. This will enhance the trade volume and intra-industry trade.

Upgrading Possibility?

For the second question, the emergence of China and South Asia implies that low-end products, mostly labor intensive products will be supplied by these countries and ASEAN should move toward upgrading production. If ASEAN succeed in upgrading, ASEAN can still expand trade intensities in some products and trade shares overall. The more upgrading possibilities exist, the larger the benefit of regional integration will be. This direction seems to be the best for ASEAN.

Still a gap exists among developing ASEAN countries and Japan. Sharp wage hikes, labor shortages, and insufficient infrastructure put ASEAN a difficult situation. China and Vietnam, on the other hand, can be expected to start competing with the ASEAN countries in attracting FDI from developed countries. In fact, the U.S. normalized the relationship with Vietnam and China recently. China and Vietnum can provide abundant low cost labor as well as large domestic markets, although they lack in infrastructure and various institutional systems. In the labor intensive industries such as food processing, apparel and relatively simple machine assembly, these two countries might increase their competitiveness even further. ASEAN countries should reinforce their international competitiveness by upgrading their industrial structure as a whole. Developments of regional integration such as NAFTA and the EU, might negatively affect these countries due to the formation of trade blocs and protectionism. In addition, the U.S., which has

9 Goto and Hamada(1993) and Naya and Plummer.

consistently been providing Asia with its largest export market in the post war yeas, seems to be losing its absorption capacity. To keep and to level up international competitiveness ASEAN should convert domestic industries from labor-intensive to increasingly capital and technology intensive industries by enhancing R&D and better machinery including robots. In which industry can ASEAN upgrade?

Automobile demand in the ASEAN countries expanded substantially after 1985, reaching 800,000 units in 1990. Although the local content of the ASEAN automobile industry has been gradually increasing, the industry is not yet internationally competitive. This is attributable to small scale of production, high price and low quantity of locally procurred parts, and high import tariffs on essential parts and raw materials. Japanese automobile companies in the region should strive to develop top-grade parts manufactures in ASEAN in cooperation with local firms, to cooperate in the development of local human resources and to promote the further division of labor within the region. Japanese automobile companies will boldly increase their investment in attractive countries and sectors with a plan to increase their exports.

Consumer electronics went through the import substitution stage in the 1960's, export oriented stage in the 1970's and grew into 30% of the total Japanese FDI in Asia in the latter half of the 1980's. The ASEAN region has grown to become a production/export base for consumer electronics as a result of the rapid increase of the Japanese FDI. Japanese FDI peaked in 1987 to Asian NIEs and it increased drastically to ASEAN since then; accordingly Japanese imports of consumer electronics from ASEAN increased rapidly while imports from the Asian NIEs decreased between 1989 and 1991. This reflects the change of Japanese FDI policy from local production to import back to Japan. The Electric Industries Association of Japan released the demand projection of electric appliances for ASEAN. Reflecting the changes of life-style, the local demand is unlikely to reach levels that would replace external demand. The consumer electronics industry in ASEAN is expected to remain highly dependent on exports for some time. The traditional advantage that ASEAN countries have so far enjoyed are being lost as a result of increasing wage costs. Thus, the industry should be upgraded by shifting production to high value-added products.

The textile and apparel sector is a typical *Wild Flying Geese Hypothesis* sector. The ASEAN textile and apparel industry has emerged as a production base with abundant, high quality labor force in contrast to Japan, South Korea, and Taiwan whose international competitiveness is falling. In the past five years, textile and apparel exports of ASEAN have quadrupled, while imports expanded three fold. Japanese exports have decreased due to competition from ASEAN and China

and imports rapidly increased from these countries, creating a deficit in 1987 for the first time. Vietnam, in addition to China, is expected to become increasingly important as a destination of FDI. China, Vietnam, and ASEAN will become ever more interdependent. Again, as Japan did first, and as Taiwan and Korea did next, ASEAN should upgrade this industry by investing in capital and by introducing technology from advanced nations.

The machine parts industry includes machine parts assembly, machine parts forming, and die technology. In recent book by Seki (1993), Ohtaku of Tokyo, where all these supporting industry small firms are located, is said to be suffering from labor shortages and plan to abandon the operation. Young labor dislike this type of profession because of the *three Ks—Kitsui, Kitanai and Kiken* (or hard, dirty and dangerous). Many firms have already gone to China or elsewhere. This actually breaks the past *one-set industrialism* because Japan itself cannot support these machine parts domestically; thus, Japan has to be dependent upon Asian neighbor countries and, like it or not, should consider to promote international division of labor in the true sense of the word. The casting industry is a typical machine parts forming industry and has been developing steadily as a supporting industry for agricultural and mining machines as well as general machines and automobile industry. This industry in ASEAN has much room for improvement and, therefore, for cooperation because of the high defect rate and other problems.

Larger Japan Market?

Given that the above two prospects apply, ASEAN needs markets for their upgraded products since the U.S. started to be less positive in providing markets to ASEAN; the only possible alternative markets will be Japan and Asian NIEs. As long as Japan is concerned, Japan necessarily can provide sufficient market to ASEAN if Japan expands its production network as a process of de-industrialization in domestic economy. Japan, like it or not, must transform from *full set industrialism* of domestic economy to that of regional or global economy. It seems that the trend is already in this direction.

Japanese FDI development necessarily results in de-industrialization of domestic economy. Since FDI is an international transfer of production base from investing country to host country, which certainly affects the economic activities in the former, there is a worry about the domestic "de-industrialization" or the "hollowing out" effect of FDI. De-industrialization can broadly be defined as a situation where there is a continued and large decline in employment, in private equipment (or research and development) investment, in high value-added manufacturing output, and in the balance of trade (an indicator of revealed internation-

al competitiveness in manufacturing) in the investing country.

What is the outcome of de-industrialization? At the specific industry level, we observe a de-industrialization effect of FDI in Japan. For example, the textile industry, a labor intensive industry, left Japan in the late 1960's mostly to the Asian NIEs and ASEAN, when textile production became too expensive in Japan (the share of textile exports in total merchandise exports in Japan declined from 7.3% in 1974 to 2.5% in 1991). However, while Japan was moving out its comparatively disadvantageous textile industry overseas, it shifted the production factors released from the declining textile industry to a further development of the machinery industry, a capital and technology intensive industry, in which Japan has comparative advantage (the share of machinery exports in total merchandises exports in Japan increased from 50.2% in 1974 to 75.2% in 1991). Thus, as a whole, the industrial structure of the Japanese economy has been upgraded and has become more internationally competitive (the total merchandise exports increased 5.7 times from 1974 to 1991, compared with an increase of 4.2 times in the U.S. for the same period). This example suggests that FDI has an important role in restructuring the economy. The higher the international dependence becomes, the easier the *de facto* regional integration results.

Necessarily the de-industrialized sector's products should be imported to Japan, thus, this process is trade expanding. In the spirit of *flying geese development* pattern, ASEAN should behave the same as Japan to give way to emerging China in some areas, while upgrading its own industry to create further demand in new industries.

FDI has impacts on trade in stages. FDI affects trade in a different manner in accordance with each development stage. First, in the period from the start of construction on an overseas production base to the start of production, exports of capital goods, such as equipment, from the home country to the host country increase (Stage 1). After production begins, exports of intermediate products, such as parts and raw materials from the home country to the host country, increase because local procurement of these products does not progress immediately (Stage 2). Exports of final products from the home country decrease as these products are replaced increasingly through local production, and/or homeward exports of final products from the host country may increase, depending on the division of labor between home and host countries and the corporate strategy (Stage 3). Finally, as local procurement of parts and raw materials progresses, exports of such intermediate products from the home country to the host country decrease (Stage 4).

Thus, we can expect a larger absorber role of Japan. Japan will lose some sectors and require imports and, thus, FDI trade stages will evolve.

Stronger Intra-Industry Trade?

The fourth question can be easily realized. As long as Japanese FDI promotes international networks in the future and as long as ASEAN endeavors to upgrade its industries, the natural result is ever stronger Intra-Industry Trade Index *(IIT)*. This in fact should be placed as immediate goal or objective of industrial policy of ASEAN.

According to Lincoln (1990), the Japanese *IIT* dropped from 26 to 23 during the 1970-1985 period while the U.S. *IIT* rose from 53 to 54. The drop of Japanese *IIT* is due to two consecutive oil crises, which raised the share of oil in total trade; but the *IIT* of manufactures alone fell from 32 to 26. Table 13 shows the combined *IIT* development of the U.S. and Japan. For the 1985 to 1990 period *IIT* expanded[10]. Particularly Japan experienced quite a gain. Japan performed *IIT* widely and intensively in the sector 46 (other manufacturing), sector 15 (plastics), sector 7 (textile), sector35/36 (chemical products), sector 24 (metal products), sector 44 (scientific tools). Country wise, *IIT* is greater than 90 in with Korea textiles and steel, other manufactures, and telecommunication equipment. On the other hand, the U.S. performed *IIT* in the following sectors and countries. The U.S. performed intensively and widely in the sectors 42 (electronic machinery) and 40 (non-electric machinery). Trade with Hong Kong, Singapore, EC, Thailand, Malaysia, and ASEAN in sector 42 all recorded more than 90 in *IIT*.

Differences in FDI between labor-intensive industries and capital- and technology-intensive industries seem to be most pronounced in local procurement of parts and raw materials. In the case of FDI in labor-intensive industries, which requires little high-level technology, local procurement of parts and raw materials makes relatively good progress. In the case of similar investment in capital- and technology-intensive industries, however, parts and raw materials of higher quality are required. Thus, in order to promote local procurement in these industries, spadework must be done in such basic areas as development of local industries and human resource development. For this reason, where FDI is made in capital- and technology-intensive industries, local procurement progresses more slowly than is the case with labor-intensive industries. Thus, exports of intermediate products from the home country do not decrease in a short period of time. It is probably for this reason that the positive intra-industry trade indexes of Japanese machinery for the NIEs and ASEAN countries have so far shown relatively small negative changes.

---

10 Abe (1994).

Table 13 Development of Intra-Industry Trade

Japan					USA				
Country	Industry	1985	1990	Trade Value(1990)	Country	Industry	1985	1990	Trade Value(1990)
World	46	0.60	0.99	186,736	World	19	0.54	0.99	18,483
USA	44	0.99	0.99	39,789	Hong Kong	42	0.47	0.99	22,125
Korea	7	0.88	0.98	18,575	EC	45	0.66	0.98	45,897
Korea	23	0.69	0.96	94,174	World	1	0.71	0.98	28,493
USA	19	0.95	0.96	11,683	ROW	21	0.80	0.96	78,320
World	35	0.89	0.96	293,180	Singapore	42	0.68	0.96	102,310
Korea	46	0.81	0.95	56,756	Taiwan	28	0.10	0.96	11,026
World	15	0.62	0.95	48,491	EC	16	0.45	0.96	26,310
EC	15	0.56	0.94	5,541	Singapore	47	0.79	0.96	27,983
China	36	0.58	0.94	34,058	Korea	40	0.80	0.96	164,321
ROW	46	0.46	0.92	231,778	EC	40	0.98	0.96	1,659,779
EC	16	0.90	0.92	31,482	ROW	8	0.90	0.95	65,565
NIES	3	0.85	0.92	70,111	EC	42	0.99	0.95	413,426
World	36	0.48	0.91	772,693	Japan	44	0.90	0.95	158,179
Korea	41	0.52	0.91	67,849	World	40	0.98	0.94	7,460,203
Taiwan	7	0.88	0.90	52,965	NIES	3	0.00	0.94	6,859
USA	15	0.68	0.89	37,781	World	20	0.85	0.94	128,026
ROW	7	0.42	0.89	136,933	Thailand	42	0.85	0.94	65,356
World	7	0.60	0.89	783,461	EC	37	0.95	0.94	179,844
EC	28	0.11	0.89	26,685	ROW	46	0.86	0.92	1,998,246
World	3	0.48	0.88	217,378	Malaysia	42	0.81	0.92	251,623
Malaysia	6	0.08	0.87	18,109	Japan	4	0.36	0.92	8,035
Korea	24	0.00	0.87	52,642	ASEAN	42	0.83	0.92	461,639
Singapore	31	0.79	0.86	7,159	Taiwan	29	0.08	0.92	140,677
ROW	36	0.75	0.85	100,739	Japan	32	0.45	0.91	36,640
NIES	18	0.83	0.85	68,086	EC	32	0.68	0.91	99,444
ROW	44	0.33	0.84	52,295	Indonesia	7	0.00	0.91	6,942
World	16	0.57	0.84	437,981	NIES	34	0.32	0.91	106,120
NIES	46	0.78	0.84	898,403	ROW	7	0.89	0.91	291,384
EC	35	0.65	0.84	305,474	China	29	0.00	0.90	9,471
USA	32	0.83	0.84	65,795	Malaysia	40	0.48	0.90	52,397
USA	46	0.51	0.83	1,273,898	China	47	0.58	0.90	276,178
World	1	0.45	0.83	62,701	Philippines	42	0.84	0.89	140,872
USA	11	0.00	0.83	58,075	Malaysia	36	0.00	0.89	11,731
World	19	0.81	0.82	217,396	ROW	42	0.94	0.89	2,236,633
World	20	0.95	0.82	155,262	ASEAN	23	0.00	0.89	6,452
Philippines	46	0.00	0.82	13,226	World	35	0.98	0.88	1,704,886
Thailand	15	0.00	0.82	6,547	EC	35	0.75	0.88	661,711
ASEAN	46	0.96	0.81	160,855	ROW	37	0.84	0.88	180,927
USA	35	0.77	0.81	340,652	Singapore	15	0.91	0.87	5,045
China	15	0.00	0.81	6,774	World	39	0.66	0.87	461,317
World	22	0.82	0.80	458,254	Singapore	46	0.76	0.87	168,939
ROW	43	0.00	0.80	18,759	EC	22	0.53	0.87	159,079

Table 13 Development of Intra-Industry Trade (concluded)

Japan					USA				
Country	Industry	1985	1990	Trade Value(1990)	Country	Industry	1985	1990	Trade Value(1990)
ASEAN	26	0.00	0.79	9,071	ROW	35	0.94	0.87	618,374
Korea	31	0.75	0.79	25,079	ASEAN	1	0.00	0.86	12,132
Korea	27	0.00	0.79	23,480	World	42	0.76	0.86	7,996,163
Thailand	7	0.84	0.78	15,604	ROW	24	0.88	0.86	737,936
World	44	0.71	0.78	1,535,416	Japan	35	0.89	0.85	269,795
Korea	18	0.71	0.78	21,047	ROW	41	0.94	0.85	817,639
Taiwan	46	0.56	0.75	413,493	ROW	10	0.98	0.85	86,504
Philippines	35	0.00	0.75	5,450	World	34	0.57	0.84	886,496
China	24	0.00	0.74	23,985	EC	18	0.84	0.84	62,162
EC	44	0.65	0.74	388,886	EC	46	0.50	0.84	2,699,996
Taiwan	24	0.00	0.74	79,000	ROW	17	0.00	0.84	29,499
Thailand	46	0.93	0.74	95,110	EC	47	0.98	0.84	4,190,345
ASEAN	15	0.00	0.74	15,271	ROW	29	0.85	0.84	9,171,719
Malaysia	25	0.00	0.73	5,724	EC	36	0.98	0.83	857,765
Singapore	46	0.69	0.73	182,144	ROW	30	0.49	0.83	158,788
Korea	21	0.00	0.73	24,696	Hong Kong	8	0.00	0.83	6,423
NIES	15	0.67	0.73	92,804	ROW	16	0.62	0.82	220,430
Korea	15	0.00	0.73	32,679	ROW	28	0.86	0.82	226,071
World	32	0.79	0.72	206,086	ROW	38	0.83	0.82	429,765
Korea	34	0.87	0.72	30,597	World	37	0.83	0.82	952,340
Philippines	36	0.46	0.72	8,962	EC	25	0.71	0.82	7,851
USA	22	0.65	0.72	238,071	ROW	33	0.26	0.82	345,530
USA	16	0.23	0.71	305,516	EC	39	0.68	0.82	168,620
EC	46	0.55	0.71	2,122,067	EC	1	0.57	0.81	58,700
Malaysia	46	0.49	0.71	92,801	Taiwan	20	0.61	0.81	10,862
World	8	0.24	0.71	481,567	Taiwan	44	0.83	0.80	69,288
Singapore	26	0.16	0.71	65,725	World	46	0.71	0.80	13,992,031
Malaysia	35	0.00	0.70	17,118	World	30	0.93	0.79	210,928
EC	7	0.95	0.70	386,338	ROW	15	0.99	0.79	395,153
Korea	3	0.68	0.68	157,148	NIES	42	0.56	0.78	2,476,188
Malaysia	21	0.00	0.68	8,376	Philippines	47	0.35	0.78	192,114
USA	39	0.98	0.68	165,765	World	47	0.62	0.77	40,738,600
NIES	23	0.47	0.68	1,476,044	ROW	18	1.00	0.77	103,688
Hong Kong	15	0.00	0.68	16,272	ROW	36	0.99	0.76	1,898,030
World	18	0.97	0.67	390,674	China	22	0.00	0.75	28,863
ROW	31	0.44	0.67	342,781	China	40	0.00	0.75	271,899
USA	7	0.28	0.67	241,625	World	41	0.56	0.75	4,626,734
World	31	0.25	0.67	990,687	Korea	22	0.89	0.75	42,828
Thailand	6	0.15	0.67	45,183	EC	17	0.44	0.74	54,285
NIES	24	0.03	0.66	328,730	ROW	23	0.38	0.74	1,142,733
NIES	26	0.30	0.66	174,767	ROW	19	0.67	0.74	207,597

As the stages of FDI development suggest, Japan will increase *IIT* with ASEAN as the current and future FDI projects mature.

More Japanese FDI to ASEAN?

Whether or not the last statement is realized is a key for the future success of ASEAN economy. As long as AFTA succeeds in uniting and opening the ASEAN market, Japanese firms might have stronger interests in the market. Any single country is not sufficient to provide good incentives, compared with the huge possible markets of China and India, so that ASEAN should benefit greatly by being considered as a single entity. For trade and investment, if Japanese firms can regard ASEAN as a single country in so far as regulations, benefits and taxes, and etc. are concerned, Japanese FDI will incrase or at least maintain its share. It all depends upon the efforts of ASEAN to build up infrastructure, to ease bottlenecks, to liberalize trade and investment, and so on.

5. Conclusions: Challenges and Directions for Cooperation

The more Asian countries engage in upgraded *wild geese flying pattern* of intra-industry trade, the more tightly their economies become inter-linked. Japan, used to be known as *full set industrialism* country, has started to engage increasingly in the international division of labor, whether she likes it or not. The pattern of FDI flows are such that this change will become more visible in the near future. Once the Japanese industrial structure changes in this direction, the integration of the Japanese economy in the region will inevitably be strong. The way Japanese industries have been integrated is as follows. The development of Japan's FDI to Asian countries varies by industry. Japanese FDI to Asian countries has particular characteristics when compared with its FDI to the world. In case of Asian countries FDI was more concentrated in manufacturing industry such as food and beverage, textile, chemical, and machinery industries. Since 1986 steel, non-ferrous metal products, and electrical industries became FDI concentrated industries. Although the share of Japanese FDI stock in Asia was much lower than that to North America, industry wise, the textile share of Japanese FDI stock in Asia was higher than that in other regions. The share of chemical, steel and non-ferrous metal products, machinery and electric machinery in Asia was greater than 20 percent. Since the flow figures are relatively large in recent years and years to come, the stock figures are expected to rise in the future, and thus, more regional integration should be realized in the true sense of the word if Japan imports more of these products. There is ample room for Japan to enhance intra-industry trade in these areas. Such a rapid development of the business activities of

Japanese firms necessarily expands networks in production, distribution, and intermediate products. The so-called globalization of Japanese firms has progressed and is going to develop tremendously in the near future.

Regional Cooperation from the Industrial Relocation Viewpoint

Although the total outflow of FDI in 1993 might result in a slight decrease like 1992, it is still at a high level by historical standards. The Asia Pacific region is one of the most dynamic growth areas in the world. The driving force behind this growth, as was already pointed out, has been the increasingly active trade and investment under an open policy environment, resulting in deepened interdependence within the region. Following Asian NIEs, ASEAN countries have succeeded in attaining rapid industrialization helped by a massive inflow of foreign capital, but now bottlenecks have emerged in infrastructure, manpower, and particularly supporting industries which mainly supply parts. If the ASEAN countries are to maintain medium-to-long term growth with such countries as China and Vietnam, who are rapidly catching up in the industrialization process, they must eliminate these bottlenecks and upgrade their industries.

It is indeed important for Japan to help these countries solve their problems as part of a process of establishing an internationally harmonious industrial structure. In other words, Japan should engage in strengthening the ongoing *wild geese flying development pattern,* leaving light manufacturing and some of more technology intensive products to Asian NIEs and ASEAN.

This region seems, whether or not the regional integration scheme is formalized, developing rapidly since the natural trading and investment linkages can be developed by Japan's initiation of de-industrialization and active relocation of industries in the region. Both AFTA and APEC will surely help this development; Regional integration will be enhanced in this region simply because of the potential attached to the region as is explained in the former section. This dynamism is more important than simple policy slogans. Asia has a tough mentality to supersede practical merits over political skepticism. From this viewpoint, we will touch upon somewhat more on what Japan and Asia can do to enhance the growth of the region and the world.

Improvement of the Industrial Cooperation Scheme

The industrial sector involved with technological transfer plays an extremely important role in supporting the upgrading of industries in developing countries. Upgrading is such a complex agenda that it is of great importance for both Asian counterparts and Japan to form a common understanding of goals to be attained, including clarifying the priorities. This is necessary for both private and public

sectors. Efforts by the entire region are necessary as exemplified by initiatives such as AFTA and other ASEAN regional cooperation schemes. As we discussed, we should now endeavor to construct one efficient *full-set industrialism* complex within broader region, i.e., APEC or the world, and continued cooperation is required by all the countries in the region. Countries alone or in small groups, cannot achieve the goal. If we should strive for this goal, we end up naturally with trade and investment liberalization and harmonization of systems and standards. In turn, all of these measures are expected to lower transaction costs in the entire Asia and the Pacific region.

With this understanding we may feel easier with the recent development of regionalism.

APEC, AFTA, NAFTA, and etc.

Intra ASEAN trade is not that significant and, in particular, if we exclude ASEAN's trade with Singapore, it becomes quite small. AFTA, therefore, although it might expand regional trade, will work to harmonize trade and investment with non-ASEAN countries. Since AFTA is not only a free trade agreement but also takes steps forward to standardize products and coordinate investment, Japan, should welcome such moves. Thus, in the future, Japan will consider ASEAN as another center in spite of the big move toward China and Vietnam in recent years as a host of Japanese FDI. Probably the effect of AFTA is not to enhance trade within ASEAN but to enhance international networks of the region and to attract more investment from Japan. This region should upgrade their industrial structure, leaving less technical products production to China and Indo-China countries.

AFTA still does not appear to address the problem of non-tariff barriers. Although the tariffs are considered squarely in the CEPT scheme, tariffs are not the real issue. ASEAN must agree to remove all quantitative restrictions, such as import quotas, and all other forms of non-tariff barriers. Nevertheless, ASEAN's potential to evolve from a political grouping into an economic one is attracting attention from outside the region.

The Japanese government is trying to make APEC successful as a model for open regional cooperation. As to whether it feels APEC should become more institutionalized, and at the end of the day become a free-trading area, this is not the direction or the objective the Japansese government believes would be desirable or that one should seek. Needless to say Asia-Pacific is a region where countries are at different stages of economic development. It is unrealistic to pursue a free-trading area in which economic transactions would take place with all the participating countries adhering to the same terms and conditions. This

framework of regional cooperation should, however, be one that is in accordance with the principles of GATT, and where benefits accrued internally should also be enjoyed by extra regional countries on a most-favored-nation basis. Japan stresses the importance of technology transfers within the APEC region. Regarding Japan's future role in regional security, besides the importance of the Japan-US Security Treaty, and that there must also be political and security dialogue among countries in the region to further increase a sense of reassurance. It is also very important to promote economic development among countries in the region, as a lack of economic development can generate instability.

Thus, *open regionalism,* AFTA and NAFTA as sub regions of APEC, seems to be an agreed upon concept in Asia and this seems coincide with the flexible approach of Asian nations. If one country should become too stubborn in leading any one scheme, it will not function smoothly. Flexibility is the virtue of Asian cultures and due process should be taken to be followed in taking further steps.

References

Abe, Shigeyuki (1993) "Nihon no ASEAN Chokusetsu Toshi to ASEAN no Hikakuyui Kozo (Japanese Direct Foreign Investment to ASEAN and ASEAN's Comparative Advantage)," a paper presented at Development Seminar, Kyoto University, July 17, 1993 (mimeo).

Abe, Shigeyuki (1994) "Nichibei no Sangyonai Boeki (Intra-Industry Trade: Japan and the U.S.A.)," *Kokumin Keizai Zasshi,* February 1994.

ASEAN Secretariat (1993) *AFTA Reader, Vol 1. Questions and Answers on the CEPT of AFTA.*

Economic Planning Agency (1992) *Economic Survey of Japan 1991-1992: Seeking for a New Perspective beyond the Adjustment Process,* 1992.

Far Eastern Economic Review, various issues.

Goto, J. and K. Hamada (1993) "Economic Preconditions for the Asian Regional Integration", February, RIEB Discussion Paper, Kobe University.

Ichimura, Shinichi (1994) "Regional Integration Issues in Asia", Osaka International University Discussion Paper.

Kohama, Hirohisa (1992) *Chokusetsu Toshi to Kogyoka: Nihon, NIES, ASEAN (Direct Foreign Investment and Industrialization: Japan, NIES and ASEAN),* JETRO, 1992.

Kohsaka, Akira, Yasuhiro Asami, Shigeyuki Abe (1993) "Changing Patterns of Trade in Goods and Services in the Pacific Region," a paper presented at the Pacific Economic Outlook Specialist Meeting, Septermber 27-28, 1993, Osaka.

Lincoln, Edward J. (1990) *Japan's Unequal Trade,* Washington: The Brookings Institution.

Ministry of International Trade and Industry (1993) *ASEAN Sangyo Kodoka Vision: Sangyo Seisaku no Susume (Prospects and Challenges for the Upgrading of Industries in the ASEAN Region)*

Seki, Mitsuhiro (1993) *Full-Set gata Sangyo Kozo o Koete: Higashi Ajia Shin Jidai no*

nakano Nihon Sangyo (Beyond Full-Set Type Industrial Structure: Japanese Industry in the New Era of East Asia), Chuokoron.

Yamazawa, Ippei "On Pacific Economic Integration" *The Economic Journal,* vol. 102, November 1992, pp. 1519-1529.

KOBE ECONOMIC & BUSINESS REVIEW, 42 (1997), 55-96

JAPANESE FINANCIAL RELATIONSHIPS IN TRANSITION

KENJI KOJIMA **Kobe University**

Abstract

This paper presents Japanese financial relationships in an international perspective. The primary purpose of the study is threefold: to identify important features of financial relationships in Japan and those structural changes; to provide economic rationale for those relationships and changes; and to develop insights concerning corporate finance and capital market under institutional and regulatory environments. Corporate finance in Japan has evolved around the main bank relationships. Financial liberalization in Japan has created difficulties for the main bank relationships. The process of change will continue, both because of continuing liberalization and because some financial patterns change sluggishly. Increasing financial sophistication and capability to exploit opportunities arising from regulatory changes will also continue to alter corporate financial practices. Financial liberalization tends to undermine the main bank system because major non-financial firms have greater access to arm's length debt as well as borrowing from foreign financial institutions.

JEL Classification: G21; G32; G33

Keywords: Cross-share holding; Financial liberalization; Financial relationships; Main bank

1. Introduction

As capital and product markets have become global, the differences in corporate behaviors across the countries have been shown distinct. Since behaviors and performances of firms substantially depend on institutional and regulatory environments where firms operate, peculiar patterns of behaviors turn out to be the rational economic responses to those environments. One of the major differences in corporate behaviors among different countries can be financing patterns, parti-

Corresponding Address:
Kenji Kojima
Research Institute for Economics and Business Administration, Kobe University
2-1 Rokkodai-cho, Nada-ku, Kobe 657-8501, Japan
E-mail: kojima@rieb.kobe-u.ac.jp
Fax: (81)-78-803-0406

cularly the financial relationships between the capital market and non-financial firms. Corporate capital structures and financing practices in Japan appear distinctive, particularly in comparison with those in the United States. Specifically, it is commonly observed that financial institutions in Japan tend to have much closer, longer relationships with their clients than do their counterparts in the United States. In large part, these differences are due to differing institutional and regulatory environments. To the extent that the institutional and regulatory constraints vary systematically across countries, so may financial relationships. While legal and historical considerations help to explain why financial relationships in each country have followed distinctive trajectories, we need to explain the difference of patterns across the countries as well as the similarity within each country and their sustainability with providing economic rationale under specific institutional and regulatory environments. The key to answer these questions is comprehensive understanding of the financial relationships with a comparative study, identifying the underlying structure of constraints.

Japanese financial institutions may hold equity and debt at the same time. Besides strengthening the long-term relationships between the financial institutions and the firm, the simultaneous holding of debt and equity clearly reduces the scope for conflict between stockholders and debtholders over the choice of policies, particularly in situations of financial distress. The significance of the main bank system is the close information-sharing relationship that exists between the bank and the firm. It is possible to view the main bank system as functioning as a substitute for the kind of screening and monitoring institutions that are prevalent in other capital markets such as bond and credit-rating institutions and security analysis agencies. The close association that the main bank has with the firm means that the bank is able to obtain inside access to the firm and its management, which is not readily available to the external capital market. It can be argued that this function of the main bank provides an important substitute mechanism for what in effect is inactive market for corporate control in Japan. Main bank intervention can take a number of forms, ranging on the one hand from cases where the main bank stipulates certain measures that requires the firm to take in exchange for the bank's support during a period of financial difficulty.

Much of corporate finance in Japan has evolved around the main bank relationship. This is changing for many firms, particularly large and highly liquid firms. Financial liberalization in Japan has created difficulties for the main bank system. Nevertheless, that system seems likely to adapt and continue to provide valuable support for medium-sized and rapidly growing firms. Exactly how this will come about is not yet clear; however, there are substantial incentives for preserving the system's advantages. More generally, the effects of financial liberalization over

the last decades have been enormous. The process of change will continue, both because of continuing liberalization and because some financial patterns change sluggishly. Increasing financial sophistication and capability to exploit opportunities arising from regulatory changes will also continue to alter corporate financial practices. Financial liberalization tends to undermine the main bank system because major non-financial firms have greater access to bond market as well as borrowing from foreign financial institutions. This makes it potentially much more difficult for the main bank to monitor and control those firms. Consequently, the main bank system could continue to be viable and advantageous for firms which is restricted the access to alternative debt sources and need strong bank support. The financing pattern of large Japanese firms is beginning to resemble the more arms-length financing patterns observed in the U.S. The infrastructure in financial market including rating agencies, disclosure rules, regulation and enforcement of insider trading are not developed well in Japan. Even though the deregulation made it possible for major firms to arm's length financing, some firms would still maintain main bank relationships.

This paper presents major characteristics of Japanese financial relationships in an international perspective. It examines the structural changes in the financial relationships and discusses the future directions. The primary purpose of the study is threefold: to identify important features of financial relationships in Japan and those structural changes, to provide economic rationale for those relationships and changes, and to develop insights concerning corporate finance and capital market under institutional and regulatory environments.

This paper is organized as follows. The next section presents the major characteristics of financial relationships in Japanese firms comparing with the counterparts in Germany and the United States. In particularly, it describes one of the most distinctive features of Japanese financial relationships, that is main bank relationships, and discusses its economic rationale. Some aspects of Japanese corporate finance have changed dramatically over the last decade. Most of these changes are the result of changes in the structure of Japanese financial markets, which in turn can be traced to regulatory changes. Section 3 discusses recent structural changes in corporate financial policies, and capital and credit markets in Japan. Finally, section 4 presents concluding remarks.

2. Financial Relationships

2.1 Close Financial Relationships

Non-financial firms have relationships with financial institutions in each country. U.S. corporations borrow from a broader array of sources than their

Japanese and German counterparts, which rely more heavily on banks for external capital. Their bank financing also differs, since in Germany lenders supply more long-term financing. With an active equities market, a vigorous commercial paper market, a strong banking system, and a variety of long-term investors, the U.S. capital market has no equivalent ones in other countries. Yet the widespread use of conventional rules of thumb to determine capital structure and the prevalent reluctance to issue common stock for internal financing purposes negate this advantage. By setting specific debt-equity goals and by refusing to issue equity for fear of diluting earning per share, U.S. firms arbitrarily limits its available capital. Consequently, the capital potentially available becomes irrelevant and unused asset. While U.S. firms draw almost 20% of their external funds from banks, their relations are not close. The natural conflict between managers, who are supposed to represent shareholders with residual claims in the firms, and the lenders, who have preferential claims on its assets, never entirely resolves. Moreover, the need to negotiate terms and restrictive covenants, which constrain management's latitude, underscore this adverse edge. U.S. legislation also prohibits commercial bank ownership of non-financial corporations, so U.S. banks act only as intermediaries on behalf of other investors.[1]

In Germany and Japan, these relationships are especially close and long-term, and it has important implications: banks are more likely to provide support when firms are in financial trouble, since helping their borrowing firms remain viable reduces the riskiness of their loans; banks support their borrowers' long-term growth to ensure their own; banks usually have sufficient influence to ensure that management's decisions are compatible with their own goals. Together with the small portion of equity in corporate capital structures, these close relationships can diminish the importance of shareholder wealth maximization as a prime goal of corporation. Banks enjoy a special position in German industry. The historically underdeveloped capital market and burdensome corporate tax policy have inclined to firms to finance with bank debt rather than equity. German banks also own a significant fraction of equity in non-financial firms, although the exact percentage of bank-owned shares is not known. In addition to direct share owner-

1 In the U.S., the Bank Holding Company Act underscores it by requiring bank passivity in wielding stock. The law prohibits not just control of a firm, but control of any voting stock. It deters taking proxies, voting trusts, and owning through non-bank subsidiaries. The Bank Holding Company Act would deter the U.S. banks with either Japanese main bank ownership or German proxy votes even if the Act allowed day-to-day influence (Roe 1993). Banks and financial institutions are allowed to exert control over non-financial firms by law. Banks assume an important monitoring role in the restructuring firms, which file for bankruptcy or restructuring their debt privately. Gilson (1990) reports that banks and other financial institutions with debt outstanding to the firm received significant blocks of voting stock in a sample of 111 listed firms that filed for bankruptcy or restructured their debt between 1979 and 1985.

ship, banks serve as depositories for stock owned by other shareholders. At the end of 1988, they held approximately 40% of the total market value of outstanding domestic shares. Banks also enjoy *Vollmachtstimmrecht,* or the right to vote shares held on deposit on behalf of the depositors. Effectively, bank controls virtually half of German shares. German law has been amended to require that banks solicit voting instructions from shareholders whom they represent and renew the right of proxy for shares held on deposit every 15 months. In the event of a takeover offer, banks must inform shareholders of pending bids only if the offer is published. Still, banks continue to obtain wide latitude in the voting of shares held on deposit. Big commercial banks and central savings banks, or *Landesbanken* in Germany, practice universal banking, which includes direct investment in equities and bonds.[2] As a result, German bankers held directorships on the supervisory boards of the firms. German commercial banks facilitated by law and tax policy, own sizable portions of many large industrial firms. Ownership gives it the power to block any change in the firm's statues. This has resulted in a concentration of ownership among major banks. The larger banks also reinforce their influence thorough the proxies they hold.[3]

---

2 Most of 4,500 German banks are universal banks, which may be active in the banking business as well as the securities. In addition, those banks may participate in the investment business, trade in real estates, rescue operations for financially distressed firms, get involved in merger and acquisition (Baums, 1992). The Germany system of investment finance in the nineteenth and early twentieth century as being one dominated by universal banks with close ties to industrial firms. It is commonly argued that universal banking facilitated German industrialization by providing substantial amount of funds and reducing the cost of external finance for industry (Calomiris, 1993). Edwards and Ogilvie (1995) argue, however, that the role of universal banks in German industrialization has been over-emphasized. The distinctive features of the relationship between universal banks and industrial firms apply only to industrial joint-stock companies, but the majority of the industrial capital stock in Germany before 1914 was accounted for by firms which were not joint-stock companies. Even for industrial joint-stock companies, careful analysis of the relationship between these companies and universal banks casts serious doubt on the conventional view that the universal banks provided a substantial fraction of the funds for investment by industrial companies and exerted a significant degree of control on their management. In most cases, internally-generated funds were be far the most important source of investment finance for industrial companies, and banks were not in a position to exert any control on these firm's management even though they occupied seats on the supervisory board. Hoshi (1995b) examines the benefits and the cost of universal banking in the post and pre-war period in Japan. He argues that combination of commercial banking and security business allowed in the pre-war period did not increase the probability of bank failures and universal banking does not increase the risk of financial instability.

3 If bank relationships can substitute for the small stock market in Germany, a bank should improve performances of non-financial firms. Gorton and Schmid (1996) shows the evidence that German banks improved the performances of firms to the extent that they held the firms' equity in 1974. They also found no evidence of conflict of interests concerning bank use of proxy votes. In 1985, however, German financial market is under structural changes and the findings in 1974 can not be valid anymore. Fohlin (1995) argues for a conservative interpretation of the role of relationship banking in industrial development showing the evidence that firms with close bank involvement did not always experience lower liquidity constraints of investment than independent firms in the period of the heyday of German universal banks, 1871-1914.

German firms tend to have strong relationships with one or a few banks, called *Hausbank*. A hausbank would be a primary lender to a firm and would often enjoy representation on the supervisory board or an equity position in the firm. Supervisory board members from such banks are valued for their knowledge of business and economic conditions, as well as for their detailed knowledge of the firm. In time of financial distress, the hausbank would tend to be more willing to aid the firm than would other banks. As in Japan, shares owned by hausbank are seldom traded. As early as the late 1960s, German banks began to transform themselves in anticipation of reform in German financial market. The hausbank system has already given way to what is called network system of financing. In the traditional hausbank system, a firm is completely dependent on a single bank for all of its financing needs. In the network system, by contrast, several banks join together informally to finance entire networks of firms. Representatives of the banks in the network sit on the supervisory boards of a particular firm. And often managers from one firm in the network sit on the board of another firm also financed by the same of banks (Baum, 1992).

Ties between banks and non-financial firms are close in Japan. Banks still play a central role in financing industries through large group of industrial firms. Bankers often serve on manufacturing firms' boards and, particularly in periods of financial distress, become heavily involved in management. Japanese firms make extensive use of leverage and intercorporate holdings of debt and equity. Banks' personnel move frequently between banks and firms as part of an ongoing relationship that involve training, consulting, and monitoring.[4] While current law requires Japanese banks to reduce their equity positions to 5% of outstanding equity of the firm, they still own about 21% of the outstanding shares of Japanese firms in the period of 1985 through 1992. In contrast, individual shareholders own only 23% of common stocks and they exercise little influence over management.

In both Germany and Japan, these close relationships between the financial in-

4 There are the six largest industrial groups, or *keiretsu*, which have their origins in the 1950s: Mitsubishi, Mitsui, Sumitomo, Fuyo, Dai-ich Kangyo, and Sanwa. Almost half of the 200 largest firms in Japan are members of one of these groups. Firms in the group are more likely to trade with their members than non-members. These trade relationships are reinforced by stable cross-shareholding in the group. The distinctive feature of the group is the relationships between its manufacturing firms and financial institutions. Group firms do a substantial fraction of their borrowing from financial institutions in their own group. One of these institutions is usually considered the main bank in the group, which takes a more active role in arranging financing for the firm, even though the firm borrows from other institutions outside the group. Fair Trade Commission (1994) in Japan provides the evidence that group firms borrow 17.5%, 17.3%, and 19.5% of their borrowing from their group's financial institutions in 1981, 1987, and 1992, respectively. In addition, group financial institutions typically own equity in the firms to which they lend. Furthermore, the placement of bank personnel in top management positions of group firms reinforces the bank's power as shareholders and creditors.

stitutions and non-financial firms foster a longer-term perspective reducing the pressures from the capital market for short-term stock performance that U.S. manager's experience. The executives of German and Japanese banks who oversee investments in manufacturers manage institutions, not portfolios. Unlike fund managers who make the equity market in the U.S., they are committed to their institutions' growth and not to the short-term performance of their investment portfolios. In sharp contrast to the high turnover rates that fund managers in the U.S. generate, financial institutions in Germany and Japan rarely sell their equity holding. Since banks' capital investments are predominantly loans, they can serve their economic interests by expanding their business with the firms in which they invest than by pressing for short-term stock price gains. For them, the greater a firm's growth, the greater the loan demand, and the more competitive the firm, the higher the quality of the loans. The high degree of leverage that banks in those countries accept decreases the cost of capital and reduces the level of return manufacturers need to seek on their investments. As a consequence of these factors, managers in German and Japanese firms do not focus as intensely on shareholder returns as their U.S. counterparts do, and they are willing to compromise shareholders interests for growth that serve a broader stakeholders.

Financial institutions in Japan, banks in particular, are more efficient providers of capital, and their equity ownership in client firms represents far more than a mere portfolio investment. Through their activities as main banks, they play essential roles in the governance of non-financial firms.[5] Their close and long-term relationships with a borrower afford them greater access to privileged information and establish them in the eyes of other lenders as delegated monitors of their major industrial clients. They effectively function as centers of information gathering about client firms, and their responses to virtually any aspects of their client firms' activities represent important signals to other corporate stakeholders. As significant equity owners, they enjoy direct or indirect board representation through which they may exercise an active voice in the governing of the corporations in which they invest. Commensurate with their status as lead lenders and major shareholders, main banks enjoy preferred status in the provision of a wide range of financial services to client firms, and in the yields received on their loans in Japan. Japanese main banks have been involved deeply in the affairs of their client firms, requiring detailed disclosures of management and investment plans on a frequent basis. It was common for bank executives to require modification of these plans as a condition for the continued provision of capital.

---

5 The large-scale questionnaire survey provides the evidence that more than 98% of public corporations in Japan have main bank relationships (Fuji Research Institute Corporation, 1993).

Although the securitization of Japanese corporate finance in the 1980s has considerably weakened main bank influence over large and highly liquid firms, they remain important suppliers of capital to smaller affiliates of these larger clients.

Main banks also have been and remained important providers of auditors and directors to many Japanese non-financial firms. Whereas virtually all U.S. firms have at least one outside director, most Japanese boards of directors are entirely inside boards with virtually all members being salaried executives of the firm. One or more members of board in Japanese firms frequently are former executives of the firm's main bank. These appointments arise from the common practice among major Japanese firms, commercial banks in particular, of retiring those senior managers not being nominated to their own firms boards of directors and placing them as directors or senior managers of client firms. Japanese main banks will often take a leadership role in corporate restructuring, dispute resolution or simply the promotion of new business for client firms.

2.2 Main Bank Relationships

2.2.1 Monitoring

Main banks in Japan have historically been the most likely to intervene because of their position as the largest supplier of capital to the group of industrial firms. In addition to having an equity investment, they have considerable amount of debt at stake. Nominally, this debt is in the form of senior collateralized short-term loans and 90-to 120 days promissory notes, which are usually routinely rolled over indefinitely. However, in the event of impending financial distress, the character of main bank's loans changed dramatically. This is because most main banks voluntarily subordinate their debt to that of other banks lending to the main bank's troubled clients. Whereas fear of such equitable subordination keeps most the U.S. lenders on the sideline until a loan agreement is formally breached, and even then restraints the degree of intervention, the Japanese main bank effectively assumes such subordination from the outset and takes far-reaching, early steps to limit the damage.

The main bank acts as an alert monitor of performance and begins to act like a private, controlling shareholder well in advance of the time when problems become acute. One effect of this intensive monitoring with early selective intervention is to reduce some of the costs normally associated with the hazards of lending. Opportunities to borrow money and then take extraordinary risks that might benefit shareholders at the expense of creditors are reduced when banks own some equity and are able to intervene early when problems are spotted. The costs normally associated with financial distress are reduced to the extent that problems are identified and corrected early.[6]

Diamond (1984), among others, argues that banks serve as corporate monitors who bear the cost of becoming informed about their client firms and who ensure that they make efficient business decisions. Diamond shows that delegating the role of monitoring to a bank minimizes monitoring costs. The alternative - issuing securities like public debt and equity - may be inefficient either because monitoring costs are needlessly duplicated among individual security holders or because monitoring is a public good that no one has an incentive to provide. He shows that bank diversification plays a key role in ensuring that banks monitor their client firms.

As Myers and Majluf (1984) point out, liquidity is an important determinant of investment when there are informational problems in the capital market. If managers are better informed than investors are about a firm's prospects, the firm's risky securities will sometimes be underpriced, thereby raising the cost of external finance. Managers find it more attractive to finance investment with internal funds. Thus, for firms facing information problems, liquidity will be an important determinant of investment. Bank monitoring is one way of overcoming these information problems. If bank lend a large fraction of a firm's debt as well as own a portion of its equity, then they have strong incentives to become informed about the firm and its investment opportunities. It is also in their interest to ensure that managers make more efficient business decisions. In this case, there should be little relationship between investment and liquidity for bank-monitored firms. If firms need funds to finance investment, they can go directly to their informed bank to raise the money. The bank should be willing to provide the capital provided the project is valuable. The close relationship with the bank is likely to mitigate information problems that typically arise when debt and equity are diffusely held and no individual investor has an incentive to monitor the firm. Since the independent firms have weaker ties with banks, they are likely to face greater difficulty raising capital. Thus, it is relatively easy to distinguish between firms that are likely to face information problems and those that are not.[7]

Sheard (1989) provides an economic rationale for this main bank system focus-

6 Aoki, Patrick, and Sheard (1994) characterize main bank system not just as a system of corporate finance based on bank lending, but one involving a nexus of relationships comprising a multitude of relationships between firms and banks, reciprocal relationships among banks, and relationships between regulatory authorities and financial sector.

7 Rajan (1992) points out that there is a fundamental trade-off between bank debt and arm's-length debt. The bank can monitor the client firm and control its investment decision. In doing this, however, it alter the division of surplus between itself and the firm. The bank's informational advantage over outside lenders provides the basis to influence the division of surplus. This causes the firm to prefer credit from the arm's-length sources. It can be shown, however, that bank's ex-post opportunism can be controlled by making more efficient use of long-term contracting (von Thadden, 1995).

ing on the role of the main bank as an agent that specializes in the collection, evaluation, and transmission of information about firms and their management, and that provides a mechanism which substitutes for the inactive market for corporate control in Japan.[8] The significance of the main bank system is the close information-sharing relationship that exists between the bank and the firm. It is possible to view the main bank system as functioning as a substitute for the kind of screening and monitoring institutions that are prevalent in other capital markets such as bond and credit-rating institutions and security analysis agencies. The close association that the main bank has with the firm means that the bank is able to obtain inside access to the firm and its management, which is not readily available to the external capital market.

The main bank system seems to exemplify in concrete way some other important aspects of monitoring: delegated monitoring. The main bank system can be characterized in terms of banks themselves delegating the monitoring of a particular firm to one particular bank: the main bank. The bank delegated to be monitoring is not only the bank with the largest loan share but also holds a significant stake in the firm as a shareholder. Having a sufficient large loan share may be the way in which the bank ensures that it obtains an adequate return on its monitoring outlays. In this regard, it is worth noting the free-rider problem may be mitigated somewhat by virtue of the fact that non-monitoring banks will not be able to imitate the loan portfolio of the main bank in size.[9]

There are well-known free-rider arguments in Leland and Pyle (1977) and Stiglitz (1985). If knowledge about the firm and its management is a public good, it may be that no agent will undertake the necessary monitoring since other agents will free ride on the results. The solution to this problem is to have the monitoring agent buy and hold assets on the basis of its specialized information, under the assumption that outsiders cannot free ride on the agent's information merely by observing its portfolio choices. Banks frequently take large positions in a firm; the nature of the loan contracts enables them to do this without undertaking undue risk. At the same time, the nature of the contract enables them to focus their attention on information gathering to a particular set of issues: those associated with the probability of default and the net worth of the firm in those low-return

8 Lichtenberg and Pushner (1994) finds evidence that equity ownership by financial firms in Japan may effectively substitute for the missing external takeover market by resulting in monitoring and intervention which minimizes the decline in productivity.

9 Aoki (1994) points out the effect of exclusive delegation of integrated monitoring to main banks is to create a unique corporate governance structure under which main banks are ex ante expected to intervene in management with a high degree of certainty if and only if firms are financially distresses.

states.[10] They need not concern themselves with either how good the best prospects of the firm are or what the probability is that the firm will make away with loans. There are syndicated loans, in which a single bank takes main bank position and undertakes responsibility for ensuring that the borrower is effectively controlled from the perspective of the lender. The main bank is also responsible for ascertaining the suitability of the borrower for the loan. Here, the problem of corporate management as a public good is resolved by means of reputation: it is in the interest of each bank to ensure that the loan on which it acts as the main bank are good, lest other bank refuse to participate in the loan it attempts to syndicate. The enforcement of cooperation can be attained in the long-term relationship. It would pay each bank to cheat in a single transaction: to syndicate a loan but then to fail to expend the resources required ensuring that the lender used the funds properly. In the long run, this is not true. A bank that lost its reputation and could not syndicate its loans would have to bear greater risk. This risk premium can be viewed as the punishment for failing to exercise control. Note that the number of banks involved is sufficiently small so that each bank can assess the reputation of the other bank. One of the central problems with banks' exercise of their control is their excessive concern for the possibility of default. Allowing bank to own equity shares in firms might alleviate this bias. Information could be shared between the bank and its equity subsidiary; and the bank, in exercising its control over management, might be induced to look not only towards the possibility of default, but also towards earning greater return on its equity.

Hoshi, Kashyap, and Schafstein (1991) compare the investment behavior of these two sets of firms, which are in a particular industrial group with the bank and independent ones. The basis of comparison is the importance of liquidity as a determinant of corporate investment. They find that firms in the group are less sensitive to their liquidity than it is for independent firms. It shows that liquidity is a more important determinant of investment for independent firms than for ones in the group with close banking ties. This suggests that close relationships with the bank relax liquidity constraints by lessening information and incentive problems in the capital market. These results can help to explain the findings for at least two reasons. First, because group-affiliated firms can take on more debt,

10 Although monitoring firms is thought to be a major function of banks, the presence of other stakeholders reduces a bank's incentive to do this. Thus loan contracts must be structured to enhance the bank's incentives to monitor, Covenants make a loan's effective maturity, and the ability to collateralize makes a loan's effective priority, contingent on monitoring by the bank. Rajan and Winton (1996) show both covenants and collateral can be motivated as contractual devices that increase a bank's incentive to monitor. The model predicts that collareralization of private debt will be correlated with financial distress at the firm level and poor business condition and also a bank demands collateral is stronger when the collateral either depreciated quickly or is quite risky in the short-run than when the collateral is relatively stable or long-lived.

they are better able to exploit its tax advantages. This lowers their cost of capital. Second, group firms that need to raise capital can do so by issuing debt. They then avoid equity issues, which tend to depress share prices. Thus, reducing the cost of financial distress facilitates investment and relaxes liquidity constraints even when firms are not distressed.[11]

2.2.2 Intervention

An another major characteristic of main bank system that is closely related to the monitoring is the role of the main bank in corporate intervention. Main bank intervention refers to the fact that the bank will often intervene in various ways in the management of the firm when it is not performing adequately or is in need of restructuring. It can be argued that this function of the main bank provides an important substitute mechanism for what in effect is inactive market for corporate control in Japan. Main bank intervention can take a number of forms, ranging on the one hand from cases where the main bank stipulates certain measures that requires the firm to take in exchange for the bank's support during a period of financial difficulty to cases where the bank sends officers to take over the management and carry out the reorganization of a firm that is on the verge of bankruptcy on the other. In the course of intervening in and managing the reorganization of the firm, a number of things are commonly observed. First, the bank may replace the top management, whose incompetence it is that has often expedites the trouble. The bank will reorganize the management structures and implement major asset liquidation. Second, the bank will often arrange some kind of tie-up or merger with another firm, which is commonly a firm also having this bank as its main bank.

One of unique characteristics in Japanese capital market is the virtual absence of an active market for corporate control. The absence of a hostile takeover market is related closely to the nature of intercorporate shareholding in Japan. The management of large firms in Japan has been able to entrench themselves from external market for control by arranging their shareholding structures so that a majority of their shares are held by closely and long-term related firms. There are known as stable shareholders in Japan and comprise principally long-term business partners and affiliate firms, all of which share the common aim of insulating themselves from the external market for corporate control. Together with the sys-

11 Elston (1996) also examines investment sensitivity for German firms in the 1973-84 and finds the supporting evidence of the hypothesis that greater sensitivity to liquidity constraints for the group of independent firms than that of firms with bank ownership. The result supports the notion that firms with close banking ties have better access to capital and as a result have investment functions which are less liquidity constraints.

tem of stable intercorporate shareholdings, the main bank performs a role that closely parallels in its effect the external takeover market: in particular in bringing about the displacement of ineffective management and the re-organization of corporate assets to improve efficiency.

In a sample of large Japanese manufacturing firms in the 1980's, Morck and Nakamura (1992) find that banks tend to send new directors to firms that have recently under-performed their industry firms in terms of stock market performance or that are in industries with depressed stock prices. Intervention is preceded by below average sales growth, investment and especially liquidity and cash flow as well as by low stock returns. It is thus not clear that bank intervention is aimed primarily at protecting shareholders. Cash flow and liquidity return to industry average levels quickly following bank intervention, as does investment. Sales growth and especially employment growth remain low for several years, but eventually recover to and even exceed industry average levels. This suggests that bank intervention is associated with a period of restructuring. Public shareholders appear to gain little from this, however, as stock market performance continues to lag that of industry peers.

Kaplan and Minton (1994) attempt to shed lights on the nature of corporate intervention by considering when banks and shareholders intervene or become active in 119 large, non-financial public firms in Japan. They consider an outside intervention to have occurred if a firm appoints one or more outsiders to its board in a given period. The likelihood of a new bank director is most closely associated with negative pre-tax income at both one- and two-years. The results suggest that bank appointments respond to poor firm performance and do so over relatively short frequencies. The patterns suggest a difference between bank interventions and corporate interventions. Banks appear to intervene in firms with poor stock performance and difficulty meeting their financial obligations to the banks. In contrast, other corporations appear to intervene in firms with poor stock performance that is not related to an inability to meet financial obligations. Outside appointments are most closely related to stock performance.[12]

The pattern provide additional support for the view that bank directors are appointed in firms and situations where there is a bank loan to protect. In contrast, the appointment of bank directors is not related to the strength of shareholdings and other relationships. This suggests that banks place less importance in maintaining those relationships. Although stock performance remains significant

12 Using data on 270 Japanese firm in 1985-90, Kang and Shivdasani (1995) also find firms with ties to a main bank are more likely to remove top executives for poor earning performance. Main bank and large shareholders also play an important role in the likelihood that a new top executive will be appointed from outside the firm.

in the determinants of appointments of corporate directors, share ownership and keiretsu membership are strongly related. These patterns provide additional support for the view that the two types of appointment, although related to performance, serve different purposes and protect different interests. The results suggest that corporate appointments be meant to protect or support intercorporate shareholdings and relationships. Such appointments do not appear to be intended to protect the main bank. Banks, corporate shareholders, and related corporations respond to poor performance by sending directors to oversee or implement responses to that poor performance. The power of a main bank to appoint directors comes from its combined role as lender, shareholder, and settler of intercorporate payment accounts. The power of corporate shareholders to appoint directors stems from their share ownership and concomitant ability to withhold proxies on the share they own. Under this interpretation, Kaplan and Minton (1994) argue that the bank and intercorporate relationships in Japan play a similar role to outside directors and, particularly, the market for corporate control in the U.S. There is, however, another interpretation. The injection of an outsider in response to poor performance may be required to signal to suppliers, customers or others that the bank or the group will support the continuation of the business. According to this view, the main bank recoups any costs of such insurance in normal times by charging above market fees for services. Similarly, corporate managers are willing to agree to such an insurance scheme in order to maintain their positions. The second interpretation suggests that the primary role for the outside appointment is as insurance rather than as discipline or monitoring. The insurance and monitoring interpretations have different implications for incumbent management. If the relationships serve to insure managers, then the appointment of an outsider should not affect executive turnover. Alternatively, if the relationships replace the control mechanisms familiar to the U.S., then outside interventions should be costly for incumbent management.

The results can be interpreted as a strong evidence that both types of outsider appointments are disciplinary - top executive turnover, particular that of representative directors, increase substantially in the same period. The fact that the outsiders tend to be appointed to the director level suggests that outside appointments oversee that transfer of control from one internal management team to another. Outside interventions have a disciplinary effect on top executives. Overall, these results suggest that bank directors be appointed to firms that are in financial distress or in the process of contracting. After the bank directors arrive, these firms continue to contract, but their performance - as measured by stock returns and earnings - does not deteriorate. Other corporations appear to send directors in response to different problems. After the corporate directors arrive,

the firm sales and asset growth rebound, and their performance - as measured by stock returns and earnings - do not deteriorate, and, if anything, improve.

As a consequence, the results suggest that the relationship-based corporate governance substitute for the market-based in Japanese firms.[13] Appointments of outsiders increase significantly with poor stock performance; those of bank outsiders also increase with negative current income. Strong evidence is found that both types of outsider appointment are disciplinary - top executive turnover increase substantially in the same year. The results suggest that bank directors are sent to manage contraction or financial distress, while corporate directors are sent to manage reverse temporary problems. Current earnings and, particularly, current stock returns are important determinants of outside appointments. It can be suggested that a firm's current stock price play an important role as a good measure of a firm's current and future prospects in Japanese firms.

2.2.3 Reducing Cost of Financial Distress

Financial distress is costly because free-rider problems and information asymmetries make it difficult for firm to renegotiate problems with their creditors in times of distress. As Gertner and Scharfstein (1990) point out that free-rider problems reduce the incentive for creditors to grant financial relief of extend credit: an individual creditor bears the full costs, but shares the benefits. When there are many creditors it is difficult to negotiate with all of them simultaneously. Holdout creditors can then free ride on others. Difficulties in negotiating with creditors may lead to underinvestment and inefficient liquidation. Even if the firm has valuable investment opportunities, an individual creditor may be reluctant to finance them because part of the greater future cash flows accrues to the holdout creditors. Similarly, even if it is efficient for creditors collectively to write down the debt, a sole creditor may be unwilling to do so because he bears all the cost and receives only part of the benefit. Moreover, when credit is diffusely held, bondholders are not likely to be well informed about the firm and may not know whether it is profitable to provide new capital or to give interest and principal concessions. In this case it is difficult to raise capital from one creditor, let alone get numerous creditors to agree to a financial restructuring that promotes investment and avoids inefficient liquidation. These problems can also spill over and disrupt supplies and sales: supplier may not be willing to provide trade credit and

13 Shleifer and Vishny (1995) point out deficiency of relationship-based control by banks. Banks themselves are typically large public-held corporations run by their managers rather than shareholders. It is possible that banks may accommodate managers of client firms rather than discipline them because of financial relationships established by managers at both sides. Thus maintaining these relationships may not leave rents for shareholders and minority investors.

make long-term commitments; and customers may be wary about whether the firm will be able to meet its implicit and explicit warranties.

Such problems are probably less severe for firms with strong relationships to banks. Because substantial debt and equity stakes are held by just a few financial institutions, free-rider problems are less prevalent. In addition, since the main bank is well informed about the firm and its prospects, problems stemming from asymmetric information between creditors and firms are likely to be small. A more subtle reason that free-rider problems may be less severe stems from the repeated participation of banks in lending consortiums. For example, one main bank may be the main bank for a firm in the group, but the firm will typically borrow from banks outside the group as well. This bank will in turn participate in lending consortiums headed by other banks that serve as the main lenders to firms outside the group. It is clear to all members of the consortium that the main bank is responsible for helping the firm in times of distress. Repeated participation in these consortiums ensures that main bank fulfills its implicit contract to provide relief even though doing so may not seem best in the short run. Furthermore, the customers and suppliers in the industrial group in which they own equity are more likely to maintain their trade relationships. The firm's main bank may also be the main bank for the suppliers and customers. This financial network could make suppliers more willing to extend trade credit and invest in long-term supply relationships, and customers more willing to buy from the firm.

In particular, a firm in financial distress may be unable to continue business without concession by its suppliers and customers. At the same time, these stakeholders will be suspicious of any plea by the firm for financial concessions even though they may face substantial costs of switching their trade with other firms. Since banks evaluate firm's financial condition routinely, non-equity stakeholders need not duplicate the bank's monitoring as long as the bank can be relied on to tell the true state about the firm's financial condition. Trustworthiness of the bank depends on the structure of the bank's financial claims on the firm. An equity ownership of the firm tends to align the bank's interests with the firm's shareholders against non-equity stakeholders. This can evoke suspicions in stakeholders that the bank and firm will collude to extract rents by seeking unwarranted reductions in the stakeholders' contractual claims. On the other hand, non-equity stakeholders with fixed claims may also be suspicious of statements made by a bank holding a pure debt claim on the firm if debt claim has greater priority than their own. Specifically, a bank with a pure debt and a firm may collude to convince stakeholders that the firm's prospects are healthy and that no concession is required. Then, given the high likelihood of bankruptcy if stakeholders do not scale down their claims, the bank's higher priority allows it to capture

nearly all of the firm's revenue and the stakeholders are effectively expropriated. Although a subordinated debt claim would reduce stakeholders' suspicions, it may be difficult for the bank to credibly subordinate its own debt claim to those of the firm's suppliers and customer. Hence, bank equity claim on the firm may be the only means for the bank to credibly subordinate sufficient fractions of its claim to uninformed stakeholders.[14] Berlin, John, and Saunders (1996) examine how the structure of an informed lender's financial claim affects its ability to resolve conflicts between a potentially distressed firm and the firm's non-equity stakeholders, such as suppliers and customers who have a direct interest in the firm's continuing viability and whose business is essential to the firm's existence. They show how the debt-equity structure of the bank's claim affects its ability firm's owners and its fixed claimants and also among the claimants themselves.

Hoshi, Kashyap, and Scharfstein (1990a) show that firms with capital structures in which free rider and asymmetric information problems are likely to be small perform better than other firms after the onset of distress. In particular, they show that Japanese firms in keiretsu invest and sell more after the onset of distress than non-keiretsu-affiliated firms sell. Moreover, firms that are not in the group, but nevertheless have close relationship with a main bank, also invest and sell more than firms without close bank relationship. When member of the group help troubled firms they do not only infuse funds, but also try actively to restructure the firm. If a firm is financially distressed, it performs better than other financially distressed firms do if its capital structure makes it relatively easy to renegotiate its liabilities. The findings suggest that, when financial claims are spread among many creditors, financial distress is more costly than when they are concentrated. In the United States, debt is more diffusely held, with large firms relying more heavily on bond financing. They argue that this form of financing exacerbates problems stemming from financial distress and suggests it may have been wise for U.S. firms to refrain from high debt levels. Japanese firms have taken on a larger amount of risky debt, but have established and institutional structure to cope with high leverage.[15] Gilson, John and Lang (1990) find that financially distressed firms in the U.S. that rely heavily on bank debt are more

14 If the bank is willing to hold junior debts on the firm, increased bank lending sends a substantial signal to other investors of the firm's prospects. There are evidences to suggest that stockholders and debtholders outside firm respond to bank decision when pricing firm's stock and the responses are larger when banks hold junior debts (James, 1987; Lummer and McConnel, 1989). Banks plays an important role to transmit firm-specific information to the capital market.

15 Fukuda and Hirota (1996) argue that main bank relationships increase the debt capacity of the firm by reducing the agency costs of debt. On the other hand, firms with high leverage will strengthen the relationships. They show the evidence to support that high leverage and main bank relationships are simultaneously determined and have positive effects on each other.

likely to avoid costly bankruptcy filing and thus more likely to restructure out of court.[16]

Sheard (1992) identifies major features of the main bank's role and its behavior when examining a large number of cases financially distresses corporate clients. The major roles of the main bank are coordinating, overseeing, and in some cases in effect carrying out an informal reorganization of the firm. This typically involves some combination of refinancing of existing debt, provision of bridging finance, dispatching directors and in severe cases a more comprehensive trouble-shooting team that works closely with promising managers in the firm. It may also involve the displacing or demotion of senior incumbent managers and the formulation and implementation of a restructuring plan centering on a program of asset disposal, repayment of bank borrowing, and organizational re-arrangement.[17] The main bank, by replacing incumbent managers with dispatching its personnel, turns to be an active participant in the corporate restructuring process directing and implementing various measures. This aspect of the main bank's role is characterization of bankruptcy via the debt contract triggering a shift in control from the incumbent managers to the creditor.[18]

One of the peculiar characteristics of the main bank system is that the main bank often behaves as if it were a kind of residual risk-bearer among creditors and even among security-holders as a whole. Sheard (1989) suggests that residual risk bearing is part of an incentive structure, which serves to economize on the agency cost of the delegated monitoring relationship between main and non-main banks. When bank assistance is directed towards a struggling firm or when losses are incurred as a result of the firm's failure, the main bank commonly assumes a

16 The U.S. banks may abandon borrowers they cannot cheaply save them. Given that courts sometimes punish a bank for intervening in its debtor's affairs, the bank may find rescues more often unprofitable. American judges have looked skeptically at creditors who intervene in debtors' business. They reason that intervening creditors may try to restructure the debtor to their private interests. Thus, its claims are often subject to subordination. One does not see in the case equivalent of equitable subordination in Japan - any series of decisions where judges voided security interests to punish a major secured creditor who intervened in the debtor's affairs (Ramseyer 1994).

17 Large numbers of firms in Japan fail regularly. Average of 13,260 and 11,870 firms with debt of over 10 million yen went bankruptcy every year during 1985-89 and 1990-94, respectively (Bank of Japan 1994, 1996).

18 There are a number of cases in which the main bank helps firm work out of financial distress. The best-known case is Sumitomo Bank's restructuring of Mazda, the automobile manufacturer. Mazda got involved in considerable financial difficulty after the 1973-oil shock caused dramatically to reduce the demand for fuel-inefficient rotary-engine cars. In responding to these troubles, Sumitomo Bank sent a number of their executives to serve as directors in Mazda and others to manage key divisions of the firm. Sumitomo Bank lent Mazda money at favorable rates and encouraged the firm to sell its share in the banks. Sumitomo Corporation, the large trading company of the group, took charge of dealer networks and the newly appointed managers worked to improve efficiency in production. The bank also promoted Mazda sales among their client firms and employees and leaned on suppliers to sell to the firm at favorable prices (Pascale and Rohlen, 1983).

significantly larger burden than would be expected. In cases of bankruptcy or major restructuring under main bank intervention, the main bank will typically absorb a share of losses exceeding its loan share. The main bank bearing a disproportionately large share of the assistance burden to firms that are in the process of undergoing adjustment. This may just reflect that the main bank possesses superior information as a result of its past and current monitoring and negligence problems with transferring information to other banks. At a more general level it might be claimed that there must be a sense in which the main bank is given the correct incentives not to shirk on its monitoring. The implicit convention in Japan that the main bank bears a disproportionately large share of any losses incurred can be viewed as part of an incentive mechanism which economizes on the agency costs of having one set of bank delegate monitoring to one bank.

What are the incentives of the main bank to behave as it does? Since the main bank is better informed than any other lender, it must be if the main bank refuses to refinance the firm because its information tells it that it is not profitable to do so. But if it is not profitable for the main bank, which already has prior claims that must be senior to any new finance, then it cannot be profitable for the supplier of incremental funds. The only time that a main bank would want to cut off finance would be when the firm is a bad prospect; inferring this, no other lender will extend finance. The decision on whether a client firm that needs an injection of finance to remain afloat obtains the required funds or not rests with the main bank. To the extent that main bank assumes special responsibilities when a client firm is in financial distress, it must be adequately compensated for the additional costs involved. When the firm is in normal times, the main bank enjoys special benefits associated with its position as a main bank, not available to other lenders.[19] In particular, it is widely believed that the main bank is able to acquire a disproportionately large share of various banking-related business such as placement of corporate bank deposits, operation of settlement accounts, involvement in bond issues as trustee administer and co-underwriter, handling of foreign exchange transactions, and access to banking business of related firms.[20]

Main banks' desire to acquire a reputation for making the right renegotiation

19 Weinstein and Yafeh (1994) examine the effects of main bank system on firm performance in Japan. They find that when access to bond and equity market is limited, close bank-firm relationship increase the availability of capital but does not lead to higher profitability or growth. This is largely because banks enjoy more market power when firms do not have easy access to other sources of finance and therefore can charge higher interest rates in exchange for liquidity services and influence firms to avoid risky but profitable projects. Using the data on a sample of over 700 listed manufacturing firms between 1977 and 1986, they find that the bank is able to capture most of the rents which client firms may enjoy due to their access to capital, and thus push down firm profits. They also suggest that conservative investment strategies motivated by the bank's position as a major debtholder may inhibit firms from growing.

versus liquidation decision provides them an incentive to devote a larger amount of resources than bondholders toward such evaluation do. Bank loans dominate bonds from the point of view of minimizing inefficient liquidation; however, firms with a lower probability of financial distress choose bonds over bank loans. Information production by main banks is particularly relevant when there is a significant possibility that the borrowing firms may be in financial distress. Banks' evaluation of the firm's future prospects may affect their decisions about whether to renegotiate the debt of a firm in financial distress or declare the firm in default and force it into bankruptcy. The important reason why banks' treatment of borrowing firms in financial distress may be fundamentally different from that of holders of publicly traded debt is that banks are long-term players in the debt market and therefore have a desire to develop a reputation for financial flexibility. Chemmanur and Fulghieri (1994) develop a model in which the ability to acquire a reputation provides banks with an endogenous incentive to devote a larger amount of resources to information production about firms in financial distress compared to bondholders, whose decisions are based only on considerations related to a specific situation. They show that, in equilibrium, entrepreneurs who assess a relatively high probability of being in financial distress find it optimal to use bank loans, despite that fact that banks charge a higher interest rate in equilibrium compared to publicly traded debt; those with a lower probability of being in financial distress, however, issue publicly traded debt to take advantage of the lower equilibrium yield on such debt. Furthermore, borrowers are willing to pay higher interest rates for loans from bank with greater reputations for flex-

20 Ramseyer (1991) argues that within the continuing relationships, the legal structure also matters. Japanese banks and firms bargain over the legal framework that will govern their deals and work hard to manipulate that framework to their private advantage. The extensive use of mortgages and guarantees suggests that banks and customers consider the rules critically important. Willing to make credible their promise to repay their loans, customers regularly acquiesce. The bank use the measures to improve their bargaining position should their customers later default. The customer uses the measures to obtain a better deal now. The only merit to mortgages and guarantees lies in the legal protection they give the borrower. Law did not require these security interests. Banks demand mortgages and guarantees to gain the power to negotiate a more favorable contract should the borrower default. Banks can also strengthen their position by keeping the terms of their loan short. By negotiating shorter contractual terms, it can use the law to retain the right to refuse to renew the loan and thereby protect itself. Its principal advantage from the shorter contractual term is its ability to reduce the default risks from its borrower's opportunistic behavior. Average of 46% of the funds Japanese banks lend come due within an year for years 1985-89, compared with the fact that the proportion of bank loan with terms over one year in the United States is the much less (Bank of Japan 1994). Banks seem to be concerned about the chance their clients will increase the risk of the project ex post. If firms did not trust their banks to cooperate and borrowed their money through short-term contracts, they would then need to protect themselves against opportunistic behavior that bank could take at the renewal. One way they could do so is by maintaining close ties with several other banks. Japanese firms diversify their credit sources broadly: most obtain less than half of their bank loans from their main bank (Fuji Research Institute Corporation, 1993).

ibility in dealing with firms in financial distress. Their model concerns reputation acquisition by banks: it is the ability to acquire a reputation that distinguishes banks from bondholders. Reputation acts as a commitment device enabling banks to credibly promise borrowers that they will make better renegotiation versus liquidation decisions in the event that the borrowing firm is in financial distress. Thus reputation acquisition provides incentive even for a bank without any superiority in its evaluation technology to make a lower proportion of incorrect renegotiation versus liquidation decisions compared to bondholders.

One can argue that Japanese banks may rescue large borrowers because they cannot credibly threaten to let them fail.[21] Given that Japanese courts will let a bank rescue a borrower without jeopardizing its rights in bankruptcy, the bank may find some rescues profitable ex post. The U.S. banks may abandon borrowers because they cannot cheaply save them. Given that U.S. courts sometimes punish a bank for intervening in its debtors' affairs, the bank may find rescue more often unprofitable even ex post. If the U.S. banks do threaten to let troubled firms die, they may be able to do so because of the bankruptcy law they face. At stake is the doctrine of equitable subordination: for the sake of fairness, a judge may subordinate the claims of a creditor than intervenes before Chapter 11 in its debtor's affairs. A bank can lose its priority whenever the bank has taken control of the debtor, thus assuming the fiduciary duties of controlling shareholders, and then breached those duties to the injury of general creditors. While equitable subordination does not make bank rescue impossible, it does make them more costly. When a firm get involved in the bad state, creditors will seldom lend more money without controlling the way it uses it. Under the U.S. law, they can do so before a Chapter 11 filing only by gambling all: if the firm succeeds, the bank recovers its claim; if the firm fails and the other creditors convince the judge the bank indulged its private interests, it potentially loses all. For the sake of making credible threats, perhaps that risk often suffices. Because of this ex post risk to intervention, the U.S. banks may be more able to credibly to threaten to abandon defaulting debtors ex ante. Japanese judges use no doctrine analogous to equitable subordination. Whether in the U.S. or Japan, in bankruptcy cases judges wield enormous discretion. Although they may phrase it differently, Japanese judges exercises this discretion in ways that resemble a bit the American judicial concerns for equity. Although they may phrase it differently,

21 Dewatripont and Maskin (1990) argue that the inability of lenders to commit ex ante not to refinance long-term projects in financial difficulties may encourage entrepreneurs to seek funding even for projects that have negative net present values. If the continuation value of a project in financial distress is known to be greater than its liquidation value, rational lenders have an incentive to refinance a project in financial difficulties, regardless of the advisability or otherwise starting the project in the first place.

Japanese judges exercise this discretion in ways that resemble somewhat the American judicial concerns for equity (Ramseyer, 1994).

3. Structural Changes

3.1 Financial Emancipation

Liquidity in the form of cash and marketable securities for Japanese firms has been increasing shown in Table 1. Furthermore, the Japanese figure is almost 4 times as large as that for the U.S. firms. Historically, a substantial portion of cash positions at Japanese firms represented compensation balances on commercial loans. However, the use of compensation balances has decreased during the 1980s as Japanese lenders have moved toward market-rate loans and fee-based services. Much of this liquidity increase occurred relatively suddenly during the second half of the 1980s in parallel with expansion of money supply, lower interest rates, and rising real estates prices in Japan. Paralleling the liberalization of Japanese corporate finance has been a dramatic buildup of financial slack on Japanese corporate balance sheets. During Japan's high-growth periods in 1948-73, Japanese firms were confronted with a volume of attractive investment opportunities that vastly exceeded their cash flow and the amount of funds most firms could reasonably expect to raise externally. Throughout this period, Japanese corporate finance served simple function. Financial managers raised the cash necessary to fund the approved projects securing a sufficient volume of external finance. Minimizing costs of capital was a secondary concern to most of them.

For all practical purposes, there are only two major sources of external funds: collateralized loans and trade credit. Essentially essentially the same institution - banks, insurance companies, and major suppliers - stakeholders that were also major shareholders in their firms supplied these, in turn. These stakeholders monitored client firms closely, even to the point of occasionally injecting new management to ensure a rational deployment of scare funds. Thus high growth, the rigors of competition at home and abroad, the heavy use of debt and trade credit, and the ownership of these claims by institutional shareholders that monitored performance closely were sufficient to ensure the deployment of cash in a pattern consistent with the priorities of the suppliers of capital.

Although remarkable growth in Japan had begun to wane even prior to 1973, the oil shock produced a sudden and dramatic reduction in Japanese economic growth. The joint effect of investment reduction and cost improvement was to lessen gradually the external capital needs of the firms. Large firms finance internally from less than 20% in the 1960s and early 1970s to more than 100% by the 1990s as shown in Table 2. The latter figure reflects the fact that many large

Table 1 Balance Sheets of Manufacturing Firms in Germany, Japan and the United States

Five-Years Average

(Percentage)

	Germany						
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-91
Cash and Equivalents	11.0	10.4	10.5	13.5	13.3	16.9	13.9
Account Receivables	16.4	17.6	20.2	21.3	22.8	24.3	24.8
Inventories	22.6	21.0	22.4	25.2	26.3	23.6	23.6
Tangible Fixed Assets	41.7	39.0	32.8	26.1	22.7	21.2	20.5
Liabilities	58.2	61.0	67.2	69.3	70.7	71.2	72.2
Account Payables	22.9	24.0	26.6	29.2	30.0	28.6	28.8
Short-Term Debt	3.3	4.0	4.0	2.9	3.6	4.3	4.7
Long-Term Debt	23.2	24.7	26.3	25.7	23.7	20.9	19.9
Stockholder's Equity	41.8	39.0	32.8	30.7	29.3	28.8	27.8
Stock	21.6	20.2	16.7	14.8	13.3	12.0	11.3
	Japan						
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94
Cash and Equivalents	10.7	12.8	13.8	14.8	15.3	19.3	17.0
Account Receivables	19.3	25.3	23.4	22.7	23.1	21.7	20.4
Inventories	17.7	15.5	16.7	18.3	18.9	13.6	12.0
Tangible Fixed Assets	34.6	37.4	30.2	26.8	25.1	25.7	26.9
Liabilities	70.2	75.5	80.2	82.1	75.4	67.0	62.1
Account Payables	16.2	18.5	19.0	18.7	19.7	16.3	14.5
Short-Term Debt	18.5	18.7	16.8	18.0	17.0	14.0	9.4
Long-Term Debt	22.3	26.0	28.8	27.7	21.9	22.0	23.9
Stockholder's Equity	29.8	24.5	19.8	17.9	24.6	33.0	37.9
Stock	16.8	13.6	8.6	6.7	6.0	7.5	8.6
	U.S.A.						
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94
Cash and Equivalents	10.2	7.1	5.8	6.9	5.5	5.7	4.9
Account Receivables	16.7	17.6	17.6	16.4	15.5	14.8	13.2
Inventories	23.3	23.7	22.7	20.9	18.3	15.5	13.4
Tangible Fixed Assets	38.7	39.5	38.1	35.2	38.2	35.1	33.0
Liabilities	35.8	42.3	46.9	47.5	51.2	57.1	61.8
Account Payables	9.2	9.7	9.4	9.1	9.2	8.2	7.8
Short-Term Debt	2.8	3.8	4.3	3.3	3.7	3.8	4.0
Long-Term Debt	14.3	18.3	22.2	22.9	25.1	31.0	36.5
Stockholder's Equity	64.2	57.7	53.1	52.5	48.8	42.8	40.2
Stock	25.3	20.1	17.5	15.0	12.5	12.0	12.8

Source: The Bank of Japan (1974, 1978, 1986, 1993, 1994, 1996), *Comparative Economic and Financial Statistics: Japan and Other Countries.*

Source Note: Statistiches Bundesamt, *Untemehmen und Arbeitsstätten,* The Bank of Japan, *Syuyokigyo Keieibunseki* (Business Analysis on Main Enterprises in Japan), The U.S. Department of Commerce, *Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations*

Note: Book values of assets in Japanese firms differs greatly from current values because face values are much lower than market values.

Table 2 Net Sources of Funds for Investment of Manufacturing Firms in Germany, Japan and the United Startes

Five-Years Average

(Percentage)

	Germany			
	1975-79	1980-84	1985-89	1990
Internal Funds	80.4	92.3	97.4	78.1
Retained Profits	26.5	31.2	40.3	23.6
Depreciations	50.4	56.3	55.8	51.6
Stock Issues	n.a.	4.7	1.2	3.0
Bonds	n.a.	-1.0	0.1	-0.1
Loans	4.9	4.4	-1.8	0.8
	Japan			
	1975-79	1980-84	1985-89	1990-94
Internal Funds	68.8	71.7	103.3	111.15
Retained Profits	15.8	17.7	22.8	18.92
Depreciations	44.7	40.0	58.8	92.23
Stock Issues	8.3	11.9	22.1	7.60
Bonds	4.0	6.7	24.8	-2.66
Loans	9.7	6.3	-18.5	5.81
	U.S.A.			
	1975-79	1980-84	1985-89	1990-94
Internal Funds	62.8	64.5	53.3	79.15
Retained Profits	25.9	16.5	3.1	6.13
Depreciations	31.8	39.6	45.5	78.54
Stock Issues	5.1	8.3	4.7	14.04
Bonds	10.1	7.6	17.2	6.25
Loans	2.0	6.9	12.1	2.94

Source: The Bank of Japan (1974, 1978, 1986, 1993, 1994, 1996), *Comparative Economic and Financial Statistics: Japan and Other Countries.*

Source Note: Statistiches Bundesamt, *Untemehmen und Arbeitsstätten,* The Bank of Japan, *Syuyokigyo Keieibunseki* (Business Analysis on Main Enterprises in Japan), The U.S. Department of Commerce, *Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations*

Note: Book values of assets in Japanese firms differs greatly from current values because face values are much lower than market values.

Japanese firms were using their enormous cash flow during this period to repay debt and build up liquid assets on the balance sheet rather than to increase dividends for shareholders. As a consequence, Japanese firms have accumulated considerable financial slack in the form of unused debt capacity and temporary investments in marketable securities. The debt-equity ratio by Japan's major manu-

facturing firms has declined more or less steadily since 1980 shown in Table 3. The buildup of financial slack on corporate balance sheets, the persistence of excess cash flow throughout the 1980s and gradual financial deregulation have led to financial liberation of Japanese non-financial firms from their traditional lenders.

Close, stable relationships between non-financial firms and banks have been essential elements of Japanese corporate finance. As such, they have contributed significantly to the mitigation of takeover activity in Japanese capital market. Today, however, this stability is being shaken by two major changes in the world of finance: the buildup of financial slacks on balance sheets in Japanese corporation and the globalization and deregulation of the Japanese financial system. The former change is altering the nature of business that banks execute with their major industrial clients and generally weakening bank control over these firms. Concurrently, the latter change is causing banks and other institutional owners of equity to demand greater returns on their holdings of client-firm stock. Together these trends are evoking a creeping instability in close financial relationships.

Japanese firms are not liquidity constrained in recent years. It is no mere coincidence that this period of less liquidity constraints has also been accompanied by weakening firm-bank relationships. The increased availability of internally generated cash to fund projects has reduced the need to raise funds externally, thus diminishing the financial dependence of industrial firms on bank. In addition, the growth and gradual deregulation of capital markets at home and the opening of capital markets abroad have distanced Japanese industrial firms still further from banks.[22] There is a hidden cost to the financial emancipation of past success, however. In the absence of the discipline exerted by capital market, Japanese managers now find themselves with far greater discretion in the allocation of corporate resources than ever before. Since firms are unwilling to breach long-standing implicit contracts with key stakeholders, especially long-term employment relationships, and unable to execute past strategies of simply growing themselves out of their current situations, they hold the direction to sustain marginal businesses and retain unrelated diversification. Thus, the free cash flow of these corporations may be reallocated from shareholders to other stakeholders, primarily employees. Despite the low priority traditionally accorded to sharehol-

22 Japanese firms moved quickly to raise capital outside Japan as soon as Japan's Foreign Exchange Control Law was relaxed in 1980. Total funds raised by Japanese firms in overseas bond markets leaped from an average of 489 billion yen per year between 1975 and 1979 to 5 trillion yen per year in 1990 through 1994. As a percent of all securities issued by Japanese firms, overseas issues rose steadily from less than 20% before 1980 to nearly 50% by 1985. Most of the funds raised outside of Japan were used to repay domestic borrowing. Thus by the late 1980s, large Japanese firms had already dramatically restructured their liabilities, substituting cheaper foreign capital for domestic financing.

Table 3 Debt-Equity Ratio of Manufacturing Firms in Germany, Japan, and the U.S.A Five-Years Average

(Percentage)

	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94
Germany	139.48	152.20	196.94	226.08	238.41	248.25	259.79
Japan	236.36	309.91	409.74	460.37	310.72	204.70	164.37
U.S.A.	55.76	73.45	88.24	90.56	105.13	133.62	161.90

Source: The Bank of Japan (1974, 1978, 1986, 1994, 1996), *Comparative Economic and Financial Statistics: Japan and Other Countries.*

Source Note: Statistiches Bundesamt, *Untemehmen und Arbeitsstätten,* The Bank of Japan, *Syuyokigyo Keieibunseki* (Business Analysis on Main Enterprises in Japan), The U.S. Department of Commerce, *Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations*

ders in Japan, it is unlikely this trend can continue for long. One by-product of the increasingly global market in which Japanese financial institutions must compete, and of their weakening relationships with industrial clients, has been a growing concern for obtaining higher direct returns on their equity investments.

Although borrowing continued to shrink as a significant proportion of total funds raised, bank loans continued to dominate security financing in domestic markets. Moreover, lending practices began to change in the wake of overseas financing by Japanese firms and the continued relaxation of domestic financial market regulation. Continued growth in the certificated-deposits market and the introduction of large-denomination money market certificated in 1985 contributed to greater variability in banks' cost of funds. The introduction of a commercial paper market in November 1987 provided another viable alternative for large firms in search of short-term funds and further reduced the dependence of corporation on banks. For all practical purposes, lending to large firms has ceased to be growing business for Japanese major banks.

Over the past two decades, capital market liberalization in Japan has made available financial instruments not previously available to corporate borrowers. Firms are now free to raise investment funds through a variety of equity, bond, and hybrid mechanisms, and in both domestic and overseas markets. Many large Japanese firms have taken advantage of these opportunities, and the results has been a substantial decline in the proportion of external corporate capital coming from traditional sources such as bank loans. With the decreasing proportion of total capital allocation channeled through the traditional prime rate system, the Ministry of Finance and the Bank of Japan are no longer able to exercise the

same degree of control over financial markets that they once could. It is also true that, with the new reliance on securities-based finance, Japanese major securities firms are now more important in financial markets than in the past. Furthermore, even as banks and other financial institutions account for an increasing share of securities-based capital, the ability of highly performing non-financial firms to fund their investments through retained earnings has reduced their overall external capital dependency and shifted the balance of bargaining power with lending firms in their direction.

Whereas most firms indicated that banks closely examined their corporate plans and investments during the 1950-80 period, none reported being subjected to such scrutiny today. Although meeting with the main bank is still held semiannually or at least annually to discuss performance, these have apparently evolved into largely perfunctory presentations of past performance rather than substantive discussions of future capital investment. Banks are now more interested in tracking the overall return earned on their total investment in client firms rather than monitoring and influencing managerial decision making. The exchange of information historically fostered by placing retiring bank officers in senior management positions at client firms also appears to be waning. Major banks have begun to experience difficulties in placing retiring employees in second careers.

As constraints on corporate finance relax and capital markets deregulate in Japan, competition among banks has further weakened traditional firm-bank relationships.[23] The securitization of Japanese corporate finance had made financing increasingly price-sensitive transactions in which past relationships count for little. A firm's main bank may win a mandate to lead-manage a deal, but only if it offers a better idea or a competitive quote. Nonetheless, although Japanese non-financial firms may be distancing themselves from banks, Japanese banks and other financial institutions still own considerable fractions of these firms' outstanding shares. However diminished the need by no-financial corporations for a close banking relationship, the Japanese bank will maintain that strong relationships with their clients are still central to the success of their institutions. Even though large no-financial firms no longer rely heavily on intermediated credit to meet financing needs, financial institutions still look to these firms for access to affiliated firms of commercial lending, access to employees for retail banking and insurance underwriting, and as customers for new products and service offered on a fee basis.

---

23 Petersen and Rajan (1995) argue that competition in market for financial services is likely to undermine the stable bank-relationships because the banks can no longer extract rents from the client firms.

Table 4 External Sources of Funds by Size of Firms in Japan

(Percentage)

	1975	1980	1985	1990
Large Firms				
Loans	73.6	69.8	21.4	67.2
Bonds	16.3	6.3	38.6	13.1
Stock Issues	10.1	23.9	40.0	19.7
Small and Medium Firms				
Loans	91.2	89.2	97.1	94.2
Bonds	0.1	0.1	0.2	0.3
Stock Issues	8.8	10.8	2.7	5.5

Source: Economic Planning Agency (1992), *Keizal Haksho, 1992* (Economic Survey of Japan, 1992).
Source Note: Ministry of Finance, *Houjinkigyou Toukei Nenpou* (Annual Statistics of Corporations), 1975, 1980, 1985, 1990.
Note: Size of firms is based on their stocks. Large firms have more than 1 billion yen value of stocks.

Since small-and-medium-size firms continue to depend heavily on bank loans shown in Table 4,they may derive an important advantage from the main bank system. However, financial liberalization tends to undermine the main bank system because major non-financial firms have greater access to market debt as well as borrowing from foreign financial institutions.[24] This makes it potentially much more difficult for the main bank to monitor and control clients' behavior. Hoshi, Kashyap, and Scharfstein (1990b) examine the investment behavior of Japanese firms before and after financial deregulation. In the period before deregulation all of the firms in their sample had close ties to a bank or set of banks. After deregulation, some of these firms loosened their ties to banks and relied more heavily on direct capital-market financing. Another set of firms maintained their close banking ties. They found that the firms that have significantly reduced their bank borrowing and increased their direct capital-market financing, exhibit a strong sensitivity of investment to cash flow after deregulation. By contrast the firms that maintained bank ties show no sensitivity of investment to cash flow in both periods- before and after deregulation. If bank monitoring overcomes information

24 Horiuch (1995a) describes the evolution of Japanese bond market from the early postwar period to the late 1980s, particularly explaining the process of relaxing eligibility of bond issues and its distorted nature. The process of liberalizing the domestic bond market was distorted during the 1980s in the sense that only well-established major firms were allowed to issue convertible and other equity-related bonds. Small-sized and relatively newly established firms are excluded from domestic bond market during the recent gradual process of liberalization.

problems and relaxes liquidity constraints, why did some firms weaken their bank ties? Diamond (1991) argues that young firms, or older ones that have done poorly, will borrow mainly from banks and those older, more successful firms will use public debt. The idea is that successful firms have more capital of reputation in performance at stake and hence have more to lose by taking inefficient actions. These firms do not need to incur the monitoring costs associated with bank borrowing. By contrast, younger firms have not yet developed a reputation and older, less successful firms do not have a good reputation to lose. It is therefore efficient for these firms to incur the costs of bank monitoring.

The results suggest that monitoring and other costs associated with bank financing must be large. Otherwise, firms would not have chosen to weaken their bank relationships until they had enough collateral to be able to get around liquidity constraints. The first cost stems from regulations requiring banks to hold a fraction of their assets in non-interest-bearing accounts. This reserve requirement means that the costs of funds to banks exceed those of individual investors; as a result, they will require a higher gross rate of return on their investment. In addition, bank loans are generally less liquid than publicly traded debt. The difficulty that bank facing adjusting their loan portfolio may also mean that they will require a higher gross return. Finally, a more subtle cost of bank financing may arise from the different objectives of banks, managers, and shareholders. Since banks mainly hold debt claims, they receive little of gain from unusually good firm performance. Shareholders, in contrast, care only about maximizes the gain. This conflict may result in excessively conservative investment policies if bank control corporate investment decisions. It may therefore be efficient to reduce bank ties to avoid this problem at the expense of becoming more liquidity constrained. As firms generate more cash from ongoing operations, they may be more willing to make this transition. In addition, managers may prefer to have more control to operating decisions than a bank is willing to allow. Managers may choose to weaken the firms' bank ties and incur greater financing costs because it gives them more control despite the fact that it inefficient to do so. Again, as firm becomes more liquid, managers may be more willing to incur these costs (Hoshi, Kashyap, and Scharfstein 1990a).

3.2 Financial Deregulation

It is clear that the ongoing financial deregulation in Japan is having important effects on corporate financing practices. In some respects, financial liberalization has been taking place since the 1960s; however, the process accelerated dramatically in the 1980s. The revised Foreign Exchange and Foreign Trade Control Law in December 1980 removed major impediments to offshore financing by Japanese

firms and improved access by foreigners to Japanese financial markets. Beginning around 1984, the liberalization process accelerated with a number of regulatory changes, which were at least partially in response to external pressure for greater openness of Japanese financial markets.[25] Since then a stream of regulatory changes have eliminated a variety of interest rate restrictions, allowed trading in new types of securities, relaxed controls on both domestic and foreign financial institutions, and generally promoted freer and more flexible financial markets. However, some regulations and practices, which cause distortions and result in unusual financing patterns still remain. The elimination of one restrictive regulation results in a regulatory arbitrage opportunity with market participants using their increased freedom to profitably exploit another, still-existing regulation. This continues until the consequent pressure on the second restriction forces its elimination or modification. Consequently, the liberalization process tends to produce windows of opportunity permitting firms to earn additional profits by exploiting regulatory differences.[26]

25 Osugi (1990) conducts comprehensive survey for the financial regulation in Japan since 1984. Hoshi (1995a) examines the post-war history of regulation of corporate bond issues and shows how internationalization and deregulation in 1980s broaden the financing opportunities in Japanese firms.

26 The "sushi bond" provides a classic example of such regulatory arbitrage. The sushi bond was a foreign currency bond issued offshore by Japanese firms and purchased by Japanese insurance companies at higher prices than other potential buyers were prepared to pay. The differentiating characteristic of a sushi bond was that Japanese firms were on both sides of the transaction. The motivation for sushi bonds was a Ministry of Finance regulation which limited the foreign currency investments of insurance companies to 10% of total assets; however, foreign currency issues by Japanese firms were not subject to that restriction. Consequently, such issues commanded a premium from Japanese insurance companies desiring to increase their foreign currency position beyond the 10% limit. As Japanese firms became able to issue foreign currency bonds offshore and swap the proceeds into yen, they discovered that this was less costly than a comparable domestic yen borrowing. Apparently some borrowers simply re-lent the proceeds of their sushi bond issues at an arbitrage profit. The resulting surge in sushi bond issues caused Ministry of Finance to relax the restriction on insurance companies' foreign currency assets. As a consequence, Japanese insurance companies were no longer prepared to accept the lower yields on sushi bonds. Then, issuance of such bonds ceased almost immediately (Hodder and Tschoegl, 1992).

Table 5 Direct Financing of Public Firms in Japan

(Percentage)

	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94
Stock Issues							
No. of Cases	63.7	38.4	60.0	53.3	43.2	38.3	36.8
Amounts	72.2	36.4	43.8	31.2	29.6	24.3	12.0
Straight Bonds							
Domestic							
No. of Cases	35.7	61.0	33.4	29.0	15.0	3.1	8.8
Amounts	25.7	58.9	42.1	43.0	22.7	4.6	24.2
Overseas							
No. of Cases	0.2	0.2	0.3	5.1	8.4	8.3	19.5
Amounts	0.4	2.9	0.7	6.9	8.9	7.6	22.2
Convertible Bonds							
Domestic							
No. of Cases	0.1	0.1	6.1	5.0	9.6	22.3	10.9
Amounts	0.1	0.4	12.9	8.7	14.2	30.8	15.4
Overseas							
No. of Cases	0.3	0.3	0.2	7.6	20.3	9.6	4.4
Amounts	0.6	1.4	0.5	10.2	21.0	7.0	3.6
Warrants Bonds							
Domestic							
No. of Cases	n.a.	n.a.	n.a.	n.a.	0.6	0.5	0.8
Amounts	n.a.	n.a.	n.a.	n.a.	0.4	0.7	2.3
Overseas							
No. of Cases	n.a.	n.a.	n.a.	n.a.	2.9	17.9	18.7
Amounts	n.a.	n.a.	n.a.	n.a.	3.2	25.0	20.2
Sub-Total of Bonds							
Domestic							
No. of Cases	35.8	61.1	39.5	34.0	25.3	25.9	20.5
Amounts	25.8	59.3	55.0	51.7	37.3	36.2	42.0
Overseas							
No. of Cases	0.5	0.5	0.5	12.7	31.6	35.8	42.6
Amounts	2.0	4.3	1.2	17.1	32.7	39.6	46.0

Sources: Tokyo Stock Exchage (1996), *Annual Securities Statistics.*

There have been several dramatic shifts in funding patterns, which can be traced to regulatory changes. It is also important to understand that the government's own financing needs have been an important influence on market regulations as well as the general character of the domestic bond market. Indeed, government issues since the mid-1970s with corporate issues representing a relatively small fraction of the total market have dominated that market. For example, during the 1985-1989 period, straight corporate bond issues accounted for just 3% of

total bond issues in Japan. Table 5 provides additional data on domestic bond issues by Japanese firms during 1960-1994. In recent years, other Japanese firms have essentially forsaken the domestic straight debt market in favor of other funding sources, including offshore bond issues. This striking aversion to domestic issues has produced enormous pressure for regulatory and procedural changes.

To a large extent, the underlying problems for domestic corporate bond issues have to do with who determines issue terms and collateral requirements. It was only after 1979, that Japanese firms were allowed to issue unsecured bonds for the first time since the 1930s. Initially, only two firms were eligible to make unsecured issues. This situation continued until January 1983, when the restrictions on convertible bonds were further relaxed so that some 30 firms become eligible to issue such bonds without collateral. Subsequently, restrictions for both convertibles and straight bonds were relaxed in stage until several hundred firms were eligible for unsecured issues as of November 1988. The official logic for a collateral requirement has been the protection of investors. However, this restriction has also made bond issuance in Japan relatively unattractive. Not only did corporate issuers have to pay management fees and underwriting commissions, but they also had to compensate a trustee for a variety of services, which substantially increased issue costs. Firms also have to obtain approval on the terms and timing of issues from a committee dominated by a group of large banks. This procedure is cumbersome and lacks flexibility regarding issue terms. This bond issuing procedure endowed the Japanese banks with considerable control over non-financial firms' access to debt markets. Under the main bank lending system, such control was important for dealing with highly levered clients. In recent years, financially sound firms have naturally tended to view this process as an expensive nuisance. Consequently, offshore issues have been attractive as a way around cumbersome and expensive procedures in the domestic market.

Table 6 illustrates the rapid growth in offshore bond issues by Japanese firms over the last decade. It was not until the early 1980s and Japanese participation no longer required permission of Ministry of Finance that the offshore market began to really take off. Total corporate issues during the 1985-1994 period were greater in the offshore market than domestically. The fact that a very large fraction of offshore issues would up in Japanese investors' portfolios provides a strong indication that the domestic market was inefficient. In the domestic market, convertible bonds have dominated straight issues since 1983. There seem to be several reasons for this. First, collateral requirements have been relaxed more rapidly on convertibles - resulting in lower effective issue costs for more firms. Second, issuing terms on straight corporate debt have been tied to government bond yields in ways, which made many corporate issues relatively unattractive for

Table 6 Direct Financing of Public Firms in Japan

(Billion Yen)

	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94
Stock Issues							
No. of Cases	3,014	1,366	2,342	1,623	1,227	2,106	1,564
Amounts	2,673	1,352	3,743	4,463	6,173	18,376	6,778
Straight Bonds							
Domestic							
No. of Cases	1,689	2,172	1,304	884	427	171	375
Amounts	953	2,187	3,598	6,152	4,725	3,478	13,640
Overseas							
No. of Cases	8	8	10	155	240	455	827
Amounts	17	109	55	988	1,848	5,785	12,529
Convertible Bonds							
Domestic							
No. of Cases	3	3	237	153	272	1,227	464
Amounts	1	15	1,106	1,246	2,951	23,360	8,648
Overseas							
No. of Cases	15	9	9	230	575	529	187
Amounts	61	52	46	1,456	4,364	5,311	2,020
Warrants Bonds							
Domestic							
No. of Cases	n.a.	n.a.	n.a.	n.a.	16	26	35
Amounts	n.a.	n.a.	n.a.	n.a.	87	544	1,306
Overseas							
No. of Cases	n.a.	n.a.	n.a.	n.a.	81	983	792
Amounts	n.a.	n.a.	n.a.	n.a.	678	18,934	11,279
Sub-Total of Bonds							
Domestic							
No. of Cases	1,692	2,175	1,541	1,037	715	1,424	874
Amounts	954	2,202	4,704	7,397	7,763	27,382	23,595
Overseas							
No. of Cases	23	17	19	385	896	1,967	1,806
Amounts	78	160	101	2,444	6,890	30,030	25,830
Grand Total							
No. of Cases	4,729	3,558	3,902	3,045	2,838	5,497	4,244
Amounts	3,704	3,715	8,548	14,303	20,826	75,788	56,203

Sources: Tokyo Stock Exchage (1996), *Annual Securities Statistics.*

initial purchasers. In contrast, terms on convertibles were more easily adjusted to make them attractive for purchasers. Third, the lower coupon rate on a convertible coupled with the generally low dividend yield on shares after conversion implies a lower cash flow drain relative to issuing straight debt. Fourth, historically, a firm could not issue bonds in excess of its paid in capital plus reserves. The June 1990 revision to the Commercial Code roughly doubled the limit; but even this relaxed constraint can be binding for a rapidly growing firm needing external funds. A convertible issue provided immediate funding but, as it was converted into shares, enhanced a firm's ability to issue additional bonds in the future. Horiuchi (1995b) shows the supporting evidences that the active issue of convertibles by a firm tends to increase its managerial perquisites, thereby deteriorating the firms' performance from their shareholders' interests. He argues that Japanese corporate governance which give large latitude to managers did not lead to serious losses for the other stakeholders, mainly because the remarkable growth of firms covered up the potential conflict of interests among the stakeholders. When the economy is faced to the structural changes, however, large discretionary power of managers may not be effective to respond to the change.

The main concern for corporate bond issues during the last decade has been the shift to issuing overseas. This is clearly due to reduced regulatory constraints on access to offshore markets where there is greater flexibility and lower costs. The rise of the offshore primary market has, however, seriously undermined the domestic primary market. Consequently, efforts are currently underway to reform domestic bond issuance procedures and make them more competitive with offshore markets.[27] This will presumably require more flexibility with regard to pricing and issue terms as well as largely eliminating the additional costs imposed by the commissioned bank system. Otherwise the dominance of the offshore markets is likely to continue (Hodder and Tschoegl 1992).

27 Eligibility requirements of issuing bonds were changed to abolish the minimum net wealth and introduce rating in 1990. Since the relative importance of corporate bonds issued by Japanese firms overseas has increased, the Ministry of Finance introduced the regulation to forbid securities companies subscription sale of Eurobonds issued by Japanese firms to domestic investors in 1993 in order to recover the domestic bond market.

3.3 Reorientation of Financial Institutions

The securitization and globalization of Japanese corporate finance dramatically changed the business of major banks in Japan. As no-financial firms have been changing the sources of funds, Japanese major banks have aggressively sought to offer product-oriented, fee-based banking services such as currency and interest swaps, leveraged lease arrangement, and M&A advisory work. As shown in Table 7, the rapid growth and low profitability of Japanese banks has led to concern about their capital adequacy. Foreign banks have sought protection from the onslaught of Japanese competition by calling for Japanese banks to operate with capital ratios comparable to those required in the United States and Europe. Japanese banks are watching their financial performance carefully. In contrast to the low-margin, volume-oriented banking practices, Japanese banks are now restraining growth and carefully tracking the profitability of their relationships with clients. Increasingly, banks according to the profitability of the relationship with them are ranking clients. Just as industrial clients are now short listing the banks with which they do business, banks are now beginning to identify and terminate relationships with clients that do not provide them with sufficiently attractive rates of return.

Table 7 Profit Performances of Commercial Banks in Germany, Japan, and the U.S.A

Five-Years Average

(Percentage)

		Germany	Japan	U.S.A.
Gross Profit Margin				
	1980-84	2.24	1.75	1.99
	1985-89	2.21	1.35	3.47
	1990-94	2.10	1.23	3.35
Pre-tax Return on Assets				
	1980-84	0.54	0.53	0.90
	1985-89	0.70	0.58	0.78
	1990-94	0.54	0.26	1.10
Equity to Assets				
	1980-84	5.89	3.69	6.19
	1985-89	6.84	3.64	6.50
	1990-94	8.15	4.41	7.20
Retum on Equity				
	1980-84	14.06	14.43	15.34
	1985-89	12.11	16.41	11.13
	1990-94	10.49	6.11	16.04

Sources: The Bank of Japan (1974, 1978, 1986, 1994, 1996), *Comparative Economic and Financial Statistics: Japan and Other Countries.*
Source Note: Statistiches Bundesamt, *Unternehmen und Arbeitsstätten,* The Bank of Japan, *Syuyokigyo Keieibunseki* (Business Analysis on Main Enterprises in Japan), The U.S. Department of Commerce, *Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations*

Deregulation of interest rates, which raised the cost of funds to banks, caused the change of bank portfolio. Coping with decreasing operating margin, Japanese banks introduced various measures to reduce operating costs and started to compete for deposits and loans more eagerly than ever. Many banks loosed loan examination cutting the staff in the department to reduce costs and accelerate the loan making. Then the bank increased easy collateralized loans to investment in real estates. Prices of assets have stagnated in the early 1990s in Japan. This stagnation of asset prices caused the large amount of non-performing loans to investments in real estates. Non-performing loans include four kinds of loans: loans to bankruptcy; loans overdue in six months; loans with reduced interest rates; and other loans used for rescue. According to the report of Ministry of Finance in April 1995, the amount of non-performing loans is 23.8 trillion yen in major banks. Large amount of non-performing loans has deteriorated banks' equity and major banks unable to meet BIS capital requirement. Japanese banks issued the subordinated debts to recover their capital-assets ratio. Non-performing loans to real estates caused the serious problems with banks' own balance sheets.

The shifting patterns of Japanese corporate finance and the competitive and regulatory pressures on Japanese financial institutions to increase their return on assets is collectively resulting in a gradual separating of claims held against non-financial firms. Rather than being key shareholders, lead lenders, and primary vendors of financial services in long-term relationships with clients, Japanese banks are now being reduced to the position of minority shareholders that must compete fiercely for a client's business on a transaction-by-transaction basis.[28] Much of corporate finance in Japan has evolved around the main bank relationship. This is changing for large firms. Financial liberalization in Japan has created difficulties for the main bank system. Nevertheless, that system seems likely to adapt and continue to provide valuable support for rapidly growing firms. Exactly how this will come about is not yet clear; however, there are substantial incentives for preserving the system's advantages. More generally, the effects of financial liberalization over the last decades have been enormous. The process of change will continue, both because of continuing liberalization and because some financial patterns change sluggishly. Increasing financial sophistication and a consequence ability to exploit opportunities arising from regulatory changes will also continue to alter corporate financial practices for some time to come. It is reason-

28 Horiuchi (1995a) points out that bank regulation in Japan provided banks with a considerable amount of rent that could be utilized when regulatory authority had a chance to rescue troubled banks. Furthermore, competition-restricting regulations kept the franchise value in the banking at a high level, giving banks incentives not to engage in activities associate with moral hazard that are likely to prevail under extensive nets.

able to expect that the role of offshore financing will not decline. Untangling the web of domestic regulations, traditional practices, and conflicting interests of various financial constituencies will take time. Financial liberalization tends to undermine the main bank system because major non-financial firms have greater access to market debt as well as borrowing from foreign financial institutions. This makes it potentially much more difficult for the main bank to monitor and control those firms' behaviors. In consequence, the main bank system could continue to be viable and advantageous for small-and-medium-sized firms, which need strong bank supports.[29]

Hoshi, Kashyap, and Scharfstein (1993) build on the idea that managers and shareholders may not completely agree about what kinds of investments should be taken. If managers place a lot of weight on shareholder concerns, then they show that firms with more attractive investment opportunities will be more prone to use public debt to finance investment. The idea is that the managers of firms with very attractive investment opportunities will find it very costly to forego these opportunities in order to take a pet project. As a result, they do not need to be monitored to ensure efficient project selection. One can predict that when managers are closely following shareholders' wishes, firms with high Tobin's q will issue public debt, while those with low Tobin's q will issue bank debt. It is also implied that firms with high net worth - those with valuable assets in place or low leverage - will use the public debt markets. Because they risk this net worth when they invest, the managers of these firms have a greater incentive to invest efficiently. Thus, the model predicts that firms with good performance, valuable investment opportunities, or valuable assets are more prone to use public debt, while other firms will rely more heavily on bank financing. They find that high net worth firms are more prone to use public debt financing. In addition, firms in keiretsu have responded to deregulation in different ways: the more successful firms have accessed the public debt markets, while the less successful firms continue rely more heavily on bank debt financing. As firms reduce their dependence on bank financing, they might lose some of the benefits of relationship-based borrowing. They may have a less ready source of financing, and creditors may be less willing to help during the time of financial difficulty. Interestingly, the financing

29 Petersen and Rajan (1994) find that borrowing from a single lender increases the availability of credit for small firms. For smaller firms without publicly traded common stock, the benefit of bank monitoring are likely to be large relative to the potential adverse incentive effects of information monopoly by a single bank. Houston and James (1996) examine the determinants of the mix of private and public debt using detailed information on the debt structure of 250 publicly traded corporation in 1980-90. They find reliance on bank borrowing is decreasing in firm size and overall leverage. They also find that the relationship between bank borrowing and the importance of growth opportunities depends on the firm's use of multiple banking relationships and public debt.

patterns of large Japanese firms are beginning to resemble the more arms-length financing patterns observed in the U.S. This arms-length approach has led to different mechanisms of corporate control in the U.S. The shift to the arms-length financing system, even if it may emerge, will certainly take time. The infrastructure in financial market including rating agencies, disclosure rules, regulation and enforcement of insider trading are not developed well in Japan. Even though the deregulation made it possible for major firms to arm's length financing, some firms still chose to depend on bank borrowing. The firms seeking the benefits of firm-bank relationships will continue to have close ties with banks.

4. Conclusion

Corporate financial patterns and practices in Japan appear quite different, particularly in comparison with those in the United States. In large part, these differences are due to differing institutional and regulatory environments. Then, a peculiar financing pattern turns out to be the rational economic response to a constraining regulation. The key to understanding such patterns are identifying the underlying structure of constrains.

Japanese financial institutions may hold equity and debt at the same time. Besides strengthening the long-term relationship between the financial institutions and the firm, the simultaneous holding of debt and equity clearly reduces the scope for conflict between stockholders and debtholders over the choice of policies, particularly in situations of financial distress. The significance of the main bank system is the close information-sharing relationship that exists between the bank and the firm. It is possible to view the main bank system as functioning as a substitute for the kind of screening and monitoring institutions that are prevalent in other capital markets such as bond and credit-rating institutions and security analysis agencies. The close association that the main bank has with the firm means that the bank is able to obtain inside access to the firm and its management, which is not readily available to the external capital market.

The main bank system can be also characterized in terms of banks themselves delegating the monitoring of a particular firm to one particular bank: the main bank. The bank delegated to be monitoring is not only the bank with the largest loan share but also holds a significant stake in the firm as a shareholder. Having a sufficient large loan share may be the way in which the bank ensures that it obtains an adequate return on its monitoring outlays. In this regard, it is worth noting the free-rider problem may be mitigated somewhat by virtue of the fact that non-monitoring banks will not be able to imitate the loan portfolio of the main bank in size. It can be argued that this function of the main bank provides

an important substitute mechanism for what in effect is inactive market for corporate control in Japan. Main bank intervention can take a number of forms, ranging on the one hand from cases where the main bank stipulates certain measures that requires the firm to take in exchange for the bank's support during a period of financial difficulty to cases where the bank sends officers to take over the management and carry out the reorganization of a firm that is on the verge of bankruptcy on the other. As a consequence, one can suggest that the relationship-based corporate governance substitutes for the more market-based in Japanese firms.

Much of corporate finance in Japan has evolved around the main bank relationship. This is changing for large firms. Financial liberalization in Japan has created difficulties for the main bank system. Nevertheless, that system seems likely to adapt and continue to provide valuable support for rapidly growing firms. Exactly how this will come about is not yet clear; however, there are substantial incentives for preserving the system's advantages. The process of change will continue because of continuing liberalization in capital market. Increasing financial sophistication and capability to exploit opportunities arising from regulatory changes will also continue to alter corporate financial practices.

Financial liberalization tends to undermine the main bank system because major non-financial firms have greater access to arm's length debt as well as borrowing from foreign financial institutions. This makes it potentially much more difficult for the main bank to monitor and control those firms. Consequently the main bank system could continue to be viable and advantageous for firms which is limited to access to alternative debt sources and need strong bank support. The financing pattern of large Japanese firms is beginning to resemble the more arms-length financing patterns observed in the U.S. The shift to the arms-length financing system, even if it may emerge, will certainly take time. The infrastructure in financial market including rating agencies, disclosure rules, regulation and enforcement of insider trading are not developed well in Japan. Even though the deregulation made it possible for major firms to arm's length financing, some firms still maintain main bank relationships. The firms seeking the benefits of main bank relationships will continue to have close ties with banks.

Acknowledgement

Financial supports from Foundation of Sanyo Broadcasting, The Japan Economic Research Foundation, Ministry of Education in Japan, Murata Foundation, and Zengin Foundation for Studies on Economics and Finance are gratefully acknowledged. The author would like to thank Takeo Hoshi, Enrico C. Perotti and

Yishay P. Yafeh for useful comments and suggestions.

References

Aoki, M. (1994), "Monitoring Characteristics of the Main Bank System: An Analytical and Developmental View," in M. Aoki and H. Patrick, ed., *The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies,* Oxford University Press, 109-141.

Aoki, M., H. Patrick, P. Sheard (1994), "The Japanese Main Bank System: An Introductory Overview," in M. Aoki and H. Patrick, ed., *The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies,* Oxford University Press, 3-50.

Bank of Japan (1974, 1978, 1986, 1993, 1994, 1996), *Comparative Economic and Financial Statistics: Japan and Other Countries.*

Baums, T. (1992), "Corporate Governance in Germany: The Role of the Bank," *American Journal of Comparative Law,* 40, 503-526.

Berlin, M., K. John, and A. Saunders, (1996), "Bank Equity Stakes in Borrowing Firms and Financial Distress," *Review of Financial Studies,* 9, 889-919.

Calomiris, C. W. (1993), "Corporate-Finance Benefits from Universal Banking: Germany and the United States, 1890-1914," working paper, National Bureau of Economic Research.

Chemmanur, T. J. and P. Fulghieri, (1994), "Reputation, Renegotiation, and the Choice between Bank Loans and Publicly Traded Debt," *Review of Financial Studies,* 7, 475-506.

Dewatripont, M. and E. Makin, (1995), "Credit and Efficiency in Centralized and Decentralized Economies," *Review of Economic Studies,* 62, 541-555.

Diamond, D. W. (1984), "Financial Intermediation and Delegated Monitoring," *Review of Economic Studies,* 51, 393-414.

Diamond, D. W. (1991), "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt," *Journal of Political Economy,* 99, 689-721.

Economic Planning Agency (1992), *Keizai Hakusho, 1992* (Economic Survey of Japan, 1992).

Edwards, J. and S. Ogilvie (1995), "Universal Banks and German Industrialization: A Reappraisal," discussion paper, Center for Economic Policy Research.

Elston, J. A. (1996), "Investment, Liquidity Constraints and Bank Relationships: Evidence from German Manufacturing Firms," discussion paper, Center for Economic Policy Research.

Fair Trade Commission (1994), *Kigyo-syudan no Jittai ni tuite* (A Survey on Corporate Groups).

Fohlin, C. M. (1995), "Relationship Banking and Firm Liquidity Constraints: Evidence from the Heyday of the German Universal Banks," discussion paper, California Institute of Technology.

Fukuda, A. and S. Hirota, (1996), "Main Bank Relationships and Capital Structure in Japan," *Journal of the Japanese and International Economies,* 10, 250-261.

Fuji Research Institute Corporation (1993), *Kigyouzaimu Kenzenka-sokushin Chosakenkyu - Meinbanku-sisutemu ni kansuru Chosa,* (Research on Promotion of Sound Corporate Finance: A Survey of Main Bank System).

Gertner, R. and D. Scharfstein, (1990), "A Theory of Workouts and the Effects of Reorganization Law," *Journal of Finance,* 46, 1189-1222.

Gilson, S. C. (1990), "Bankruptcy, Boards, Banks and Blockholders: Evidence on Changes in Corporate Ownership and Control when Firm Default" *Journal of Financial Economics,* 27, 355-88..

Gilson, S. C., K. John, and L. H. Lang, (1990), "Troubled Debt Restructuring: An Empirical Study of Private Reorganizations in Default," *Journal of Financial Economics,* 27, 315-353.

Gorton, G. and F. A. Schmit (1996), "Universal Banking and the Performance of German Firms," working paper, National Bureau of Economic Research.

Hodder, J. E. and A. E. Tschoegl, (1992), "Corporate Finance in Japan," discussion paper, Center for Economic Policy Research, Stanford University.

Horiuchi, A. (1995a), "Liberalization and Stability in the Japanese Financial System: An Overview," discussion paper, University of Tokyo

Horiuchi, A. (1995b), "An Evaluation of Japanese Financial Liberalization: A Case Study of Corporate Bond Market," discussion paper, University of Tokyo

Hoshi, T. (1995a), "Financial Deregulation and Corporate Financing in Japan," mimeo, University of California, San Diego.

Hoshi, T. (1995b), "Back to the Future: Universal Banking in Japan," mimeo, University of California, San Diego.

Hoshi, T., A. Kashyap, and D. Scharfstein, (1990a), "The Role of Banks in Reducing the Costs of Financial Distress in Japan," *Journal of Financial Economics,* 27, 67-88.

Hoshi, T., A. Kashyap, and D. Scharfstein, (1990b), "Bank Monitoring and Investment: Evidence from the Changing Structure of Japanese Corporate Banking Relationships," in R. G. Hubbard,ed., *Asymmetric Information, Corporate Finance, and Investment,* University of Chicago Press, 105-126.

Hoshi, T., A. Kashyap, and D. Scharfstein (1991), "Corporate Structure, Liquidity, Investment: Evidence From Japanese Industrial Groups," *Quarterly Journal of Economics,* 106, 33-60.

Hoshi, T., A. Kashyap, and D. Scharfstein, (1993), "The Choice between Public and Private Debt: An Analysis of Post- Deregulation Corporate Financing in Japan," mimeo, University of California, San Diego.

Houston, J. and C. James, (1996), "Bank Information Monopolies and the Mix of Private and Public Debt Claims," *Journal of Finance,* 51, 1863-1889.

James, C. (1987), "Some Evidence on the Uniqueness of Bank Loans," *Journal of Financial Economics,* 19, 217-235.

Kang, J-K. and A. Shivdasani, (1995), "Firm Performance, Corporate Governance, and Top Executive Turnover in Japan," *Journal of Financial Economics,* 38, 129-58.

Kaplan, S. N. and B. A. Minton, (1994), "Appointments of Outsiders to Japanese Boards: Determinants and Implications for Managers," *Journal of Financial Economics,* 36, 225-258.

Leland, H. E. and D. H. Pyle (1977), "Information Asymmetries, Financial Structure, and Financial Intermediation," *Journal of Finance,* 32, 371-387.

Lichtenberg, F. R. and G. M. Pushner (1994), "Ownership Structure and Corporate Performance in Japan," *Japan and the World Economy,* 6, 239-261.

Lummer, S. L. and J. J. McConnel, (1989), "Further Evidence on the Bank Lending Process and the Capital-Market Response to Bank Loan Agreements," *Journal of Financial Economics,* 25, 99-122.

Morck, R. and M. Nakamura, (1992), "Banks and Corporate Control in Japan," working paper, University of Alberta.

Myer, S. and N. Majluf (1984), "Corporate Financing and Investment Decisions when Firms Have Information that Investors Do Not Have," *Journal of Financial Economics,* 13, 187-221.

Osugi, K. (1990), "Japan's Experience of Financial Deregulation since 1984 in an International Perspective," BIS economic paper, Bank for International Settlements.

Pascale, R. and T. P. Rohlen, (1983), "The Mazda Turnaround," *Journal of Japanese Studies,* 9, 219-263.

Petersen, M. A. and R. G. Rajan (1994), "The Benefits of Lender Relationship: Evidence from Small Business Data," *Journal of Finance,* 49, 3-37

Petersen, M. A. and R. G. Rajan (1995), "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics,* 110, 407-443.

Rajan, R. G. (1992), "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt," *Journal of Finance,* 47, 1367-1400.

Rajan, R. G. and A. Winton, (1995), "Covenants and Collateral as Incentives to Monitor," *Journal of Finance,* 50, 1113-1146

Ramseyer, J. M. (1991), "Legal Rules in Repeated Deals: Banking in the Shadow of Defection in Japan," *Journal of Legal Studies,* 20, 91-117.

Ramseyer, J. M. (1994), "Explicit Reasons for Implicit Contracts: The Legal Logic to the Japanese Main Bank System," in M. Aoki and H. Patrick, ed., *The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies,* Oxford University Press, 231-257.

Roe, M. J. (1993), "Some Differences in Corporate Structure in Germany, Japan, and America," *Yale Law Journal,* 102, 1927-2003.

Sheard, P. (1985), "Main Banks and Structural Adjustment in Japan," Pacific Economic Paper, Australian National University.

Sheard, P. (1989), "The Main Bank System and Corporate Monitoring and Control in Japan," *Journal of Economic Behavior and Organization,* 11, 399-422.

Sheard, P. (1992), "The Role of the Japanese Main Bank When Borrowing Firms are in Financial Distress," discussion paper, Center for Economic Policy Research, Stanford University.

Shleifer, A. and R. W. Vishney (1995), "A Survey of Corporate Governance," discussion paper, Harvard Institute of Economic Research.

Stiglitz, J. E. (1985), "Credit Markets and the Control of Capital," *Journal of Money, Credit and Banking,* 17, 133-152.

Tokyo Stock Exchange (1996), *Annual Securities Statistics.*

Von Thadden, E-L. (1995), "Long-term Contracts, Short-term Investment and Monitoring," *Review of Economic Studies,* 62, 557-575.

Weinstein, D. E. and Y. Yafeh, (1994), "On the Cost of a Bank Centered Financial System: Evidence from the Changing Main Bank Relations in Japan," discussion paper, Harvard Institute of Economic Research.

KOBE ECONOMIC & BUSINESS REVIEW, 42 (1997), 97-115

ORGANIZATIONAL COORDINATION FOR PROJECT INTERDEPENDENCY IN NEW PRODUCT DEVELOPMENT

KENTARO NOBEOKA **Kobe University**

Abstract

In many industries, the effective management of concurrent multiple projects that share components has become a critical issue. Firms need to coordinate engineers in different projects in order to leverage their design work and technical knowledge across more than one product. This study explores the influence of inter-project interdependencies on organizational coordination requirements. A questionnaire survey of 256 component engineers in the U.S. and Japanese automobile firms provides evidence that the organizational coordination required to manage component design - with and without inter-project interdependencies - differs significantly. For example, in projects with no dependencies on other projects, only cross-functional coordination has a significant influence on schedule and cost performance. But in projects with dependencies on other projects, both intra-functional coordination and cross-functional coordination have a strong impact on the performance of component design.

JFL Classification: Management

Keywords: Product development; Coordination; Project interdependency; Differentiated matrix organization

1. Introduction

A stream of studies on new product development has been exploring the effective organizations and management of new product development. One of the central issues that many studies have examined is the implications of project-oriented and function-oriented organizations (Marquis and Straight, 1965; Galbraith, 1974; Davis and Lawrence, 1977; Allen, 1977; Tushman, 1978; Katz and Allen, 1985; Clark and Fujimoto, 1991). Most studies have argued that product development

Corresponding Address:
Kentaro Nobeoka
Research Institute for Economics and Business Administration, Kobe University
2-1 Rokkodai-cho, Nada-ku, Kobe 657-8501, Japan
E-mail: nobeoka@rieb.kobe-u.ac.jp
Fax: (81)-78-803-0414

organizations require two different coordination mechanisms to achieve two major goals. First, in order to increase the quality and quantity of inputs of technical knowledge, a high degree of coordination among technical specialties is needed. Second, in order to integrate all technical knowledge toward well-defined products, a high degree of coordination within and around a project is required. These two aspects of coordination requirements have primarily been discussed with respect to the issues of the balance between project and function orientations in the new product development organization.

However, there has been one critical factor missing in this perspective. The existing studies have examined the organizational coordination mostly focusing on the effective management of a single project. In many industries such as an automobile, however, large manufacturers have at least several product lines and simultaneously undertake multiple development projects. In these firms, the extent to which these concurrent multiple projects are related to each other in technologies and design is an important strategic issue. For example, in order to enjoy the economies of scope, separate projects should extensively share the similar technologies and other resources. Multiple projects may want to share some portion of design in order to decrease development costs and maximize the scale economies. In particular, he effective management of concurrent projects can allow firms to leverage their engineering resources by facilitating quick and efficient transfer of new technology across multiple products (Nobeoka and Cusumano, 1997). In addition, even when component designs are not exactly the same, firms may also try to manufacture components for a variety of projects using a same process equipment.

This type of strategy selection usually causes interdependencies regarding specific technologies and components among multiple development projects. The nature of inter-project interdependencies should, in turn, have an influence on organizational coordination requirements, which should be one of the key determinants in designing appropriate organizational structures and processes. This paper specifically explores the influence of the inter-project interdependencies on the organizational coordination requirements in new product development, focusing on the importance of both cross-functional (i.e., project) and intra-functional coordinations. In order to examine this question, we conducted a questionnaire survey of 256 design engineers in ten international automobile firms.

There have been numerous studies on the advantages and disadvantages of project-oriented and functional-oriented organizations. In these empirical studies, project-oriented structures, rather than function-oriented structures, generally resulted in higher performance particularly in terms of cost and schedule performance, while in some cases functional orientation was appropriate for the technical

performance. For example, Marquis and Straight (1965), in their pioneering work, by investigating thirty eight R&D projects under contract with a government agency, have concluded that function-oriented organizations are more effective in technical performance, while project-oriented organizations tend to be more successful in cost and lead time. Katz and Allen (1985) examined the relationship between project performance and the relative influence of project and functional managers. They have concluded that performance reaches its highest level when organizational influence is centered in the project manager and influence over technical details of the work is centered in the functional manager. Larson and Gobeli (1988), on the other hand, have found that in all schedule, cost and technical performances, project-oriented teams tend to be more successful than function-oriented organizations. In their study of automobile product development, Clark and Fujimoto (1991) also argued that strong project manager responsibility (i.e., "heavyweight product manager" in their term) had a positive influence on project performance in lead time, productivity, and design quality.

These studies have provided useful insights for managing a new product development project. However, few studies have explicitly addressed questions of inter-project interdependencies in design or engineering, either conceptually or empirically. It is important to study the influence of inter-project interdependency on organizational coordination requirements, because it should impose a critical dimension of contingency on product development organizations. The findings and frameworks of the existing studies without considering this dimension may have been misleading and has to be reinterpreted. For example, the existing literature suggests that in order to shorten lead time, project-oriented organization be the most appropriate structure (Clark and Fujimoto, 1991). However, one of the critical issues many automobile manufacturers currently face is the way to share components and technical knowledge among multiple projects. A project organization that is too project-oriented with a relatively autonomous power tends to result in the development of many proprietary components for each project, and may require excessive financial and engineering resources. The next question is whether firms should adopt a traditional function-oriented organization when the management of the inter-project interdependencies is critical. The inter-project interdependencies, however, may not be managed within each functional organization alone. The inter-project management should also be affected by the needs of a separate individual project. This study specifically focuses on these issues related to the management of inter-project interdependencies.

In the next section, we discuss the potential influence of inter-project interdependencies on organizational requirements, particularly with respect to cross-functional and intra-functional coordinations in new product development orga-

nizations. The cross-functional coordination is directly related to coordination around project, and the intra-functional coordination is to that of each function. The following sections explain our research methods and the results from a questionnaire survey of automobile design engineers. In these sections, we provide an evidence that the organizational coordination required to manage component design differs significantly depending on the nature of inter-project interdependencies. In the final section, we discuss theoretical and managerial implications drawn from our survey results.

2. Framework and Hypotheses

New product development organizations at large automobile firms appear to be a matrix organization, although there are some variations with respect to the orientation of either project or function (Clark and Fujimoto, 1991). In order to examine the influence of inter-project interdependencies on the organizational coordination, our study used two separate simplified patterns of component design engineering as a research framework. In the first pattern, an engineer designs components for a new vehicle project that has no direct interdependency with any other on-going product development projects. In the second pattern, on the other hand, an engineer designs components for a new vehicle development project that has some direct interdependency with equivalent components in at least one of other on-going projects.

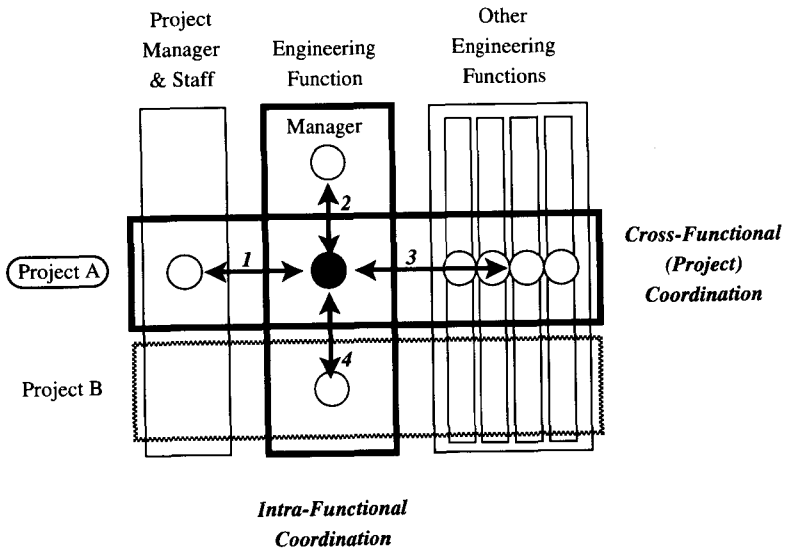
The inter-project interdependencies can exist when two projects share at least some portion of component designs or divide some tasks to avoid duplications in engineering and financial resource usage. Consideration of utilizing the same process equipment may also cause some interdependencies between different vehicle projects. Figure 1 and Figure 2 explain the differences in a simplified model of a matrix product development organization, positioning design engineers in an engineering function at the center of the matrix.

2.1 Hypotheses on Component Design without Inter-Project Interdependency

Figure 1 shows the first pattern, in which an engineer designs a component for Project A that does not have particular types of interdependencies with those for Project B. Each design engineer works both for a functional manager, primarily on issues pertaining to technical or component questions (indicated by *2* in Figure 1), and for a project manager, on issues pertaining to the integration of inputs and intermediate outputs into a specific final product (*1* in Figure 1). In addition, many engineers formally or informally interact with engineers in other functions such as manufacturing and other components, who work for the same new pro-

duct project, to integrate technical outputs across functional areas (*3* in Figure 1). Furthermore, even in this model, engineers may also want to have some interactions and coordination with engineers in the same technical discipline, including those who work for other projects, to update and refine "state-of-the-art" technologies (*4* in Figure 1).

Figure 1 Cross-Functional Coordination and Intra-Functional Coordination



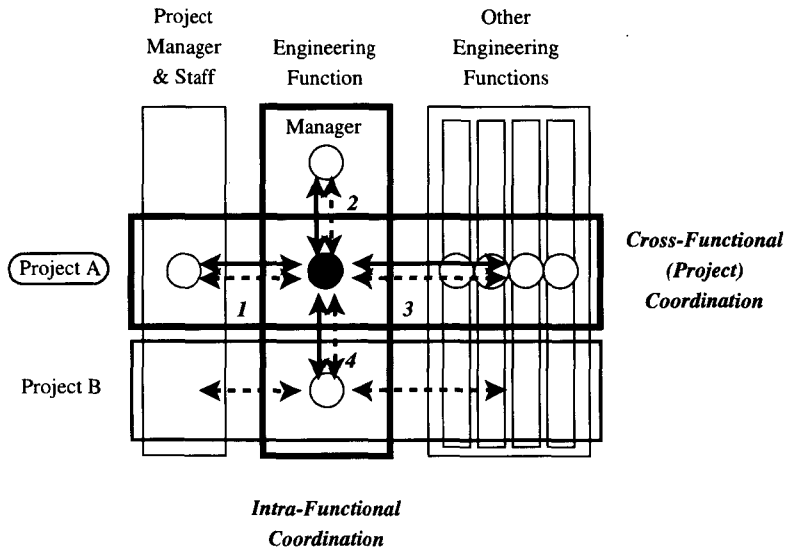
In the framework, as shown in the figure, cross-functional coordination is defined as the degree of coordination between the design engineers and a project manager (including his or her staff) as well as engineers in other engineering functions. "Other engineering functions" consist of design engineers for other components and manufacturing engineers who work for Project A. Intra-functional coordination refers to the degree of coordination between engineers and a functional manager as well as engineers in their same technical function or system area who work for other vehicle projects. The same definition of coordination is also applied to the next model shown in Figure 2.

Based on the past studies discussed above, we hypothesize that, *without* inter-project interdependencies with respect to certain components, cross-functional coordination may have a particularly strong positive influence on operational performance such as cost and schedule. In addition, intra-functional coordination may be more important than cross-functional coordination particularly regarding technical performance.

2.2 Hypotheses on Component Design with Inter-Project Interdependency

The model in Figure 2 shows the next hypotheses regarding possible influences of inter-project interdependency on the degree of organizational coordination. The potential additional organizational requirements for coordination are indicated by the dotted lines. This model assumes that there is an interdependency between two projects regarding at least the design of a particular component, on which the engineer in the center of the figure works. In the particular model outlined in Figure 2, the engineer in the new product project develops a design in conjunction with another project, Project B, in which the engineer is not directly involved. We chose this research framework, as opposed to an alternate potential model in which the same engineers work on component design for multiple product projects, because our research aim here is to explore the requirements for organizational coordination when multiple projects are interdependent and yet engineers in these projects are separate.

Figure 2 Influence of Inter-project Interdependencies



Assume that requirements for the component's design are not likely the same between these two projects, and that these two vehicle projects target different customer groups and compete against different competitors. In other words, engineers for Project A and B may not use exactly the same design, but try to share some resources or some technologies. In this case, additional coordination between engineers involved in these two different projects may be needed in order for engineers to minimize task duplications or to share as much of the design as possible (indicated by *4* in Figure 2). This coordination efforts may also have to be overseen by the functional manager (*2* in Figure 2). The degree of intra-functional coordination, therefore, may have a stronger influence on project performance in this kind of design work than in a project without any inter-project interdependencies. In other words, more coordination may be needed within the functional group because of the interdependency.

More importantly, in addition to this relatively direct requirement of the intra-functional coordination between engineers on the two projects, requirements for cross-functional coordination may also be higher than in projects without inter-project interdependencies (*1* and *3* in Figure 2). A product development project is a system consisting of multiple closely coupled engineering functions (Rosenberg, 1982; Iansiti, 1993). Uncertainty in any part of the vehicle system increases the requirement for coordination across sub-systems (Tushman, 1979; Clark and Fujimoto, 1991). In other words, uncertainty in the design of each component within a functional sub-system increases the coordination requirement across the entire system of a new product project. Uncertainty in the engineer's task within a function, in this model, is higher than that in a project without any interdependencies with other vehicle projects.

For example, suppose that engineers for Project A have to modify design specifications of a certain component in order to share some portion of the design with an equivalent component for Project B. In this case, a design change in Project A is caused by its interdependency with Project B. The change must be also incorporated into the whole set of vehicle system within Project A. Therefore, the design change should require additional cross-functional coordination within Project A, in addition to coordination between engineers in Project A and B within the function. Thus, we hypothesize that in a component design that is interdependent with another project, the influence of the cross-functional coordination on design performance is also stronger than in projects without inter-project interdependencies. In addition, the more interdependent components are with other components within a project, the more difficult it may be to coordinate component design between multiple projects.

We sum up the hypotheses for additional coordination requirements for compo-

nent design with interdependencies as follows: the importance of both cross-functional cooperation and intra-functional cooperation for design performance may be significantly higher in projects with inter-project interdependencies and interactions than in those without this type of inter-project interactions.

3. Sample and Measures

To examine these hypotheses, we conducted a questionnaire survey of design engineers at seven Japanese and three U.S. auto manufacturers. The questionnaires were distributed in April 1992 and were collected between May and August in the same year. One central contact at each company distributed questionnaires to design engineers. We asked the contact persons to distribute the questionnaires to engineers in as many different engineering divisions as possible, such as chassis, body, and engine. In addition, we requested that the questionnaires be filled out by junior engineers who actually designed components rather than senior engineers or managers. In our research framework, the questionnaires were not supposed to be filled out by functional managers. Of 280 questionnaires sent to Japanese firms and 90 questionnaires sent to U.S. firms, 224 (return rate of 80%) and 32 (return rate of 36%) were returned, respectively, which resulted in a total sample of 256 responses[1]. The low return rate from the U.S. firms may have resulted from the U.S. firms' reluctance to provide data on poorly-implemented projects, a reticence which we noticed in discussions with them. Because the primary purpose of this study is not a comparison of performance between U.S. and Japanese firms, we believe that this return rate does not affect the issues probed by this research, although we also used control variables to detect possible differences between the two samples.

In the questionnaire, each respondent chose one specific component that he or she recently had worked on for a specific product development project, excluding components built for basic research or for general use. One of the questions asked whether there was at least one other on-going vehicle development project that had interdependencies with the vehicle project he or she had worked on, particularly with respect to the design of his or her component. Specifically, this question asked whether, in conjunction with the vehicle project for which the respondent worked, there was at least one other new vehicle development project

1 These return rates are not actual return rates in the meaning of the term that is commonly used. The actual number of questionnaires distributed to engineers and the selection of engineers were decided primarily by the contact persons. The only guideline with respect to the number of questionnaires was to distribute the questionnaires to at most 35 engineers in as many different design functions as possible within a firm.

that was using similar component designs and was sharing some of the technology or designs of the respondent's project, which necessitated some inter-project interactions. Respondents were asked to think only about other projects in which they were not directly involved, so that the issue of coordination could be explicitly explored. Among 256 component developments, 122 appeared to have at least one other project with which they had this type of inter-project interdependency. Thirteen of the 32 U.S. component developments (41%) and 109 out of 224 Japanese component developments (49%) exhibited inter-project interdependencies. We analyzed data separating these two sample groups to explore how organizational requirements differed between these two component development types.

3.1 Performance Measurements

The questionnaire asked respondents to rate on a 7-point Likert-type scale whether each component development performed above or below their expectation in schedule, cost, design quality, and the degree of match with customer needs. Cost and schedule performance data were averaged to measure the operational performance, because these variables are highly correlated and seem to capture a common factor both conceptually and statistically (% explained by the first principal component = 83%). For the same reason, performance ratings of design quality and the degree of match with customer needs were also averaged to measure design quality performance (% explained by the first principal component = 87%).

3.2 Measurements of the Degree of Coordination

There is no single best measurement of the degree of coordination. The degree of coordination among different groups rather than the specific means of coordination needs to be stressed in this particular analysis. The degree of communication could possibility be used to measure coordination (Allen, 1977; Tushman, 1978). However, the degree of communication is not a good measure of the degree of coordination when extensive communication is needed to solve problems or conflicts. The degree of goal sharing among different groups could be an alternative measure. Lawrence and Lorsch (1967) used it to measure the degree of integration. This is not a good measurement for this study either, because all groups which responded to the survey are in a specific new product development project, and there may not be enough natural variations in their goals. Thus, in this study, the degree of satisfaction with the cooperative working relationship on the particular engineering task that each respondent chose was used as a proxy for the degree of coordination between different groups. This variable captures

the willingness of engineers and managers in one group to coordinate with those in other groups. Respondents rated the satisfaction level of their working relationship regarding a specific component development with people in different groups: a functional manager, a project manager, product engineers in other functions, manufacturing engineers, as well as engineers in their same technical function working for other product projects.

First, ratings regarding product engineers in other functions and manufacturing engineers were averaged to measure the degree of coordination (i.e., satisfaction with the working relationships) with engineers in other functions. Second, as indicated in the model shown in Figures 1 and 2, the degrees of cross-functional coordination and intra-functional coordination were calculated. The degrees of coordination with a project manager and with engineers in other functions were averaged to measure the degree of cross-functional coordination. The degrees of coordination with a functional manager and with other engineers in the same function were averaged to obtain the measure of intra-functional coordination.

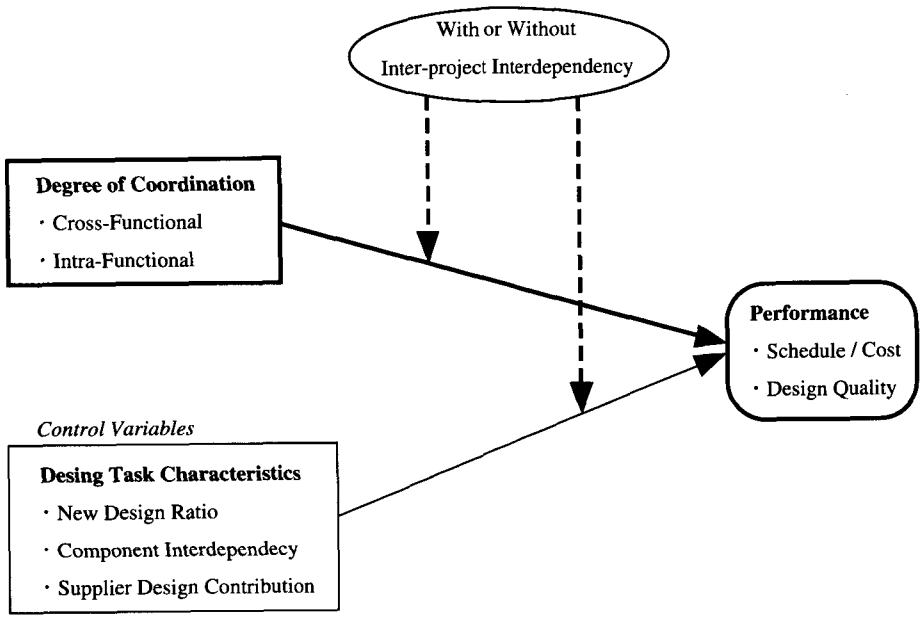
3.3 Control Variables and the Entire Analytical Framework

Other variables of component design task characteristics that may affect the relationship between component development performance and any type of organizational coordination are summarized in the analytical framework in Figure 3. These control variables are added because they may identify additional task complexity, which might make component design more difficult and lead to lower performance ratings regardless of the degree of coordination. These variables might also have different influences on design performance depending upon whether there are inter-project interdependencies.

First, we asked respondents to estimate the percentage of new design as opposed to carry-over portion of the design for each new component development. Many new designs are not usually 100% new, because engineers often use existing designs as a base. This ratio should be controlled, because components with more new design may require more inputs from other engineers within the same function, including engineers working for other projects. On average, 79% of the designs in the component developments with inter-project interdependencies were newly designed, and 86% of the designs were new in projects without inter-project interdependencies. Second, respondents estimated a component's inter-functional interdependency with other parts of the product by rating, on a 7-point Likert-type scale, the extent the component design affects the other parts of the product. Third, respondents estimated the percentage of design that suppliers engineered for each component design. On average, 34% of the design was done by suppliers in component designs with inter-project interdependencies and 31%

in those without interdependencies.

Figure 3 Analytical Framework of the Relationship between Coordination and Performance



4. Results

Descriptive data and a correlation matrix are shown in Table 1 for component developments with inter-project interdependencies (top half) and those without (bottom half). On average, engineers who work on component design without inter-project interdependencies rated the component's performance higher than those who worked on component design with interdependencies. The degree of organizational coordination is also rated higher in component design without inter-project interdependencies, which indicates that achieving high levels of coordination is generally more difficult in component design with inter-project interdependencies. The current research, however, focuses on the differences between these two types of component design in the relationship between the performance and different types of coordination, rather than the differences in performance or the degree of coordination alone.

Table 1 Descriptive Data and Correlation Matrix

With Inter-project Interdependencies (N=122)

	Mean	S.D.	1	2	3	4	5	6
1 Performance: Schedule/Cost	3.47	.86						
2 Performance: Design Quality	4.37	.96	.36***					
3 Coordination: Cross-Functional	4.36	1.00	.39***	.38***				
4 Coordination: Intra-Functional	4.50	1.10	.37***	.34***	.59***			
5 Component Interdependency	4.82	1.73	-.06	.24***	.35***	.13		
6 New Design Ratio	.79	.29	.02	.02	.06	.03	.13	
7 Supplier's Design Contribution	.34	.25	-.11	-.12	.02	.13	-.04	-.03

Without Inter-project Interdependencies (N=134)

	Mean	S.D.	1	2	3	4	5	6
1 Performance: Schedule/Cost	3.69	1.05						
2 Performance: Design Quality	4.69	.99	.37***					
3 Coordination: Cross-Functional	4.66	1.00	.25***	.19**				
4 Coordination: Intra-Functional	4.66	1.00	.15	.26***	.55***			
5 Component Interdependency	4.90	1.57	-.04	.02	.03	.01		
6 New Design Ratio	.86	.24	.14	.12	.11	.05	.30***	
7 Supplier's Design Contribution	.31	.23	-.06	-.13	.05	.12	-.16	-.12

**p<.05; ***p<.01

Performance variables, in general, are correlated more strongly with the coordination variables in component developments with inter-project interdependencies than those without the interdependencies. Specifically, in component developments with inter-project interdependencies, both measurements of performance, those for schedule/cost and design quality, are strongly correlated with both cross-functional and intra-functional coordination variables. On the other hand, in those developments without inter-project interdependencies, schedule/cost performance is significantly correlated only with cross-functional coordination, while design quality is strongly correlated only with intra-functional coordination. The results from the simple correlation matrix show that component design with inter-project interdependencies requires both cross-functional and intra-functional coordination to be successful. Component design without the interdependencies particularly requires cross-functional coordination for schedule and cost, and intra-functional coordination for design quality. These results with respect to component design without inter-project interdependencies fit with past studies (for example, Marquis and Straight, 1965; Katz and Allen, 1985). The following analyses explore these relationships more precisely, using regression analyses in which the control variables are added.

4.1 Schedule/Cost Performance

Table 2 shows the regression results for project performance in terms of schedule and cost. The results show that the organizational coordination required to perform well differs significantly between component design with and without inter-project interdependency. The differences generally support our hypotheses.

Table 2 Regression Analysis for Performance in Schedule and Cost

	With Inter-project Interdependencies (N=122)		Without Inter-project Interdependencies (N=134)	
Independent variables	Model 1	Model 2	Model 3	Model 4
Constant	0.00	0.00	0.00	0.00
Degree of Coordination				
Cross-Functional		0.34***		0.19*
Intra-Functional		0.20*		0.01
Component Interdependency	-0.10	-0.23***	-0.13	-0.12
Supplier's Design Contribution	-0.14	-0.17*	-0.06	-0.05
New Design Ratio	0.06	0.04	0.16*	0.14
Nation (US=1, Japan=0)	0.19**	0.12	0.23***	0.19**
Adjusted Squared Multiple R	0.02	0.22	0.06	0.08

Coefficients are standardized numbers. *p<0.1, **p<0.05, ***p<‹0.01

First, in component design without inter-project interdependencies, as most of the past studies found, cross-functional coordination, not intra-functional coordination, is particularly important to high performance in terms of schedule and cost. Second, in component design with inter-project interdependencies, intra-functional coordination is important to manage inter-project coordination even for schedule/cost performance. Third, the influence of cross-functional coordination is stronger in component design with inter-project interdependencies than in design without interdependencies. These results support the view that, in order to manage inter-project interdependencies, not only strong intra-project coordination is required to deal with inter-project interdependency, but also cross-functional coordination is required to absorb within each project any uncertainties caused by inter-project interdependencies.

In addition to the differences in the influence of organizational coordination variables, other design task variables also affect performance differently between these two types of component design. First, as our hypothesis suggests, a component's interdependency with other parts of the vehicle causes more difficulties in component design with inter-project interdependencies. When the cross-functional component interdependency is strong, inter-project interdependency cannot be

managed within each function. Second, the extent of supplier contribution has a significant negative effect on performance only in component design with inter-project interdependencies. This result may imply that it is difficult for multiple projects to manage a supplier relationship jointly.

These independent variables, especially the organizational coordination variables, explain more about schedule and cost performance in component design with inter-project interdependencies (adjusted $R^2=0.22$) than in design situations without interdependencies (adjusted $R^2=0.08$). This difference may imply that coordination variables are particularly important in component design with inter-dependencies, because of its complicated nature in coordination tasks.

4.2 Design Quality Performance

Design quality performance is also significantly affected by both cross-functional coordination and intra-functional coordination in only component design with inter-project interdependencies, as shown in Table 3. In design without inter-dependencies, intra-functional coordination is particularly important, which again generally fits with the results from the past studies discussed earlier. In addition, a supplier's contribution to the design also again has a stronger negative influence on design quality performance in component design with inter-project inter-dependencies.

Table 3 Regression Analysis for Performance in Design Quality

	With Inter-project Interdependencies (N=122)		Without Inter-project Interdependencies (N=134)	
Independent variables	Model 1	Model 2	Model 3	Model 4
Constant	0.00	0.00	0.00	0.00
Degree of Coordination				
Cross-Functional		0.20*		-0.02
Intra-Functional		0.17*		0.20**
Component Interdependency	-0.17**	0.19	-0.09	-0.08
Supplier's Design Contribution	-0.16*	-0.18**	-0.13	-0.10
New Design Ratio	0.05	0.03	0.11	0.11
Nation (US=1, Japan=0)	0.35***	0.30***	0.41***	0.38***
Adjusted Squared Multiple R	0.16	0.25	0.17	0.19

Coefficients are standardized numbers. *p<0.1, **p<0.05, ***p<0.01

As both Table 2 and Table 3 indicate, respondents at the U.S. firms tended to rate their performance higher than the Japanese respondents. This may have been caused by the low return rate from the U.S. firms, who may have returned surveys only for high-performing component design projects, as pointed out earlier. This difference may also have reflected the difference in language, either in English or Japanese, used in the questionnaire. In any case, this bias does not affect the results regarding the general theoretical propositions posed.

4.3 Summary

Table 4 summarizes the influence of coordination and task variables on design performance. It is evident that organizational requirements significantly differ between component design with and without inter-project interdependencies.

Table 4 Summary of the Regression Analyses

		Cross-Functional Coordination	Intra-Functional Coordination	Component Inter-dependency	Supplier's Design Involvement
With Interdependencies	Schedule/Cost	***	*	*** (Negative)	* (Negative)
	Design Quality	*	*		** (Negative)
Without Interdependencies	Schedule/Cost	*			
	Design Quality		**		

Statistically significant at: ***1% Level, **5% Level, *10% Level

In component design development in the context of inter-project interdependencies, organizational coordination in general tends to have a stronger impact on performance than in designs without those interdependencies. Specifically, the influences of both cross-functional coordination and intra-functional coordination are strong in designs with inter-project interdependencies. Intra-functional coordination, which directly involves engineers across multiple projects, affects schedule/cost performance only in those designs with inter-project interdependencies. In addition, design quality is affected by cross-functional coordination only in component design with inter-project interdependencies. With respect to coordination requirements for component design without inter-project interdependencies, our data basically fit the findings from past studies. In a component design without inter-project interdependency, cross-functional coordination is particularly important for operational performances such as schedule and cost. Design quality is more greatly influenced by intra-functional coordination among engineers in the

same technical discipline than cross-functional coordination.

Complexity caused by other task characteristic elements, such as component interdependency with other parts of the product and the degree of supplier involvement in design, seems to impose greater penalties on component design with inter-project interdependencies. This may be because component design without inter-project interdependencies is simpler than design with interdependencies, and thus it may be easier to manage the complexity of component interdependency and a supplier's involvement more effectively. In addition, this result reflects our hypothesis, in which we argue that interdependency with other components makes it difficult to manage inter-project interdependencies. Otherwise, a traditional functional organization could manage inter-project interdependencies within each function.

5. Discussions and Conclusions

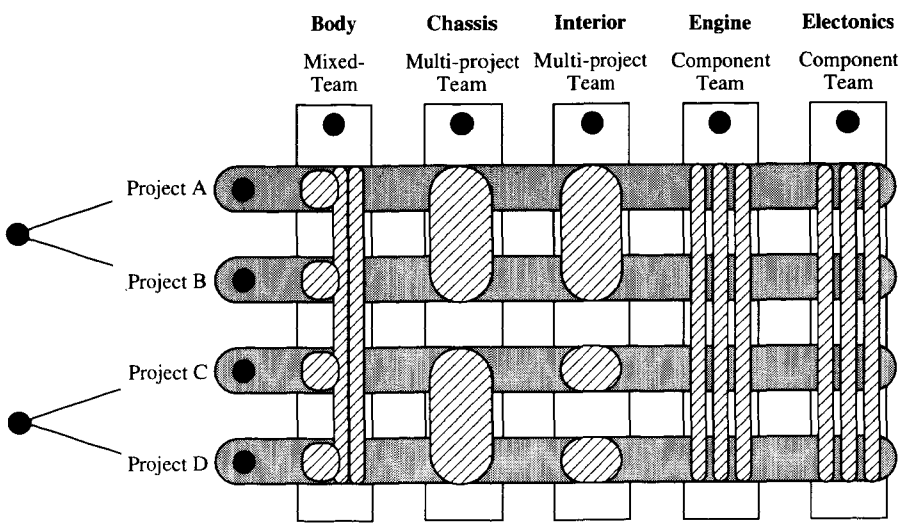
The results of this survey indicate that in order to effectively manage schedules/costs and design quality for component design across multiple projects, not only stronger intra-functional coordination but also stronger cross-functional coordination is needed than for single project component design. In addition, other factors that impose further complexity on the organization, such as component interdependency and supplier involvement, tend to cause greater difficulties to the organization engaged in component design with inter-project interdependencies. This result theoretically implies that different models are required to predict the relationship between organizational coordination patterns and project performance, depending on the nature of inter-project interdependencies. In our sample, about a half of engineers designed components dealing with some direct interdependencies with other vehicle projects. A simplified theory based on the context of a single project management cannot directly apply to this type of multi-project management.

This study has also provided managerial implications. The coordination requirements for component design with inter-project interdependencies are so different from those without interdependencies that different organizational structures and processes are likely to be needed. For example, this study has supported the existing studies, which have argued that in order to shorten lead time in the single-project context, project-oriented organization should be adopted. However, this study concludes that this solution is appropriate only when the inter-project interdependency is not an issue. At the same time, even when the interdependency exists, this study has implied that organizational structures and processes should not be purely opposite reactions to a project-oriented management system.

Rather, organizations should be aimed at achieving both cross-functional coordination and intra-functional coordination simultaneously through the active coordination of multiple projects. This goal cannot be achieved by either traditional project-oriented or function-oriented organizations. The inter-project interdependencies must be coordinated within the context of a specific project as a system. In other words, firms need organizational structures and processes that enable system-level coordination across multiple projects.

As the product development competition becomes more sophisticated, firms may have to place more importance on the management of concurrent multiple projects. In our follow-up interviews[2], we found that some firms have actually introduced a few new concepts to their organizations to deal with the inter-project interdependencies. First some Japanese automobile firms have employed the idea of extensively differentiated mechanisms within a matrix organization. They are creating a variety of working structures to manage the development of different design tasks based on an explicit recognition of the degree of inter-project and cross-functional interdependencies. Figure 4 depicts an example of a differentiated matrix from one of the Japanese automobile firms. Depending on the nature

Figure 4 An Example of Differentiated Matrix Organization



2 Our field study includes three trips to Japan, one to Europe, and several to Detroit, augmented by numerous interviews around Boston with International Motor Vehicle Program participants. We conducted in-depth interviews with approximately 130 engineers and 30 new product project managers at five Japanese, three U.S., and four European firms between August 1992 and July 1994.

of the interdependency, there is flexibility in changing task partitioning and organizational structure.

For example, components like batteries and audio systems in the electronics design division tend to be developed by a pure component group, while platform components are developed by a multi-project team. Engineers working on some body components are totally devoted to a single project through a project-oriented group. Because the nature of both cross-functional and inter-project interdependencies changes all the time depending on the combination of projects being developed and their strategies, they should be able to quickly and dynamically change this micro-level structure. In future research, we plan to explore this concept of a "dynamic" differentiated matrix structure both empirically and theoretically.

Second, some firms introduced a level of strong control above project managers and now have "group" project managers, who are responsible for multiple concurrent projects, so that coordination among multiple projects can be effectively achieved. One common mechanism for control is to divide the whole project portfolio into several groups and to place general managers above the individual project managers for individual projects. A good example can be seen in the recent Toyota's major reorganization in 1992. Toyota, by the late 1970s, had already shifted from functionally-oriented organizations to project manager-based structures. Its "shusa" system or heavyweight project manager system has been widely discussed as an example of an effective project-oriented organization (Ikari, 1985; Shiosawa, 1987; Clark and Fujimoto, 1991). However, Toyota now has a chief engineer who is responsible for several concurrent projects above individual project shusas. The person in this position assumes some of authorities that a powerful leader for a single project, a shusa, used to have. One of the primary purposes of creating a position more powerful than the shusa is facilitating the transfer and sharing of new designs among multiple projects (Fortune, January 25, 1993, p. 78). This shift at Toyota represents a growing importance of managing the inter-project interdependencies at an automobile firm.

We believe the research presented here provides a new perspective on the management of new product development and important findings for organizational implications on the inter-project interdependencies. This study is, however, one of the first explorations of the effectiveness and efficiency of managing linkages of multiple projects. Because past studies on product development have mostly focused on the management of a single project, researchers need to pay more attention to the management of the inter-project interdependencies from the multi-project management perspective.

References

Allen, T. 1977. *Managing the Flow of Technology, Cambridge,* Mass.: MIT Press.

Clark, K., and T. Fujimoto. 1991. *Product Development Performance: Strategy, Organization, and Management in the World Auto Industry,* Boston, MA, Harvard Business School Press.

Davis, S. and P. Lawrence. 1977. *Matrix,* Massachusetts, Addison-Wesley.

Fortune: New York, NY, *Time* Inc. Magazine Company. Biweekly.

Galbraith, J. 1974. "Organization Design: An Information Processing View", *Interfaces,* 4, May, 28-36.

Ikari, Y. 1985. *Toyota tai Nissan: Shinsha Kaihatsu no Saizensen* (Toyota versus Nissan: The Front Line of New Car Development). Tokyo, Diamond.

Imai, K., I. Nonaka and H. Takeuchi. 1985. "Managing the New Product Development Process: How Japanese Learn and Unlearn," in K. B. Clark et al., ed., *The Uneasy Alliance: Managing the Productivity-Technology Dilemma,* MA, Harvard Business School Press).

Iansiti, M. 1993. "Technology Integration: Managing technological evolution in a complex environment." Working paper 93-057, HBS.

Katz, R. and T. Allen. 1985. "Project Performance and the Locus of Influence in the R&D Matrix", *Academy of Management Journal,* 28, 1,67-87.

Larson, E. and D. Gobeli: 1988. "Organizing for Product Development Projects", *Journal of Product Innovation Management,* 5,180-190.

Lawrence, P. and J. Lorsch. 1967. *Organization and Environments: Managing Differentiation and Integration,* Homewood, IL, Irwin.

Marquis, D. and D. Straight. 1965. "Organizational Factors in Project Performance", Unpublished Working Paper, MIT Sloan School of Management.

Nobeoka, K. and M. Cusumano. 1997. "Multi-Project Strategy and Sales Growth: The Benefits of Rapid Design Transfer in New Product Development", *Strategic Management Journal,* Vol.18, Bo.3, 169-186.

Rosenberg, N. 1982. *Inside the Black Box: Technology and Economics,* Cambridge, MA, Cambridge University Press.

Shiosawa, S. 1987. *The Chief Engineer: Project Teams of Toyota,* Tokyo, Japan, Kodansha.

Tushman, M. 1978. "Technical Communication in R&D Laboratories: The Impact of Project Work Characteristics", *Academy of Management Journal,* Vol. 21, No. 4, 624-645.

KOBE ECONOMIC & BUSINESS REVIEW, 42 (1997), 117-136

A REGIME SHIFT IN LONG-RUN MONEY DEMAND IN THE UNITED STATES

RYUZO MIYAO **Kobe University**

Abstract

This paper presents evidence for a regime shift in an equilibrium M1 demand relation in the postwar United States. It is first shown that there is no robust evidence for the presence of M1 cointegration from conventional cointegration tests that do not allow for a possible break in the cointegrating vector. Once a regime shift is taken into account, however, strong evidence for M1 cointegration emerges through a procedure proposed by Gregory and Hansen (1996). With the restriction of the unit income elasticity, test results consistently support the case for a shift in the interest semielasticity and the intercept. The breakpoint is estimated to be 1976. The estimate of the interest semielasiticity is -0.07 prior to the break and -0.02 after the break.

JEL classification: E41

Keywords: Long-run money demand; Cointegration; Regime shift.

1. Introduction

An equilibrium relation of money demand has been used in many empirical macroeconomic models as a key building block that connects real and nominal variables in the economy. Recent developments in cointegration econometrics have renewed research interests on long-run money demand. It is fairly well known by now that when the variables constituting a money demand relationship —most typically, real money balances, real output and nominal interest rates— are cointegrated, one can obtain super-consistent estimates of the cointegrating vector which correspond to money demand elasticities. Previous analyses of cointegration in the U.S. money demand (for M1, the commonly used narrow measure of monetary aggregates) include Hoffman and Rasche (1991), Friedman and

Corresponding Address:
Ryuzo Miyao
Research Institute for Economics and Business Administration, Kobe University
2-1 Rokkodai-cho, Nada-ku, Kobe 657-8501, Japan
E-mail: miyao@rieb.kobe-u.ac.jp
Fax: (81)-78-803-0390

Kuttner (1992), Stock and Watson (1993), Hoffman, Rasche and Tieslau (1995), Gregory and Hansen (1996), among others.[1]

It appears, however, that there is no agreement in the previous studies as to the evidence on M1 cointegration in the postwar period and the related, and more important issue of the stability of parameter estimates. On one hand, Friedman and Kuttner (1992) demonstrated that cointegration disappears for the postwar period of 1959-1990, and in particular in the 1980s, by using Johansen's (1988) maximal likelihood tests. Based on the same methodology, on the other hand, Hoffman and Rasche (1991) and Hoffman, Rasche and Tieslau (1995) argued that cointegration prevails for the similar postwar sample with a dummy variable. The latter study further provided evidence for the parameter constancy in M1 demand. In a more recent paper, Gregory and Hansen (1996) proposed a formal residual-based test for cointegration with possible breaks in the cointegrating vector ("regime shifts"). As an example, they applied the procedure to the U.S. money demand. The evidence suggested that M1 cointegration exists with a regime shift for the period of 1960-1990.

This paper reexamines evidence on M1 cointegration in the postwar U.S. and attempts to resolve the disagreement raised by earlier work. In summary, there are at least three working hypotheses to examine: (H_1) no cointegration in M1 demand, (H_2) M1 cointegration with the constant cointegrating vector(s), and (H_3) cointegration with a regime shift. Our investigation starts with testing the null of H_1 against the alternative of H_2. This is of course carried out by conventional tests for cointegration. If we obtain robust rejection results in this stage, then we are able to proceed to the test of H_2 against H_3 to examine the parameter constancy, as Hoffman-Rasche-Tieslau did.[2] If not, we can alternatively implement Gregory-Hansen's test of H_1 against H_3.

The analysis is based on a trivariate model of (M-P, Y, R) and a bivariate model of (M-P-Y, R), where M, P, and Y denote the logs of M1, the price level and real output, respectively and R denotes a measure of short-term interest rates, for which we use the level of three-month Treasury bill rate. The bivariate specification imposes the restriction of the unit income elasticity, which has been seen as a key to stability especially for the postwar period (see e.g. Lucas (1988)). We use the U.S. quarterly observations for 1959:1-1996:3, taken from International Financial Statistics database.[3]

---

1 For broadly defined aggregates (M2), see e.g. Miyao (1996) that reexamines evidence of cointegration in the postwar United States.

2 Other procedures to test H_2 against H_3 include Hansen (1992).

3 All the data are seasonally adjusted except for the interest rate. The precise variable codes in the IFS are 59mac (M1), 99b.r (gross domestic product in 1990 prices for Y), 99b.c (nominal gross domestic product used to obtain the price deflator P) and 60c (the three-month Treasury bill rate).

The following results emerge from our investigations. First, it is shown in Section 2 that there is no robust evidence for the presence of M1 cointegration from conventional cointegration tests. Friedman-Kuttner's result of disappearance in the 1980s is replicated especially under the bivariate model. On the other hand, the use of a dummy variable does not restore M1 cointegration, as opposed to Hoffman-Rasche-Tieslau's evidence.

Second, using Gregory-Hansen's test for a regime shift, we obtain evidence for M1 cointegration with a shift in the intercept and slope coefficients of the cointegrating vector (Section 3). The breakpoint is estimated to be 1976. It is important to note that the evidence is found with the restricted bivariate model. This suggests that the income elasticity of M1 demand remains constant without a break in the postwar period examined.

Third, in Section 4, we estimate the M1 demand cointegrating vector with a structural shift using a dynamic OLS procedure of Stock and Watson (1993). With the restriction of the unit income elasticity, the point estimate of the interest semielasticity is -0.07 prior to the break and -0.02 after the break. The shift is statistically significant and quantitatively nontrivial as well.

2. Tests for M1 Cointegration without Regime Shifts

2.1 Disagreement in Previous Evidence

This section investigates previous evidence on the postwar M1 cointegration which was shown through usual cointegration tests with no allowance of regime shifts. In particular, we examine two recent, quite contrary pieces of evidence: One is Friedman and Kuttner's (1992) evidence of no M1 cointegration and the other is Hoffman, Rasche, and Tieslau's (1995) evidence for the presence of M1 cointegration. More precisely speaking, Friedman and Kuttner demonstrated that M1 cointegration is detected in the subsample before 1980s but then disappears in the full sample that ends in 1990. Hoffman and others showed that M1 cointegration prevails even in the 1980s from their estimations in which the sample ends in 1974, 1975, ..., and 1990, recursively.

The two analyses share a lot of similarities. Both studies used the same maximal likelihood methodology of Johansen (1988) and Johansen and Juselius (1990) with a similar lag structure: the maximal-eigenvalue test with four lagged differences for the former paper, and the trace test with three lags for the latter. The full sample is alike: 1959:1-1990:4 and 1955:2-1990:4, respectively. Both are also based on similar model specifications with short-term interest rates: trivariate and bivariate models with the level of 4-6 month commercial paper for the former, and a trivariate specification with the log of 3-month Treasury bill rate for the lat-

ter. The only qualitative difference seems to be that Friedman and Kuttner did not include a dummy variable in the estimation, while Hoffman and others employed a dummy equal to 1.0 after 1981:4.

The fact that the two studies provided completely opposite test results —no cointegration vs cointegration— is all the more controversial because of those similarities. More importantly, the disagreement implies two conflicting views on long-run money demand: no presence vs presence of a long-run M1 demand relationship. In the following two subsections we carefully reexamine each evidence and attempt to resolve the controversy.

2.2 Tests without a Dummy Variable

The first task here is to test for M1 cointegration without using a dummy variable. Johansen's trace and maximal eigenvalue tests are conducted with four and eight lags. The estimations are based on the full sample, 1959:1-1996:3, and subsamples that end in 1975:4, 1980:4, 1985:4, 1990:4 and 1993:4, to account for the developments in the 1980s and 1990s. Both trivariate and bivariate specifications are investigated with the three-month Treasury bill rate (the level) as our measure of short-term interest rates. All tests are detrended and the critical values are tabulated by Osterwald-Lenum (1992) (p.468, Table 1).

Table 1 displays the test results. Original ("uncorrected") test statistics are reported in the third and fifth columns. In addition, following the procedure proposed by Cheung and Lai (1993), we compute test statistics to correct possible size distortions of Johansen's procedure in finite samples (we call them "corrected" statistics). It is well known that the Johansen procedure tends to over-reject the null of no cointegration due to its poor finite sample properties. The proposed factor is $(T\text{-}nk)/T$ where T, n, and k denote the numbers of observations, dimension in the system, and lagged differences, respectively. An original trace or maximal eigenvalue statistic times the correction factor yields the corrected statistic shown in fourth and sixth columns.

Table 1 Test for M1 Cointegration

		Trace		Max-eigenvalue	
Sample	Lag	Uncorrected	Corrected	Uncorrected	Corrected
		A. (M-P, Y, R) system			
96:3	4	21.54	19.77	15.14	13.89
	8	30.52*	25.36	17.47	14.52
93:4	4	21.09	19.22	14.72	13.41
	8	29.25†	23.89	18.04	14.74
90:4	4	21.53	19.43	15.27	13.78
	8	33.41*	26.67	20.70	16.53
85:4	4	24.09	21.29	19.20†	16.96
	8	45.45**	34.43**	33.19**	25.14*
80:4	4	24.76	21.18	14.54	12.44
	8	31.20*	21.72	21.39**	14.89
75:4	4	24.46	19.80	16.75	13.56
	8	41.85**	24.82	25.84**	15.33
		B. (M-P-Y, R) system			
96:3	4	9.11	8.61	6.89	6.51
	8	8.93	7.92	7.55	6.70
93:4	4	12.20	11.47	7.82	7.36
	8	12.17	10.69	6.61	5.80
90:4	4	13.03	12.19	9.45	8.83
	8	13.52†	11.70	9.20	7.96
85:4	4	16.81*	15.51*	13.95†	12.86†
	8	20.58**	17.25*	16.98*	14.23*
80:4	4	16.41*	14.83†	16.36*	14.79*
	8	21.79**	17.38*	21.72**	17.32*
75:4	4	21.11**	18.43*	21.11**	18.43*
	8	30.05**	21.90**	29.99**	21.86**

Notes: Each entry reports Johansen's (1988) trace and maximal eigenvalue statistics testing for M1 cointegration in the trivariate and bivariate models (Panels A and B). All tests are detrended and use the U.S. quarterly observations running from 1959:1 to the end of the sample period indicated in the first column. For each test, corrected statistics are computed using a factor to correct size distortions of Johansen's procedure in finite samples suggested by Cheung and Lai (1993). Critical values are tabulated by Osterwald-Lenum (1992), Table 1:

	A. Trivariate			*B. Bivariate*		
	10%(†)	5%(*)	1%(**)	10%(†)	5%(*)	1%(**)
Trace	26.79	29.68	35.65	13.33	15.41	20.04
Max-eigenvalue	18.60	20.97	25.52	12.07	14.07	18.63

Our test results of Table 1 indicate that M1 cointegration disappears in the late 1980s, especially based on the bivariate model. In Panel B, both test statistics, trace and max-eigenvalue, show strong rejections for all the subsamples prior to 1985. It should be emphasized that those rejection results are obtained not only from uncorrected test statistics but also from corrected statistics. Then all the rejections disappear for the longer samples that extend in the 1990s. With the trivariate specification (Panel A), the rejections before the late 1980s are less obvious. The unstable estimation results in Panel A can be attributed to the observations by Lucas (1988) and Stock and Watson (1993). Real output and interest rates in the postwar data contain a similar upward linear trend until the early 1980s. Those two studies pointed out that the multicollinearity makes the unrestricted trivariate estimation unstable for the postwar period. The results here provide another illustration that the unit income elasticity is a plausible restriction to impose in the analysis.[4]

Summarizing the results of Table 1, the Friedman-Kuttner's (1992) evidence of disappearance has been well replicated in our exercise. M1 cointegration remains non-existent for the full sample period of 1959-1996.

2.3 Tests with a Dummy Variable

Next we examine the evidence of Hoffman, Rasche and Tieslau (1995) for the presence of M1 cointegration. We implement exactly the same analysis as above, except for including a dummy variable set to be 1.0 after 1981:4 into all the regressions. Hoffman and others included the dummy to take into account a possible break in the deterministic trends in M1 velocity and interest rates around that time.[5] Note again that the use of the dummy variable in their analysis appears the only qualitative difference from Friedman-Kuttner's approach.

Table 2 shows the test results. There are virtually no rejections found in the table (except for only some rejections from uncorrected statistics in the trivariate test of Panel A). This is especially true for the bivariate result in Panel B, which is presumably more reliable in light of the earlier discussions on the multicollinearity. It is apparent that we fail to replicate the Hoffman-Rasche-Tieslau's evidence in this exercise.

---

4 Indeed, the property that the trivariate estimation generates imprecise results will be seen in the whole empirical exercises of this paper.

5 As they pointed out, the inclusion of a dummy in the regression may account not only for a shift in the linear trends of the variables but also for a possible shift in the intercept of the cointegrating relation. Hence the alternative hypothesis here includes both cointegration with the constant relationship and cointegration with a break in the intercept. Those two cases need to be distinguished explicitly in a subsequent analysis *in case* the test rejects the null of no cointegration.

Table 2 Test for M1 Cointegration with a Dummy Variable

		Trace		Max-eigenvalue	
Sample	Lag	Uncorrected	Corrected	Uncorrected	Corrected
		A. (M-P, Y, R) system			
96:3	4	27.04†	24.82	15.03	13.80
	8	29.63†	24.63	12.40	10.31
93:4	4	21.12	19.24	13.78	12.55
	8	23.30	19.03	12.21	9.97
90:4	4	23.43	21.14	12.45	11.24
	8	29.53†	23.57	14.23	11.36
87:4	4	18.28	16.30	12.20	10.88
	8	31.29*	24.27	21.03*	16.31
85:4	4	18.88	16.68	12.68	11.21
	8	35.02*	26.53	24.44*	18.51
		B. (M-P-Y, R) system			
96:3	4	12.14	11.47	11.18	10.56
	8	12.76	11.32	10.24	9.09
93:4	4	9.87	9.29	9.61	9.04
	8	9.69	8.51	9.35	8.21
90:4	4	12.50	11.69	11.87	11.10
	8	12.79	11.07	11.77	10.19
87:4	4	9.43	8.75	9.39	8.71
	8	8.54	7.26	8.51	7.24
85:4	4	12.24	11.29	11.92	11.00
	8	15.51*	13.01	15.50*	13.00†

Notes: See the notes to Table 1. All tests include a dummy variable equal to 1.0 after 1981:4.

In the Appendix, we also report more complete results with additional lag structures —three and six lags— in Table A1 and A2, which correspond to Table 1 and 2 of the text. Note that Hoffman, Rasche and Tieslau used three lagged differences in their analysis. In Table A2, the trivariate tests (Panel A) with three lags indeed detect some rejection results for the samples that end in the late 1980s and 1990s. But the tests with higher lags and/or the bivariate model do not provide rejection results. We find a similar pattern in Table A1 where the null tends to be rejected with three lags in the 1990s samples. Those rejection results

with three lags in Table A1 and A2 and in Hoffman, Rasche and Tieslau (1995) can be attributed to the under-parametrization of the lag structure. Cheung and Lai (1993) reported simulation results that the size distortions of Johansen procedure become larger when the lag length is shorter than the true length, i.e., under-parametrized.

The additional exercises above further strengthen our contention that there is no strong evidence for the existence of M1 cointegration even with the use of a dummy variable. The evidence is regarded as the prerequisite for Hoffman and others to proceed to their formal analysis of the stability in M1 demand parameters. Accordingly our test results cast doubts on their argument for the parameter constancy as well.

3. Tests for a Regime Shift in M1 Cointegration

3.1 The Test Procedure

In this section we investigate evidence on M1 cointegration with allowance of a regime shift, or equivalently, a shift in the cointegrating vector. We first describe the testing method used here, a residual-based test proposed by Gregory and Hansen (1996). The procedure tests the null of no cointegration against the alternative of cointegration with a break in the intercept and slope coefficients. The timing of the break is treated as unknown in the procedure, so that we can estimate the breakpoint as well.

Let y_t and x_t denote a scalar variable and a vector of m variables ($x_t = (x_{1t},...,x_{mt})'$) in our dataset. All the variables are characterized as integrated of order one ($I(1)$). A standard cointegration model without regime shifts can be described as a static single-equation model:

$$y_t = \beta_0 + \beta' X_t + e_t, \quad t = 1,....,T \tag{1}$$

where β_0 and $\beta = (\beta_1,..., \beta_m)'$ correspond to the intercept and slope coefficients of the cointegrating vector and e^t is an $I(0)$ disturbance term. To introduce a structural break in the cointegrating vector, the following dummy variable is defined:

$$D_{\tau t} = \begin{cases} 1.0 \ (t > [\tau T]) \\ 0.0 \ (\text{otherwise}) \end{cases} \tag{2}$$

where τ is the unknown timing of the structural break in a relative term defined over the (0, 1) interval and $[\cdot]$ is its integer part. Therefore $[\tau T]$ denotes the break date. Using this dummy variable, a cointegration model with a structural shift can be written as:

$$y_t = \beta_0 + \beta' X_t + \gamma_0 D_{\tau t} + \gamma' X_t D_{\tau t} + e_{\tau t}, \ t = 1,....,T \tag{3}$$

where γ_0 and $\gamma = (\gamma_1,\ldots, \gamma_m)'$ denote the changes in the intercept and slope coefficients.[6]

Under this model, the test for the presence of a regime shift can be implemented as follows. We estimate the model (3) by OLS for each possible breakpoint τ, and obtain the estimated residual $e_{\tau t}$. The augmented Dickey-Fuller (1979) (ADF) test is then applied to each residual series and the corresponding ADF statistic is calculated. Of all those ADF statistics, we report the smallest value as the test statistic for a regime shift, denoted by *ADF*. For the actual computation, we consider τ as a step function over (0.15, 0.85) jumping every $1/T$ period. Thereby the possible breakpoints here consist of all integers over ([0.15T], [0.85T]).

3.2 Test Results for a Regime Shift

Using the Gregory-Hansen's procedure described above, we now test for a regime shift in M1 cointegration. As in the previous section, both trivariate and bivariate models are examined. That is, $y_t = M_t - P_t$ and $x_t = (Y_t, R_t)'$ for the trivariate model (m=2), and $y_t = M_t - P_t - Y_t$ and $x_t = R_t$ for the bivariate model (m = 1). To examine robustness, we employ the samples of 1959:1-1990:4, 1993:4, and 1996:3. For the optimal lag included in each ADF test, we choose it using the stepdown (reducing-lag) procedure proposed by Campbell and Perron (1991) with the maximum lag length equal to eight. Critical values are tabulated by Gregory and Hansen (1996) (Table 1, p.109).

Table 3 indicates the test results. Based on the trivariate model, we could not find rejections (Panel A). However, the restricted bivariate tests, shown in Panel B, provide support for a regime shift for all the samples examined. The breakpoint is estimated to be consistently 1976:3. Figure 1 plots the series of the ADF statistics for all the possible breakpoints based on the bivariate test with the full sample. The smallest ADF is accomplished at 1976:3, but other ADF statistics in 1976 all indicate rejections at the 5% significance level (the statistics are -5.29, -5.43, and -5.02 for 1976:1, 1976:2, and 1976:4, respectively). The figure clearly indicates that there is a shift in the M1 cointegrating vector in 1976.[7]

---

6 In addition, Gregory and Hansen (1996) consider two simpler models that incorporate a shift in the intercept only ("level shift") and the intercept shift with a time trend ("level shift with trend"). The regime shift model used here is the most general version in their testing framework.

7 I also performed the tests using the optimal lag length chosen by the Schwarz-Bayesian information criterion (SBIC). The bivariate test with the full sample also rejects the null at the 5% significance level and the breakpoint is estimated to be 1976:2.

Table 3 Test for a Regime Shift in M1 Cointegration

Sample	*ADF**	Lag	Breakpoint	(τ)
		A. (M-P, Y, R) system		
96:3	-4.85	6	76:2	(0.46)
93:4	-5.02	0	75:1	(0.46)
90:4	-4.95	0	75:1	(0.51)
		B. (M-P-Y, R) system		
96:3	-5.48**	5	76:3	(0.47)
93:4	-5.33*	5	76:3	(0.51)
90:4	-5.07*	5	76:3	(0.55)

Notes: *ADF** is Gregory and Hansen's (1996) statistic testing the null of no cointegration against cointegration with a break in the cointegrating vector (both intercept and slope coefficients). The test statistic is obtained as the smallest value of residual-based augmented Dickey-Fuller (1979) statistics for all the possible breakpoints (τ) in the sample. The lag length is chosen based on the stepdown procedure of Campbell and Perron (1991) with the maximum length equal to eight. Critical values are tabulated by Gregory and Hansen (1996), Table 1:

	A. Trivariate			*B. Bivariate*		
	10%(†)	5%(*)	1%(**)	10%(†)	5%(*)	1%(**)
*ADF**	-5.23	-5.50	-5.97	-4.68	-4.95	-5.47

The evidence here is consistent with the earlier finding by Gregory and Hansen (1996), in which they found M1 cointegration with a structural shift based on a trivariate model for the period of 1960:1-1990:4.[8] Compared to the Gregory-Hansen's evidence, we provide the evidence for a regime shift through the restricted bivariate tests. This suggests that the structural break took place in the interest semielasticity as well as the intercept while the income elasticity remains constant without a break. It should be stressed that this paper supports the case for the parameter stability with respect to the income elasticity.

8 Gregory and Hansen found a regime shift not from the *ADF** procedure but from Phillips (1987) type residual-based tests (Z_t* and Z_α * tests in their notation). The failure for the trivariate *ADF** test to reject the null is associated with its lower power in the finite samples that include the period of the strong collinear movements in income and interest rates.

The evidence of the last section that M1 cointegration disappears in the late 1980s —a replication of the Friedman-Kuttner's (1992) evidence— can be also reconciled with the evidence here. When there is indeed a shift in the intercept and slope coefficients, conventional tests for cointegration which assume the constant relationship may not be able to detect cointegration. Gregory and Hansen illustrated a low power of a standard cointegration test in their Monte Carlo experiment. Moreover, rejections found in the late 1970s and early 1980s samples in Table 1 (particularly in Panel B) are consistent with the presence of a constant M1 cointegrating relation before the structural shift. The allowance for a break in the intercept and slope coefficients restores the long-run cointegrating relationship in the 1980s and 1990s.

It is true that our evidence sharply conflicts with Hoffman, Rasche and Tieslau (1995)'s evidence for the stability of M1 cointegration. The two studies are indeed contrary because both of them use the restricted bivariate model. However, as was demonstrated in the last section, especially in Panel B of Table 2 and Table A2 in the appendix, we could not replicate their evidence for M1 cointegration in the late 1980s and 1990s even with a dummy variable, which is the key evidence for their argument of the stability. Having shown the weakness of Hoffman and others' evidence and the strong evidence for a regime shift here, we are able to conclude that there exists M1 cointegration with a structural shift in the postwar United States and that the shift occurred in the parameters of the intercept and the interest semielasticity in 1976.

3.3 A Monte Carlo Study to Examine Size Distortions

Since our evidence for a regime shift shown above is drawn from purely statistical tests, it is always important to further examine small-sample properties of the test. I conduct a Monte Carlo analysis to check possible size distortions (or "Type I error") of the rejection results in our finite sample.[9] In this experiment, the data generating process under the null of no cointegration is assumed to be a vector autoregressive (VAR) model of ($\Delta(M\text{-}P)$, ΔY, ΔR) with four lags and a constant. The coefficients and covariance matrix of the model are obtained from actual estimates of the regression with the full sample. Then we generate 1000 replications of the data from random drawings and count how many times the null of no cointegration is rejected from the bivariate ADF^* test (with the Campbell-Perron lag length) using the critical values employed above.

The simulation results indicate that size distortions of the test are in fact not

9 It is a legitimate concern because Gregory and Hansen (1996) reported some degree of size distortions in a Monte Carlo experiment, where the proposed test rejects the null by 10% using the 5% critical value with 100 observations.

large. Using the 10% critical value, the null hypothesis is rejected by 11.8% in our experiment (that is, 118 times out of the 1000 replications). Similarly, the rejection rates are 6.8% and 1.8% with the 5% and 1% critical values, respectively. We can regard our evidence for a regime shift as reliable from this exercise.

4. Estimating the Shift in the M1 Demand Cointegrating Vector

Having established the existence of a regime shift in M1 demand, we now address a more practical question: What are the estimates of the elasticities of money demand before and after the structural break? The use of correct estimates which incorporate the shift will have a potential impact on existing monetary analyses (e.g. King, Plosser, Stock and Watson (1991)).

To estimate the shift in the money demand cointegrating vector, we use a dynamic OLS procedure proposed by Stock and Watson (1993). Under the maintained hypothesis that the parameters of short-run dynamics stay constant, the following two regression models can be considered. For the trivariate specification,

$$M_t - P_t = \beta_0 + \beta_y Y_t + \beta_r R_t + \gamma_0 D_{76:3} + \gamma_y Y_t D_{76:3} + \gamma_r R_t D_{76:3} + d_y(L)\,\Delta Y_t + d_r(L)\,\Delta R_t + e_t, \quad (4)$$

and for the bivariate system,

$$M_t - P_t - Y_t = \beta_0 + \beta_r R_t + \gamma_0 D_{76:3} + \gamma_r R_t D_{76:3} + d_r(L)\,\Delta R_t + e_t, \quad (5)$$

where $D_{76:3}$ is a dummy variable equal to 1.0 after 1976:3 and $d_i(L)$, $i=r, y$ is a polynomial of the lag operator which contains both leads and lags ($d_i(L) = \sum_{j=-K}^{K} d_{ij}L_j$ and K is the number of leads and lags). Clearly, (β_0, β_y, β_r) is the cointegrating vector before the break and (γ_0, γ_y, γ_r) represents the change in those coefficients. Based on those models, we compute the estimates using four leads and lags. The sample starts in 1959:1 and ends in 1990:4, 1993:4 and 1996:3 to examine the development in the 1990s. Standard errors are computed using Newey and West's (1987) covariance matrix with the truncation of four lags.

Table 4 indicates the estimation results, which can be summarized into the following three sets of evidence. The first concerns the results before the break. In the trivariate estimation (Panel A), the point estimates of the income elasticity and interest semielasticity are (0.25, -0.005), respectively. The too low point estimates can be attributed to the unstable estimations of the trivariate model. Once the restriction of the unit income elasticity is imposed, the estimate of interest semielasticity becomes a plausible value of -0.070 with a small standard error (see Panel B). The estimates are stable across the samples and quite similar to some of the earlier estimates. For instance, Stock and Watson's (1993) 95% confidence

interval for the interest semielasticity is (-0.13, -0.08) for the period of 1900-1989. Lucas (1988) reported the same point estimate -0.07 based on the various prewar and postwar estimations.

Table 4 M1 Demand Cointegrating Vectors with a Regime Shift

Sample	β_0	β_y	β_r	γ_0	γ_y	γ_r	Wald Stat. (p-value)
			A. (M-P, Y, R) system				
96:3	5.075	0.252	-0.005	-10.230	0.672	-0.014	177.23
	(0.918)	(0.063)	(0.006)	(1.144)	(0.077)	(0.006)	(0.000)
93:4	5.147	0.247	-0.004	-10.104	0.664	-0.014	174.95
	(0.920)	(0.064)	(0.006)	(1.167)	(0.079)	(0.006)	(0.000)
90:4	5.067	0.252	-0.006	-9.922	0.652	-0.013	165.69
	(0.947)	(0.066)	(0.006)	(1.223)	(0.083)	(0.006)	(0.000)
			B. (M-P-Y, R) system				
96:3	-5.798	1.000	-0.070	-0.517	0.000	0.048	219.67
	(0.042)	—	(0.009)	(0.044)	—	(0.008)	(0.000)
93:4	-5.793	1.000	-0.071	-0.508	0.000	0.048	174.48
	(0.042)	—	(0.009)	(0.045)	—	(0.008)	(0.000)
90:4	-5.790	1.000	-0.071	-0.490	0.000	0.046	117.58
	(0.042)	—	(0.009)	(0.050)	—	(0.008)	(0.000)

Notes: All the estimates are computed using the dynamic OLS procedure of Stock and Watson (1993) with four leads and lags. See equations (4) and (5) in the text for the regression models. The sample begins in 1959:1 and ends in the period indicated in the first column. Standard errors, shown in parentheses, are calculated using the Newey-West (1987) covariance matrix with four lags to account for autocorrelation. Wald statistics reported in the last column test the hypothesis that all the shift parameters (γ's) are jointly equal to zero and have $\chi^2(3)$ and $\chi^2(2)$ distributions for the trivariate and bivariate tests, respectively. Below the Wald statistics are the p-values shown in parentheses.

Secondly, we turn to the results after the break. All the estimates of γ's that represent the structural change are significantly different from zero. In particular, under the bivariate model with the full sample, the change in the interest semielasticity is estimated to be 0.048 with a standard error 0.008. The estimate of the interest semielasticity is now shifted to -0.022 from -0.070, and the degree of its shift can be viewed as significant statistically and quantitatively. Moreover, the trivariate point estimates after the break, i.e. (0.92, -0.019), are very similar to the assumed unit income elasticity and the bivariate estimate of the interest semi-

elasticity. The problematic comovements in income and interest rates are now largely absent for the post-break period, which leads to the similarity. This provides further support to our result that the interest semielasticity shifted to -0.02 while the income elasticity remains unity without a shift.

Our third evidence concerns the test for the significance of the structural change in this regression model. We compute Wald statistics to test the null hypothesis that the coefficients of γ 's are jointly equal to zero. The statistics, shown in the last column of Table 4, have $\chi^2(3)$ and $\chi^2(2)$ distributions for the trivariate and bivariate systems, respectively. It is obvious that the null is rejected at all the conventional significance levels for both models (the *p*-values are all 0.000). The estimates of the shift parameters γ 's are all significant jointly as well.

5. Conclusions

The main contributions of this paper can be summarized as threefold. The first is that this study has disentangled three conflicting views on M1 cointegration in the postwar United States raised by previous work: (i) no M1 cointegration, (ii) M1 cointegration with constant cointegrating vector, and (iii) cointegration with a shift in the cointegrating vector. Through the investigations based on the test procedure of Gregory and Hansen (1996) as well as conventional cointegration tests, we have concluded that there was a regime shift in an M1 cointegrating relationship for the period of 1959-1996. The breakpoint is estimated to be in 1976.

Secondly, this paper has demonstrated the case for the parameter stability as well with respect to the income elasticity. We have shown the evidence for a regime shift using the bivariate system where the restriction of the unit income elasticity is imposed. The robust evidence for M1 cointegration before the 1980s is also obtained with the restricted bivariate model. All those results consistently suggest that while the interest semielasticity and the intercept went through the structural change, the income elasticity can be considered as constantly unity without a break.

The third contribution is that this paper have presented the actual estimates of long-run M1 demand before and after the regime shift. The point estimate of the interest semielasticity before the break is -0.07 and is shifted to -0.02 after the break. The estimates of the regime-shift parameters are all statistically significant individually and jointly.

In conclusion, taking the prewar evidence by Lucas (1988) and Stock and Watson (1993) together with our postwar evidence, it is safe to say that the parameter of the income elasticity has been a "numerical constant" over this century. The

parameter of the interest semielasticity had also been stable until the mid 1970s in this century, when it shifted to a significantly lower level. The empirical finding then raises a further question. Why did the shift happen only in the interest elasticity, and not in the income elasticity? What sort of theoretical model would be consistent with such a finding?

One possible explanation is based on a cash-in-advance model illustrated by Lucas (1988). He provided a money demand relationship under a tight theoretical framework, in which the interest elasticity is written as a function of the parameters describing preferences and the transaction environments. The income elasticity is, on the other hand, exactly shown as unity. Using this illustrated framework, it is possible to argue that some major events around the late 1970s, such as the monetary target regime by the Federal Reserve that caused large and volatile movements in interest rates and the introduction and rapid growth of interest-bearing checking accounts, might have shifted behavioral parameters, leading to the break only in the interest elasticity. A detailed analysis is needed on this subject and is left for future research.

Acknowledgment

This research was conducted during my visit at Australia-Japan Research Centre, Australian National University. I wish to thank Peter Drysdale, Director and staff members at the centre for their warm hospitality. I also thank Adrian Pagan and Paul Lau for their helpful comments.

References

Campbell, John Y. and Pierre Perron, "Pitfalls and Opportunities: What Macroeconomists Should Know about Unit Roots," *NBER Macroeconomics Annual,* Vol.6 (1991), 141-201.

Cheung, Yin-Wong and Kon S. Lai, "Finite-Sample Sizes of Johansen's Likelihood Ratio Tests for Cointegration," *Oxford Bulletin of Economics and Statistics, 55* (1993), 313-328.

Dickey, D. A. and W. A. Fuller, "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of American Statistical Association, 74* (1979), 427-431.

Friedman, Benjamin M. and Kenneth N. Kuttner, "Money, Income, Prices, and Interest Rates," *American Economic Review, 82* (1992), 472-492.

Gregory, Allan W. and Bruce E. Hansen, "Residual-Based Tests for Cointegration in Models with Regime Shifts," *Journal of Econometrics, 70* (1996), 99-126.

Hansen, Bruce E., "Tests for Parameter Instability in Regressions with I(1) process," *Journal of Business and Economic Statistics, 10* (1992), 321-335.

Hoffman, Dennis L. and Robert H. Rasche, "Long-Run Income and Interest Elastici-

ties of Money Demand in the United States," *Review of Economics and Statistics, 73* (1991), 665-74.

Hoffman, Dennis L., Robert H. Rasche and Margie A. Tieslau, "The Stability of Long-Run Money Demand in Five Industrial Countries, " *Journal of Monetary Economics, 35* (1995), 317-339.

Johansen, Soren, "Statistical analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control, 12* (1988), 213-54.

Johansen, Soren and Katarina Juselius, "Maximum Likelihood Estimation and Inference on Cointegration with Application to the Demand for Money," *Oxford Bulletin of Economics and Statistics, 52* (1990), 169-210.

King, Robert G., Charles I. Plosser, James H. Stock and Mark W. Watson, "Stochastic Trends and Economic Fluctuations" *American Economic Review, 81* (1991), 819-840.

Miyao, Ryuzo, "Does a Cointegrating M2 Demand Relation Really Exist in the United States?" *Journal of Money, Credit and Banking, 28* (1996), 365-380.

Newey, Whitney K. and Kenneth D. West, "A Simple, Positive Semi-Definite, Heteroscedasticity and Autocorrelation Consistent Covariance Matrix," *Econometrica, 55* (1987), 703-708.

Phillips, P. C. B., "Time Series Regression with a Unit Root," *Econometrica, 55* (1987), 277-301.

Stock, James H. and Mark W. Watson, "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems," *Econometrica, 61* (1993), 783-820.

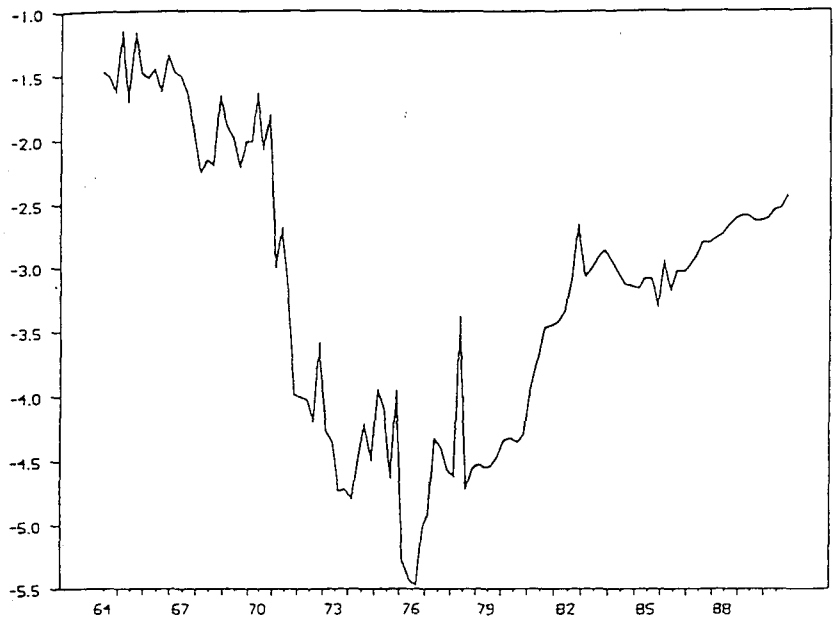


Figure 1: ADF Statistics with a Regime Shift

— Horizontal line: possible break date —

Appendix

Table A1. Test for M1 Cointegration: Complete Results

		Trace		Max-eigenvalue	
Sample	Lag	Uncorrected	Corrected	Uncorrected	Corrected
		A. (M-P, Y, R) system			
96:3	3	27.87†	26.16	21.79*	20.45†
	4	21.54	19.77	15.14	13.89
	6	28.54†	24.97	17.65	15.44
	8	30.52*	25.36	17.47	14.52
93:4	3	28.48†	26.59	21.67*	20.23†
	4	21.09	19.22	14.72	13.41
	6	25.58	22.12	16.32	14.12
	8	29.25†	23.89	18.04	14.74
90:4	3	26.73	24.79	20.95†	19.43†
	4	21.53	19.43	15.27	13.78
	6	28.37†	24.15	16.21	13.79
	8	33.41*	26.67	20.70†	16.53
85:4	3	27.72†	25.32	22.78*	20.81†
	4	24.09	21.29	19.20†	16.96
	6	33.09*	27.19†	24.21*	19.90†
	8	45.45**	34.43*	33.19**	25.14*
80:4	3	29.04†	25.93	19.87†	17.74
	4	24.76	21.18	14.54	12.44
	6	26.93†	20.95	20.75†	16.14
	8	31.20*	21.72	21.39*	14.89
75:4	3	25.80	22.17	19.28†	16.57
	4	24.46	19.80	16.75	13.56
	6	35.90**	25.31	25.47*	17.95
	8	41.85**	24.82	25.84**	15.33

Table A1. (continued)

Sample	Lag	Trace		Max-eigenvalue	
		Uncorrected	Corrected	Uncorrected	Corrected
		B. (M-P-Y, R) system			
96:3	3	10.73	10.29	7.19	6.89
	4	9.11	8.61	6.89	6.51
	6	10.42	9.55	9.15	8.39
	8	8.93	7.92	7.55	6.70
93:4	3	14.24†	13.61†	8.83	8.44
	4	12.20	11.47	7.82	7.36
	6	13.85†	12.60	8.67	7.89
	8	12.17	10.69	6.61	5.80
90:4	3	15.07†	14.34†	10.03	9.55
	4	13.03	12.19	9.45	8.83
	6	15.59*	14.05†	12.16†	10.96
	8	13.52†	11.70	9.20	7.96
85:4	3	18.58*	17.51*	14.74*	13.89†
	4	16.81*	15.51*	13.95†	12.86†
	6	21.46**	18.91*	18.79**	16.55*
	8	20.58**	17.25*	16.98*	14.23*
80:4	3	12.74	11.83	12.53†	11.63
	4	16.41†	14.83†	16.36*	14.79*
	6	17.53*	14.93†	17.10*	14.57*
	8	21.79**	17.38*	21.72**	17.32*
75:4	3	16.70*	15.13†	16.55*	15.00*
	4	21.11**	18.43*	21.11**	18.43*
	6	18.23*	14.64†	18.22*	14.63*
	8	30.05**	21.90**	29.99**	21.86**

Notes: This table shows complete test results for M1 cointegration, corresponding to Table 1 of the text. Additional results are reported here with three and six lags. See also the notes to Table 1.

Table A2. Test for M1 Cointegration with a Dummy: Complete Results

		Trace		Max-eigenvalue	
Sample	Lag	Uncorrected	Corrected	Uncorrected	Corrected
		A. (M-P, Y, R) system			
96:4	3	35.32*	33.15*	23.13*	21.72*
	4	27.04†	24.82	15.03	13.80
	6	27.20†	23.80	12.02	10.52
	8	29.63†	24.63	12.40	10.31
93:4	3	29.59†	27.63†	21.81*	20.36†
	4	21.12	19.24	13.78	12.55
	6	21.07	18.22	10.51	9.08
	8	23.30	19.03	12.21	9.97
90:4	3	31.44*	29.16†	20.77†	19.26†
	4	23.43	21.14	12.45	11.24
	6	25.05	21.33	10.26	8.73
	8	29.53†	23.57	14.23	11.36
89:4	3	30.99*	28.67†	21.07*	19.49†
	4	23.30	20.95	13.22	11.89
	6	24.43	20.67	9.59	8.12
	8	27.89†	22.07	12.66	10.02
88:4	3	28.37†	26.17	20.58†	18.98†
	4	20.40	18.27	12.51	11.21
	6	22.42	18.85	10.92	9.18
	8	24.17	18.95	13.00	10.19
87:4	3	26.64	24.50	20.14†	18.53
	4	18.28	16.30	12.20	10.88
	6	29.74*	24.83	22.25*	18.57
	8	31.29*	24.27	21.03*	16.31
86:4	3	29.62†	27.15†	19.45†	17.83
	4	20.79	18.46	12.09	10.73
	6	27.88†	23.10	21.25*	17.60
	8	32.15*	24.66	22.65*	17.37
85:4	3	25.70	23.48	19.24†	17.58
	4	18.88	16.68	12.68	11.21
	6	28.46†	23.39	20.94†	17.21
	8	35.02*	26.53	24.44*	18.51

Table A2. (continued)

Sample	Lag	Trace		Max-eigenvalue	
		Uncorrected	Corrected	Uncorrected	Corrected
		B. (M-P-Y, R) system			
96:4	3	13.66†	13.11	12.10†	11.61
	4	12.14	11.47	11.18	10.56
	6	14.66†	13.44	12.93†	11.85
	8	12.76	11.32	10.24	9.09
93:4	3	11.35	10.85	10.62	10.15
	4	9.87	9.29	9.61	9.04
	6	12.18	11.08	11.56	10.52
	8	9.69	8.51	9.35	8.21
90:4	3	14.24†	13.55†	12.85†	12.23†
	4	12.50	11.69	11.87	11.10
	6	15.60*	14.05†	14.81*	13.34†
	8	12.79	11.07	11.77	10.19
89:4	3	13.95†	13.25	12.59†	11.96
	4	12.21	11.38	11.62	10.84
	6	14.76†	13.25	14.01†	12.57†
	8	11.58	9.96	10.61	9.14
88:4	3	12.96	12.28	12.04	11.42
	4	11.41	10.62	11.16	10.39
	6	13.82†	12.35	13.57†	12.13†
	8	9.83	8.41	9.77	8.36
87:4	3	10.89	10.30	10.33	9.78
	4	9.43	8.75	9.39	8.71
	6	11.76	10.47	11.74	10.45
	8	8.54	7.26	8.51	7.24
86:4	3	10.09	9.53	10.00	9.45
	4	9.27	8.58	9.19	8.50
	6	15.29†	13.54†	15.21*	13.47†
	8	15.28†	12.91	14.76*	12.47†
85:4	3	13.58†	12.79	12.46†	11.74
	4	12.24	11.29	11.92	11.00
	6	17.69*	15.59*	17.64*	15.55*
	8	15.51*	13.01	15.50*	13.00†

Notes: This table shows complete test results for M1 cointegration with a dummy variable, corresponding to Table 2 of the text. Additional results are reported here with three and six lags and with the samples that end in 1986:4, 1988:4 and 1989:4. See also the notes to Table 1.

KOBE ECONOMIC & BUSINESS REVIEW, 42 (1997), 137-161

THE COMPETITION BETWEEN REGIONAL STANDARDS AND THE SUCCESS AND FAILURE OF FIRMS IN THE WORLD-WIDE MOBILE COMMUNICATION MARKET

JEFFREY L. FUNK **Kobe University**

Abstract

This paper describes the evolution of competition in the world-wide mobile communication market. Most firms have succeeded with products (infrastructure and phones) and phone services that are based on domestic standards, while relatively few firms (Ericsson, Motorola, and Nokia) have succeeded in the development of infrastructure and phones that are based on non-domestic standards. The lack of firms which have succeeded in non-domestic standards means that firms are given a significant competitive advantage when their countries create or adopt early a system which eventually becomes a world-wide standard. Systems that were adopted early and were open in terms of both content and the standard-setting process became world-wide standards.
JEL classification: L96; M11
Keywords: Cellular; Standards

1. Introduction

The growth in the mobile communication market is expected to continue well into the 21st century at a rate that is far faster than the wireline market. This growth has of course had a strong effect on the direction of many telecommunication equipment firms. For example, Ericsson, Nokia, and Motorola (which does not produce wireline equipment) had much higher sales of mobile communications equipment in 1996 than traditional wireline equipment. The growth rates in the mobile communications field for other major telecommunication equipment firms such as Alcatel, Lucent, Northern Telecom and Siemens also exceed their growth rates in the wireline equipment markets. Further, the mobile communica-

Corresponding Address:
Jeffrey L. Funk
Research Institute for Economics and Business Administration, Kobe University
2-1 Rokkodal-cho, Nada-ku, Kobe 657-8501, Japan
E-mail: funk@rieb.kobe-u.ac.jp
Fax: (81)-78-803-0399

tions equipment market may actually become bigger than the traditional wireline market as many developing countries become more dependent on mobile than wireline communication systems. (Egan, 1997; Frieden, 1997).

This paper argues that the success[1] of firms in the mobile communications market is strongly related to the evolution of standards. In each generation of technology, the most successful firms are from countries or regions whose mobile communication systems become world-wide standards. Few firms have been able to succeed in services, infrastructure, or phones that are based on what I shall call a "*non*-domestic standard" (i.e., a standard that was not adopted early in the firm's home country). Since the country or region that has been the source of the world-wide standards has changed each time the technology has changed, few firms (the exceptions are Ericsson, Motorola, and Nokia[2]) have had a large degree of success in more than one generation of technology.

Most firms have to a large extent ignored the standards that have been created outside of their own region. This is in spite of the fact that these firms have operations in most major countries as suppliers of central office switches, private branch exchanges, consumer electronics products, and/or mobile communication products. In cases where firms have attempted to develop products based on a non-domestic standard, most have failed due to a variety of reasons such as late market entry, a lack of good products, poor distribution systems, patent problems, a lack of design engineers with skills in the non-domestic standard, and poor access to the chips and discrete components developed for these standards. This is even the case when the firms have had a large technological advantage

---

1 Success is measured in terms of market share since market share is considered a good surrogate for profitability. Nevertheless, there are variety of ways used to measure market share in the mobile communications industry and even when the same method is used, the numbers often vary by source. In particular, the shares released to the press are typically inflated or use a measure that has the highest share for the particular firm. For phones, market share is typically measured on a per unit basis. US numbers are from Herschel Shosteck and Associates, Japanese numbers are from Nomura and Yano Research Institutes and Telecommunication Magazine (in Japanese), and the European numbers are from Yano Research Institute. For infrastructure, market share is typically measured in terms of the percent of subscribers connected to a firm's infrastructure. However, since this data is not available for all firms and standards, data from the US Department of Commerce on the percent participation in orders is used. Similarly, for services, although market share is typically measured in terms of the percent of subscribers connected to a particular carrier, since this data is not available for all countries and does not specify the participation by all carriers in a particular service (particular services usually include multiple investors), the percent participation in services is used. Nevertheless, since the percent participation does not account for the number of subscribers in the particular service, this method overestimates the market share for firms who have either supplied infrastructure to many small carriers or carriers who are operating particularly as a minority investor in many small markets.

2 For a discussion of the reasons behind the success of Ericsson, Motorola, and Nokia, see Funk, Jeffrey, "Creating Influence in Standards Development Through Success in "Non-Domestic" Standards," Kobe University Working Paper, August, 1997.

such as the advantage held by Japanese mobile phone producers in consumer electronics' technology.

The lack of firms which have succeeded in non-domestic standards means that firms are given a significant competitive advantage when their countries create or adopt early a system which eventually becomes a world-wide standard. Therefore, the factors which drive the selection of standards and the social and political factors that cause certain countries to create systems that became world-wide standards is of great interest to firms and policy makers. This paper first summarizes the evolution of standards. Second, it compares the degree of success by firms in each generation of technology. Third, the factors which drive the selection of standards and fourth the social and political factors that cause certain countries to create systems that became world-wide standards is described. Fifth, future competition in third generation systems is discussed.

2. The Evolution of World-Wide Standards

Table 1 shows the evolution of standards in countries which contain the world's leading producers of telecommunication products. The major advantage of digital systems (second generation) over analog systems (first generation) are in voice quality and in the level of efficiency which with they use the frequency spectrum. Low mobility digital systems are cheaper to install than conventional digital systems in high density areas[3] but the phones cannot be used in fast moving vehicles (PHS, DECT, and CT-2) and cannot be used to receive calls in the case of CT-2. Third generation systems are expected to include higher than existing frequency spectrum efficiencies and much higher than existing data transmission rates (greater than 1 Mbps) than second-generation cellular systems along with multi-media capability and world-wide roaming.

3 The cost effectiveness of PHS is debatable considering the deficits being run by the PHS operators. The PHS operators are unfortunately dependent on NTT's wireline system which is one if not the most expensive wireline system in the industrialized world. As a result, the PHS operators pay half their revenues to NTT. Nevertheless, there is widespread agreement that the capital costs for PHS are lower than that for existing cellular systems in high-density areas. Not only are switching stations not needed but PHS base stations are much less expensive than existing cellular base stations. For example, a PHS base station that covers a 100 meter radius can handle three calls and costs about $2000 to implement. A cellular base station that can handle 100 calls costs about (covers an area with a radius of 1 km) $1M. Therefore, the base station cost per potential call is $600 for PHS and $10,000 for cellular. In low-density areas, where coverage not capacity is the issue, cellular systems have lower capital costs per subscriber or per call.

Table 1 Evolution of Mobile Communication Standards in Major Countries and the Year in Which Service Began

Country	1st Generation Analog Cellular	2nd Generation Digital Cellular	3rd Generation Digital Cellular	Low Mobility Cellular
US	AMPS(83)	DAMPS(92), GSM(95), IS95 CDMA(96)	Wide-Band IS95 CDMA	none
Japan	NTT(79) TACS(89)	PDF(93) IS95 CDMA(98)	Wide-Band CDMA(99)	PHS(95)
Scandinavia	NMT(81)	GSM(92)	?	none
UK	TACS(84)	GSM(92)	?	CT-1
Italy	RTMS-450(85) TACS(89)	GSM(92)	?	DECT(98)
France	RC200(85) NMT(89)	GSM(92)	?	none
Germany	CNETZ(85)	GSM(92)	?	PHS or DECT(98)

In countries where a single standard was not chosen, the most widely used standards are shown in Table 1. For example, although a single digital standard was not adopted in North America, DAMPS, GSM, and IS95-CDMA are the most widely used digital standards. DAMPS was the most widely used standard in the early-to mid 1990s and IS95-CDMA and GSM are the most widely used standards in the new personal communication services which are being started in 1997 and 1998. Several of the standards are very similar. Since the only difference between AMPS and TACS are their channel spacings, they are often referred to as the same standard in this paper. Although PDC, DAMPS and GSM are all based on TDMA technology, there are many more differences between these three standards than between the AMPS and TACS standards[4].

4 The major differences between the three standards are in channel spacings, the number of time slots per channel (the number of calls per channel), and the number of cells which cannot reuse the same frequency. Although DAMPS uses the same channel spacing as AMPS (30kHz), there are three time slots per channel with DAMPS as compared to 1 time slot per channel with AMPS. PDC, like TACS, has 25 kHz channel spacings but like DAMPS, there are three time slots per channel. GSM has 200 kHz channel spacing and 8 time slots per channel. Further, with GSM the number of adjacent cells in which the same frequency cannot be reused is 1/3 that of PDC.

Table 2 The Evolution of World-Wide Standards

Generation of Technology	Gommunication Standard	The Standards Country or Region of Origin	Number of Adopting Countries (end of96)	Number and Percent of Generation's Subscribers	
				end of92	end of96
1st Generation Analog Cellular	AMPS/TACS	North America (83) & Britain (84) Scandinavia	103	17.6 80%	64.0 90%
	NMT	(81)	39	2.2 10%	5.0 6%
2nd Generation Digital Cellular	GSM	Europe(92)	101		36.0 72%
	IS95-CDMA?	US and Korea (96)	3		1.0 2%
Low Mobility Digital Cellular	PHS?	Japan(95)	1		4.0 98%
3rd Generation Digital Cellular	Wide-Band CDMA	Japan?(2001) US?(?)			

Table 2 shows the evolution of world-wide mobile communication standards. The degree to which a standard has become a "world-wide standard" is defined in terms of the number of countries which have introduced services and the number of people who have subscribed to a service which are based on the standard. For example, although there were only 5 million subscribers to systems based on the NMT system, 36 countries had introduced systems based on the standard by the end of 1996. For second-generation digital systems, the non-GSM or non-IS95 CDMA subscribers have primarily subscribed to services based on Japan's PDC system in Japan and to a lesser extent to North America's DAMPS standards. The country or region of origin refers to where the standard was first widely used.

Question marks are placed next to PHS, IS95 CDMA, and the third generation digital cellular systems since it is still unclear whether PHS, IS95 CDMA or which

third generation digital cellular system will become a world-wide standard. Although PHS systems have more subscribers than NMT and IS95 CDMA, there are more countries that have adopted both of the latter systems than PHS. Further, more than 20 countries are expected to begin services based on the IS95 CDMA system and these services are expected to have more subscribers than services based on PHS by the year 2000. Therefore, most people believe that IS95 CDMA has a much greater chance of becoming a "world-wide" standard than does PHS.

Although it is still too early to make a definitive forecast about third generation systems, it appears that more than one system or a hybrid of the Japanese and US systems will become the world-wide standard. The Japanese system is backed by NTT Docomo, major European (including Ericsson and Nokia) and Japanese manufacturers, and numerous non-Japanese service providers. The US system is backed by Motorola, Qualcomm, Lucent, Northern Telecom and several service providers.

Further, there will be continued competition between GSM, IS95 CDMA and third generation systems probably into the 21st century. The competition between these systems will depend on at least five factors. First, it will depend on the extent to which countries and carriers value world-wide roaming. The popularity of the GSM digital system provides the GSM system with a very large advantage over the other systems. GSM can be used in over 100 countries versus three countries for IS95 CDMA and presently none for both wide-band CDMA systems. Further, most areas within the three countries that have adopted IS95 systems do not have significant coverage and may never have significant coverage by IS95 systems. Therefore, carriers who have implemented IS95 systems are selling dual mode phones that are much heavier, larger, and more expensive than phones being used in alternative systems such as GSM or AMPS systems. It may be very difficult for these carriers to attract subscribers until the size, weight, and price of these phones decline substantially.

Second, the competition will depend on the extent to which countries and carriers value data communication. When wide-band CDMA is implemented in the year 2000, it is expected to have a 2 Mbps capability vs. projections of 384 kbps for IS95 wide-band CDMA and 115 kbps capability for GSM (Global Packet Radio Services). However, it's not clear there are a large number of applications for a 115 kbps service much less a 384 kbps or 2 Mbps service. As of early 1997, PDC had a 28.8 kbps (packet communication service), GSM a 9.6 kbps, and IS95 CDMA a 14.4 kbps capability. Both IS95 CDMA and GSM are expected to have a 64 kbps capability by the end of 1997. Nevertheless, it is estimated that fewer than 5% of the subscribers in the US, Europe, and Japan have the capability to

send data using their phones and less than 3% of the traffic is for data transmission.

Third, the competition will depend on the extent to which countries and carriers value frequency spectrum efficiency. Wide-band CDMA has 2-3 times the frequency spectrum efficiency of IS95 CDMA which has about twice the current frequency spectrum efficiency of GSM. Frequency spectrum efficiency is of large importance to Asian countries where population densities are high.

Fourth, the competition will depend on the expectations of countries and carriers; which standards do countries and carriers expect to become widely operational and thus costs decline and world-wide roaming becomes possible? The low cost, extensive features, and large diffusion of GSM systems provides it with a significant advantage over other systems. The backward and forward compatibility of the US consortium's wide-band and narrow-band system and the early implementation of NTT Docomo's system in Japan and Korea may increase the carriers expectations for these systems.

Fifth, the competition will depend on the type of system that is chosen by the International Mobile Telephone Group (IMT) for the Future Land Mobile Telephone System (FLPMTS). This system is supposed to provide many of the capabilities that are expected in third-generation cellular systems of which international roaming appears to be the most important capability. Japan has already announced its intention to propose NTT Docomo's wide-band CDMA system, North America is expected to propose a wide-band version of IS95 CDMA, and Europe is expected to propose a modified version of NTT Docomo's wide-band CDMA system. The decision will be finalized before the year 2000.

3. The Relative Success of Firms

Table 3 shows the degree of success by selected country/region for firms in mobile communication services, infrastructure, and phones in each generation of technology. Table 4 shows the most successful firms in these countries/regions. As shown in Table 3 and Table 4, most firms have succeeded with products and services that are based on the standards adopted in their home market (domestic standard) and they have failed to succeed in products or services that are based on a standard different from the standard (non-domestic standard) used in their home market.

Table 3 Degree of Success in Communication Standards (the cases of domestic standards are outlined) by Firms in Major Countries/Regions

New Technology	Communication Standard	Product Type	North American Firms	Japanese Firms	Scandinavian Firms	Other European Firms
Analog	AMPS/TACS	Service	high	none	none	none
Cellular		Infrastructure	high	none	Ericsson-high	none
		Phones	high	low	Nokia-med, Ericsson-low	Technophone-low
	NMT	Service	none	none	high	none
		Infrastructure	none	none	high	Philips-low
		Phones	low	none	high	none
Digital	GSM	Service	none	none	high	high
Cellular		Infrastructure	Motorola-medium	none	high	high
		Phones	medium	none	high	low
	DAMPS	Service	high	none	none	none
		Infrastructure	high	none	Ericsson-medium	none
		Phones	high	none	medium	none
	PDC	Service	none	high	none	none
		Infrastructure	Motorola-med	high	Ericsson-med	none
		Phones	none	high	none	none
Low Mobility	PHS	Service	none	high	none	none
Digital		Phones	none	high	none	none

Authors estimates based on data sources cited in article using the follow criteria: High is $>$ 40% or $>$30%, medium is between 25% and 39% or 20% and 29%, and low is between 15% and 25% or 10% and 19% for infrastructure (plus orders from multiple carriers) and phone or services respectively.

Table 4 Most Successful Firms in the Worldwide Wireless Communication Industries

Technology	Product Type	Most Successful Firms	Communication Standard
Analog	Service	AT&T, Baby Bells	AMPS/TACS
Cellular		Scandinavian Carriers	NMT
	Infrastructure	Motorola, Lucent, Northern Telecom(NT), Ericsson	AMPS/TACS
		Ericsson, Nokia	NMT
	Phones	Motorola, Nokia	AMPS/TACS
		Nokia, Ericsson	HMT
Digital	Service	European	GSM
Cellular		AT&T, Baby Bells	DAMPS
		Japanese	PDC
	Infrastructure	Ericsson, Motorola, Siemens, Alcatel, Nokia,	GSM
		AT&T, Ericsson, Motorola, NT	DAMPS
		NEC, Fujitsu, Ericsson, Motorola	PDC
	Phones	Nokia, Ericsson	GSM
		Motorola, Nokia, Ericsson	DAMPS
Low Mobility	Service	DDI Pocket, NTT Personal	PHS
Digital	Infrastructure	Kyocera, NEC	PHS
Cellular	Phones	Sharp, Kyocera	PHS

3.1 Analog

North American firms are the largest suppliers of analog services, infrastructure and phones since AMPS is the most widely used analog standard in the world and it was originally adopted in North America. As of 1993, North American carriers had been awarded 48% of the non-North American analog cellular licenses that had been awarded to foreign firms. North American infrastructure suppliers (See Table 5) participated in 53% of the non-North American analog infrastructure contracts[5]. Motorola is the largest supplier of analog phones in the world with about 40% market share.

British firms also benefited from the early adoption of the TACS system and its similarities to the AMPS system. Technophone was one of the largest producers of TACS and AMPS phones in the world (third in Great Britain) until its acquisition by Nokia in 1991. Vodaphone and Millicom operated or had started TACS- and AMPS-based services in 14 and 17 countries respectively as of 1994.

Scandinavian carriers along with Nokia and Ericsson are the leading suppliers of NMT-based products and services in the world. Scandinavian carriers had the second highest participation rate (23%) after the North American carriers in service contracts awarded to foreign firms for analog services since NMT was the second most widely adopted analog standard. For the same reason, Nokia and Ericsson are the major suppliers of NMT-based infrastructure (See Table 5 under analog domestic standards). As of January, 1996, Ericsson had supplied NMT based systems to 28 countries which served 67% of the 4 million total NMT world-wide subscribers.

---

5 Since sales figures for mobile communication infrastructure are not available, the number of subscribers served by a particular firm's infrastructure is typically used to measure market share. However, since this data is not available for all firms and standards, I have used participation in orders as a proxy for market share. Like the data on number of subscribers, one problem with this definition is that some firms supply a larger percentage of a mobile communication system than other firms. Further, an additional problem with using participation in orders as a proxy for market share is that some orders are much bigger than other orders.

Table 5 Percent Participation in Non-US Infrastructure Orders for Both Domestic and Non-Domestic Standards**

	Analog Standards			Digital Standards			Both Domestic and Non-Domestic	
Firm	Domestic		Non-Domestic	Domestic		Non-Domestic	Analog	Digital
Motorola	(AMPS)	36%	28%	(DAMPS)	50%	34%	26%	33%
Northern Telecom	(AMPS)	27%	0%	(DAMPS)	0%	4%	12%	8%
Lucent	(AMPS)	16%	2%	(DAMPS)	4%	4%	7%	4%
Plexsys	(AMPS)	28%	0%	(DAMPS)	8%	0%	10%	<1%
Total North America							53%	44%
Ericsson	(HMT)	76%	30%	(GSM)	30%	28%	39%	34%
Nokia	(HMT)	35%	<1%	(GSM)	17%	2%	8%	14%
Siemens	(CNETZ)	75%	0%	(GSM)	20%	2%	1%	16%
Alcatel	(RC2000)	0%	1%	(GSM)	20%	2%	2%	16%
Other	NA	3%	7%	(GSM)	7%	0%	5%	2%
Total Europe							39%	61%
Japan	(NTT)	100%	8%	(PDC)	91%	4%	9%	2%
Total*							100%	100%

* The sums of percent participation for individual firms is greater than 100% since multiple firms participate in most orders

** analog orders and 280 digital orders (through 3/97)

3.2 Digital

European firms are the largest suppliers of digital-based services and products with the adoption of GSM as a world-wide digital standard. European carriers such as Cable & Wireless, Vodaphone and the national telephone companies of France, Germany, Italy, Sweden, Norway, Denmark, Britain, and Spain are leading exporters of digital mobile communication services. For mobile phones, Nokia has become the largest, Ericsson the second largest, and Siemens the fourth largest producers of phones in Europe. Ericsson has used its knowledge of soon-to-be introduced features in GSM systems (e.g., frequency hopping and output power control which are important to raise system capacity) in order to be the first firm to develop and introduce phones that are compatible with these new fe-

atures.

In infrastructure, as shown in Table 5, European companies participated in a greater percentage of non-US digital equipment orders than US firms, a reversal from the analog situation. Further, without Motorola's success in supplying GSM- and PDC-based infrastructure, the percent of non-North American infrastructure orders which had participation from North American suppliers would have dropped even further than the 53% to 44% drop which occurred in the change from analog to digital technologies. Ericsson, Nokia, Alcatel and Siemens are the leading European suppliers of GSM-based infrastructure. In January, 1996, there were 18 million GSM subscribers in more than 80 countries and half of the subscribers were connected to an Ericsson system. Siemens and Alcatel, who are two of the largest producers of wireline switching equipment in the world increased their participation in non-North American infrastructure orders from about zero in analog infrastructure (the market for CNETZ equipment was very small) to 20% in digital infrastructure.

With the success of GSM, it has been largely forgotten that in the late 1980s few people expected the non-Scandinavian European firms to become successful in the mobile communications field. The weakness of European firms in the information, consumer electronics, and semiconductor industries made most people believe that the European market would be dominated by US and Japanese firms[6]. Even Ericsson was pessimistic about succeeding in digital phones due to the strength of Japan's chip industry[7]. However, not only do the European firms largely dominate the European digital market, the success of GSM has enabled European firms to become the leading suppliers of digital mobile communications equipment and phones in the world.

3.3 Low Mobility Digital Cellular

Since there is almost no participation by foreign firms in the Japanese PHS market, Japanese firms are expected to dominate the foreign, albeit small foreign market for PHS. As of the end of 1996, Japanese firms had received 10 billion Yen in orders and they expected to receive 100 billion yen in orders per year through the year 2000. Most of these orders were expected to come from carriers in Thailand, Hong Kong, China, the Philippines, Indonesia and Australia.

---

6 Doubts raised over Europe's ability to meet date for digital radio, Financial Times, October, 21, 1986, p. 15.

7 Financial Times conference on world mobile communication, November 9, 1986, p. 12.

4. Factors Driving the Selection of World-Wide Standards

Table 6 Selected Information for Selected Mobile Communication Systems

Generation of Technology	System	Introduction Date	The Standard's Country or Region of Origin	In Country or Region of Origin soon after introduction		Degree of Openness
				# of Subscribers (1000s)	Petetration Rate (%)	
First Generation Analog Systems	AMPS	1983	US	400(86)	16(86)	High
	NMT	1981	Scandinavia	310	1.5	High
	TACS	1984	UK	150	.28	High
	CNETZ	1986	W.Germany		<.01	Low
	RC2000	1985	France		<.01	Low
	NTT	1979	Japan	50	<.05	Low
	RTMS	1985	Italy		<.01	Low
Second Generation Digital Systems	DAMPS	1992	US	<10(93)	<.01(93)	High
	GSM	1982	Western Europe	500(92) >1000(93) >4000(94)	>.4%(93) >1.6% (94)	High
	PDC	1993	Japan	<10(93) 600(94)	<.01%(93) .5%(94)	Low
	IS95	1995	US and Korea	1000(96)	.3%(96)	High
Low Mobility Digital Cellular	PHS	1995	Japan	4000(96)	3%(96)	Medium
	CT-2	1994	Hong Kong	175(96)	1%(96)	High

Table 6 summarizes for selected cellular systems a number of factors that are generally believed to affect the choice of standards: date of introduction of service, the initial growth rates of service both in terms of the number of subscribers and penetration rate, and the openness of the standard. Similar to other non-mobile communication industrial standards, services based on the world-wide mobile communication standards were introduced very early and acquired users very quickly. For example, services based on AMPS, TACS, and NMT which can be defined as the analog world-wide standards had acquired more than 80% of the world's subscribers by the end of 1986 - this was less than three years after

service had been started in the US and UK. Further, in spite of the small population in Scandinavian which was where the NMT system was conceived, almost one-fourth of the world's subscribers were using an NMT-based system at the end of 1986. The high penetration rates achieved in Scandinavia (almost ten times that of the US at that time) caused a large number of countries to adopt services based on the NMT system. Further, many countries, for example Belgium, the Netherlands, Luxembourg, Spain, and Austria decided to adopt the NMT system before services had started in the US. The early introduction of service and acquisition of subscribers is also characteristic of the world-wide digital standard, GSM. At the end of 1993 and 1994, more than 99% and 80% respectively of the world's digital subscribers were connected to a GSM-based system.

However, in addition to the early introduction of service and acquisition of subscribers, the degree of openness is also an important characteristics of those systems which became world-wide standards. Openness is measured in terms of the extent to which: 1) the system's specifications are made available to all interested parties; 2) the standard setting process is clear and participation is open to all firms including foreign firms; 3) the reasons for decisions within the standard setting process are specified in the resulting specifications; and 4) rules concerning intellectual property rights are made clear. As shown in Table 6, the systems which became analog and digital world-wide standards are considered very open in terms of these four factors and they are considered much more open than the systems which did not become analog and digital world-wide standards.

For example, it is generally agreed that a lack of openness in Japan's analog (NTT), digital (PDC), and its low mobility digital cellular systems (PHS) are key reasons why the NTT and PDC systems did not become and PHS may not become a world-wide standard. Although the NTT system was introduced two years before the NMT system was introduced in 1981, no other countries have adopted the NTT system. PDC was introduced only slightly later than GSM, it is similar in terms of both technology and performance to GSM (better efficiency in the use of the frequency spectrum), and by the end of 1994, Japan had more digital subscribers than any other country in the world. Nevertheless, whereas more than 100 countries have adopted GSM-based services, no other country besides Japan has adopted PDC-based services. It is generally agreed that NTT Docomo controls the PDC standard including the standard setting process and this is a major reason for its lack of adoption by other countries.

PHS has also not been adopted by the rest of the world to the extent that its rapid growth in subscribers in Japan and its relative low costs suggests that it would be adopted. In comparison to other low-mobility systems, Japan's PHS system is vastly superior in performance to CT-2 and similar to DECT which was

not scheduled to be first installed until two years after PHS was installed. Therefore, many people expected PHS to become the world-wide standard in the market for low-mobility cellular systems which were also expected to become an important niche market in mobile communications. Nevertheless, PHS is only enjoying a modest level of success in that only two countries are expected to begin PHS-based services in 1997. It is generally agreed that the delay in opening details of the PHS system to foreign infrastructure and phone producers has discouraged many countries from adopting PHS. Foreign firms were not invited to participate in the standard setting process and the system specifications were not made public until one year after service was started in July, 1995.

Further, contrast the openness of the mobile communication systems which became world-wide standards with that of a well-known industrial standard, the Wintel computer standard (Microsoft windows and Intel microprocessor) in terms of the four factors presented above. First, the Wintel computer standard is only made available to certain firms and even then it is often alleged that key interfaces of the latest software are kept secret. Second, in spite of the fact that the Wintel computer standard constantly changes, the standard setting process is closed; it is only open to a limited extent and only to those firms whom Microsoft and/or Intel invite to participate. Therefore, third, the reasons for decisions about the standards are not made available in public specifications. Fourth, the intellectual property rights concerning the use of the standard are not made clear; they are under are constant negotiation between Microsoft, Intel, and other firms.

This comparison between the Wintel computer standard and the mobile communication standards highlights the importance of openness to the mobile communication standards. Whereas most of the products and services that have become standards in other industries, in particular defacto standards have been created by individual firms, the degree of openness needed to create world-wide mobile communications standard has required different strategies for success. The systems which have became world-wide standards have been created by government sponsored organizations in order to ensure a high degree of openness. Each standard setting process including the degree of openness in this process has reflected a country's or region's institutional, philosophical and market characteristics at that time.

5. Social and Political Factors that Caused the Creation of Systems that Became World-Wide Standards

Institutional, philosophical, and market differences have caused government sponsored organizations to make different decisions concerning mobile com-

munication standards. This section discusses these differences.

5.1 Analog

North America (AMPS), Scandinavia (NMT), and Great Britain (TACS) each adopted a single analog communication standard that was open to all firms. All three countries/regions believed that a single standard was necessary in order to promote inter-connectivity and economies of scale. For example, in order to reduce the risk of obsolescence to early users in North America, all subsequently made phones were required to be compatible with the AMPS standard. Great Britain's carriers, in particular Vodaphone, wanted to adopt the AMPS standard in order to benefit from the potential economies of scale in handsets. However, since AMPS was not perfectly compatible with the frequencies allocated to mobile communication in Great Britain, Vodaphone and Cellnet adopted a version of AMPS that was modified for the British market (TACS). North America and Great Britain subsequently experienced falling service prices through competition between carriers (a duopoly was introduced in each region).

Scandinavian countries realized falling prices through the desire by carriers to increase demand. The Scandinavian carriers cooperated on the creation of NMT through the oversight of each countries Ministry of Public Telecommunications. The ministries and carriers believed that the potential market for mobile communication was large due to the lack of an adequate wireline system, concerns about safety on the roads in the long, cold winters in Scandinavia, and the relative success of the pre-cellular mobile communication systems in Scandinavia.

Other European countries and Japan allowed their public telephone companies to control the analog mobile telecommunication services and the result was the adoption of unique standards and the slow introduction of competition. For example, Germany (CNETZ450), France (RC2000), Italy (RTMS-450), and Japan (NTT System) initially adopted standards which have not been used much outside of the country of origin. Although Germany and France attempted to collaborate with Great Britain on the creation of a world-wide standard, the efforts were too late and the firms in the countries were unable to overcome their competitive rivalries. Germany, France and Italy did not introduce competition until GSM was introduced in 1992 and Japan did not introduce competition until 1989 when DDI and IDO began providing service. Further, unlike the Scandinavian carriers, the public telephone companies in these countries did not attempt to create demand with lower prices. Instead, they took a very cautious approach in capital spending and user fees.

For example, NTT did not believe there was a large market for mobile communication services in Japan and thus did not install many base stations and set

user fees at high levels (Wakabayashi, 1984). Further, Japan's Ministry of Public Telecommunications (MPT) originally started the mobile communications service in order to create an amukudari post for an MPT official. The MPT attempted to minimize complaints by setting fees high to prevent people from subscribing who could not afford the service. Therefore, it set a basic monthly charge of 40,000 Yen (US$333 at August, 1997 exchange rates) and it rented the phones because it thought the purchase of phones would confuse users. It also restricted the hours of service to 8-12 AM and 1-5 PM. The MPT was also influenced by the Ministry of Transportation whose offices were adjacent to the MPT at the time. The MPT controlled the renting of phones and the awarding of spectrums like the Ministry of Transportation controlled vehicle licenses[8].

5.2 Digital

With digital technology, North America took a very different approach than with analog technology. North America used its success in the personal computer industry as a model for setting standards in digital cellular and personal communication services. It has approved a number of communication standards and encouraged competition between them in the expectation that the best "defacto" standard would emerge. In the case of digital cellular (before personal communication services), it required that the digital systems be constructed such that analog phones could also be used in them. Although the cost to change the infrastructure from analog to digital was relatively small due to the design of the most widely used digital standard (DAMPS) and AMPS, dual-mode phones were required which were more expensive and heavier than the AMPS phones. Since the carriers felt that users would not be interested in these phones, this naturally discouraged the implementation of digital systems.

Further, North America has less of a need for digital cellular than many other countries due to its lower population densities and lower traffic. One of the major advantages of digital cellular is that it uses the frequency spectrum more effectively than analog cellular. However, the low population densities that exists in most parts of North America means there are few shortages of frequency spectrum. Further, there is lower traffic in North America due to the fact that owners of mobile phones must pay for both outgoing and incoming calls in North America which reduces the incentive for users to either pass around their phone numbers or leave the power on. North American mobile phone numbers are not distinguishable from wireline numbers so from a consumer advocate's stance, it would be unfair for someone to pay for a more expensive mobile phone call when they

8 Personal communication with NTT Docomo official who wishes to remain anonymous.

didn't realize they were calling a mobile phone.

In Japan, NTT Docomo (NTT Docomo was spun off from NTT in 1992) continued to dominate the mobile communication standard setting process with the move towards digital technology. Further, since NTT Docomo was not allowed to operate services overseas, it had little interest in creating a world-wide standard. Although Japan's MPT did require NTT Docomo to use the same TDMA technology that GSM and DAMPS are based on, the frequencies that it allocated for digital cellular systems were not compatible with these systems. The result was that NTT Docomo used its control of the standard setting process to create a relatively closed unique standard that continues to help it to dominate the Japanese market.

Europe on the other hand, had multiple analog standards and it wanted to adopt a single digital standard (GSM) in order that the same phone could be used in different countries. Discussions concerning a digital standard began in the early 1980s between European service providers, infrastructure makers and ministries of telecommunications from multiple countries and they occurred simultaneously with discussions to create a single European common market. These firms and ministries decided to move to digital very early due to their optimistic forecasts about digital technology. The multi-country standard-setting process created a fully documented standard in which there were more than 10 times the amount of documentation than with Japan's PDC system. It was also flexible in that the standard could be used with three different frequencies (900 MHz, DCS 1800 MHz, and PCS 1900 MHz).

It is interesting to speculate on what would have happened if Japan had allocated frequencies that are compatible with GSM and adopted the GSM standard instead of the PDC standard. Since Japan has much more expensive cellular service than European countries, Japanese consumers would probably have benefited from a lower-cost GSM service. Further, the adoption of GSM would have helped Japanese producers of mobile phones and infrastructure. The early adoption of the GSM standard certainly would have solved the patent problems that were faced by Japan's mobile phone producers and thus enabled them to be more successful than they are now in the GSM mobile phone market. It would probably have also helped Japan's producers of infrastructure compete in the GSM market in that the Japanese firms could have been the firms that solved GSM's frequency spectrum weakness and thus filled this niche in the supply of GSM infrastructure. The major weakness of GSM is that its initial versions were not very efficient in terms of using the frequency spectrum. Since Japan now has the greatest needs in terms of frequency spectrum efficiency, Japanese firms could have been the firms who first solved these problems as opposed to Ericsson who

is now steadily increasing the frequency spectrum efficiency of GSM for the Asian markets where this is required. As of 1997, the frequency spectrum efficiency of GSM is now equal to full rate PDC[9] and Ericsson believes that it will be possible for GSM to equal half-rate PDC in the future[10].

5.3 Low-Mobility

In low mobility cellular communications, it appears as if Japan's standard (PHS) has the greatest chance, albeit a relatively small chance, of becoming a world-wide standard. Japan adopted a significantly different philosophy than North America and Europe in their approaches to personal communication services. The Japanese Ministry of Posts and Telecommunications would only approve a system that was 1/4 as expensive as cellular technology in order to open a new mobile communication market for the masses. This directive required Japanese firms take full advantage of the low cost potential of the small cell, small base station approach whereas Europe and North America (as of early 1997) decided to create personal communication systems that are almost identical to digital cellular. Because both North America and Europe have decided that communication in a fast moving vehicle is a necessary capability in a mobile communication system, their personal communication systems do not utilize as small of cells as the Japanese system and they include complex switching equipment which also raises the costs of the system.

The MPT also wanted PHS to become a world-wide standard and for Japanese manufacturers to become the leading suppliers of the PHS-based phones, infrastructure, and services. In particular, it believed that countries with high-population densities, for example Asian countries would introduce services based on the PHS standard. However, the MPT underestimated the importance of an open standard and the extent to which foreign firms could use the lack of openness to discourage the adoption of PHS. Similar to the behavior often attributed to Japan's Ministry of International Trade and Industry[11], the MPT delayed the opening of the standard in order to give Japanese manufacturers an advantage.

---

9 Although PDC has 1/3 the channel width per call (25 kHz for 3 calls) of GSM (200 kHz for 8 calls), with GSM the number of cells in which the frequency cannot be reused is 1/3 that of PDC. For example, for the same cell size, PDC requires 21 adjacent cells to use different frequencies vs. 7.5 cells with GSM (although the actual numbers change with the size of the ceil, the ratios of cells for PDC and GSM do not change). Further, GSM includes the concepts of micro-cells within macro-cells where different frequencies are used in both the micro- and macro-cells. This enables GSM to effectively use the frequency spectrum in the areas of a city which have the highest traffic. Smart Tone has this type of GSM system operating in Hong Kong.

10 Personal communication with Dr. Martin Hallerdt, Senior Manager, Telecom Standards and Regulations for Nippon Ericsson KK.

11 *Trading Places: How We Allowed Japan to Take the Lead,* Prestowitz, C.V. Jr, 1988, NY: Basic Books; MITI and the Japanese Miracle, Johnson, C., 1982, Stanford University Press)

Although Japanese manufacturers now dominate the PHS markets both in Japan and elsewhere, it is generally agreed that the size of the market is much smaller than it would have been if foreign manufacturers had been allowed to participate in the standard-setting process.

5.4 Third Generation Systems

By the mid-1990s, general agreement was reached among most participants on several key characteristics of the mobile communication industry. First, the market was very large; the market had surpassed every forecast. Second, firms from countries whose system becomes a world-wide standard have a large competitive advantage over other firms. Third, systems will only become world-wide standards if they are open both in terms of content and participation by domestic and foreign firms. Fourth, the decision by the ITU to choose a single world-wide standard in 1999 encouraged firms to begin efforts to create a world-wide standard without first creating a country or regional standard.

These four factors plus key aspects of the Japanese market caused NTT Docomo to be the first firm to propose a third-generation system. Key aspects of the Japanese market include NTT Docomo's large profits through its domination of the Japanese market, its easy access to NTT's well-funded (by Japanese tax dollars) research programs, changes in NTT's charter which will enable it to operate services overseas, and MPT's pressure on NTT Docomo to either create or adopt a world-wide standard. NTT Docomo's large profits and its access to NTT's research programs made the development of a third generation system possible. The ability to operate overseas and MPT's pressure either to create or adopt a world-wide standard caused NTT Docomo to promise the creation of an open standard and to invite foreign participation.

In early 1997, NTT Docomo announced that it would work with Korea Mobile Phone, China Telecom, Australia Telstra, and Singapore Telecom and that it had invited carriers from North America (including AT&T), Great Britain, Sweden, France, Germany, Italy, Thailand, Malaysia, Indonesia, and New Zealand to participate (these carriers are not installing IS95 systems) in the development of a wide-band CDMA system. It also announced that it had invited Ericsson, Lucent, Fujitsu, NEC, and Matsushita to supply infrastructure and Motorola, Nokia, NEC, Matsushita, Mitsubishi, Sharp, and Toshiba to supply handsets for the experimental systems.

In May, 1997, a four-firm US group consisting of Motorola, Qualcomm, Northern Telecom, and Lucent announced the development of a wide-band version of IS95 CDMA. Within a few days of the announcement, Ericsson, Nokia, and Siemens announced that they would support NTT Docomo wide-band CDMA sys-

tem. Rumors suggest that there is large chance that NTT Docomo will adopt a GSM network interface in the wide-band system at the request of Ericsson and Nokia. This network interface will make it easier for carriers to adopt Docomo's wide-band system particularly since Docomo's original proposal included an ISDN network interface and most countries have not installed ISDN in their wireline systems[12].

At the same time that Ericsson, Nokia, and Siemens agreed to support Docomo's wide-band system, Japanese carriers who had previously agreed to adopt IS95 CDMA complained about their lack of invitation and were invited to participate in the development of a wide-band version of IS95 CDMA. Therefore, within one months time, it was determined that both of the competing systems were to be developed by not just regional consortiums but multi-regional consortiums. Further, these events also demonstrated the importance of openness and foreign participation to the creation of world-wide standards in the mobile communications industry.

It will be interesting to see how much the US consortium and NTT Docomo continue to open their standards to foreign participation. Qualcomm, the largest holder of IS95 patents and a member of the US consortium is charging relatively high royalties for the patents and it is attempting to control the production of key chips for the handsets in the case of IS95 CDMA. Similar actions with the wide-band system will reduce the rate of cost reductions in handsets and thus discourage carriers from adopting the US consortium's standard.

NTT Docomo has created an international team and it claims that it will open its standard much more than it has done in the past with its second generation digital standard, PDC. Nevertheless, its recent actions in the Japanese market suggest that it will use the propriety of PDC to gain market share and it will not be satisfied unless it has a complete monopoly[13]. An important question is how much pressure will Japan's MPT put on NTT to create a system that has a high chance of becoming a world-wide standard.

---

12 If a GSM network interface is used in the wide-band CDMA system , operators who have already adopted GSM can use their GSM switching equipment in the wide-band CDMA system. Further, many countries, particularly third-world countries do not have a public telephone ISDN network so if an ISDN network interface is a required part of the wide-band CDMA system, a country that wanted to adopt NTT Docomo's wide-band CDMA system would have to install a public ISDN system.

13 NTT Docomo was able to delay the introduction of digital cellular systems by other carriers through its slowness to release key information on PDC. It has also restricted the sale of handsets by other carriers for the PDC system and it has not made its 28.8 kbps or its messaging services available to other Japanese carriers. Since December, 1996, it has used these advantages (along with its financial advantage from having a ten year monopoly until 1989) to gain more than 80% of new subscribers in the Osaka and Tokyo regions.

6. Future Competition Between Firms

It is still too early to forecast whether IS95 or either wide-band CDMA system will become a standard on the level of GSM or AMPS. Further, it is still to early to say which firms other than Qualcomm and NTT Docomo will succeed in products and services that are based on narrow-band or wide-band CDMA technology. Nevertheless, it is safe to say that if a form of CDMA becomes a world-wide standard, the firms located in the country or region where it is initially heavily adopted will receive a significant advantage in the world-wide market. These firms will be able to develop experience in their home markets and based on this experience will be able to sell services, infrastructure, and phones to the rest of the world.

It is also possible to summarize the advantages and disadvantage of countries. In other words, which country has the best chance develop a large amount of experience in the standards that will be installed the most in the early years of the 21st century? Currently, it appears that these technologies will be IS95 and wide-band CDMA and improved versions of GSM. The Korean and North American advantages lie in their early development and implementation of IS95 CDMA and in the case of North America its strong infrastructure suppliers, primarily Motorola. At the end of 1996 there were more than 700,000 IS95 subscribers in Korea and a few thousand in North America (plus about 60,000 in Hong Kong). This provides Korean firms with their first opportunity to be a major producer of mobile communications products. However, it is expected that by sometime in 1999, there will be more IS95 subscribers in North America than in Korea. The experience from implementing and operating these systems will provide a large initial advantage to North American firms such as Motorola, Lucent, and Northern Telecom.

The disadvantages for North America include the lack of a single standard and slow market growth. Since the lack of a single North American digital standard in the late 1980s and early 1990s was one reason the rest of the world chose GSM, the lack of a single standard with respect to personal communication services does not encourage firms to adopt North American standards such as IS95 CDMA. The recent slow growth in the North American market raises questions about what will drive a large scale diffusion of IS95 or wide-band CDMA in North America. And unless there is a great deal of diffusion of either IS95 or wide-band CDMA in North America, North American firms may not develop the experience necessary to be the major suppliers of CDMA services, infrastructure, and phones in the world-wide market. Forecasts for a slow growth in subscribers (25% a year) and voice traffic (even lower growth rates) in 1997 in North Amer-

ica coupled with its low penetration rate (20% as of 8/97) as compared to Scandinavia and recently Japan (see below) suggest that expansion of system capacity will not drive a large scale diffusion of IS95 CDMA. Further, the recent slow growth and low penetration rate in North America also suggests that the needs for data communication in North America are much lower than those in Scandinavia and Japan. Therefore, expansion of system capacity for either voice or data communication will most likely not drive a large scale diffusion of IS95 CDMA or wide band CDMA in North America.

The financial problems that North American carriers are experiencing will also reduce the chances for both a large scale adoption of IS95 in North America and exports of infrastructure based on the IS95 standard from North America. Many carriers, in particular the new carriers who are implementing IS95 CDMA (AT&T did not implement IS95) are having difficulty paying the US government for the frequency space they acquired in the auction and acquiring financing for the construction of infrastructure. These problems will most likely increase as the next wave of auctions results in lower prices for the frequency spaces than were paid in the first wave of auctions. Many infrastructure makers are forced to provided more than 100% financing in order to receive an infrastructure order. While Ericsson is reportedly turning down orders that contain such requirements, Lucent (AT&T) and Northern Telecom are apparently aggressively pursuing these orders. The financing of these orders will reduce the funds available to these firms for the development of improved CDMA infrastructure and the sales of CDMA in foreign markets.

Japan's advantages include the fastest growing market for mobile communication (including PHS and cellular) and the largest shortage of frequency spectrum. The number of subscribers has been growing about three-to four times faster than other major countries in 1994 (100%), 1995 (200%), and 1996 (150%). The market for mobile phones in Japan is now the largest in the world and its penetration rate (25%) is several percentage points higher than the North American penetration rate. If present trends continue (800,000 cellular and 300,000 PHS per month or increasing at 1% a month), Japan's penetration rate will become equal to the Scandinavian penetration rates by the end of 1998. Further, voice traffic is much higher in Japan than in North America; for example, while the average income per subscriber was about 17,000 Yen (about $140) per month in Japan in 1996, it was less than $50/month in North America. The high voice traffic, penetration rates, and rapid growth in penetration rate suggest that there may also may be rapid growth in data communication traffic which combined with the increasing voice traffic and high population densities means that IS95 and even wide band CDMA may be implemented on a wide-scale due to shortages in the frequency

spectrum. Even with the full use of half rate PDC or IS95 CDMA (both roughly equivalent in terms of the frequency spectrum efficiency), only 40 million users can be accommodated in Japan. If present trends continue, Japan will have 40 million cellular subscribers before the year 2000. If this occurs, NTT Docomo will need to begin changing its half rate PDC systems to wide-band CDMA and DDI and IDO will need to change not only their analog but also their PDC systems to IS95. Naturally, the allocation of frequency spectrum for wide-band CDMA by Japan's Ministry of Posts and Telecommunication will also force carriers towards wide-band CDMA.

Japan's disadvantages are its inability to agree on standards and its poor performance in international standard setting activities. Japan adopted unique standards in both analog (NTT) and digital technology (PDC) due to NTT Docomo's dominance of the standard-setting process. Although the successful implementation of PHS may suggest that Japan is capable of agreeing on a single effective standard, the inability of the PHS carriers to choose a single data communication standard (32 kilobit standard), the decision by IDO and DDI to choose IS95 CDMA over PDC, and the inability of NTT Docomo and the other carriers to work together on wide-band CDMA suggests otherwise. Several firms have publicly announced they will not support NTT Docomo's standard in the committees which will choose the nation's wide-band CDMA standard in the Association of Radio Industry Business unless NTT Docomo allows handset suppliers to sell their phones to other carriers[14].

Europe's advantages are its high penetration rates in Scandinavia, its success with GSM, and its strong infrastructure suppliers - Ericsson and Nokia. The high penetration rates of Scandinavia suggests that it may also be an early user of data communication and thus an early adopter of high data communication services in its GSM system. Further, the success of GSM both has taught European firms to effectively write specifications for large scale communication systems and suggests that the rest of the world will be looking to Europe for leadership in FLMTS.

Europe's disadvantages are its slow growth outside of Scandinavia and Great Britain. For example, three of its largest countries, Italy (10.3%), Germany (6.8%) and in particular France (3.8%) had very low penetration rates at the end of 1996; far less than the levels of the US and Japan. These low penetration rates suggest that there is little need for systems (either IS95 or wide-band CDMA or

14 NTT Docomo requires its handset suppliers to wait about six months before they sell their newest handsets to other carriers which enables NTT Docomo to sell better handsets than the other carriers. Nikkei Shinbun, 8/7/9, p. 9. Anxieties about Docomo's Technology Monopoly in the Warped 10 Years of Dominating Mobile Communication - The Obstacle of Allowing Outside Sales (Ido denwa kokufuku dekiruka 10 nen no yugami docomo no gijtsu dokusen ni kenmei - gaihan kyodaku kabe).

improved GSM) with higher data communication rates or higher efficiencies in the frequency spectrum. Therefore, European firms will have trouble developing experience in these areas. Their best chance of developing these experiences is probably in the US and Japanese markets.

7. Conclusions

This paper describes the evolution of competition in the world-wide mobile communication market. Most firms have succeeded with products (infrastructure and phones) and phone services that are based on domestic standards, while relatively few firms (Ericsson, Motorola, and Nokia) have succeeded in the development of infrastructure and phones that are based on non-domestic standards. The most successful firms are from those countries which have created systems which became world-wide standards. Systems that were adopted early and were open in terms of both content and the standard-setting process became world-wide standards.

Although the openness of these systems was partly due to the role played by government sponsored organizations in their creation, the next generation of systems will be created without the sponsorship of a single country's or region's government. Instead, firms are attempting to create an world-wide standard without first creating a country or regional standard. They are doing this by creating an open, international standard-setting process.

KOBE ECONOMIC & BUSINESS REVIEW

CONTENTS

NO.39 (1994)

NO.40 (1995)

NO.41 (1996)

Published on February 1998
by
Research Institute for Economics & Business Administration(RIEB)
Kobe University

2-1Rokkodai-cho, Nada-ku, Kobe 657-8501, Japan
Phone: 81-78-803-0383
F a x: 81-78-861-6434
Home page at http:// www.rieb.kobe-u.ac.jp/

Printed in Japan