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Abstract

In this paper, I have explained the locomotive supply arrangement that supported the rapid development of Japan's railway industry at the turn of the century while focusing on the independence of Japanese mechanical engineers and the export of American-made locomotives to Japan. As a result, this paper clarified how American locomotive manufacturers dismantled the British monopoly, and penetrated the Japanese market, by paying attention to changes in technological development and business systems on the demand side of the railways, and the role of the international trading companies that mediated the supply of locomotives and rolling stock. In particular, I examined the case study of Frazer & Co. as an agent of Baldwin Locomotive Works by investigating cooperation related to the marketing activities of trading companies and makers in the locomotive industry. The trading companies, such as Frazer & Co., introduced the locomotive manufacturers to the engineers of railway companies, government officers, and academics in Japan, China, and elsewhere. In the emerging market, the search and transaction costs between makers and customers were very expensive. The trading companies in Japan or China had information related to the emerging market and contributed to lowering these costs to increase overall profits.

Introduction

The purpose of this paper is to reexamine the international background to the development of Japanese railways by investigating the dynamics of the supply mechanism for railway rolling stock, especially steam locomotives, which made possible the rapid development of Japan's railway industry in the period from the 19th to the 20th centuries.

Jones (2005) has, from a long-term perspective, termed the unprecedented scale of the integration of the world economy that occurred in the late 19th century as the “first global economy.” In particular, the integration of the product market proceeded with alacrity due to the arrival of the transport revolution in the transition period of the 19th to 20th centuries, causing export competition to intensify among the Western advanced countries. Providing an overview of the world market for locomotives, American and German locomotive makers fought to keep pace with British makers, who had pioneered locomotive exports, bringing about a relentless struggle for market share throughout the world. The main market also shifted from Europe and South America in the 1880s to the early 1890s, to East Asia in the late 1890s, and then to British and French colonies in the 1900s. What should be emphasized among these shifts is that the importance of the East Asian market grew from the 1890s onward, with the core of that market being Japan.

It is thought that intensification of international competition over the Japanese market allowed the railway companies, the prospective customers for locomotives, to reduce the costs and delivery times for material procurement and expand the scope of technological choice. In that sense, it can be presumed that there existed in the background to the rapid development of Japanese railways an international environment as well as a material procurement system that made possible a stable supply of railway materials at moderate cost. Railways, in an island country such as Japan, were considered to be an entirely domestic venture by previous studies. However, we can say that the issue of railway development within one country cannot be discussed without a study of the background of globalization during that era. Therefore, I clarify the various international momentum related to the establishment of Japan’s railway industry by focusing on steam locomotives, which represent one of the most important inventions of the 19th century and were the most advanced machines around the turn of the 20th century.

In addition, it is also necessary to pay attention to the role played by trading companies in mediating the import and export of locomotives to emerging markets, such as East Asia, in the early 20th century. We have to consider why trading companies were needed, both by the locomotive manufacturers and their client railways.

Research on steam locomotives in Japan has been carried out in various disciplines. In the field of economic history, Minoru Sawai provided a comprehensive description of the formation and development of Japan’s railcar manufacturing industry (Sawai 1998). However, the focus of Sawai’s research was the establishment process of the railcar manufacturing industry as an example of a building-type of machine industry, which differs from this paper’s focus on the supply of locomotives, which were essential to the railway industry’s expanded reproduction process. For this reason, the turn-of-

the-century period that is the main focus of this paper (the 1890s and 1900s) is treated only as pre-history in Sawai's seminal work on railcar manufacturing history.

On the other hand, one of the best books on steam locomotives in the US is the case study of the Baldwin Locomotive Works by John Brown (Brown 1995). Steven J. Ericson examined marketing activities by American locomotive manufacturers in Japan and competition among British, American, and German locomotive manufacturers in the Japanese market based on the diary of Willard C. Tyler who was a travel agent of the Schenectady Locomotive Works (Ericson 2005). This is the important previous research related to marketing activities of American locomotive makers around the turn of the century.

In addition, a substantial amount of research has been accumulated on the importation activities of Japanese and international trading companies around the turn of the century. One example of such research on international trading companies is Kanji Ishii's study of the Jardine Matheson & Co. (Ishii 1984). Ishii examined the activities of foreign trading companies by analyzing company documents at the account ledger level of Jardine Matheson, and clarified the state of "external economic pressure" during the period of reform at the end of the feudal system. However, Jardine Matheson's documents were of limited value as historical records since records for the 1890s and later when the trade-in locomotives became active are extremely rare and contain very few references to transactions related to railways materials (Ishii 1984, 403-405). With regard to Japanese trading companies, robust research has accumulated on the business history of the Mitsui & Co. and other Japanese trading companies (Asajima 2001). For example, in the process of analyzing Mitsui & Co. transactions related to machinery, Shoichi Asajima also conducted a detailed examination of transactions involving railway materials including locomotives. Taking this previous research into account, in this study, I investigate the business activities of Japanese and international trading companies responsible for the import and export of locomotives and also delve into the nature of the trade mediation by these companies.

Keeping the above points in mind, this paper takes up locomotives and examines the structure of competition among locomotive makers and trading companies in the Japanese market from the end of the 19th century to the early 20th century. For this purpose, the locomotive, the representative railway rolling stock, and mechanical products during this period, will be taken as the main case study to answer the following two research questions:

- 1) Why was it possible for Japanese railways to achieve smooth procurement of locomotives and rapid railway development during the first global economy when the competition was particularly harsh?
- 2) How was it possible for a newly developing country at that time, like the U.S., to enter and expand its share in the East Asian locomotive market, once dominated by British firms?

Moreover, this paper will draw fully upon the strength of primary historical sources both in Japan and the US, including records of NARA and the major American locomotive makers.

1. Development of Japanese railways during the first globalization

1-1. Technological independence of Japanese railways

In 1871, the first ten locomotives arrived in Japan one after the other from Britain. Operation of the government railway line between Tokyo (Shimbashi) and Yokohama, the first railway in Japan, was launched the following year in 1872. At the time, the construction and operation of the government railway relied almost entirely on foreign employees, the vast majority of whom were British. The director, engineer-in-chief, locomotive superintendent, secretary, and others in managerial positions had the authority to decide specifications for railway construction and for procuring materials. For this reason, as of 1887, British locomotives accounted for 99% of all locomotives in Japan and held a monopoly on the locomotive market (Table 1).

From the late-1870s to the early-1880s, the Imperial Government Railways (IGR) undertook rapid localization of various technologies, especially those related to civil engineering. Let us examine this point in terms of the change over time in the number of foreign engineers that were employed by the government railway (Figure 1). As can be seen from the figure the number of foreign engineers peaked at over 30 during the latter half of the 1870s, and fell dramatically to under 10, in 1878.

Underlying such efforts were the cessation of foreign investments stemming from fears of being colonized and the drying up of funds for railway construction resulting from the inflationary pressures following the Satsuma Rebellion, which had depleted governmental coffers. Both of these circumstances made it difficult to hire expensive foreign employees. The replacement of foreign engineers by Japanese engineers became

an urgent challenge for the financial survival of the government railway. Having managed to overcome this threat through the establishment of a cadre of Japanese civil engineers, the government railway took subsequent steps to further eliminate foreign dependence. In the latter half of the 1890s, British employees with the authority to procure materials, including the British directors, engineers in chief, and locomotive superintendents were dismissed, and the authority to select and procure railway materials was transferred from British to Japanese personnel. Japanese engineers and managers who had experienced studying abroad in the US played a pivotal role in this transition.

With regard to managers in the Railway Operations Bureau in the latter half of the 1890s, of the six engineers and administrative officials ranked class 3 or higher, four had experience studying abroad in the US¹. The eventual replacements for the hired British employees were Japanese engineers and managers who, for the most part, had studied in the US. It is also notable that the individuals responsible for materials procurement, the Director (Sōichiro Matsumoto) and the head of the accounting section (Tamiyoshi Zushi), both had experience studying in the US. This had a favorable impact on the inflow of American products to the railway materials market in Japan.

Next, let us examine the sudden rise in prosperity of the private railways. The first railway boom occurred in the mid-1880s, followed by a second boom in the mid-1890s, both of which led to the establishment of numerous railway companies. As a result, in the 1890s, the number of locomotives under private operation was greater than that under government operation (Figure 2), resulting in the collapse of the government railway's monopoly on locomotive technology. Except for Nippon Railway, the majority of the private railway companies did not receive technical support from the government railway and had to secure engineers and railway materials on their own. Kyūshū Railway, for example, hired a German engineering consultant and procured all materials from Germany. Similarly, Sanyo Railway and other private railways in Western Japan began proactively purchasing American-manufactured locomotives at the start of the 1890s. The reason why Sanyo Railway was able to become the first railways to escape the influence of the government railway and to procure locomotives on its own had to do with the formation of a cadre of Japanese mechanical engineers centered around Hikomatsu Iwasaki (a graduate of the Imperial College of Engineering).

¹ Naofumi Nakamura, *Umi wo wataru kikansha* (Trading locomotives: The first globalization and the development of Japan's railways, 1869-1914), (Tokyo: Yoshikawa Kōbun-kan, 2016), p.153.

Another factor contributing to the diversification in the source of locomotives was the sequential adoption of open, competitive, and selective bidding arrangements by both the government railway and private railways, which led to the creation of a competitive materials procurement system. For example, the Sanyo Railway's "goods procurement regulations" allowed for both selective bidding and negotiated (limited-tender) contracts, indicating that competitive bidding was also being used by private companies. The intensification of competition, in terms of price and lead time brought about by the introduction of competitive bidding, was favorable to American and German manufactures that had succeeded in reducing costs and manufacturing times through the development and implementation of American-style interchangeable parts manufacturing. In contrast, the British manufacturers, who were fixated on high-quality production through skilled manual work, were unable to compete in terms of cost and lead time. As a result, in 1897, the number of new locomotives purchased from the US exceeded that from the UK; and the share of new locomotives purchased from Germany also began to increase in the 1900s (Table 1).

1-2. Procurement of locomotives on a global market

In addition, the intensification of international competition in the supply of railway materials resulting from the first phase of globalization enabled both the government railway and private railways to optimize the procurement of locomotives on a global scale. Specifically, this led to a dramatic increase in the purchase of American-made locomotives by private railways. Concerns regarding the circumstances at the time and the penetration of American-made locomotives into the Japanese market are expressed in the following report by the British Consular to Japan dated July 16, 1894:

For railway locomotives, of which there has also been an increased import, the Japanese private railway companies appear inclined to have recourse rather to the United States than to England; and in one recent instance, at least a private company disposed of several of their English built engines to the Government railways,

supplying their place with newly-imported American engines at a cost greatly in excess of the proceeds realised by the sale of the old ones².

In the midst of the second railway boom, the British Secretary of Legation in Tokyo, Gerard Lowther, composed two detailed reports titled *Report on the Railways of Japan* in 1896 and 1897, which he sent back to his home country. In these reports, Lowther describes the circumstances surrounding the railway boom in Japan and, in addition, warning British locomotive manufacturers not to miss out on this business opportunity³. And he pointed out that the British monopoly in the Japanese market is starting to crumble and urges the British manufacturers to prepare for coming competition in the locomotive export market⁴.

The US was not the only challenger to British dominance. Among the railways that were newly established during the first railway boom, some companies such as the Iyo Railway and the Kyūshū Railway imported technology from Germany. For example, at the same time as its establishment in 1888, Kyūshū Railway hired a German engineering consultant, Hermann Rumschöttel, and purchased the full array of railway materials including rails, bridge materials, and locomotives from the Gutehoffnungshütte Ironworks via the C. Illies & Co. trading company. In turn, the Gutehoffnungshütte Ironworks outsourced the manufacture of locomotives to the Hohenzollern and Krauss companies⁵.

If we consider the diversification of locomotives, whereas, in 1887, all but two locomotives in Hokkaido were British-made (the other two being American-made), by 1897, the number of American-made locomotives had increased to 33.8%, and the number of manufacturing countries had diversified to include Germany, Switzerland, and Japan (Table 1). As a result of the government railway and private railways independently procuring railway materials from various countries around the world, a

² Foreign Office (UK), “Report on the foreign trade of Japan for the year 1893”, *Diplomatic and Consular Reports*, 16 July 1894, p.9.

³ Gerard Lowther, “Report on the railways of Japan”, *Foreign Office 1896 miscellaneous series, Consular reports on subjects of general and commercial interest*, No.390, (London: Her Majesty’s Stationary Office, 1895).

⁴ Gerard Lowther, “Report on the railway of Japan”, *Foreign Office 1897 miscellaneous series, Consular reports on subjects of general and commercial interest*. No.427, (London: Her Majesty’s Stationary Office, 1897).

⁵ Shigenobu Usui, *Kikansha no keifu-zu 2* (Genealogy of locomotives vol.2), (Tokyo: Kōyu-sha, 1973), p.211.

great variety of different locomotives, with varying specifications, operated in Japan around the turn of the 19th century,

2. American locomotives in Japan: Baldwin Locomotive Works and Frazar & Co.

2-1. The entry of Baldwin Locomotive Works into Japan

The main protagonist of the expansion of American locomotive manufacturers into Japan in the late 1890s was the Baldwin Locomotive Works, headquartered in Philadelphia. As described earlier, Baldwin Locomotive Works underwent rapid growth from the 1860s to the 1870s in the context of America's extremely large domestic market. By the end of the 1870s, the company had started expanding into overseas markets and began full-fledged export in the early 1880s. As can be seen in Table 2, as of 1884, Baldwin Locomotive Works was exporting 39.6% of its total production volume, with the primary destinations being Brazil, Argentina, and other countries in Latin America. Exports declined for a short period in the late 1880s due to the prosperity of America's domestic market by its railway boom. Stagnation of the domestic market in the mid-1890s led once again to a rapid increase in exports, with exports accounting for 40 to 50% of production volume in 1894 onward. During this period, Baldwin Locomotive Works developed an international sales network by signing agreements with sales agents in Havana, Rio de Janeiro, Melbourne, and Yokohama, and by establishing a branch office in London.*⁶ The agent in Yokohama at the time was Frazar & Co. (described in detail later). As can be seen in Table 2, by 1897, exports to Japan accounted for 23% of Baldwin Locomotive Works' total production volume, making Japan the company's largest export market.

Baldwin Locomotive Works first entered Hokkaido, which saw railway construction in 1887 using American technology. As can be seen in Table 3, Baldwin Locomotive Works received orders for two C tank locomotives for sulfur mines in Hokkaido on March 8, 1887. The price for each locomotive was 6,250 USD, with the intermediary, Frazar & Co., receiving a commission of 5%. A sales contract was entered into wherein 1/3 of the total price was to be paid upfront by Frazar & Co., with another 1/3 being paid upon shipment, and the final 1/3 being paid upon arrival of the locomotives (in Yokohama). In all cases, payment was to be made by wire transfer. In 1888, Baldwin received an order

6 Brown, John K., 1995, *The Baldwin Locomotive Works: 1831-1915*, Baltimore: John Hopkins University Press, pp.44-46.

for two 1C tender locomotives from Horonai Railway. This was followed by an order in 1890 for two 1B1 tank locomotives and ten 1C tender locomotives from Hokkaido Colliery and Railway. In the latter case, the intermediary was Takada Shokai, which was not paid in the form of a commission but, rather, in the form of a shipping discount equivalent to 5% of the locomotive price.⁷ A one-time payment for the locomotives was to be made in cash (check guaranteed by the Yokohama Specie Bank, Ltd.) within 10 days of shipment. This arrangement differed from that made through Frazar & Co. in 1890 (as in the cases of the Imperial Government Railways and Chikuho Kogyo Railway), wherein payment was to be finalized after the arrival of the products in Japan (Table 3). This difference in arrangement suggests that, by 1890 or thereabouts, Frazar & Co. already had the trust of Baldwin Locomotive Works, and that it was seen as something akin to a company agent in Japan.

The next entry point for Baldwin Locomotive Works was Kyushu, which, similar to Hokkaido, had a thriving coal mining industry. On July 18, 1889, Baldwin Locomotive Works received an order for one B1 tank locomotive and one B tank locomotive from Chikuho Kogyo Railway through Frazar & Co. Baldwin Locomotive Works was able to deliver these locomotives in a little over three months and received high praise for their rapid turnaround. Thereafter, Chikuho Kogyo Railway became a valued customer for Baldwin Locomotives Works, ordering two more locomotives in October of the same year followed by three locomotives in July 1892. In each case, Frazar & Co. received a commission of 5% per locomotive for their work as the intermediary; one-third of the total payment was made upfront in cash, with the remaining 2/3 being paid upon arrival of the locomotives in Japan (Kobe). This arrangement became the standard practice for transactions involving Baldwin Locomotives Works brokered by Frazar & Co.

After their foray into Kyushu, Baldwin Locomotive Works finally entered the Japanese main island, Honshu, in 1890. In December 1889, Baldwin Locomotive Works received an order for two 1C tender locomotives from the government railway through

⁷ Philip Scranton, who analyzed the order books of the American machine tool manufacturer G. A. Gray, explained that discounts awarded by manufacturers to dealers were used as a means of paying the dealers' sales commissions (Scranton, Philip, 1997, *Endless Novelty: Specialty Production and American Industrialization, 1865-1925*, Princeton: Princeton University Press). In the case of Baldwin Locomotive Works, however, either commissions or discounts were used depending on the dealer. Based on the fact that orders where the dealers received commissions were aggregated under the category "ordered through agency," in this book, "commissions" are distinguished from the typical brokerage fees paid to dealers and are interpreted as intermediary brokerage fees paid to agents. For more information on the above, see "Baldwin Locomotive Works Orders for Engines: 1890-1892" (Smithsonian Institution Archives Collections, Baldwin Locomotive Works Collection #157) and Table 4.

Frazar & Co. These 1C tender locomotives were shipped in March 1890. For the government railway, this was a trial introduction of American-made locomotives. As discussed earlier, thanks to the enthusiastic endorsement of Baldwin locomotives by Sanyo Railway's Kiyoshi Minami, the manufacturer received orders for 47 locomotives over the three years from 1892 to 1894, from Chikuho Kogyo Railway, Bantan Railway, Hoshu Railway, and other railways connected with Minami (Table 3). In the late-1890s, large numbers of Baldwin locomotives began to be used by the Imperial Government Railways, Nippon Railway, and other private railways that had previously relied primarily on British locomotives. By 1897, both the Imperial Government Railways and Nippon Railway had become important Baldwin Locomotive Works customers, with the two railways ordering 38 and 44 locomotives, respectively, that year.

Trials comparing British and American locomotives conducted by F. H. Trevithick in 1894-95 played a significant role in the rise of Baldwin locomotives.*⁸ The experiments conducted from 1894 to 1895 comparing British (Beyer, Peacock & Co. and Nasmyth, Gaskell & Co.) and American (Baldwin Locomotive Works) 1C tender locomotives led to the assessment that, whereas the British locomotives were superior in terms of fuel efficiency, American locomotives were superior in terms of pulling power and speed⁹. After the experiment, Japanese railways began selecting British or American locomotives based on these characteristics and their suitability for specific purposes.

2-2. Frazar & Co. as an agent for Baldwin Locomotive Works

Frazar & Co., which served as the intermediary for the majority of exports by Baldwin Locomotive Works to Japan, was an American trading company founded in Guangdong (Canton) in 1834 by George Frazar who was an American owner of a clipper ship.*¹⁰ In 1878, in addition to dispatching a partner, John Lindsley, to establish

8 Naofumi Nakamura, 2009, 'Seiki tenkanki niokeru Kikansha Seizo-gyo no Kokusai-kyoso'(International Competitions among the Locomotive manufacturers in the turn of the 19-20 centuries), T. Yuzawa, T.Suzuki, T.Kikkawa, and S.Sasaki eds.,*Kokusai Kyoso-ryoku no Keiei-shi* (Business Histories of International Competitiveness), Tokyo: Yuhi-kaku, pp.45-47.

⁹ Nakamura 2016, pp.54-55.

10 Mitsui Bussan Head Office, Machinery Division ed.,1920(?), *Chosa Iho Higo, Hantaisho no Kinjyo,Dai-ni* (Secret Research Reports, the Recent Situation of Competitors, Vol.2), Tokyo: Mitsui & Co., pp.43-46, Morita, Chukichi, 1910, *Yokohama Seiko Meiyō Kagami*(Who's Who Directory in Yokohama), Yokohama: Yokohama Shoukyo Shinpo-sha, pp.831-832, and W.

a branch office in Yokohama, Frazar & Co. began importing American machines into Japan. With G. Frazar's retirement, the founder's son Everett Frazar assumed directorship of the company and moved the headquarters to Yokohama, and Lindsley became the head of the New York branch office. Frazar & Co.'s main customers (agents) as of 1898 were as follows.*¹¹

New York & National Board of Marine Underwriters

Atlantic Mutual Insurance Co. (New York)

Baldwin Locomotive Works (US)

Westinghouse Electric & Manufacturing Co. (US)

Newport Engine & Ship Building Co. (US)

Niles Tool Works (US)

From this, it is evident that Frazar & Co.'s main business was to import machinery and electrical appliances from American manufacturers and that it served as an agent for not only Baldwin Locomotive Works but, also, major electrical appliance manufacturers such as Westinghouse and Newport. Furthermore, the composition of Frazar & Co. employees shown in Table 5 indicates that, in addition to the main office in Yokohama, the company had branch offices in Kobe and New York, and that it comprised 17 staff members including four partners. In addition, the Yokohama main office also had a permanent sales engineer (W. H. Crawford) from Baldwin Locomotive Works whose job was to sell railcars. As will be explained in greater detail later, this sales engineer played an extremely important role in the marketing activities of American locomotive manufacturers.

In 1900, the Frazar & Co. partnership was dissolved and the company was re-established as an incorporated company with a capital stock of 800,000 JPY. Upon the death of E. Frazar in the following year, 1901, the son, Everett W. Frazar took over management of the business. In 1902, he acquired the shares owned by Lindsley and

Feldwick ed.1919, *Present-day Impression of Japan*, Yokohama: The Globe Encyclopedis Co., p.215.

11 Yokohama Seimei-roku Hakko-sho ed., 1898, *Yokohama Seimei-roku Zen* (Biographical Dictionary of Yokohama), Yokohama: Yokohama Seimei-roku Hakko-sho, p.72.

thus gained full control over the company. Thereafter, in 1904, Frazar & Co. was merged with C.V. Sale to form Sale and Frazar Co.

As of 1919, Sale and Frazar Co. had blossomed into a trading company headquartered in Tokyo with locations (branch offices, sub-branches, agents) in Yokohama, Osaka, Kobe, London, New York, Sydney, Shanghai, Beijing, Tianjin, and Dalian. The company's operating structure around 1920 was described by Mitsui Bussan as follows.

In addition to brokering the import of all types of machinery, metal goods, canned foods, phonographs, typewriters, automobiles, aeroplane components, and ships, the finance division of Frazar & Co. is currently expanding into the buying and selling of all manner of public debt. Since the recession of March 1920, Frazar & Co. has conducted steady business by carefully selecting clients and collecting deposits for ordered goods. To manage its expanding business, Frazar & Co. has opened a sub-branch in Hakodate and contracted agents in Beijing and Tianjin. The annual value of goods traded by Frazar & Co. is 20 million JPY. Among its peers, it is a top-notch, extremely well-trusted company. As of April 1919, it had a capital stock of 1 million JPY, which increased to 2 million JPY in January 1920. Payment of this sum has been completed.*¹²

As can be seen from the above, Sale and Frazar Co., while maintaining its main business of importing/exporting machinery, ventured into financial transactions during the interwar period and grew into "a top-notch, extremely well-trusted company."

Continuous transactions with Baldwin Locomotive Works played an extremely important role in the above-described growth of Sale and Frazar Co. When we examine the change over time in the composition of intermediaries that brokered exports by Baldwin Locomotive Works in Table 4, the sale of 234 locomotives was brokered by Frazar & Co. over the 11 years from 1890 to 1900, making it the third most prolific intermediary for Baldwin Locomotive works next to Simon J. Gordon (370 cars) which mainly provided locomotives to Trans-Siberian Railway and the Norton Megaw (324), which dealt with business in Latin America. It is further evidence that, whereas the value of transactions brokered by the top two trading companies fluctuated dramatically depending on the time of year, Frazar & Co. transactions remained constant over time. In 1897, during the period when purchases by the government railway and Nippon

12 Mitsui Bussan Head Office, Machinery Division ed.,1920, pp.45-46.

Railway increased dramatically, Frazar & Co. brokered, if only temporarily, more than 56% of Baldwin Locomotive Works' total global exports.

It is through such continuous transactions that Frazar & Co. became an agent in East Asia for Baldwin Locomotive Works, which even went so far as to dispatch a sales engineer to the trading company in the latter half of the 1890s. Okura & Co. described this special relationship between Frazar & Co. and Baldwin Locomotive Works as of 1901 as follows.^{*13}

On my trip to Philadelphia the other day, I also visited Baldwin Locomotive Works. Mr. Converse, whom I had met on my earlier visit was not there. However, I was able to meet with Mr. Johnson. Contrary to what Mr. Converse had said, Mr. Johnson explained that, because Frazar & Co. has been an agent of Baldwin Locomotive Works for many years, it would be difficult for Baldwin Locomotive Works, as a practical matter, to provide a price quote for any trading company other than Frazar & Co.

It can be seen from this description that, at least at the time, Frazar & Co. was indispensable to Baldwin Locomotive Work's entry into the East Asian market.

2-3. Marketing activities of American locomotive manufacturers: Focusing on

Baldwin Locomotive Works

Baldwin Locomotive Works' marketing strategy of dispatching a sales engineer to its agent Frazar & Co. to conduct sales while also responding to customers' technological demands was not unique to Baldwin Locomotive Works but was a common characteristic of American manufacturers. A report by the British Consulate in Japan filed on February 22, 1896, discusses this point as follows:

As a concrete instance of the result of this experiment in one case only, that of American locomotives may be mentioned. Railways owe their original introduction into Japan to English capital. The only foreign that has ever been employed on them has been English, and it is from English instructors that every Japanese engaged in railway construction or management from the Director-in-Chief down to

13 Letter from New York Branch (Majiro Yamada) to Tokyo Head Office on 13 August 1901, 'Tokio Letter No.1 (1901-1902)', RG131/A1/Entry-124/856 Okura (NARA), pp.21-24.

the humblest mechanic, has learnt all he knows. Originally, all railway plant of every descried was obtained solely from England. But, during the last 5 years, fully one hundred American locomotives have been introduced into Japan both for Government and private railways, and that this has been so is very largely owing, according to one of most experienced merchants in Tokio, to fact that the leading firm of makers in the United States has, for several years past, maintained an energetic export in Japan, who has throughout worked in association with a mercantile firm in Tokio.¹⁴

In this report, the British consul points out that, over the past five years, 100 American locomotives were delivered to both the government railway and private railways, and emphasizes as a reason for this development the fact that, starting several years prior, American manufacturers had been working aggressively with trading companies based in Tokyo to export locomotives to Japan.

The aggressive marketing activities of American manufacturers carried out by trading companies acting as quasi-agents were also a topic of discussion in Japan. For example, *Tetsudo-Jiho* [The Railway Times] described Kansei Railway's competitive bidding process in 1897 as follows.

The trend is for each American locomotive manufacturer to have its own contracted agent in Japan. These agents compete on price to create good relations with both public and private railways. On the 20th of the previous month (September 1897), at the competitive bid held by Kansei Railway for the purchase of six new locomotives, China-Japan Trading Co. based in Kobe won the contract by submitting the lowest bid price of 8,540 USD per locomotive. This is 100 USD lower per locomotive than the transaction price offered by Takata Shokai, which won the competitive bid held by the Railway Bureau on the 25th of the month before last. Furthermore, the ordering of these locomotives looks to be a bit more troublesome.*¹⁵

Regarding such direct marketing efforts by American locomotive manufacturers in Japan, one well-known example is the promotion of locomotive sales in the East Asian market by Willard C. Tyler representing the Schenectady Locomotive Works, as reported

¹⁴ Foreign Office (UK), 1896, *Diplomatic and Consular Reports on Trade and Finance, Annual series*, No.1695, p.44

¹⁵ "Competitions in the Supply of Locomotives", *Kogyo-zasshi* (Engineering Magazine), No.133, November 1897, p.23.

by Ericson 1998.¹⁶ Tyler lived in Japan from 1898 to 1902 as a traveling agent for Schenectady ALCO, during which time he poured his energy into selling American-made locomotives to the government railway and Nippon Railway, which had previously been within the sphere of influence of British locomotive manufacturers. In his diary, Tyler mentions a W. H. Crawford, who was a sales engineer for Baldwin Locomotive Works, as a trailblazer in terms of selling American locomotives in Japan.¹⁷ With this in mind, let us take a more granular look at the marketing activities of American locomotive manufacturers in Japan through the example of Baldwin Locomotive Works.

In 1897, Baldwin Locomotive Works produced a hard-cover catalog of narrow-gauge locomotives for Frazar & Co.¹⁸ In this catalog, Baldwin Locomotive Works provided the information needed to make sales pitches, including an explanation of standard gauges as well as careful explanations aimed at sales agents of the ordering method and telegram codes to be used when ordering. A large number of pages were devoted to explaining the Vaucrain compound locomotive, which was the company's newest model at the time. It can be surmised that the presence of sales engineers with specialized knowledge was also essential to the selling of new products such as the Vaucrain compound.

As mentioned above, the first sales engineer dispatched by Baldwin Locomotive Works to Frazar & Co. was W. H. Crawford.¹⁹ Crawford played a major role in promoting the export of American locomotives to Japan, selling 200 locomotives to the government railway and private railways in 1897. In addition, he supervised the building of the Mikado-type (1D1 tender) locomotive for Nippon Railway and assisted Sanyo

16 Ericson, Steven J., 1998, 'Importing Locomotives in Meiji Japan: International Business and Technology Transfer in the Railroad Industry', *Osiris*, second series Vol.13.pp.146-147.

17 This was a different Crawford from Joseph Ury Crawford, the former consulting engineer for the Hokkaido Development Commission, who had returned to the US and was living in Philadelphia as of 1901 (Ericson, Steven J., 2005, 'Taming the Iron Horse: Western Locomotive Makers and Technology Transfer in Japan, 1870-1914', G. L. Bernstein, A. Gordon, and K. W. Nakai eds. *Public Spheres, Private Lives in Modern Japan, 1600-1950*, Cambridge Mass.: Harvard University Press, p.203).

18 Burnham, Williams & Co. 1897, '*Baldwin Locomotive Works Narrow Gauge Locomotives, Japanese Edition, Frazar & Co. of Japan Agents, Yokohama*', Philadelphia: J.B.Lippincott Co. (SMU, TJ625, B41, 1897ja)

19 As of 1898, W. H. Crawford was stationed in the Frazar & Co. Yokohama office as an engineer for Baldwin Locomotive Works, where he engaged in the marketing of Baldwin locomotives in Japan (Yokohama Seimei-roku Hakkosho (eds.) 1898, p. 72)

Railway in switching from British locomotives to Baldwin locomotives.^{*20} Crawford's successor, who was dispatched to Japan in 1904, was Samuel M. Vauclain Jr.

Vauclain Jr. was born in 1880 in Philadelphia. His father was Sir. Samuel M. Vauclain, the man who designed the Vauclain compound locomotive. In 1904, the elder Vauclain was serving as the president of Baldwin Locomotive Works. Vauclain Jr., a promising young engineer, was dispatched to Japan at the age of 24 as a sales engineer for Japan and Australia. However, after falling ill in mid-1905, he returned home and prematurely passed away eight years later in 1913.^{*21} Among the documents related to Baldwin Locomotive Works held by the Southern Methodist University are Vauclain Jr.'s diary and notebook from 1904.^{*22} These documents give a clear picture of Vauclain Jr.'s activities in Japan and Australia. In the section below, we elucidate the marketing activities of Baldwin Locomotive Works by tracing the steps of Vauclain Jr. in 1904 based on Table 6.

Vauclain Jr. left Philadelphia on February 3, 1904, and arrived in Yokohama via Hawaii on April 20. He began working at Frazar & Co. immediately after arriving in Japan, and left the area for his first business trip, an eight-day trip to Hokkaido, on June 1. On this trip, Vauclain Jr. traveled via Nippon Railway, crossing over to Hokkaido from Aomori, where he visited Sapporo, Muroran, Iwamizawa, and Asahikawa and met with locomotive superintendents of Hokkaido Colliery and Railway and the Hokkaido Government Railway Division. The objective of the business trip was to obtain information from the Hokkaido Government Railway Division regarding bidding on two Mogul type 1D1 tender locomotives and related components. Vauclain Jr. participated in bidding in Tokyo on June 20 along with members of Frazar & Co. including E.M. Barnby, Everett Frazar, Inuzaki, and Idzumi [Table 5].

Soon thereafter, on June 25, Vauclain Jr. left for a business trip to Yawata Iron Works in Kyushu. However, on June 27, he suddenly returned to Yokohama after receiving a telegram from Baldwin Locomotive Works at the Frazar & Co. Kobe branch. It is unclear what business drew him back to Yokohama at this point; the fact that he subsequently headed back to Kobe from June 30 to July 2 and then traveled to Australia

20 Ericson 2005, pp.202-203.

21 Samuel M. Vauclain and Earl Chapin May, 1930, *Steaming Up! The Autobiography of Samuel M. Vauclain*', New York: Brewer & Warren Inc., pp.194-200, and 'Vauclain family papers and genealogical research material', Collection 3666, The Historical Society of Pennsylvania.

22 Samuel Matthew Vauclain Jr., 'Japan Diary 1904' and 'Japan and Australia Diary 1904' (SMU, A2011/0020)

suggests that the reason was related to Australian business. At this point, Vauclain Jr. left the comment on the diary, “Baldwin engines doing all the hard work,” hinting at the demanding nature of his work. On July 12, Vauclain Jr. left for a 3-month business trip to Australia. During this trip, he carried out marketing activities all around Australia, stopping by Hong Kong, Guangdong, and the Philippines to conduct market research.

Soon after returning to Yokohama on October 2, 1904, Vauclain Jr. began enthusiastically making the rounds to customers in the Kanto area, visiting Hiroshi Hiraoka of Kisha Seizo Co., Ltd. and Tokyo Electric Railway Company in Tokyo on October 15 and Narashino Horse-drawn Railway in Chiba on the 19th of the same month. From October 23 to 29, he traveled to Moji, Osaka, and Kyoto, making the rounds to Kyushu Railway, Sanyo Railway, Kisha Seizo, Osaka Electric Railway, and Kyoto University. In particular, in the case of Kyushu Railway and Sanyo Railway, he met with the likes of Mitsugi Sengoku (President of Kyushu Railway), Sojiro Suzuki (chief engineer, head of the Kyushu Railway Manufacturing Dept. and head of the Kokura plant), and Hikomatsu Iwasaki (head of the Sanyo Railway Locomotives Section) to discuss details about component and locomotive orders. For example, on October 28 at Sanyo Railway, he discussed a report comparing the performance of Mallet and Vauclain compound locomotives.*²³

Even after entering November, Vauclain Jr. continued to enthusiastically call on customers, visiting the Imperial Japanese Army Nakano Railway Battalion, Koku Railway, the Railway Bureau, and Tokyo Electric Railway in Tokyo on consecutive days from the 15th to the 18th and again traveling to Fukuoka, Kobe, Osaka, and Kyoto from the 23rd to the 30th to visit the Kyushu, Hakatawan, and Kansei Railways. During this trip, on November 25, he spoke with President Sengoku and Kokura plant director Suzuki to confirm the information on the production of 500 freight cars and received blueprints for coal cars from the chief engineer.*²⁴ From December 7 to 12, he again visited Hokkaido via Nippon Railway, where he visited the Hokkaido Colliery and Railway Temiya plant in Otaru and Iwamizawa.

As can be seen from the above, in the nine months between April and December 1904, Vauclain Jr. was away on business trips inside and outside Japan, including Australia, for a total of 126 days. The destinations of those trips included major railway companies including the Railway Bureau, the Hokkaido Government Railway Division,

23 Vauclain Jr. 'Japan Diary 1904' Oct.28.

24 Vauclain Jr. 'Japan Diary 1904' Nov. 25.

Nippon Railway, Hokkaido Colliery, and Railway, Kyushu Railway, Sanyo Railway, Kansei Railway, Kobu Railway, and Hakatawan Railway, as well as other sites such as the government steelworks, the Imperial Japanese Army, electric railway companies, steam locomotive manufacturing companies, and universities. The purposes of these visits varied widely from participation in bidding, discussion of order details, exchange of information, collection of customer information, or confirmation of contract details. One noteworthy point is the majority of orders received by Vauclain Jr. were for replacement parts rather than for new locomotives themselves. Once locomotive manufacture had sold a locomotive to a customer, they were able to receive additional orders for parts for maintenance continually. Accordingly, agents of the trading company or manufacturers would periodically make rounds with their customers. Whenever he visited railway companies, Vauclain Jr. was able to meet with the heads and chief engineers of locomotive sections and, in the case of Kyushu Railway, even to become acquainted and exchange information with President Sengoku. From the railway companies' perspective, the technical information possessed by sales engineers dispatched from the manufacturers was extremely valuable. In Vauclain Jr.'s case, the sales engineer was the first son of the president of Baldwin Locomotive Works, the world-renowned engineer S. M. Vauclain. Thus, there was value for the top management, and not just individuals with direct business interests, to interact with Vauclain Jr. That said, there is no doubt that the marketing activities that involved traveling on business for half a year constituted "grueling work." This busy work schedule was likely one of the causes of Vauclain Jr. falling ill.

Conclusion

In this paper, I have explained the locomotive supply arrangement that supported the rapid development of Japan's railway industry at the turn of the century while focusing on the independence of Japanese mechanical engineers and the export of American-made locomotives to Japan. As a result, this paper clarified how American locomotive manufacturers dismantled the British monopoly, and penetrated the Japanese market, by paying attention to changes in technological development and business systems on the demand side of the railways, and the role of the international trading companies that mediated the supply of locomotives and rolling stock. In particular, I examined the case study of Frazar & Co. as an agent of Baldwin Locomotive Works by investigating

cooperation related to the marketing activities of trading companies and makers in the locomotive industry.

In conclusion, I would like to answer two research questions, 1) the reasons why Japanese railways were able to achieve smooth procurement of locomotives during the “first global economy,” 2) the factors that allowed the U.S. makers to enter the locomotive market and expand its share in East Asia and Japan.

To answer the questions, we have to consider the aspects which are domestic and international factors. For the domestic factors, there were the following 4 aspects.

- ①the technological independence of railway engineers in the 1890s.
- ②the introduction of a competitive bidding system
- ③the successful raising of capital in the domestic financial market
- ④the growth of Japanese and foreign trading companies

As for the international factors, they were as follows;

- ⑤global competition between British, American, and German locomotive makers
- ⑥global activities of the traveling sales engineers of American locomotive makers
- ⑦cooperation between trading companies and locomotives makers

Of course, all of them were important, but, in this paper, we had focused on the ①, ④, ⑥, and ⑦.

The factors ① and ④ were the foundation of Japanese railway development and related to the answer to the first research question. In the 1890s, the Japanese engineers became to write the specifications of railway materials, and freely order them through trading companies that were both Japanese and foreign. It was the important factor to achieve a smooth procurement of locomotives, and one of the preconditions for the development of Japanese railways.

The factors ⑥ and ⑦ were tools of marketing of American locomotive makers and connected to the answer of the second question. During the second railway boom (1893 to 1899), the emergence of large numbers of new railway companies and the expansion of existing railway companies resulted in a sudden jump in demand in Japan for locomotives. It was Baldwin Locomotive Works, and other American manufacturers, which responded promptly to this increase in demand and expanded their share of the Japan locomotive market. At that time, American locomotive makers dispatched traveling sales engineers to Japan, and these engineers cooperated with their local agents. This type of direct marketing activity was original to American locomotive makers and exercised great effect on the development of the emerging market. And, as a result, it was one of the reasons why the British manufacturers had fallen behind them.

Finally, we have to consider the role of trading companies in the locomotive trade in East Asia. Of course, the sales engineers, such as Samuel Vauclain Jr., could not speak Japanese or Chinese and did not have personal connections with their customers. The trading companies, such as Frazer & Co., introduced them to the engineers of railway companies, government officers, and academics in Japan, China, and elsewhere. In the emerging market, the search and transaction costs between makers and customers were very expensive. The trading companies in Japan or China had information related to the emerging market and contributed to lowering these costs to increase overall profits.

Table 1 Nationalities of locomotives in Japan: 1872–1912.

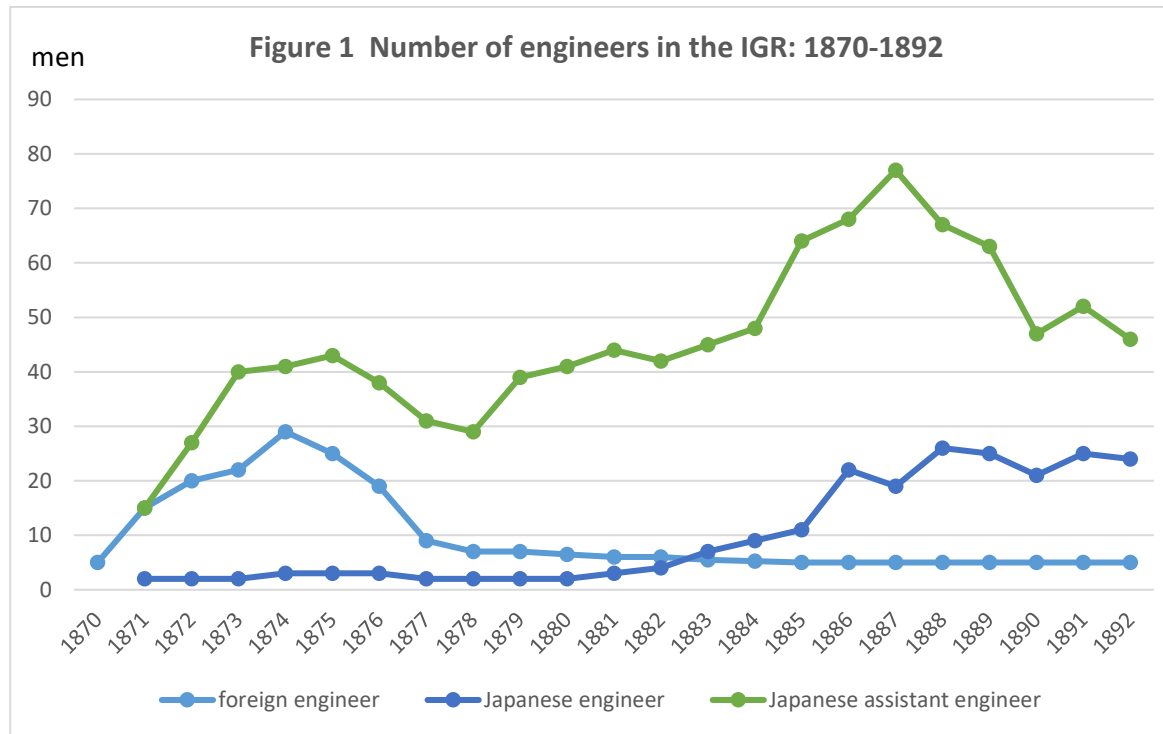
(cars)

| Year | British | | American | | Germany | | Swiss | | Japanese | | Total | |
|------|---------|----------|----------|----------|---------|----------|--------|----------|----------|----------|--------|----------|
| | number | increase | number | increase | number | increase | number | increase | number | increase | number | increase |
| 1872 | 10 | | | | | | | | | | 10 | |
| 1877 | 36 | 26 | | | | | | | | | 36 | 26 |
| 1882 | 47 | 11 | | | | | | | | | 47 | 11 |
| 1887 | 95 | 48 | 2 | 2 | | | | | | | 97 | 50 |
| 1892 | 240 | 145 | 26 | 24 | 28 | 28 | | | | | 294 | 197 |
| 1897 | 484 | 244 | 282 | 256 | 55 | 27 | 3 | 3 | 11 | 11 | 835 | 541 |
| 1902 | 684 | 200 | 524 | 242 | 70 | 15 | 11 | 8 | 30 | 19 | 1,319 | 484 |
| 1907 | 966 | 282 | 908 | 384 | 160 | 90 | 11 | 0 | 95 | 65 | 2,140 | 821 |
| 1912 | 983 | 17 | 995 | 87 | 226 | 66 | 11 | 0 | 162 | 67 | 2,377 | 237 |

Source: Minoru Sawai, *Nihon tetsudō sharyō kōgyō-shi*, *op. cit.*, p. 27.

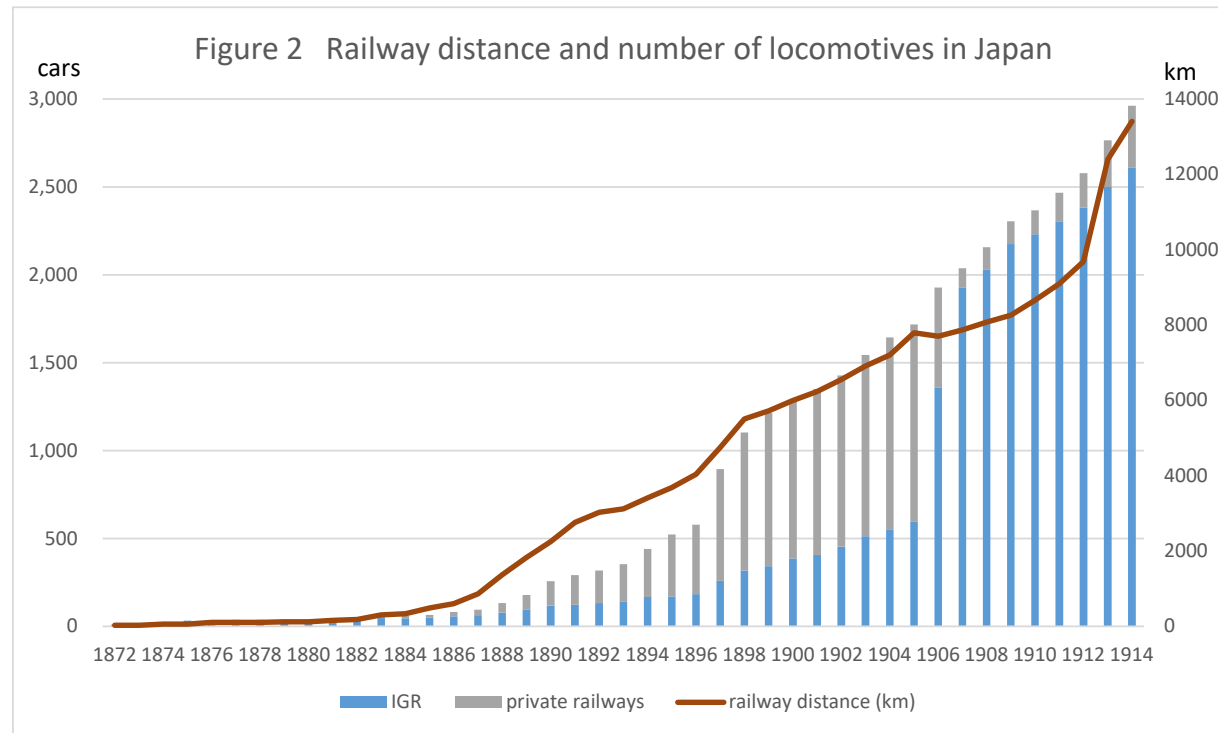
foreign Japanese engineer assistant engineer

| | | | |
|------|------|----|----|
| 1870 | 5 | | |
| 1871 | 15 | 2 | 15 |
| 1872 | 20 | 2 | 27 |
| 1873 | 22 | 2 | 40 |
| 1874 | 29 | 3 | 41 |
| 1875 | 25 | 3 | 43 |
| 1876 | 19 | 3 | 38 |
| 1877 | 9 | 2 | 31 |
| 1878 | 7 | 2 | 29 |
| 1879 | 7 | 2 | 39 |
| 1880 | 6.5 | 2 | 41 |
| 1881 | 6 | 3 | 44 |
| 1882 | 6 | 4 | 42 |
| 1883 | 5.5 | 7 | 45 |
| 1884 | 5.25 | 9 | 48 |
| 1885 | 5 | 11 | 64 |
| 1886 | 5 | 22 | 68 |
| 1887 | 5 | 19 | 77 |
| 1888 | 5 | 26 | 67 |
| 1889 | 5 | 25 | 63 |
| 1890 | 5 | 21 | 47 |
| 1891 | 5 | 25 | 52 |
| 1892 | 5 | 24 | 46 |



Source: Naofumi Nakamura, Umi wo wataru Kikansha, *op. cit*, p.94.

| | IGR | private railw | railway distance (km) |
|------|-------|---------------|-----------------------|
| 1872 | 10 | | 29 |
| 1873 | 10 | | 29 |
| 1874 | 22 | | 62 |
| 1875 | 32 | | 62 |
| 1876 | 34 | | 105 |
| 1877 | 38 | | 105 |
| 1878 | 38 | | 105 |
| 1879 | 38 | | 118 |
| 1880 | 36 | | 123 |
| 1881 | 45 | | 162 |
| 1882 | 47 | | 185 |
| 1883 | 48 | 7 | 303 |
| 1884 | 46 | 12 | 332 |
| 1885 | 50 | 16 | 487 |
| 1886 | 57 | 25 | 603 |
| 1887 | 64 | 30 | 866 |
| 1888 | 78 | 55 | 1371 |
| 1889 | 97 | 82 | 1829 |
| 1890 | 117 | 140 | 2251 |
| 1891 | 123 | 169 | 2761 |
| 1892 | 133 | 185 | 3028 |
| 1893 | 142 | 211 | 3119 |
| 1894 | 167 | 273 | 3409 |
| 1895 | 171 | 351 | 3686 |
| 1896 | 183 | 395 | 4034 |
| 1897 | 258 | 636 | 4745 |
| 1898 | 317 | 786 | 5503 |
| 1899 | 343 | 871 | 5721 |
| 1900 | 387 | 892 | 5999 |
| 1901 | 407 | 943 | 6230 |
| 1902 | 453 | 974 | 6554 |
| 1903 | 513 | 1,031 | 6914 |
| 1904 | 552 | 1,092 | 7202 |
| 1905 | 594 | 1,123 | 7793 |
| 1906 | 1,357 | 570 | 7700 |
| 1907 | 1,926 | 111 | 7870 |
| 1908 | 2,031 | 125 | 8079 |
| 1909 | 2,174 | 131 | 8256 |
| 1910 | 2,231 | 135 | 8661 |
| 1911 | 2,305 | 162 | 9095 |
| 1912 | 2,381 | 197 | 9679 |
| 1913 | 2,500 | 265 | 12401 |
| 1914 | 2,611 | 351 | 13405 |



Source: Minoru Sawai, Nihon tetsudō sharyō kōgyō-shi, op. cit, p.6, 16.

Table 2 Products and Exports of Baldwin Locomotive Works

| Year | Employee men | Products cars | Exports cars | Export ratio | Destinations (cars) | | | | | | | | | |
|-------|-----------------|------------------|-----------------|--------------|---------------------|------------------|------------------|--------------------|--------|-------|-------|---------------|---------|---------------------------|
| | | | | | US (Domestic) | North America | South America | Central America | Europe | Japan | China | South Asia | Oceania | Africa, Middle East |
| 1884 | 2,377 | 429 | 170 | 39.6% | 259 | 6 | 111 | 17 | 3 | 0 | 0 | 0 | 33 | 0 |
| 1886 | 2,411 | 550 | 42 | 7.6% | 508 | — | — | — | — | — | — | — | — | — |
| 1887 | 2,879 | 653 | 43 | 6.6% | 610 | 1 | 17 | 23 | 0 | 2 | 0 | 0 | 0 | 0 |
| 1888 | 3,329 | 737 | 95 | 12.9% | 642 | 3 | 19 | 68 | 0 | 2 | 0 | 0 | 3 | 0 |
| 1889 | 3,579 | 898 | 212 | 23.6% | 686 | 9 | 114 | 83 | 1 | 3 | 0 | 0 | 2 | 0 |
| 1890 | 4,493 | 946 | 144 | 15.2% | 802 | 3 | 46 | 76 | 3 | 12 | 0 | 0 | 1 | 3 |
| 1891 | 4,440 | 899 | 292 | 32.5% | 607 | 13 | 166 | 46 | 1 | 6 | 0 | 0 | 55 | 5 |
| 1892 | 4,039 | 731 | 127 | 17.4% | 604 | 1 | 56 | 57 | 8 | 3 | 0 | 0 | 0 | 2 |
| 1893 | 4,313 | 772 | 162 | 21.0% | 610 | 1 | 78 | 55 | 1 | 27 | 0 | 0 | 0 | 0 |
| 1894 | 2,150 | 313 | 132 | 42.2% | 181 | 4 | 56 | 38 | 2 | 30 | 0 | 0 | 2 | 0 |
| 1895 | 2,551 | 401 | 161 | 40.1% | 240 | 1 | 105 | 18 | 22 | 13 | 0 | 0 | 2 | 0 |
| 1896 | 3,490 | 547 | 289 | 52.8% | 258 | 5 | 92 | 33 | 126 | 31 | 0 | 0 | 2 | 0 |
| 1897 | 3,191 | 501 | 205 | 40.9% | 296 | 10 | 36 | 16 | 8 | 115 | 12 | 0 | 2 | 6 |
| 1898 | 4,888 | 755 | 348 | 46.1% | 407 | 63 | 25 | 37 | 164 | 7 | 1 | 0 | 27 | 24 |
| 1899 | 6,336 | 901 | 374 | 41.5% | 527 | 41 | 9 | 65 | 134 | 9 | 16 | 45 | 0 | 55 |
| 1900 | 8,208 | 1,217 | 365 | 30.0% | 852 | 32 | 25 | 70 | 139 | 8 | 33 | 14 | 1 | 43 |
| total | | 11,250 | 3,161 | 28.1% | 8,089 | 193 | 955 | 702 | 612 | 268 | 62 | 59 | 130 | 138 |

Source: 'Baldwin Locomotive Works Orders for Engines', 1884–1900 and Brown 1995, p.241.

Notes: Japan include Taiwan and Korea. Chinese Eastern Railway was included by Russia (Europe).

Table 3 Baldwin Locomotive Works' exports to Japan: 1887–1892

| Year | Name of purchaser | Name of agent | Type of engines | No. of cars | Date of quote | Date of order | Date of shipped | Price(\$) | Commission | Note |
|------|------------------------------|---------------|--------------------|-------------|---------------|---------------|-----------------|-----------|------------|--|
| 1887 | Hokkaido Sulfur Mining | Frazar | C tank | 2 | 1887/2/21 | 1887/3/8 | 1887/6/13 | 6,250 | 5.0% | 1/3 in advance from which FRT & INS are F(Frazar) & Co paid. 1/3 by cable transfer when ealy for shipment. 1/3 on dely at Yokohama. (4/22/87. \$100 Mexican worth \$75.50 US gold @ 30 days) |
| 1888 | Horonai Railway | | 1C tender | 2 | | | | | | |
| 1899 | Chikuho Railway | Frazar | B1 tank | 1 | 1889/8/27 | 1889/7/18 | 1889/10/26 | 4,450 | | |
| 1899 | Chikuho Railway | Frazar | B tank | 1 | 1889/8/27 | 1889/7/18 | 1889/10/26 | 4,100 | | |
| 1890 | Mitsui Mining Co. | Frazar | B tank | 2 | 1889/11/10 | 1889/11/17 | 1890/1/4 | 3,750 | | |
| 1890 | IGR, Japan | Frazar | 1C tender | 1 | 1889/10/23 | 1889/12/10 | 1890/3/28 | 13,000 | 5.0% | Ship by steamer via Suez. Terms of payment: cash within 7 days after delivery in Yokohama. 5% to Frazar & Co. |
| 1890 | IGR, Japan | Frazar | 1C tender | 1 | 1889/10/23 | 1889/12/10 | 1890/3/28 | 11,450 | 5.0% | |
| 1890 | Chikuho Railway | Frazar | 1C1 tank | 2 | 1889/9/24 | 1889/10/11 | 1890/8/23 | 7,350 | 5.0% | Ship by steamer via Suez Canal to Kobe to arrive about October. Terms: 1/3 cash in advance, 2/3 on delivery in Kobe. 5% com(mission) on base price, exc of FRT & INS to Frazar & Co. |
| 1890 | Hokkaido Coal Mining Railway | Takata | 1B1 tank | 2 | 1890/5/5 | 1890/4/25 | 1890/10/1 | 4,900 | 5.0% | 5% shipping discount to Takata & Co. Payment guaranted by the Yokohama Specie Bank. |
| 1890 | Hokkaido Coal Mining Railway | Takata | 1C tender | 4 | 1890/5/5 | 1890/4/25 | 1890/10/1 | 7,000 | 5.0% | |
| 1891 | Hokkaido Coal Mining Railway | Takata | 1C tender | 6 | 1890/12/19 | 1890/12/19 | 1891/7/25 | 6,600 | 5.0% | 5% discount to Takata & Co. Cash 10 days after shipment. |
| 1892 | Chikuho Railway | Frazar | 1C tender | 2 | 1892/5/25 | 1892/7/2 | 1892/10/7 | 9,600 | 5.0% | Order from Kiyoshi Minami, 5% to Frazar & Co. |
| 1892 | Chikuho Railway | Frazar | 1C compound tender | 1 | | 1892/7/2 | | 10,250 | 5.0% | |

Source: 'Baldwin Locomotive Works Orders for Engines', 1884–1900 and Usui 1972.

Table 4 Export agents of Baldwin Locomotive Works

| Name of agent | (cars) | | | | | | | | | | | 1890-1900 total | Destinations (Territories) |
|----------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|---|
| | 1890 | 1891 | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | | |
| Simon James Gordon | | | | | | 22 | 122 | 7 | 126 | 60 | 33 | 370 | Russia (include Chinese Eastern Rly) |
| Norton Megaw | 10 | 47 | 15 | 56 | 40 | 50 | 58 | 29 | 17 | | 2 | 324 | South America |
| Frazar | 6 | 6 | 3 | 24 | 20 | 12 | 31 | 115 | 7 | 2 | 8 | 234 | Japan and East Asia |
| Sanders | | | | | | | | | | 91 | 127 | 218 | |
| Axel von Knorring | | | | | | | | | 24 | 14 | 25 | 63 | Russia |
| W. G. Irwin | 3 | 5 | 1 | 1 | 1 | 1 | 3 | 4 | 5 | 5 | 18 | 47 | Hawaii |
| R. Towns | | 47 | | | | | | | | | | 47 | Australia |
| Edward Mahony | | | | | 2 | 4 | 8 | 2 | 4 | 24 | | 44 | |
| Reynolds Carter & Reynolds | | | | | | | | | | 3 | 28 | 31 | Africa |
| Hemerway & Browne | | | | | | 17 | | | | | | 17 | Chili |
| Vionnet | 1 | 7 | 4 | 4 | | | | | | | | 16 | Europe |
| Chas Denby, Jr. | | | | | | | | | | 16 | | 16 | |
| C. S. Christensen | | | | | | | | 1 | 7 | 4 | 3 | 15 | |
| G&O Braniff | | | | | | | | 1 | 3 | 5 | 6 | 15 | Central America |
| Charles Jameson | | | | | | | | 12 | | | | 12 | China |
| Edward Benn | | | | | | | 6 | | | | 4 | 10 | South America |
| Newell | 1 | 6 | | | | | | | 2 | | 1 | 10 | Australia |
| Beeche | | | | | | | | | | | 8 | 8 | |
| Samuel B. Hale | | | | | | | 4 | | | | | 4 | |
| Krajewski Pesant | | | | | | | | | 1 | 2 | 1 | 4 | Central America |
| Fecheimer | | | | | | | | | | 2 | 2 | 4 | |
| Emiho F. Wagner | | | | | | | | | 1 | | 1 | 2 | Europe |
| Yensen | | | | | | | | | | | 2 | 2 | Europe |
| Williams Dimond | | | | | | | | | | 1 | | 1 | Hawaii |
| London Office | | | 3 | | | | | | | | | 3 | Europe |
| Exports by Agents | 21 | 118 | 26 | 85 | 63 | 106 | 232 | 171 | 197 | 229 | 269 | 1,517 | |
| Total exports | 144 | 292 | 127 | 162 | 132 | 161 | 289 | 205 | 348 | 374 | 365 | 2,599 | |
| Agent ratio | 14.6% | 40.4% | 20.5% | 52.5% | 47.7% | 65.8% | 80.3% | 83.4% | 56.6% | 61.2% | 73.7% | 58.4% | |
| Frazar & Co. ratio | 4.2% | 2.1% | 2.4% | 14.8% | 15.2% | 7.5% | 10.7% | 56.1% | 2.0% | 0.5% | 2.2% | 9.0% | |

(出典) 'Baldwin Locomotive Works Orders for Engines', 1890-1900

Table 5 Partners and Employees of Frazar & Co. in 1898 and 1904

| Name | Branch | Years | Note |
|---------------------|----------|-----------|--|
| Everett Frazer | Yokohama | 1898 | Owner. George Frazar(founder)'s son, head of Shanghai Branch from 1856, died in 1901. |
| John Lindsley | New York | 1898 | Partner. Head of Yokohama Branch from 1878, retired in 1901. |
| Everett W. Frazer | Yokohama | 1898,1904 | Partner(signs. per. pro.). Everett Frazar's son, owner from 1901, later managing director. |
| W.A Crane | Yokohama | 1898 | |
| E. Meregalli | Yokohama | 1898 | |
| W.B. Curtis | Yokohama | 1898 | |
| H.K.A. Onderdonk | Yokohama | 1898 | |
| W. H. Crawford Jr. | Yokohama | 1898 | |
| W.A. Brenner | Yokohama | 1898,1904 | |
| E.M. Barnby | Yokohama | 1898,1904 | |
| A.W. Upton | Yokohama | 1898 | |
| M. Campbell | Yokohama | 1898 | |
| William H. Crawford | Yokohama | 1898 | Engineer, Baldwin Locomotive Works |
| H.J.Rothwell | Kobe | 1898 | Partner(signs. per. pro.). Head of Kobe Branch? |
| G.W. Barton | Kobe | 1898 | |
| C.H. Waters | Kobe | 1898 | |
| M. Marshal | Kobe | 1898 | |
| A.W. Crombie | Kobe | 1898 | |
| S.M. Vauclain Jr. | Kobe | 1904 | Engineer, Baldwin Locomotive Works |
| Keitaro Nakamura | Yokohama | 1904 | Japanese employee. Later director |
| C.E. Kirby | Yokohama | 1904 | |
| Greig | Yokohama | 1904 | |
| O'may | Yokohama | 1904 | |
| Inuzaki | Yokohama | 1904 | Japanese employee |
| Idzumi | Yokohama | 1904 | Japanese employee |
| Suzuki | Yokohama | 1904 | Japanese employee |

Source: Yokohama Seimeiroku Hakkosho 1898, p.72,
Mitsui Bussan Head Office, Machinery Division ed., 1920(?), pp.43-46,
W. Feldwick ed. 1919, *Present-day Impression of Japan*, p.215,
Yokohama Kaikou Shiryo-kan ed., 1998, *Zusetsu Yokohama Gaikokujin Kyoryu-chi*
(illustration manual of the foreign settlements in Yokohama), p.90,
Samuel Matthew Vauclain Jr., 'Japan Diary 1904' and 'Japan and Australia Diary 1904'
(SMU, A2011/0020)

Table 6 Business trips by S.M.Vaulclain Jr. in 1904

| Date | No. of days | Destinations | Notes |
|-------------------|-------------|---|---|
| 2/3~4/20 | 77 | from Philadelphia to Yokohama via Honolulu | coming to Japan |
| 6/1~8 | 8 | Hokkaido (Sapporo, Muroran, Iwamizawa, Asahikawa etc) | by rails (via Nippon Railway), visit to Hokkaido Coal Mining Railway Co. and Railway Division of Hokkaido Prefectural Office |
| 6/20 | 1 | Tokyo | participating to the tender of locomotives and parts (for Railway Division of Hokkaido Prefectural Office) |
| 6/25~27 | 3 | Kyushu | on the way to Yawata Steel Works, returned from Kobe to Yokohama due to an emergency telegram |
| 6/30~7/2 | 3 | Kobe | |
| 7/12~10/2 | 83 | Australia, China (Hong Kong, Guangdong etc) , Philippines | market research |
| 10/15 | 1 | Tokyo | visit to Kishaseizo-kaisha (president H.Hiraoka) and Tokyo Electric Railway. |
| 10/19 | 1 | Chiba (Tsudanuma) | visit to Narashino Horse-drawn Railway |
| 10/23~29 | 7 | Kyushu (Moji), Kwansai (Kobe, Osaka, Kyoto) | visit to Kyushu Railway (president M.Sengoku), Sanyo Railway(locomotive superintendent H.Iwasaki), Kishaseizo-kaisha, Osaka City Electric Railway, Kyoto University(professor S.Tomonaga) |
| 11/15~18 | 4 | Tokyo | visit to Department of the Army, Kobu Railway, Imperial Government Railways, Tokyo Electric Railway |
| 11/23~30 | 8 | Kyushu(Fukuoka, Moji), Kwansai(Kobe, Osaka, Kyoto) | visit to Kyushu Railway, Hakata Bay Railway, Kwansei Railway etc. |
| 12/4 | 1 | Tokyo | |
| 12/7~12 | 6 | Hokkaido(Otaru, Iwamizawa etc) | visit to Temiya Works of Hokkaido Coal Mining Railway etc |
| Total days | 203 | | 126 days after coming to Japan. |

Source: Samuel Matthew Vauclain Jr., 'Japan Diary 1904' and 'Japan and Australia Diary 1904'(SMU, A2011/0020)