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Timber Trade in Industrialization of Modern Asia

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Timber Trade in Industrialization of Modern Asia^{*}

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Abstract

Forests are used as essential materials and energy sources for industrial applications. Since the mid-nineteenth century, timber trade has expanded globally. However, Asian timber trade has not been fully elucidated as Europe has been the center of the world timber trade. This study examines the Asian timber trade of the late nineteenth century and 1930s from the perspective of the use of forest resources in the Asian industrialization. A brief overview of the world timber trade will be presented. The Asian timber trade in four periods—the late nineteenth century prior to World War I, during World War I, the 1920s, and the 1930s—will be examined. Moreover, the factors that define timber trade and the formation and development of the world timber market will be discussed. The results of the study show that although the Asian timber trade volume was small compared to those of Europe, it increased steadily with changing supply areas.

Keywords: timber trade, forest resources, industrial wood

^{*} This study contents are based mainly on Yamaguchi(2015b), but the English version has been revised substantially.

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I. Introduction

This study aims to examine the Asian timber trade from the late nineteenth to the 1930s by placing it in the world timber trade from the perspective of the use of forest resources in the Asian industrialization.

Since ancient times, forests were used worldwide as a material and energy source for economic development. Over time, along with the expansion of arable land due to population growth, logging for commercial purposes increased, and timber trade gradually expanded. Timber, although bulky and unsuitable for transport, ranked second to fifth in world trade in the mid-1930s and was a major trade item in the United Kingdom, accounting for 10% of the cargo loaded on tramp ships (Department for Timber Utilization 1937, p.3; Gripaios 1959, p.15). However, while the history of deforestation has been clarified (Westoby 1989; Ponting 1991; Richards 2003; Williams 2006), the history of timber use and trade and the world timber market has not been sufficiently clarified. Although the timber trade was a cause of deforestation, it made industrialization possible. Therefore, it is necessary to clarify timber trade in relation to industrialization. Moreover, the study of the world timber trade can contribute to a better understanding of regional differences in the natural environment and resource usage. It may also lead to a revelation of an unconventional history of commodity circulation. While the commodities studied in world trade studies have been non- or semi-durable consumer goods such as food and clothing, timber has the characteristic of being a non-durable and a durable commodity.

Thus, this study focuses on timber trade in Asia. Since the mid-nineteenth century, the world market has become increasingly integrated under Pax Britannica. Asia was incorporated into the international division of labor under European leadership. While Asia's trade with the West has increased, inter-Asian trade has expanded on a comparable scale (and at a much higher growth rate) (Sugihara 1996). Simultaneously, the industrialization of Asia progressed, and the timber trade expanded. The center of the world's timber trade was Europe. However, the trade statistics of the League of Nations used in the analysis were compiled based on materials submitted by member countries and, therefore, are not comprehensive. Additionally, when compared to the European continent of many small countries, Asia comprises many large countries, such as China and India. Thus, domestic trade volumes increase while trade volumes across national borders decrease—the statistical problem of underestimating the Asian timber trade volumes in comparison with European timber trade volumes. Therefore, this study examines the largely unknown Asian timber trade and its relations with other regions as a first task to elucidate the timber trade in relation to industrialization.

The rest of the paper is organized as follows. Section II provides an overview of the timber trade. Sections III to VI examine the timber trade during four time periods: the late nineteenth century before World War I, during World War I, the 1920s, and the 1930s. Finally, the conclusions of the study are presented.

II. Overview of the timber trade

Wood usage can be divided into fuels and materials. Wood for fuel (firewood and charcoal) was used for household and industrial energy resources. As a material, wood (industrial wood) was used for construction, furniture, engineering, ships, railway sleepers, mining, utility poles, pulpwood, and packaging. From the late eighteenth century—when the Industrial Revolution took place in England—to the nineteenth century, the demand for various types of timber increased, and the demand and supply balance changed dramatically in many regions. For example, the wood shortage worsened, arousing strong concerns in Britain, Germany, and other European countries (Perlin 1991, pp.227-245; Radkau 2012, pp.304-306). Although the industrialization of Asia lagged behind that of Europe, deforestation also increased in Asia. In China, agricultural land development and fuelwood logging proceeded as the population increased prior to the eighteenth century; in India and Southeast Asia, the construction of plantations, agricultural land development, and the export of forest products accelerated after the late nineteenth century (Ueda 1999, pp.190-205; Sugihara 2020, pp.628-629).

Against the background of changes in wood demand and supply balance in various regions, the world timber trade had expanded since the mid-nineteenth century, when the use of steam locomotives, steamships, and telegraphs caused dramatic reduction in transportation and communication costs. There are few statistics available to form a comprehensive picture of world timber trade volumes prior to World War II; however, the Food and Agriculture Organization (FAO) of the League of Nations started conducting surveys after the 1920s. According to the FAO materials, which have some issues as noted above, the world wood consumption was 1.5 billion m³ (fuelwood 53%, timber as material 47%), and the world timber trade was 132 million m³ (fuelwood 1%, timber as material 99%) in 1937 (Table1). There was no significant difference in the consumption of fuelwood and industrial wood, but industrial wood became an important trade good. This is because fuelwood was cheaper than industrial wood and is therefore unsuitable for long-distance transportation. Industrial wood also had a higher demand for big logs (requiring a longer time for reproduction) than fuelwood. The percentage shares of industrial wood consumption were as follows: 33% in North America, 33% in Europe, 18% in Russia, 10% in Asia, 3% in

Central and South America, 1% in Africa, and 1% in Oceania. The percentage shares of timber trade volume were as follows: 25% in North America, 24% in Europe, 19% in Asia, 17% in Russia, 12% in Central and South America, 3% in Africa, and 1% in Oceania (Food and Agriculture Organization of the United Nations 1948). Europe and North America stood at the center of the timber trade as their demand for the material had increased with industrialization. In the 1910s, Asia's percentage was 1% (Zon and Sparhawk 1923, p.58); therefore, it may have increased afterward, but it did not alter the Eurocentric structure.

[Table 1]

Various goods featured in the timber trade, and while they changed over time, construction materials occupied a high share. However, notably, as industrialization progressed, the demand for industrial wood increased, such as railway sleepers, pitprops, pulpwood, and timber for port and shipbuilding and road maintenance, which expanded the timber trade. For example, the trade volume of pulpwood was about one-third of that of construction materials in the first half of the 1910s (Food and Agriculture Organization of the United Nations 1948), but it was at the same level as construction materials in 1937. The consumption and trade volume of industrial wood was the highest in highly industrialized regions such as Europe and North America. Nevertheless, in Asia, where the proportion of fuelwood demand was high, the trade in timber such as railway sleepers, ship materials, wooden boxboards, and match sticks steadily expanded.

It is well known that the forests of the world that supply wood can be divided into several types depending on temperature, precipitation, and soil. Representative cases are as follows: tropical forests characterized by diverse species (Southeast Asia, South Asia, Latin America, around the equator in Africa), subarctic forests that are often single-type coniferous (North America, Northern Europe, Russia), and temperate forests that comprise either broadleaf trees or a mix of needleleaf and broadleaf (distributed between the other). According to earlier estimates of forest area, the world's forest area decreased by approximately 500,000,000 ha from the mid-nineteenth century to the mid-twentieth century, and tropical deforestation has accelerated since the 1920s (Richards 1990, p.164). The expansion of the world timber trade was also associated with this deforestation but to a lesser extent than the expansion of arable land and the impact of commercial agriculture (Richards and Tucker 1988, pp.5-6).

III. The late nineteenth century before World War I

1. The Intra-Asian timber trade

(1) Temperate Asia

In the second half of the nineteenth century, the world market became increasingly integrated, and Asia was incorporated into the international division of labor parallel to colonization by European countries. In Asia, exports of primary commodities to Europe increased rapidly, and intra-Asian trade expanded with the development of the international division of labor within Asia (Sugihara 1996, chap.1). The rapid construction of transportation and communication infrastructures such as railways, ports, and telegraph lines by European countries increased the demand for timber, facilitating deforestation and long-distance transportation of large volumes of timber. Compared to previous periods, this period saw a major expansion of the Asian timber trade.

There were various timber flows in the Asian timber trade, but some new and larger flows appeared during this period. A particularly noticeable flow was that of timber from Japan to China, Korea, and other East Asian countries. In China, coastal trade was developed by sailing ships such as junks. Nevertheless, after the signing of the Treaty of Nanking in 1842, major ports were opened, and the Chinese market gradually strengthened its relationship with the world economy, while the traditional coastal trade retreated by the end of the 19th century (Miyata 2006, chap.2). As for timber trade, a new flow of timber transported by steamship emerged after the 1890s. At the open ports, the demand for timber for the construction of factories and government buildings in various countries increased. However, China lacked large forests except for timber-producing areas in the drainage basins of the Yalu River in the north (pine) and Yangtze River in the south (cedar), and the Fujian Province. Consequently, imported timber and timber from these production areas have increased in open ports. For example, in Shanghai, timber trade from Fujian and southern Zhejiang increased in the 1870s, and the South City Association of Timber Merchants was established in 1875. Additionally, timber imports increased in the 1890s, and an imported timber organization was established in 1905. Moreover, in Tianjin, while timber from the Yalu River Basin increased, the quantity of imported timber also increased (Zhang 2017, p.146-147; Nagayama 1922, pp.409-410). Following the First Sino-Japanese War, as a result of explicit stipulations regarding factory construction by foreigners in the Treaty of Shimonoseki, an increasing number of factories were built on the initiative of Western companies (Feuerwerker 1980, pp.29-31). This may have increased the demand for timber for industrial development. China's timber import volumes (transported by steamship only) increased from 180,000 m³ in 1904 to 270,000

m³ in 1905 and an average of 450,000 m³ from 1906 to 1913 (Figure 1). In addition, the coastal timber trade by junks may have reached more than twice the amount of timber imports by steamships, although junk trade lost its role to the steamship trade. Although little timber was transported between northern and southern China, timber was transported from neighboring areas in coastal cities, intensifying competition with imported timber (Nagayama 1922, p.410; Nōshōmushō 1905, pp.178-179).

[Figure 1]

At the center of China's imported timber trade was timber from Japan (Hokkaidō) and the United States, which could then be transported due to lower ocean freight charges. Initially, timber from the United States (Oregon pine) was primarily used to construct office buildings for government agencies and factories, grand hotels, and Western-style houses in the foreign settlements. However, eventually, it was used for general construction and other purposes (Zhang 2017, p.147; Nōshōmushō 1905, pp.370-371). Meanwhile, the major use of Japanese timber was for railway sleepers. In China, railway construction initiated by Western powers generated considerable demand for timber, and, following the Russo-Japanese War, timber import volumes for sleepers and other uses soared as Japan advanced into Northern China. The annual sleeper need (for repairs) in China around 1910 was approximately 300 per mile—they needed approximately 1,800,000 sleepers (125,000 m³) for 6,000 miles of railway (Nagayama 1922, p.427). Japan's advance into Korea also increased the demand for Japanese sleepers and munition materials in Korea (Ōkurashō 1905, p.104). According to a survey by the Japanese Ministry of Agriculture and Commerce, roughly half of the sleepers used to construct and repair railways in East Asia were made in Japan (Nōshōmushō 1905, p.1). Japanese timber was of lower quality than the competing timber of the United States, but it was cheaper. Therefore, it was used as a construction and engineering material and for match sticks and wooden boxboards. The Japanese timber share on the Chinese import timber market increased from an average of 27% in 1904–1905 to 50% in 1906–1913 (Figure 1). Although Japan's demand for timber had increased with the rapid economic development following the opening of ports in 1859, the construction of railways and logging roads made it possible to fall natural forests that had previously been unused. Consequently, Japanese timber exports rose from 180,000–340,000 m³ during 1900–1905 to 600,000–1,120,000 m³ during 1906–1913 (Figure 2); thus, Japan became a primary timber supplier in East Asia.

[Figure 2]

Similar to Japan, there was a high demand for pine, cedar, and other temperate softwoods in China. Softwood

made up the largest proportion of timber imported from Japan and the United States, and the share of softwood in total timber imports gradually increased to over 80% before World War I. Softwood was imported mainly through China's two major timber markets in Shanghai (47%) and Tianjin (16%), as well as Dalian (13%) and Hankou (13%). Simultaneously, China imported various tropical hardwoods such as teak, sandalwood, rosewood, ebony, and bishop wood via Hong Kong and Singapore and other hardwoods such as jarrah from Western Australia and oak from Japan. Tropical hardwoods from Southeast Asia made up more than 80% of imported hardwoods during 1904–1905, but the growing proportion of temperate hardwoods from Japan and the United States increased. Tropical hardwoods were imported mainly to Shanghai (25%) and Kowloon (20%), and temperate hardwoods were imported mainly to Tianjin (30%) prior to World War I (Zon and Sparhawk 1923, pp.375-378; Nagayama 1922, pp.418-423).

This kind of tropical hardwood import also increased in parallel with the railway construction. For example, teak, which is resilient against temperature changes, vermin, and rot, was used for railway sleepers and the door and window frames of vehicles moving across various regions. Jarrah was used for railway sleepers. However, compared to sleepers in Japan and the United States, which were mostly used in Northern China, such as Tianjin, Fengtian (Shenyang), and Niuzhuang (Yingkou), tropical hardwood sleepers were used in regions further south. In Shanghai, jarrah sleepers were used in addition to Japanese sleepers and preserved sleepers from the United States. Even further south in subtropical and tropical Guangdong and Hong Kong, sleepers of Japan and the United States were not used as much, and those used were mainly jarrah sleepers. Timber usage depended on transportation costs and each country's policy for railway material procurement and use (Nōshōmushō 1910, pp.16-18).

(2) Tropical Asia

Tropical timber from a diverse range of tree species was produced in Southeast Asia, the primary supplier of tropical timber. Southeast Asian timber was distributed within Asia mainly via Singapore and Hong Kong, which had developed into transit ports. Timber varieties that had few alternatives, such as teak, were exported worldwide. For example, after the 1890s, tropical hardwood exports increased in the Dutch East Indies and British North Borneo, and British North Borneo mainly supplied timber destined for China via Hong Kong. Exports there were about 4,000 m³ in 1913, while the Malay Peninsula where Singapore is located was supplied with large volumes

of timber from the Dutch East Indies and Thailand (Dixon 1991, p.107; Nagayama 1922, p.492; Mori 1944, p.104). According to Zon and Sparhawk, the volume of timber destined for the Malay Peninsula was comparable to that of Chinese imports (Zon and Sparhawk 1923, p.60). While the demand for timber for fuel and construction materials was high in the Strait Settlements, they had almost no forests. Similarly, British Malaya had a high demand for timber for tin mine development and concomitant transportation infrastructure development. The Philippines occupied a special status in Asia because of its U.S.-dependent trade structure. While the demand for timber to construct roads, railways, telegraph lines, and factories increased, they did not have sufficient modern logging equipment domestically; thus, they imported an annual average of 20,000 to 30,000 m³ of timber from the United States (Mori 1944, p.164; Hagino 1961, p.84).

Another large timber flow came from Southeast Asia. It flowed from British Burma and Thailand to British India and grew during the second half of the nineteenth century. In India, deforestation has accelerated due to the expansion of arable land and commercial demand for timber since British colonization. British India had large forests only in East and Central India, close to Burma, and near the Himalayas (Nagayama 1922, p.431). Major ports such as Bombay and Madras strengthened their links with Britain, but India's timber trade expanded in the context of its traditional trade with Southeast Asia. Most of the timber imported by India was teak, which had all but disappeared from India due to logging. India's timber imports increased from an average of approximately 40,000 m³ in the 1890s to 100,000 m³ in the 1900s. Teak made up 40% of imports in the 1890s and 50% in the 1900s (Figure 3). Approximately 85–90% of imported teak was from Thailand, and the rest from Java and French Indochina, and most of it ended up in Bombay State. Most non-teak timber were softwood from the United States and Japan and were mainly imported to Bombay State, Bengal State, and other Sindh States. Furthermore, British Burma's teak imports, which were treated as Indian domestic trade in the statistics due to the incorporation of Burma into British India after the Third Anglo-Burmese War in 1885, were an average of 170,000 m³ in the 1890s and the 1900s (Figure 4). As such, at least 200,000 to 300,000 m³ of teak was transported into India annually around this time.

[Figure 3]

[Figure 4]

In India, teak was used as a vermin-resistant construction material and broadly for engineering, furniture, and railway sleepers. In particular, the demand for sleepers increased with the construction of railways, which started

in the 1850s and reached its peak in the 1890s and the 1900s. Teak and Indian sal were used as suitable railway sleepers in India, but they were in short supply for rapid railway construction. Therefore, Himalayan timber, Australian jarrah, preservative-infused Scandinavian timber, and steel or cast iron were also used (Williams 2006, p.338; Nōshōmushō 1910, pp.20-21; Mitsui Bunko 2004, p.142). Japanese timber also found a bigger market in India due to lower freight charges. However, the tropical regions with their wet and dry seasons caused Japanese sleepers to quickly rot or break as they were susceptible to temperature changes and termites. Consequently, timber imported from Japan and the United States was mainly used as wooden boxboards for tea and not for sleepers. India's estimated consumption of sleepers during 1900 was 26.1 million (23.7 million for construction and 2.4 million for repair), and India's total railway length reached 52,767 miles in 1910 (Williams 2006, p.339). In India and Southeast Asia, construction of railways and ports was promoted in connection with plantation construction and mining development by Western countries after the latter half of the nineteenth century. In addition to the expansion of arable land for the cultivation of primary products, the demand for sleepers and fuelwood for the production and transportation of these products increased. Consequently, trade in timber and other forest products, such as camphor and rubber, expanded with deforestation (Tucker 1983, pp.146-166).

Teak was primarily produced in the mountains of Southeast Asia, adjacent to Thailand, British Burma, and French Indochina. The teak market expanded due to the rapid increase in global demand, especially for shipbuilding and railway construction in the mid-nineteenth century. As the forests of Malabar in southern India were largely depleted of quality teak by the 1820s, the British started teak production in Lower Burma in the wake of the First Anglo-Burmese War in 1826. The British control of teak forests throughout Burma was established after the Third Anglo-Burmese War in 1885. Five major British companies, including Bombay Burmah Trading Corporation Limited, monopolized logging, and Burma's teak exports, increased rapidly (Bryant 1997, chap.2-5). During the period 1880–1898, Burma's teak production rapidly increased from 71,000 m³ to 495,000 m³, and export volumes increased from 171,000 m³ to 387,000 m³, with approximately 70% of exports going to India and 25% to Europe (Figure 4).

With the advent of British control over Burmese teak forests, other countries had no choice but to look for teak in Thailand. The Annual average of Thai teak exports were 5,600 m³ from 1873 to 1876, and 27,000 m³ from 1883 to 1887. They increased rapidly after the 1890s with the increase in European capital and reached 122,000 m³ from 1905 to 1909. Consequently, teak exports accounted for most of the teak production in Thailand (Ingram

1971, pp.97, 105-106; Manarungsan 1989, p.135). Figure 5 shows the teak exported from Bangkok along the Chao Phya River. It does not include those exported to Burma along the Salween River, of which 67% were headed for India and Ceylon, 16% for Europe, and 12% for Hong Kong. The main export destinations for Thai teak since the twentieth century have been India and Burma. As a principal export destination, other places like Java and French Indochina also supplied India with teak. For example, 40,000–60,000 m³ of teak was exported to India from Java before World War I and 20,000 m³ of teak from French Indochina in 1913 (Zon and Sparhawk 1923, pp.386, 393).

[Figure 5]

As discussed above, there were two significant flows within Asia: one of Japanese timber to China and Korea and one of Southeast Asian timber to the Malay Peninsula and India. Although there were many smaller timber flows between the temperate regions, mainly in East Asia, and tropical regions, mainly in Southeast Asia and South Asia, the two can be considered as separate timber trade areas.

2. Timber Trade with Regions outside Asia

Timber trade flows between Asia and regions outside of Asia were small prior to World War I. The timber flows from the United States to Asia stood out slightly, but timber exports from the United States to Asia were an annual 200,000 to 250,000 m³ from 1905 to 1913. Over 80% of this went to China and 2–3% to Japan. They were used as sleepers and construction materials. Some were also exported in the form of wooden boxboards to the Philippines (then under the rule of the United States) and other regions in Southeast Asia and India. However, Pacific coast timber exports were extremely limited compared to those of the Atlantic coast; therefore, timber exports to Asia only made up approximately 5% of the total timber exports of the United States (Figure 6). The United States also exported timber to South America and Australia, accounting for most of the timber imports in those regions, but the principal timber export market of the United States was Europe. Most exports were from ports on the Atlantic coast. Moreover, India and Southeast Asia were supplied with wooden boxboards for tea, rubber, tobacco, and other agricultural exports by Britain (Northern European timber), Germany, and the United States, but this was not a conspicuous timber flow. The timber exported from Russia to China and Japan (matchstick and wood pulp) was similarly small in volume, approximately 50,000 m³ in 1913, and the Russian supply areas for Europe and Asia differed (Nagayama 1922, pp.265-277). Regarding wood pulp and paper

(processed timber products), which are not included in the timber trade statistics of each country, Japan, China, and India imported such products from Sweden and Norway. However, the main raw materials for paper in Asian countries were rags, weeds, rice straw, and hemp (Zon and Sparhawk 1923, p.425; Yamaguchi 2015a, p.172).

[Figure 6]

What stood out in the flow of timber from Asia to regions beyond Asia was the flow of tropical hardwoods from Southeast Asia to the rest of the world. At the center of this flow were teak exports destined for Britain, the Netherlands, France, and other European countries. However, judging from Burma and Thailand's teak exports from 1890 to 1913, it can be estimated to have been an annual average of about 80,000 m³; hence, the exports to regions beyond Asia are estimated to have been below 100,000 m³, even if it includes exports to regions other than Europe. Moreover, as the demand in Europe was for high-quality teak, the Asian teak market differed from the European teak market. For example, Thai teak was sold for two to five times more in Europe than in Asia (Great Britain, Foreign Office 1895b, p.2; Great Britain, Foreign Office 1904, pp.4-5), and the price of Burmese teak meant for Europe (mainly Britain) was 1.7 times higher than the price for India (Figure 7). Good-quality teak was transported to Europe, while low-quality teak and defective products that were often created in production and transportation processes (4–7 years from logging to export) were supplied to Asian markets. Thus, about 80–90% of Burmese teak was consumed in India and Burma in the twentieth century (Figure 4). Thailand also switched their principal export market from Europe to India, with 65–85% going to Asia, due to a decline in high-quality teak, high transportation costs compared to Burmese teak, and the imposition of high import duties on Thai teak to Britain (Manarungsan 1989, pp.136-137). Likewise, in Java, a decline in the natural teak forests led to an increase in small-diameter logs. Consequently, the principal market for Javanese teak transitioned from overseas to domestic, where it was used as fuel and for the construction of houses and huts to dry tobacco leaves (Takayama 1943, pp.103-108).

[Figure 7]

Figure 8 shows the world timber trade before World War I. This is also an explanation of the timber trade in Europe, which was the heart of the world timber trade. In Europe, during this period, the industrial countries and top timber importers were Britain, Germany, France, and Italy, who imported timber from Northern European countries and Russia. In Britain, although the demand for timber increased, the timber price gradually decreased after the mid-nineteenth century. It did not fluctuate significantly from the 1890s, when the volume of timber

imports began to increase rapidly, until before World War I. The background for this was Northern European and Russian forestry development. Russia, in particular, surpassed Sweden to become the world's number one timber exporter by exporting most of the timber they produced. Russia's timber exports doubled from 5,890,000 m³ in 1902 to 12,900,000 m³ in 1913. Most of it was exported to Europe, and Russian timber accounted for approximately half of European countries' timber imports. For example, Britain, which depended on imports for 95% of its timber consumption, started importing pitprops from Russia instead of Norway or Sweden. This was because Russia had more relaxed logging regulations, while the other two prohibited the felling of small-diameter timber. Russia's share of British timber imports increased from 24% to 48% between 1900 and 1913. Sweden and Norway grew as exporters of pulpwood, wood pulp, and paper, while Germany increased its paper production while importing pulpwood and wood pulp from the other two. Moreover, developments in maritime transportation lowered sea freight charges, thus allowing Europe to import more timber from the United States, the world's largest timber producer. Timber exports of the United States grew from 4,750,000 m³ in 1905 to 7,770,000 m³ in 1913, while timber of the United States was exported worldwide (1910–1914; 36.1% in Europe, 22.5% in Central and South America, 21% in Canada, 7% in Australia, 3% in Asia, 2% in Africa); Europe was the main export market, and only a small share went to Asia (Zon and Sparhawk 1923, pp.169-197, 292-294, 336, 535; Fitzgerald and Grenier 1992, pp.17-21; Nagayama 1922, pp.265-272; Sonobe 1924, 143-144).

[Figure 8]

The above shows that Asia was self-sufficient in timber and did not have a strong connection with Europe. Temperate Asian timber and European timber were interchangeable; however, it is unlikely that many species were competitive in other markets due to transportation costs, except for some special species such as teak.

IV. Timber trade during World War I

The outbreak of World War I caused major changes to the world economy and world order that followed. As the import of European industrial products plunged in Asian countries, the production of industrial products increased. Import substitution advanced, and the intra-Asian trade of industrial products and their raw materials expanded. World trade shrank due to shipping shortages, rising freight charges and insurance premiums, and wartime trade control; however, intra-Asian trade volumes soared to more than three times the pre-war figures (Sugihara 1996, p.95). A characteristic of the Asian timber trade during this period is the decline in trade with Europe and the United

States: timber imports from the United States and teak exports to Europe declined. Wood pulp and paper imports from Sweden and Germany also declined, and import substitution was promoted in Asian countries. In addition to these changes in timber trade with regions outside Asia, the soaring timber demand that accompanied the remarkable economic development of Asian countries also changed the intra-Asian timber trade.

China's timber demand rose rapidly as it entered its "golden era" of Chinese industrialization. However, the steep rise in sea freight charges caused a sudden decline in timber imports from the United States—from 200,000 m³ in 1914 to 30,000 m³ in 1918. Japanese timber, which had been competing with timber from the United States, continued to be imported. However, the import of Japanese sleepers dove to roughly two-fifths between 1913 and 1918 due to the suspension of railway construction and stricter quality controls in China. Simultaneously, China saw more imports from Japan in terms of pine squared timber and match sticks for the match industry, which had been undergoing import substitution (*Ōkurashō* 1915-1919). Timber imports from Japan averaged 360,000 m³ and comprised 67% of China's timber imports from 1914 to 1918. From 1916, there was an increase in the imports of Chinese timber and Russian (Siberian) timber, which was likely used mainly for match sticks (*Shanghai Nichi-nichi Shinbunsha* 1929, p.49). Regarding imports from Southeast Asia, imports via Singapore decreased slightly; however, China started importing timber from the Philippines, which switched from being an importer to an exporter in 1916, owing to the development of their timber industry (Nagayama 1922, pp.473-474). China's imports of Thai teak gradually increased against the background of the decline in Thai teak exports to Europe and India, where tariffs were raised in 1916 due to increased military spending. Thus, China could also keep importing an annual average of 550,000 m³ of timber during the war (Figure 1).

India saw a decrease in teak imports from Thailand but continued to import roughly the same 160,000 m³ of teak from Burma that they imported before World War I (Figure 3). India also continued to import Southeast Asian timber via the Strait Settlements. Meanwhile, although timber for railway and port construction in Egypt and Mesopotamia was transported from India, India's export volume of teak (produced in Burma) to Europe decreased, and the use of India's forest resources for military purposes increased (Tucker 1983, p.95; Westoby 1989, p.120). The difficulty of demanding matchsticks from both domestic and foreign countries restricted the development of the match industry in India (*Ōishi* 2002, pp.86-87). However, the import of wooden boxboards for tea from Japan increased, which is characteristic of the Indian timber trade during this period. The proportion of Japanese timber in India's timber imports, excluding teak (average of about 80,000 m³ from 1914 to 1918), increased from 1% in

1913 to 36% in 1917. This was because of the declining timber imports from the United States and Northern Europe. Likewise, as exports of agricultural products and minerals increased in Southeast Asia, wooden boxboard imports from Japan increased when those from Britain, Russia, and the United States declined. Consequently, Southeast Asia developed into a Japanese timber export market that rivaled East Asia. Deforestation increased in Southeast Asia, but there was almost no box material production. Therefore, the import duties on box materials were lowered to promote agricultural product exports, which contributed to the increase in timber imports from Japan (Ōkurashō 1914-1918; Hagino 1961, pp.42, 46).

As discussed above, Asia's timber trade with outside regions declined during World War I. Japan simultaneously became an important supplier of timber in Asia. However, Japan's timber demand soared because of remarkable economic growth and urbanization. Consequently, the price of Japanese timber quickly increased by about three to four times, and the new-expensive Japanese timber became less competitive in Asian markets. While Japan remained a timber supplier to Asia, Japan's timber exports decreased from 960,000 m³ in 1914 to 670,000 m³ in 1918 (Figure 2). Japanese supply could not meet the soaring domestic timber demand for a time. Japan started to import timber from Karafuto (Sakhalin) which was a colony of Japan. Karafuto's timber was used in the production of wood pulp, for which import substitution had advanced during World War I, and Siberian timber was used for match sticks as the adaptable tree species had been drained. There was a deepening supply shortage of mainly construction materials. Thus, in the summer of 1919, the Japanese discussed revising import duties to lower the timber price and thus promote timber imports, and the import duties were duly lowered in August 1920 (Yamaguchi 2015a, pp.42-43). Consequently, large volumes of timber were imported from the United States, and the post-1920s timber trade underwent major changes. The United States saw its timber exports to Asia decline to about one-third between 1914 and 1918. However, timber exports to Asia increased in the post-war period owing to the forestry development on the Pacific coast and the opening of the Panama Canal during the war (Elchibegoff 1949, p.46). While Russian timber became less visible in the timber trade because of the Russian Revolution, timber from the United States came to play an important role in post-war Asian and European timber markets.

V. Timber trade in the 1920s

Following World War I, the total volume of intra-Asian trade decreased in the first half of the 1920s due to the

reestablishment of trade in Europe and the United States. Intra-Asian trade subsequently recovered in the second half of the 1920s. Moreover, the relative importance of East Asia increased in intra-Asian trade because of the decrease in East Asian exports to the West and the increase in East Asian exports to other Asian countries in the post-war period (Sugihara 1996, chap.4). The world timber trade began to increase due to the increase in timber demand for European reconstruction and the decrease in sea freight rates (United Nation Dept. of Economic Affairs, Economic Commission for Europe and Food and Agriculture Organization 1953). Thus, the timber trade connections between Asia and other regions were strengthened. In Asia, the connections between the timber trade area in temperate and tropical regions were also strengthened.

After the 1920s, Japan's timber exports to China, Korea, and the rest of East Asia decreased, while timber exports from the United States to Japan and China soared. Exports to India and Southeast Asia rose to pre-war levels. The United States' timber exports started increasing in 1919 and reached their pre-war level of 7,000,000 m³ in the mid-1920s owing to expanded timber exports to Asia. Before World War I, approximately 80% of the United States' timber exports were to Europe; however, Asia became an export market for timber of the United States that rivaled Europe in the 1920s (Figure 6). Timber from the United States increased its competitiveness in the Asian markets owing to the sudden drop in timber prices, resulting from timber oversupply during the post-war recession, the massive decrease in transportation charges over the Pacific Ocean, and Japan's lowered import duties (Yamaguchi 2015a, pp.44-46). The timber exports of the United States from the Pacific coast (mainly to Asia) increased from 670,000 m³ (17% of total exports) in 1919 to 3,850,000 m³ (46%) in 1928. Meanwhile, timber exports of the United States from the Atlantic coast (mainly to Europe) decreased to approximately 60% of pre-war exports. With the demand for timber soaring in Europe because of post-war reconstruction, imports increased from Northern Europe as well as Poland, Latvia, and Czechoslovakia, replacing Russia, whose timber production had been reduced (United Nation Dept. of Economic Affairs, Economic Commission for Europe and Food and Agriculture Organization 1953; Tōkyō Gaikoku Mokuzai Yunyū Kyōkai Chōsabu 1928, pp.56-57).

As the United States' timber was distributed worldwide and its use increased rapidly, Asia's connections with Europe and other regions became stronger. Japan's timber imports from the United States increased from 70,000 m³ (29%) in 1919 to 990,000 m³ (40%) in 1922, reaching 2,760,000 m³ (83%) in 1924, due to the high demand for reconstruction materials after the Great Kanto earthquake in 1923. Timber was felled in large volumes on Karafuto (Sakhalin) because of a vermin outbreak, and Karafuto's timber was imported into the Japanese market

as much as the United States' timber. This caused the production of Japanese timber to stagnate as it lost its price advantage (Yamaguchi 2015a, pp.46-47). The timber of the United States was easily traded in large quantities because of its standardization. It could be processed into various sizes; therefore, the demand for the United States' timber as sleepers and construction material also increased in China. China's timber imports from the United States increased from 90,000 m³ (18%) in 1919 to 820,000 m³ (58%) in 1929, and the top import changed from Japanese timber to the United States' timber in 1921. The United States' timber dominated the Chinese timber market, especially in coastal areas (Mitsui Bunko 2005, pp.189-190). Moreover, when pine was used as a pulp material, imports from Canada and the United States increased as they were major producers of wood pulp and paper. While Japan's self-sufficiency rate for wood pulp and paper increased during World War I, China was highly dependent on imports as its modern paper industry was still considerably young (Kubo, Kajima, Kigoshi 2016, pp.49-50).

Japan and China also increased timber imports from Russia (Siberian timber) in the 1920s. Immediately after the end of the war in 1919 until the latter half of the 1920s, Japanese imports of Russian timber increased from 60,000 m³ to 400,000 m³ and Chinese imports from 20,000 m³ to 50,000 m³. Part of the timber was used for match sticks and wood pulp. China also imported match sticks from Japan and Canada, in addition to Russia (Zenkoku Keizai linkai 1940, p.70). Japan's timber imports from Southeast Asia increased from 5,500 m³ to 60,000 m³. Thus, Japan became an export market for Southeast Asian timber comparable to China, which had imported Southeast Asian timber prior to World War I. In British North Borneo and the Philippines, Western capital, overseas Chinese and Japanese capital promoted the development of forestry during World War I, and timber exports to East Asia increased in the 1920s (Hagino 1961, pp.106-109; Mori 1943, p.104). Southeast Asian timber was mainly used as plywood for boxes and was imported to Nagoya, while timber for match sticks was imported mainly to Kobe. Simultaneously, the wooden boxboards that had been Japan's principal timber export shifted their main export destination from India to the Strait Settlements, making Southeast Asia an important export market for Japanese timber (Ōkurashō 1926-1930).

Meanwhile, there were changes in the flow of teak from Southeast Asia to India in the 1920s. India conducted major tariff revisions in 1921 and 1922, doing the opposite of Japan by increasing import duties to compensate for budget deficits. Thus, India's timber imports decreased from 100,000 m³ (of which 60,000 m³ were Thai teak) in 1920 to 40,000 m³ (20,000 m³ Thai teak) in 1926 (Figure 3). Therefore, Burmese teak gained a price advantage relative to Thai teak (Manarungsan 1989, p.137). The production of Burmese teak roughly doubled compared to

production before the war, and 80–90% of Burmese teak exports (300,000 m³) went to India (Figure 4). During World War I, Thailand was in the process of shifting its teak exports from India to China (including Hong Kong) and Japan. However, the raised Indian import duties were a damaging blow that further decreased exports to India and expanded exports to East Asia and Singapore. Simultaneously, exports of Thai teak to Europe did not grow markedly due to the global disarmament (reduced warship construction). Exports to Africa increased in the latter half of the 1920s as European investments and development proceeded there (Figure 5). Moreover, exports of tropical hardwoods increased in Africa and South America in the 1920s, peaking in 1929 and 1930 (Laaman 1988, p.150).

VI. Timber trade in the 1930s

In the first half of the 1930s, world trade shrank because of the Great Depression at the end of the 1920s, but it recovered during the latter half of the 1930s. During this time, the relative importance of East Asia in intra-Asian trade increased. While Japan and China shifted emphasis from trade with the West to Asian trade, Southeast Asia and South Asia maintained trade with the West by avoiding the Japanese bloc economy (Sugihara 1996, chap.4). The connections between the timber trade area in temperate and tropical regions did not disappear, but the Asian timber trade developed in response to economic, political, and military factors in each country.

Japan's timber imports soared in the 1920s, but this eventually caused a timber oversupply and a continuous fall in timber prices. As such, the second half of the 1920s saw a debate concerning raising tariffs to protect domestic forests, which was put into action as import duties mainly on timber from the United States were raised in 1929 (Yamaguchi 2015a, p.47). Meanwhile, the Great Depression that had started the same year hit the United States, and the domestic timber demand suddenly shrank after having shown a trend of decline throughout the late 1920s. The overflowing timber on the United States' market was redirected for export, but it had lost competitiveness in the Japanese market due to the raised import duties. Moreover, Russian timber exports had increased rapidly since 1927 as a result of their recovering production. This contributed to a deepening worldwide competition to sell cheap timber (League of Nations, Economic Organisation 1932, p.7). In Asia, timber from the United States was undersold in China, as it was shut out from Japan. In addition, China saw an increase in timber imports from Russia and Canada. Japan's timber imports (excluding Karafuto's timber) plummeted from 4,160,000 m³ to 1,590,000 m³ between 1928 and 1933 (Figure 2), while China's timber imports rapidly increased

from 900,000 m³ to exceed 2,000,000 m³ (Figure 1).

After 1933, the world timber trade started increasing as the economy recovered, but timber trade volumes stopped at 62–70% of the mid-1920s levels due to countries raising tariffs with the spread of bloc economies (Elchibegoff 1949, p.5). Timber exports of the United States also did not recover, settling around 3,000,000–3,500,000 m³ as the timber export share from the Pacific coast to Asia declined (Figure 6). China's timber imports peaked at 2,070,000 m³ in 1933 and went down to 680,000 m³ in 1937 due to stagnating timber imports from the United States and Canada, and statistically excluding of Northeast China's imports (Manchuria) after July 1932 (Figure 1). Simultaneously, timber production increased in Japan, and exports to China (mainly to Manchuria) expanded in relation to Japan's advance into Northern China after the start of the Sino-Japanese War in September 1937 (Figure 2). Timber imports of China (excluding Manchuria) from Japan soared from 190,000 m³ in 1938 to 580,000 m³ in 1940, so that Japanese timber replaced the timber of the United States as the leader in the Chinese import timber market (Figure 1). The value of Japan's timber exports to East Asia, mainly China, accounted for 70% of Japan's timber exports in 1921, which subsequently decreased to 31% in 1932 due to increasing wooden boxboard exports to Southeast Asia and increasing oak exports to Britain, but rallied to as high as 71% in 1938 (Hagino 1961, pp.46-50).

In addition to the increase in timber exports from Japan to East Asia, another feature of Asian trade in this period was the increase in timber exports from Southeast Asia to East Asia. China's timber imports from Southeast Asia increased from 80,000 m³ to 130,000 m³ between 1930 and 1937 (Figure 1), while Japan's timber imports from Southeast Asia increased from 110,000 m³ to 740,000 m³ (Figure 2). The increase in exports to Japan was remarkable—Southeast Asian timber accounted for 54% and 60% of Japan's timber imports in 1938 and 1939, respectively. The timber exports of the Philippines, British North Borneo, and the Dutch East Indies continued to rise throughout the 1920s, partially owing to foreign investments but increased sharply after 1933. Subsequently, the Philippines' principal export destination shifted from the United States to Japan and that of British North Borneo from Hong Kong to Japan. Moreover, the Dutch East Indies continuously increased exports to Singapore and Malaya while expanding exports to Japan. In these regions, timber production and export were invigorated as the limitations of Thai and Burmese production started to become visible. While Burmese and Thai teak exports totaled approximately 450,000 m³ in the second half of 1930, the timber exports of the Dutch East Indies were 400,000–700,000 m³, those of the Philippines 340,000–590,000 m³, and those of British North Borneo 130,000–

180,000 m³ (Taiwan Sōtoku Kanbō Gaijika 1937, pp.1396-1398; Dixon 1991, p.107). Most of the timber exported to Japan did not comprise hardwoods such as teak but rather softwoods. The use of Southeast Asian timber as plywood materials also expanded in Japan, mainly in Nagoya, with the development of veneer technology and processed plywood. Plywood boxboards were exported to Asia and other countries such as Britain (Ōkurashō 1931-1938). Tropical wood use in Japan persists to date, and the range of tree species used has expanded with improvements in plywood technology and mechanized logging and transportation after World War II (Mather 1990, p.163).

Thus, timber imported from the United States decreased, while Japanese and Southeast Asian timber increased in East Asia in the 1930s. Southeast Asia had clearly become a timber supplier to East Asia. Meanwhile, Southeast Asia continued to supply India with teak. India's teak imports from Burma declined from 1930 to 1933 but started increasing after 1934. While teak imports from Thailand decreased, teak imports from Java and French Indochina increased gradually so that an annual average of 250,000 m³ of teak was imported (Figure 3, Figure 4). In Thailand, teak exports increased after 1934, going mainly to East Asia, Europe, and Africa, and compared to the 1920s, the proportion going to Europe and Africa had grown (Figure 5). The higher share going to Europe was due to the expanding demand for warships (mainly for deck), and this was true for both Burmese and Javanese teak. However, when compared to the timber of the United States and Japan, there were no dramatic changes to teak export volumes and destinations after the 1920s—a price difference between teak going to Europe and that to Asia was still evident in the 1930s (Figure 7).

More than the teak trade, the wood pulp and paper trade may have strengthened the connections between Asia and other regions. The global demand for wood pulp increased rapidly, and in export markets, pulpwood was scarce, and its price soared (Department for Timber Utilization 1937, p.67). Most of the wood pulp and paper imported by Asian countries came from Canada, the United States, and Northern Europe. China's imports continued to increase, and Japan had no choice but to rely on wood pulp imports for rayon, whose global demand had increased rapidly. Moreover, in India, where it was difficult to secure conifers as pulp materials, government protectionism promoted an increase in bamboo pulp production (Roy 2011, p.192), but pulp and paper imports continued to increase.

VII. Conclusion

As discussed above, the Asian timber trade changed with the formation of the international division of labor under European leadership and the progress of industrialization in Asia from the second half of the nineteenth century to the first half of the twentieth century. The principal timber exporters in Asia before World War I were Japan, Thailand, and Burma. Japan exported timber mainly to East Asia, while Thailand and Burma exported teak to India. Asia was self-sufficient in terms of timber and had no strong connections with other regions. However, with the sudden increase in timber demand in Japan and China during World War I, Japanese timber exports to Asia decreased, and large volumes of timber from the United States was imported into East Asia in the post-war period. The United States had exported timber mainly to Europe, and consequently Asia was clearly integrated into the Europe-centered timber trade. Moreover, when India raised tariffs, Thailand decreased teak exports to India and increased exports to Europe and Africa in the 1920s. Thus, Asia's connections with other regions became stronger than before World War I. In the first half of the 1930s, the world timber trade shrank due to the effects of the Great Depression, and the United States' supply of timber to Asia also declined when Japan raised import duties in the late 1920s. However, Japanese timber exports to China once again increased in the second half of the 1930s, and Southeast Asian regions other than Burma and Thailand appeared as new key timber exporters in Asia. Thus, although Asian timber trade volume was small compared to those of Europe, it increased steadily, with successive changes in the timber supply area in response to changes in timber demand. In this timber trade, industrial wood such as construction and civil engineering materials, sleepers, packaging materials (wooden boxboards and barrels), and match sticks were traded, which enabled the construction of factories, railways, and ports, the transportation of various commodities, and industrial development in Asia. In this sense, the expansion of timber trade in Asia provided conditions to support inter-Asian trade.

In addition, through the examination in this study, it can be pointed out that the factors that define timber trade are not only the price of timber but also the tree species and timber processing technologies. While the timber trade changed due to price differences similar to other products, it also changed due to the suitability of tree species and technological advancements that eliminated the restrictions on species that could be used. For example, timber in the United States became relatively cheap after World War I; consequently, the Asian timber market was supplied with large volumes of timber from the United States. However, the United States did not become a key timber supplier to India, where there was a large demand for tropical hardwood. Moreover, Japanese timber was rarely

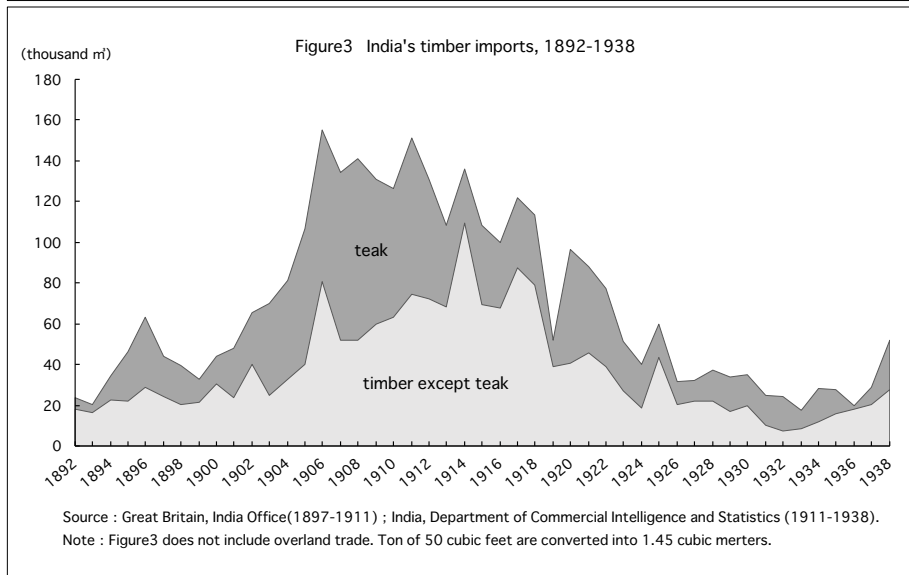
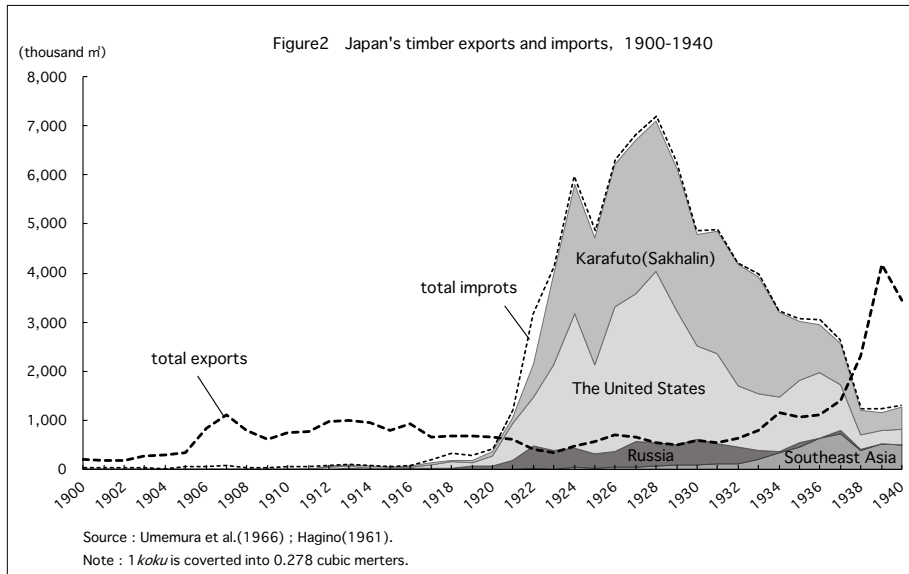
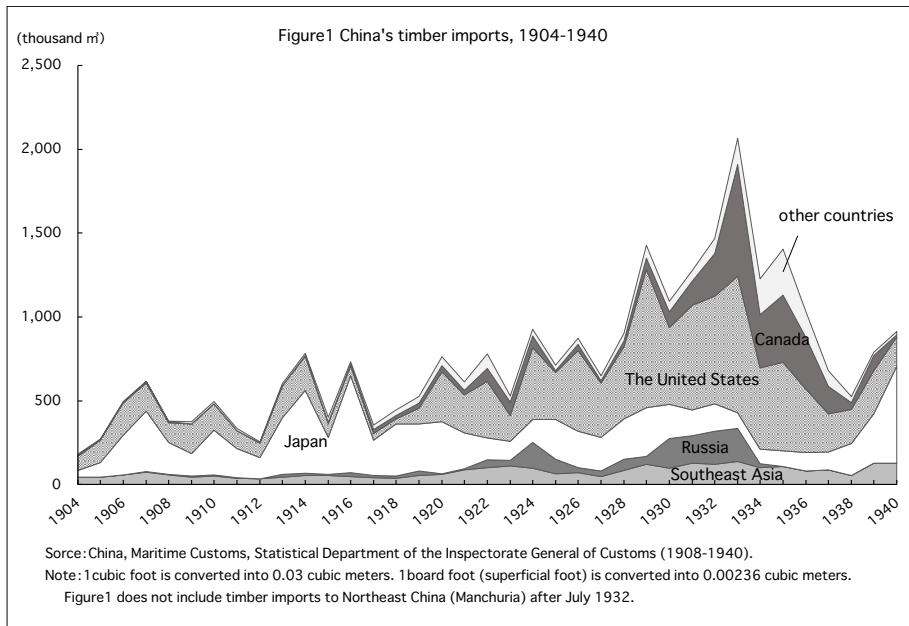
used in tropical regions, except for wooden boxboards. Except for specialized uses such as teak, there was little connection between the timber trade area in temperate regions and that in tropical regions. This is probably because most of the traded timber was used as durable consumer goods such as construction materials and sleepers, although the quantity of forest resources available may also have been a factor. Nevertheless, similar to how the development of plywood technology made Southeast Asia a timber supplier to Japan in the 1930s, technological advances could give rise to a timber trade that transcended such trade areas. It is probable that pulp manufacturing technology and preservation technology, which were not discussed sufficiently in this study, also caused changes in the timber trade.

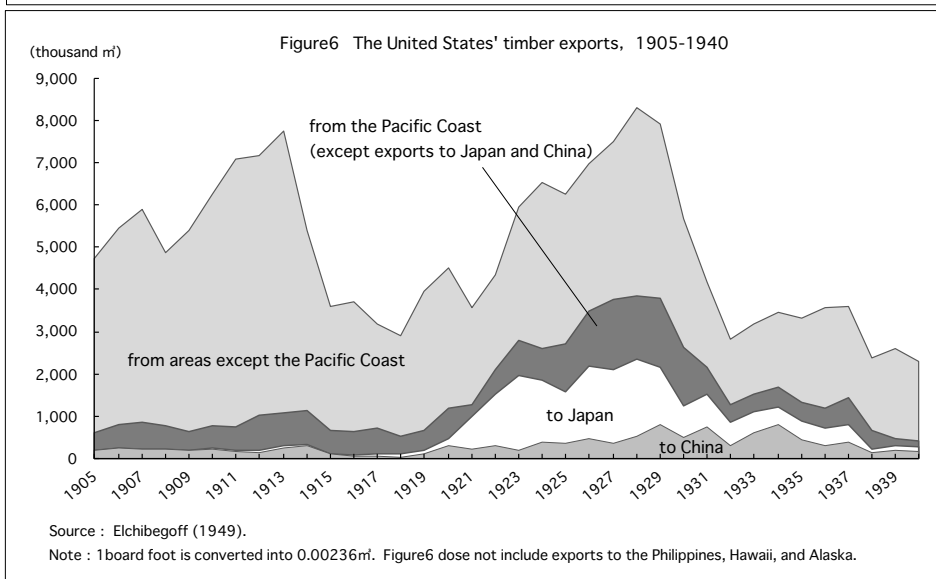
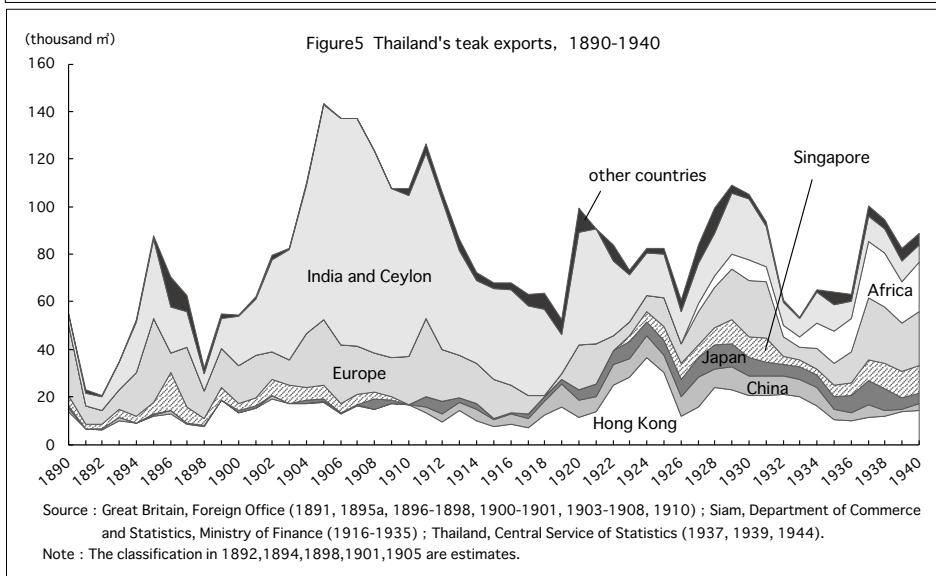
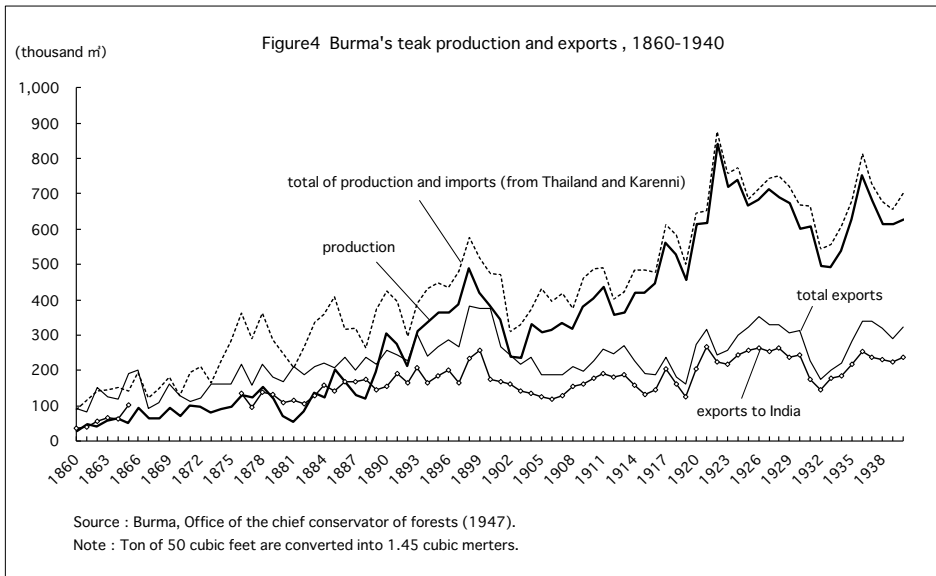
The above observations indicate that the timber market tended to divide because of differences in natural environments and timber uses (tree species). However, this division was alleviated by technological advances, and the timber market transformed itself into a multilayered one. To clarify how the world timber market was formed and developed with the industrialization, it is necessary to analyze timber trade by uses. It is also necessary to examine changes in timber prices and interregional price linkages, the development of the timber trade including Europe, the relationship between the expansion of world trade, colonialism and the timber trade, and the activities of timber companies and trading companies. These tasks should be explored in future studies.

Table1 World wood consumption and trade volume, 1937

	consumption (a) (million m ³)	trade volume (b) (million m ³)	(b)/(a)
industrial wood	700	131	19%
construction materials	450	61	14%
pulpwood	105	60	57%
sleepers	30	2	7%
pitprops and pitwood	30	6	20%
others	85	2	2%
wood for fuel	800	1	0%
total	1,500	132	9%

Source : Food and Agriculture Organization of the United Nations(1948).





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