Strategic Interdependence: Quasi-Experiment in the Maritime Industry during the 1880s in Japan

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Abstract

Without a sufficiently informative dataset, it would be difficult to explore strategic interdependencies among firms, such as demand estimation. This paper investigates strategic interdependence through a unique historical case of duopoly in the Japanese maritime industry during the 1880s. Yubin Kisen Mitsubishi, led by Iwasaki Yataro, was a monopoly. A new entrant, Kyodo Un'yu, led by Shibusawa Eiichi, offered superior services and implemented a strategy of one-sided fare reductions. Yubin Kisen Mitsubishi delayed in taking countermeasures. This paper regards this delay as a quasi-experiment, and reveals the process by which Kyodo Un'yu gained market share. A simple elasticity calculation shows that a 1% price cut by Kyodo Un'yu resulted in a 10.065% increase in cargo transport demand.

Keywords: Strategic Interdependence, Duopoly, Price Reduction, Elasticity, Maritime Industry, Shibusawa Eiichi, Iwasaki Yataro.

JEL Classification: D43, N75, N85, R41.

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Exploring strategic interdependencies among firms, such as demand estimation, could not be easily done without an appropriate data set (Ackerberg, Benkard, Berry, and Pakes, 2007; Davis and Garces, 2009; Nevo, 2011). In terms of this aspect, special cases do exist in history: one company in a duopoly market implemented a price-reduction strategy while its rival did not change its strategy remarkably. The duopoly market this paper discusses here is the Japanese maritime industry during the 1880s. This duopoly was caused by the emergence of new entrants in a formerly monopolistic market. The former monopoly was Yubin Kisen Mitsubishi, led by Iwasaki Yataro. The new entrant is Kyodo Un'yu, led by Shibusawa Eiichi. The latter initiated the one-sided price reduction. The paper regards this price reduction by Kyodo Un'yu as a quasi-experiment to analyze the strategic interdependence of the two firms.

The history of Yubin Kisen Mitsubishi and Kyodo Un’yu can be summarized as follows (Nippon Yusen Kaisha, 1936; 1956; 1988a; Oishi, 2008; Matsuda and Shinohara, 2018; Takeda and Sekiguchi, 2020). The origin of Yubin Kisen Mitsubishi is the Tsukumo Shokai shipping company founded by the Tosa clan in 1870. In May 1875, this company was renamed Mitsubishi Kisen Kaisha. Kisen means shipping, and Kaisha means company. In the same year, Japan and Taiwan clashed militarily. Yataro Iwasaki petitioned the government to entrust his company with military transportation. The government accepted this petition and adopted a policy of sole protection for Mitsubishi Kisen Kaisha. In September 1875, the company changed its name again to Yubin Kisen Mitsubishi. Yubin is the Japanese translation for postal. By the late 1870s, the negative effects of Yubin Kisen Mitsubishi's monopoly, such as rising shipping fares and aging vessels, became problematic. Those who recognized such negative influence would have promoted the founding of Kyodo Un’yu in 1882. Kyodo means cooperation, and Un'yu means transportation. Since Iwasaki Yataro had supported politician Okuma Shigenobu financially, those who had been anti-Okuma also participated in the founding of Kyodo Un’yu. This company initiated one-sided price reductions between 1883 and 1884. In February 1885, Iwasaki died, and these companies merged to form Nippon Yusen Kaisha (NYK Line).

The purpose of this paper is to examine strategic interdependence in the maritime industry before the establishment of Nippon Yusen. While Takeda and Sekiguchi (2020)

provide a detailed analysis on fares strategies of Yubin Kisen Mitsubishi, they faced the lack of data on fares of Kyodo Un'yu. Fortunately, Nippon Yusen Kaisha company history, which is not the most recent version but an older version, contains only two years of data on shipping revenues and transport volumes. This paper utilizes this data set to quantify the strategic interdependence of the two companies.

Using the data set, this paper shows that Kyodo Un'yu pursued aggressive reductions in fares for cargos but that Yubin Kisen Mitsubishi became late to respond. The paper regards this delay in response as a quasi-experiment to test how a price reduction on one side would change the market share of each of the two companies.

This paper derives the strategy of Kyodo Un'yu from the archive of Shibusawa Eiichi's letter to his friend. This company had purchased vessels in advance to increase its loading volume, i.e., supply capacity, before implementing aggressive price reduction. Yubin Kisen Mitsubishi's response to this strategy was delayed. As Takeda and Sekiguchi (2020) have already found, the company had reduced shipping fares to some extent due to deflationary policies during the early 1880s. Yubin Kisen Mitsubishi did not have the capacity to lower shipping fares again in response to Kyodo Un'yu.

The contribution of this paper is to quantify the strategic interdependence in the case of duopoly in the maritime transportation during the industrialization phase in Japan. This paper finds that Kyodo Un'yu gained market share from Yubin Kisen Mitsubishi by reducing fares and providing quality service, and that Kyodo Un'yu resulted in a 10.065% increase in transport volume through a 1% reduction in fares.

There are other examples of new entrants into monopolistic markets creating strategic interdependence of duopolies. One example is the U.S. soft drink market. Gasmi, Laffont, and Vuong (1992) explore cost and demand functions to examine Nash and Stackelberg behavior using data on the Coca-Cola and Pepsi-Cola markets from 1968 to 1986. Another example was the start of Soviet nuclear testing in the 1950s. This new entrant ended the U.S. nuclear monopoly and created a confrontational situation between the two countries. The "Prisoner's Dilemma" has been popularized as a concept to explain this Cold War situation (Poundstone, 1992).

This paper finds that Kyodo Un'yu could increase its payoffs by the one-sided price reduction strategy in a prisoner's dilemma game and that Yubin Kisen Mitsubishi reduced payoffs without countermeasures. The relationship between the two companies would differ from the simple Nash equilibrium in the prisoner's dilemma.

The Nash behavior was realized after the death of Yataro Iwasaki in February 1885. A few weeks after his death, the two companies signed an agreement to stop extreme competition through the mediation of the Tokyo Prefectural Government. Competition between the two companies had been causing small local shipping companies to lose customers. In spite of the agreement, *shusenya* (the middlemen) who had contracted with each company to handle the cargos decided to lower the fares without permission. In an unexpected way, the prisoner's dilemma was realized. The government decided to merge the two companies under the mediation of the Navy. *Shusenya* could earn income based on the number of customers. The situation in which agreements reached at the top level are not enforced due to distorted incentives at the organization's end or by counterparties is an essential problem that arises even today (Marshall and Marx, 2020).

Nippon Yusen Kaisha, the new company established after the M&A, began to pay middlemen a fixed salary by grade. The company took this measure to avoid encouraging excessive customer traffic. In the late 1880s, shipping companies were being established one after another. Although Nippon Yusen Kaisha remained the dominant shipping company, a more competitive market emerged. Japanese maritime industry during the 1880s is an interesting subject from a microeconomics perspective.

The remainder of the paper is as follows. Section 1 explains the background of the founding of Yubin Kisen Mitsubishi and Kyodo Un'yu respectively. Section 2 describes Kyodo Un'yu's pricing and service strategies and Yubin Kisen Mitsubishi's reaction to them, and explains how Kyodo Un'yu's strategy implementation represents a quasi-experiment. Analyses of both companies' revenue per unit and demand volumes are summarized in Section 3. Section 4 details the merger history of the two companies, along with a discussion. Finally, Section 5 concludes. In the Appendix, the original Japanese sentences of the cited archives are listed.

1 Historical Background

This section explains (1) the history of Yubin Kisen Mitsubishi and the harmful effects of its monopoly, and (2) the circumstances surrounding the establishment of Kyodo Un'yu. Related literature in English, such as NYK (1936) and Matsuda and Shinohara (2018), gives more details.

1.1 Monopoly

In 1874, for the conquest of Taiwan, the government decided to outsource military transport to Mitsubishi Shokai. On this occasion, the company had the advantage of forming a telegraph network connecting its head office in Tokyo with its branches in Yokohama, Osaka, Kobe, and Nagasaki (Mizukami, 2018). In May 1875, the company was changed its name to Mitsubishi Kisen Kaisha. The government had already instituted a policy of sole protection for Mitsubishi Kisen Kaisha. The Tokyo Maru and 13 other vessels purchased by the government during the conquest of Taiwan were transferred to the company without consideration. This special measure was intended to increase production and logistics and promote trade through low-cost marine transportation. In September of the same year, the company was renamed Yubin Kisen Mitsubishi. Although many shipping companies in each region were committed to marine transportation, Yubin Kisen Mitsubishi was the only shipping company that was able to transport goods over long distances throughout the Japanese archipelago. The company must have gained a considerable advantage by linking the nation's major ports with a communications network.

Under this monopoly, the company used three pretexts to drive up shipping fares. First, inflation caused by the Civil War of 1877. Second, the company decided to require the purchase of marine insurance and collect insurance premiums as well (Teishinsho, 1941, p.929). The last means of raising the price was to list shipping fares in U.S. dollars. The shipping fares became raised roughly to 1.6 times effectively (Shibusawa Seien Kinen Zaidan Ryumonsha, 1956, pp. 35-36).

Albert R. Brown, advisor to the Japanese government on shipping, has submitted his report to the government on the state of the shipping industry. In this report, he noted that lack of ships and lack of shipping facilities had not only hindered the development of trade but had also caused losses to our nation (Nippon Yusen Kaisha, 1988b, p,449).

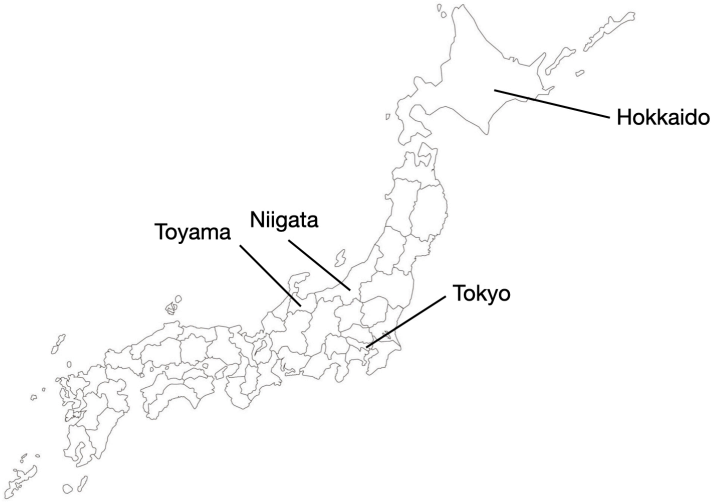
Price raising and under-supply would be two characteristics of a monopoly. These characteristics were also observed in Yubin Kisen Mitsubishi's monopoly.

1.2 Duopoly Established by New Entrants into a Monopoly

In the 1880s, a movement emerged in many areas for sole proprietorships of shipping companies to combine and form corporate entities such as Hokkaido Un'yu and Echu Fuhansen. These shipping companies were too small to compete with Yubin Kisen Mitsubishi and had a limited business area. The government began to seek to create shipping companies large enough to compete with the company.

Tokyo Fuhansen Kaisha was founded in 1880. Eiichi Shibusawa's cousin, Kisaku, was the first founder. Hideyuki Totake, a captain in the Navy, was appointed president. Takashi Masuda, a manager of Mitsui & Co. Masuda, worked hard to gather investors, including Nozo Fujii, who devoted himself to the shipping industry in Toyama Prefecture, and Sansaku Kagitomi, a wealthy man from Niigata Prefecture.

Figure 1 Map: Tokyo, Hokkaido, Niigata, and Toyama



Iwasaki Yataro had three obstacles in his way against Tokyo Fuhansen. First, he tried to persuade those who had helped establish the company to become his allies. In 1881, Fujii established Echu Fuhansen with himself as director. Echu is the old name of Toyama. Fujii might have expected to obtain Iwasaki's cooperation. The second strategy was to spread gossip about the new company. At the time, Kisaku Shibusawa had borrowed money from Dai-Ichi Kokuritsu Bank, of which Eiichi Shibusawa was president, to cover losses from the speculation in rice trading. Iwasaki used this loan as an excuse to get newspapers and magazines to run scoops on the new company in an attempt to ruin its reputation and make it less competitive. Iwasaki's third strategy was to use political pressure. Iwasaki complained to Okuma Shigenobu that Shibusawa Eiichi was in the wrong. However, Shibusawa was saved from trouble by Godai Tomoatsu, a businessman close to Shibusawa, who convinced Okuma.

A turning point also came to Iwasaki and Okuma. Ito Hirobumi and others who favored a German-style constitutional monarchy ousted Okuma's faction, which believed that a British-style parliamentary cabinet system should be followed as a model. Okuma formed a political party, Rikken Kakushin-To (the Constitutional Reform Party), with a view to establishing a parliamentary system. Ito Hirobumi and his close confidant Inoue Kaoru found the growth of this party unfavorable. Their rivalry also turned to Iwasaki, who financially supported Okuma's political activities. Ito also took an interest in Jiyu-To (the Liberal Party), a rival to Rikken Kakushin-To. JIyu-To remained critical of Iwasaki's monopoly in the maritime industry. The spread of dissatisfaction with Iwasaki through the political activities of Jiyuto became also convenient for Ito and Inoue.

Inoue Kaoru approached Shibusawa Eiichi and Takashi Masuda to merge Tokyo Fuhansen, Echu Fuhansen, and Hokkaido Un'yu into a new company. While Echu Fuhansen had been established with Iwasaki's involvement, negotiations proceeded through Sansaku Kagitomi, a collaborator in the establishment of Tokyo Fuhansen and a supporter of the shipping industry in Hokuriku.

In 1882, Tokyo Fuhansen, Echu Fuhansen, and Hokkaido Un'yu merged to form Kyodo Un’yu. This new company had a business area that encompassed the seas around Japan as Yubin Kisen Mitsubishi had already done. Of Kyodo Un’yu's capital of 6 million yen,

3.4 million yen was privately financed, while the remaining 2.6 million yen was financed by the government. 6 million yen at that time would be worth more than 200 billion yen (or $1.5 million) today, considering that the starting salary for elementary school teachers in 1886 was 5 yen (Asahi Shimbun, 1988). The government's investment was conditioned on the company's ability to handle military transportation in times of emergency. In addition to the government investment, the Bank of Japan loaned Kyodo Un'yu 300,000 yen for one year at an interest rate of 8%. Upon repayment of the loan, the interest was waived in response to a petition from Kyodo Un'yu. This exemption constituted an extra-judicial measure not only regarding the loan but also the interest rate (the Bank of Japan, 1982, p. 334).

Kyodo Un'yu's first president was Navy Rear Admiral Toshiyoshi Ito, and its vice president was Hideyuki Toyotake, former president of Tokyo fuhansen. The founders were Takashi Masuda, Kisaku Shibusawa, and Sansaku Kagitomi, as well as businessmen such as Takenosuke Mitsui and Kihachiro Okura, who were competing with Iwasaki. While Eiichi, by virtue of his position as president of Daiki-Ichi Kokuritsu Bank, was not to be named to the management team of Kyodo Un'yu, he had to become a de facto advisor on management matters.

2 Supply Capacity and Services

This section confirms (1) the supply capacity of both companies and the attitude of their fares strategies and (2) non-price competition, and then shows (3) that Kyodo Un'yu's one-sided fares reduction can be regarded as a quasi-experiment for demand estimation.

2.1 Supply Capacity

In September 1883, Shibusawa Eiichi sent a letter to his business associate Godai Tomoatsu. In the letter, Shibusawa informed Godai that Kyodo Un'yu would increase the number of vessels "next year," i.e., in 1884, and that he planned to implement reductions in shipping fares. The important sentences of the letter are quoted as follows:

> “(September 24, 1883)…Since last year, business has been sluggish and financial activity has been slow, and the banking business has been inadequate. What is your outlook for the future? If there is anything you have noticed, please let me know....(omitted)...Kyodo Un'yu Kaisha is also committed to gradually adding vessels to its fleet, and next year we will be able to make significant reductions in our shipping fares.” (Shibusawa Seien Kinen Zaidan Ryumonsha, 1971, p.395)

Shibusawa's letter clearly indicates his intention to carry out a bold strategy of reducing fares. Once the price reduction competition starts, demand would be expected to increase. Let me next examine whether the management policies that Shibusawa wrote about in his letter were carried out.

Table 1 Supply Capacity of the Two Companies as of 1885

	Number of Vessels	Total registered tonnage	Average registered tonnage per vessel	Standard deviation of registered tonnage
Kyodo Un’yu	27	16,562	613.4	437.3
Built before 1883	13	5,651	434.7	331.5
Built after 1884	14	10,911	779.4	468.5
Yubin Kisen Mitsubishi	29	22,208	765.8	423.9
Built before 1883	27	19,428	719.6	401.6
Built after 1884	2	2,780	1,390.0	55.2

Source: Oishi (2008, Table 1).

Table1 shows basic statistics of the loading capacity of vessels owned by Kyodo Un’yu and Yubin Kisen Mitsubishi, respectively, as of 1885. The measurement of loading capacity this paper uses is registered tonnage, which is a ship's total internal volume. The basic statistics used here are the number of vessels, total registered tonnage, average registered tonnage per vessel, and standard deviation of registered tonnage. Since the year of manufacture is known for each vessel, they can be grouped into two categories: vessels built before 1883 and vessels built after 1884.

Kyodo Un'yu's supply capacity as of 1885 can be summarized as follows, with a notable increase in 1884. This company owned 27 vessels as of 1885, with a total tonnage of 16,562 tons, giving an average (± standard deviation) of 613.4 (±437.3) tons per vessel. Of these vessels, 13 were built before 1883, with a total tonnage of 5,651 tons, or an average of 434.7 (±331.5) tons per vessel. 14 vessels were built after 1884, a total tonnage of 10,911 tons, or an average of 779.4 (±468.5) tons per vessel. In 1884, the company increased its supply capacity by 1.8 times over the previous year. Takeda and Sekiguchi (2020) point out that Kyodo Un’yu expanded its lines by 6 routes in 1884.

Yubin Kisen Mitsubishi owned 29 vessels as of 1885, with a total tonnage of 22,208 tons, giving an average (± standard deviation) of 765.6 (±423.9) tons per vessel. Yubin Kisen Mitsubishi was ahead of Kyodo Un'yu in terms of vessel loading capacity. Of these 29 vessels, 27 were built before 1883.

As of 1884, newcomer Kyodo Un'yu had many new ships in operation. The newer vessels were well appreciated by customers for their ability to transport them more quickly. This reputation was also known to the employees of Yubin Kisen Mitsubishi, who reported a sense of urgency in a report to Yataro Iwasaki, an employee of Yubin Kisen Mitsubishi (Takeda and Sekiguchi, 2020).

Yubin Kisen Mitsubishi purchased two 1,000-ton class vessels in 1884. Takeda and Sekiguchi (2020) have already confirmed that (1) Yubin Kisen Mitsubishi had reduced shipping fares under the deflationary policies of the early 1880s, and (2) the company issued notification at the end of 1884 indicating that it would be acceptable to follow Kyodo Un'yu's fare reductions—as of November of the same year, an internal notice proposed a 15% refund per 100 yen.

Oishi (2008) points out that Yubin Kisen Mitsubishi sought to improve management efficiency by closing unprofitable routes and increasing the number of voyages by reducing sailing intervals and the number of sailing days. In the midst of these management policies, new and larger vessels began to sail. Until both the increase in supply capacity through the purchase of large vessels and the shift in the route strategy, it might have been too difficult for the company to reduce fares.

2.2 Services

Takeda and Sekiguchi (2020) have found in their archival research on Yubin Kisen Mitsubishi that there was internal sharing of information on the service reputations of the two companies. Kyodo Un'yu posted a manager at the Port of Yokohama who was dedicated to serving ship guests, and this manager gave instructions to each vessel regarding the reception of guests.

According to explanations by Takeda and Sekiguchi (2020), Yubin Kisen Mitsubishi members asked those who recommended the company's vessels the reason for their recommendation in May 1885. The answer was that there had been a difference in the attitude of the waiters. When the passengers asked for hot tea on Yubin Kisen Mitsubishi vessels, the waiters sometimes did not respond, or even if they did, they did not bring the tea for a long time. On the Kyodo Un'yu, on the other hand, the waiter would rather ask the passengers if they wanted tea, and when they asked the waiter for tea, he was always willing to help them. Furthermore, when a passenger became ill, Kyodo Un'yu did not leave it up to the waiter, but had other crew members take turns to check on the passenger.

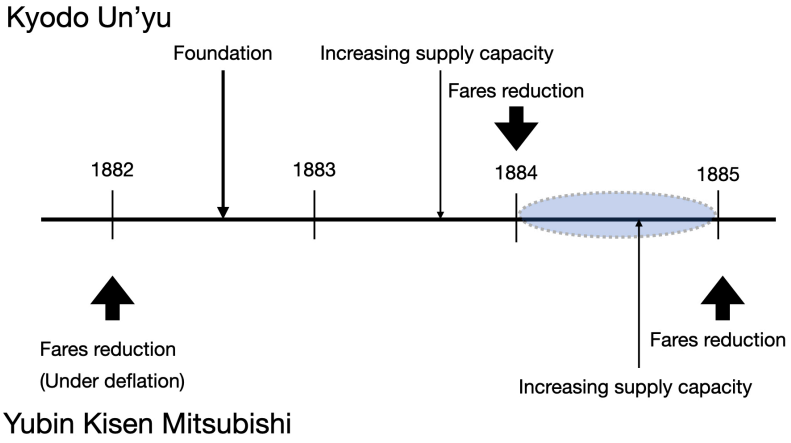
Such non-price competition would be more pronounced for ship passengers than for cargos (Nippon Yusen Kaisha, 1956; 1988a; Oishi, 2008; Takeda and Sekiguchi, 2020). An important non-price competition in cargos was transit. Customers valued not only lower fares, but also the convenience of moving cargos from ship to ship at relay ports. Shippers in Otaru, Hokkaido, who wanted to use Yubin Kisen Mitsubishi to deliver their cargos to Tokyo had to take it to Hakodate, also in Hokkaido, before transshipping it onto a ship bound for Tokyo. Many Otaru shippers could become frustrated. In light of this situation, Kyodo Un'yu started a direct route between Otaru and Tokyo.

As already discussed on Table 1, Yubin Kisen Mitsubishi lagged behind Kyodo Un'yu in terms of purchasing newer vessels. Kyodo Un'yu had a better reputation in non-price competition, such as the attitude of its waitstaff, the concern of its crew members when their health deteriorated, the relay of cargos at ports, and the speed of its vessels.

2.3 One-Sided Price Reduction as a Quasi-Experiment

Figure 2 shows the timeline of the fare reductions by Yubin Kisen Mitsubishi and Kyodo Un'yu. This paper focuses on the fact that Kyodo Un'yu reduced its shipping fares from 1883 to 1884, while Yubin Kisen Mitsubishi's countervailing reduction was delayed by about one year.

Figure 2　Time Line



As Oishi (2008) and Takeda and Sekiguchi (2020) have already pointed out, Yubin Kisen Mitsubishi reduced shipping rates between 1882 and 1883 in response to requests from brokers to contract with customers to accept shipments at ports in the face of ongoing deflation.

Kyodo Un'yu had used the year 1883 as a run-in period to increase its supply capacity before lowering its rates, and in 1884, as Shibusawa Eiichi had intended, the company decided to lower its rates. At this point, Yubin Kisen Mitsubishi no longer had the capacity to supply, but it purchased a larger vessel in 1884 and the following year. This purchase is considered to be an increase in supply capacity with the intention of lowering fares. In increasing supply capacity, Iwasaki Yataro could have observed the extent to which Kyodo Un'yu's reduction in fares deprived its customers. Based on his own observations, Iwasaki could have decided to increase supply capacity. Under this view, the quasi-experiment described in this paper is merely a reproduction of Iwasaki's observations 140 years later.

3 Revenues and Fares

This section (1) examines the data and (2) calculates price elasticities of demand to determine what percentage of Yubin Kisen Mitsubishi customers would have increased in response to this company's 1% price reduction.

3.1 Revenues per Unit

Table 2 shows the shipping revenues of the two companies for passenger and cargos, respectively, in 1883 and 1884.

Table 2 Revenues and Fares of Two Companies

	Kyodo Un'yu		Yubin Kisen Mitsubishi		Two companies	
	1883	1884	1883	1884	1883	1884
Passengers						
Revenue (yen)	41,087	196,113	817,979	634,462	859,066	830,575
Number	14,377	67,499	195,267	157,498	209,644	224,997
Revenue per unit	2.858	2.905	4.189	4.028	4.098	3.691
Cargo						
Revenue (yen)	336,200	807,953	2,216,001	1,663,214	2,552,201	2,471,167
Tons	35,525	286,539	555,207	551,670	590,732	838,209
Revenue per unit	9.464	2.820	3.991	3.015	4.320	2.948
Total revenue (yen)	377,287	1,004,066	3,033,980	2,297,676	3,411,267	3,301,742

Data Source: Nippon Yusen Kaisha (1956, p.20)

Kyodo Un'yu's passenger volume increased from 14,400 to 67,500, while Yubin Kisen Mitsubishi's passenger volume decreased from 195,300 to 157,500. Dividing the revenue per passenger by the number of passengers, Kyodo Un'yu and Yubin Kisen Mitsubishi's revenue per passenger changed from ¥2.85/person to ¥2.91/person and from ¥4.19/ person to ¥4.03/person, respectively. If we consider the unit cost of revenues as shipping fares, Kyodo Un'yu succeeded in expanding its customer base even though it did not lower its shipping fares. In other words, Kyodo Un'yu took customers away from Yubin Kisen Mitsubishi through non-price competition.

Kyodo Un'yu increased from 55,500 tons to 286,500 tons, while Yubin Kisen Mitsubishi decreased from 555,200 tons to 551,700 tons. Kyodo Un'yu and Yubin Kisen Mitsubishi reduced their unit prices from ¥9.47/ton to ¥2.82/ton and from ¥3.99/ton to ¥3.01/ton, respectively. Kyodo Un'yu's price reduction was more remarkable than that of Yubin Kisen Mitsubishi. Kyodo Un'yu's reduction strategy succeeded in attracting customers for cargos as well as passengers.

In Yubin Kisen Mitsubishi, reductions in shipping rates for both passengers and cargos can be observed. Oishi (2008) notes the role of brokers in attracting customers at ports, and points out that they were lowering shipping fares regardless of the intentions of the head office of the shipping company with which they contracted. While the unit price revenue data would contain some degree of noise with upward bias, the market share of Yubin Kisen Mitsubishi could not avoid decreasing.

3.2 Elasticity

Table 3 shows the growth rates of revenue and unit revenue, for passengers and cargo for the two companies from 1883 to 1884, and the ratios of these growth rates. This paper regards this value as price elasticities of demand.

Table 3 Price Elasticity of Demand

	Kyodo Un'yu	Yubin Kisen Mitsubishi
Passengers		
$g_q = \frac{\Delta Revenue}{Revenue}$	3.695	-0.193
$g_q = \frac{\Delta RevenuePerUnit}{RevenuePerUnit}$	0.017	-0.224
$\frac{g_q}{g_p}$	221.873	0.862
Cargo		
$g_q = \frac{\Delta Revenue}{Revenue}$	7.066	-0.006
$g_q = \frac{\Delta RevenuePerUnit}{RevenuePerUnit}$	-0.702	-0.249
$\frac{g_q}{g_p}$	-10.065	0.026

Kyodo Un'yu is calculated to have an elasticity of -10.065 for cargo. Negative elasticity implies a case where a price reduction leads to an increase in the quantity demanded. The calculated value implies a 10.065% increase in the quantity demanded for a 1% decrease in price. On the other hand, this company is calculated to have an elasticity of -221.873 for passengers. This value indicates an extremely high sensitivity of demand to price changes, which suggests factors other than price may be influencing demand. One factor pointed out by this paper is the consequence of excellent services provided by the company.

For Yubin Kisen Mitsubishi, elasticities are calculated with negative values for both ship passengers and cargo (-0.862 and -0.026, respectively). This company lost market share to Kyodo Un'yu in both non-price competition in the passenger segment and price competition in the cargo segment. If Iwasaki had been able to observe this situation, he might have been considering a reduction, particularly with regard to cargo, by purchasing newer vessels to increase his company's supply capacity.

4 Merger

This section describes (1) the adverse effects of duopolistic competition in the maritime transport industry and (2) mergers to overcome these adverse effects, and confirms (3) the existence of the unique middlemen who act as intermediaries between shippers and shipping companies to reduce fares.

4.1 Negative Effects of Duopoly

Competition between Kyodo Un'yu and Yubin Kisen Mitsubishi became a serious problem for the maritime industry. The biography of Inoue Kaoru, who was in charge of the Ministry of Foreign Affairs at the time, describes how competition between the two companies was putting pressure on small and medium-sized shipping companies in various regions. The important sentences of the letter are quoted as follows:

> “With the advent of Kyodo un'yu, Mitsubishi had no choice but to engage in business regardless of profit margins in order to maintain its maritime rights, including lower freight rates, competition for voyages, and customer retention. The old selfish attitude was gradually corrected, and traders and passengers alike finally began to benefit. However, as was natural, where there was one advantage, there was one disadvantage: the two companies, Kyodo and Mitsubishi, were competing with each other to lower shipping rates, compete for customers, and compete for ships. The result of this competition not only put each other's businesses in jeopardy, but also affected small rowers nationwide, making it difficult for them to do business. The business difficulties of the small shipping companies in turn caused a slump in the shipbuilding industry, which was an unfortunate trend in the development of the maritime transport industry in Japan.” (Inoue Kaoru Ko Denki Hensan Iinkai, 1968, p.559)

In February 1885, Iwasaki Yataro passes away. During the period before and after his death, the Ministry of Agriculture and Commerce made several attempts at peace and arbitration between the two companies. As a result of these arbitrations, an agreement was reached between the two companies, the main objective of which was to reduce competition.

However, *shusenya* (middlemen) at the ports, who were facilitating customers for the shipping companies, started a proxy war on behalf of the shipping companies. These *shusenya* served to convey to the headquarters a variety of information, including the reputation of other companies' services (Takeda and Sekiguchi, 2020). On the other hand, they engaged in hidden actions. The revenue from commissions given to *shusenya* was a performance-based fee according to the number of clients brought in. *Shusenya* on both sides ignored the agreement at the head office level and lowered fares on their own initiative (Oishi, 2008). Both companies entered into a prisoner's dilemma unwillingly. Assuming that such shusenya behavior was also occurring in 1884, one would have to say that the data in this paper contains some noise. This point is a limitation of this paper.

Despite the agreement, *shusenya*'s actions intensified the competition to reduce fares. Both the management of the two companies and the government had to take different actions to deal with the situation.

4.2 Establishment of Nippon Yusen Kaisha

On September 25, 1885, the founding committee of Nippon Yusen Kaisha (hereafter, NYK), chaired by Masazumi Morioka, president of Kyodo Un'yu, submitted an application for the establishment of NYK to the Minister of Agriculture and Commerce, Tsugumichi Saigo, who granted the charter with an order consisting of 37 articles on September 29, and on October 1, Kyodo Un'yu and Postal Steamer Mitsubishi were merged to form NYK Line. NYK submitted its articles of incorporation to the Japanese government and received approval from the Ministry of Agriculture and Commerce on November 7, and on December 15, the articles of incorporation were approved at the first general meeting of shareholders (Nippon Yusen Kaisha, 1936; 1956; 1988a).

The articles of incorporation established strict rules for shipping rates. Changes in passenger and cargo fares are subject to approval by the Minister of Agriculture and Commerce (Nippon Yusen Kaisha, 1988b). Prior to approval, the decision shall be made by the President, Vice Presidents, and Directors. Changes in fares and cargo handling charges were to be advertised in the newspapers. These newspaper advertisements could be expected to prevent *shusenya* from opportunistic behavior.

The situation prior to the founding of NYK was sometimes described in the economic discourse as "Kyodo has ships but no human resources, and Mitsubishi has human resources but no ships" (Matsushita, 1940, p. 4). While Kyodo Un'yu's had cutting-edge vessels, the skills of its crew and engineers had lagged behind. On the other hand, Yubin Kisen Mitsubishi had an aging vessels but a reputation for having the human capital to operate its vessels. The merger of the two companies to form NYK Line resulted in a new management team that was dominated by members of the Yubin Kisen Mitsubishi side (Nippon Yusen Kaisha, 1988a). In this respect, the establishment of NYK can be seen as a successful matching of management personnel with cutting-edge facilities.

5 Concluding Remarks

This paper examines the facts of the Japanese maritime transportation industry during the 1880s, when a large new entrant entered a market dominated by a single shipping company, and the two companies merged after fierce competition. Kyodo Un'yu gained market share from Yubin Kisen Mitsubishi through non-price competition in the passenger market and through reductions in fares in the cargo market. As for cargo, the reduction strategy worked, with a 10% increase in demand for a 1% reduction in fares.

Various shipping companies were founded, including Osaka Shosen in 1884 and Asano Kaisoubu (later Toyo Kisen) in 1886. The maritime transport industry also developed as a result of the development of the joint-stock company system. Shipping companies led Japan through a new era of industrialization and the expansion of trade on the Pacific Rim. In the duopoly between Kyodo Un'yu and Yubin Kisen Mitsubishi, demand was never inelastic with respect to price.

Japanese maritime industry during the 1880s would be an interesting subject from a microeconomics perspective, involving monopoly, Bertrand competition, organizational failure, and the promotion of further competition. Further research would be needed to understand how these markets have changed and evolved in response to changes in the competitive landscape.

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Appendix 1 Quotation from the Letter from Shibusawa to Godai

「（明治一六年）九月二四日…（中略）…昨年来諸商業不景気、金融も寛裕ニて銀行業も不充分ニ御坐候、大坂ハ別而商業之不振ニハ相感候様子ニ相見へ候、此末之御見込如何、御心附も御坐候ハヽ来示被下度候…（中略）…共同運輸会社も追〃船舶相増頻ニ尽力いたし、来年ニ相成候ハヽ、運賃ハ著しき下落も相見へ可申可歟」（渋沢青淵記念財団竜門社 Shibusawa Seien Kinen Zaidan Ryumonsha, 1971, 395頁）

Appendix 2 Quotation from the Biography of Inoue Kaoru

「共同運輸の出現によつて、三菱も自己の海上権を保持するためには、運賃の低下・航海の競争・顧客の維持等利益の多少を問はず事業に従事せねばならなかつた。かくして従来の専恣な態度は次第に匡正され、貿易業者や一般旅客は漸く便益を得るようになつた。併し亦一利ある所に一害の生ずるのは自然の数である。共同・三菱両会社が互いに雄を争うて、運賃の値下・顧客の争奪・船舶の競航をなし、月を遂うてそれが激烈となり、この競争の結果は啻に相互の経営を危殆に導いたばかりでなく、その影響は全国の小運漕業者にも及ぼし、その営業を困難ならしめた。小運漕業者の営業困難は引いては造船業にも不振を来たし、我が海運界の発展上おもしろからぬ傾向が生じた」（井上馨侯伝記編纂委員会 Inoue Kaoru Ko Denki Hensan Iinkai1968, 559頁。一部、旧漢字を改変）